2013 RSNA (Filtered Schedule)

Sunday, December 01, 2013
10:30-12:00 PM  • VSPD11  • Room: S100AB  • Pediatric Radiology Series: Pediatric Neuroimaging I
10:45-12:15 PM  • SSA15  • Room: N226  • Neuroradiology/Head and Neck (Temporal Bones)
10:45-12:15 PM  • SSA16  • Room: N227  • Neuroradiology/Head and Neck (Vascular Disease of the Head and Neck)
10:45-12:15 PM  • SSA17  • Room: N229  • Neuroradiology (Parkinson's Disease)
12:30-01:00 PM  • LL-NRS-SUA  • Room: Lakeside Learning Center  • Neuroradiology/Head and Neck - Sunday Posters and Exhibits (12:30pm - 1:00pm)
01:00-01:30 PM  • LL-NRS-SUB  • Room: Lakeside Learning Center  • Neuroradiology/Head and Neck - Sunday Posters and Exhibits (1:00pm - 1:30pm)

02:00-03:30 PM  • RC105  • Room: S406B  • Traumatic Brain Injury
02:00-03:30 PM  • RC106  • Room: E451A  • Eye and Orbit
02:00-03:30 PM  • RC108  • Room: E353B  • Imaging of the Traumatized Spine (Traditional) (An Interactive Session)
02:00-03:30 PM  • RC111  • Room: S505AB  • Multi-modal Imaging Workup for Alzheimer's Disease, Parkinson's Disease, and Related Disorders: Case-based App...
02:00-03:30 PM  • RC118  • Room: E353A  • Interactive Game: Interactive Quiz Cases in Neuro-oncologic Imaging
02:00-03:30 PM  • RC120  • Room: E352  • Radiographic Evaluation of the Post-Radiotherapy Brain

Monday, December 02, 2013
07:15-08:15 AM  • SPSH20  • Room: E451B  • Hot Topic Session: Concussion and Traumatic Brain Injury
08:30-10:00 AM  • MSRO21  • Room: S103AB  • BOOST: Head and Neck-Anatomy and Contouring (An Interactive Session)
08:30-10:00 AM  • RC206  • Room: E450A  • Head and Neck Top Ten: Missed Diagnoses and Imaging Pearls (An Interactive Session)
08:30-10:00 AM  • RC250  • Room: S403A  • Interventional Stroke Treatment: Practical Techniques and Protocols (How-to Workshop)
08:30-12:00 PM  • VSNR21  • Room: N230  • Neuroradiology Series: Spine
10:30-12:00 PM  • MSCM22  • Room: S100AB  • Case-based Review of Magnetic Resonance: Neuroradiology (An Interactive Session)
10:30-12:00 PM  • MSRO22  • Room: S103AB  • BOOST: Head and Neck-Integrated Science and Practice (ISP) Session
10:30-12:00 PM  • SSCI1  • Room: N226  • Neuroradiology (Imaging Genomics and New Techniques in Brain Tumors)
10:30-12:00 PM  • SSCI2  • Room: N229  • Neuroradiology/Head and Neck (Traumatic Brain Injury)
12:15-12:45 PM  • LL-NRS-MOA  • Room: Lakeside Learning Center  • Neuroradiology/Head and Neck - Monday Posters and Exhibits (12:15pm - 1:00pm)
12:45-01:15 PM  • LL-NRS-MOB  • Room: Lakeside Learning Center  • Neuroradiology/Head and Neck - Monday Posters and Exhibits (12:45pm - 1:15pm)
03:00-04:15 PM  • MSRO23  • Room: S103AB  • BOOST: Head and Neck-Case-based Review (An Interactive Session)
03:00-04:00 PM  • SSE16  • Room: N229  • Neuroradiology (The Aging Brain and Neurodegenerative Diseases)
03:00-04:00 PM  • SSE17  • Room: N228  • Neuroradiology (Stroke and Cerebrovascular Reserve)
03:00-04:00 PM  • SSE18  • Room: N230  • Neuroradiology/Head and Neck (ENT Oncology)
03:00-04:00 PM  • SSE21  • Room: S102AB  • Pediatric (Neuroimaging)
03:00-04:00 PM  • S104A  • Radiation Oncology and Radiobiology (CNS)
03:00-05:00 PM  • MSM124  • Room: S406B  • Molecular Imaging Symposium: Molecular Brain Imaging: From Research to Clinical Applications
04:45-06:00 PM  • MSRO29  • Room: S104B  • BOOST: Head and Neck Hands-on Contouring (In Cooperation with ASTRO)

Tuesday, December 03, 2013
08:30-10:00 AM  • MSCC31  • Room: S406A  • Case-based Review of Nuclear Medicine: PET/CT Workshop-Head and Neck Cancers (In Conjunction with SNMMI) (An I...)
08:30-10:00 AM  • RC306  • Room: E451A  • Temporal Bone Imaging
08:30-12:00 PM  • VSNR31  • Room: N227  • Neuroradiology Series: Brain Tumors
10:30-12:00 PM  • SSG11  • Room: N226  • Neuroradiology (Advances in Intracranial CT and MR Angiography)
10:30-12:00 PM  • SSG12  • Room: N229  • Neuroradiology (Imaging of White Matter and Demyelinating Disease)
12:15-12:45 PM  • LL-NRS-TUA  • Room: Lakeside Learning Center  • Neuroradiology/Head and Neck - Tuesday Posters and Exhibits (12:15pm - 12:45pm)
12:45-01:15 PM  • LL-NRS-TUB  • Room: Lakeside Learning Center  • Neuroradiology/Head and Neck - Tuesday Posters and Exhibits (1:00pm - 1:30pm)
03:00-04:00 PM  • SSJ07  • Room: N227  • Emergency Radiology (Brain Emergencies)
03:00-04:00 PM  • SSJ15  • Room: S504CD  • Molecular Imaging (Neurosciences)
03:00-04:00 PM  • SSJ18  • Room: N226  • Neuroradiology (Cognitive and Psychiatric Disorders)
03:00-04:00 PM  • SSJ19  • Room: N228  • Neuroradiology (Epilepsy)
03:00-04:00 PM  • SSJ20  • Room: N229  • Neuroradiology (Neurointerventional Radiology)
04:00-06:00 PM  • RC405  • Room: E451B  • Interactive Game: Pediatric CNS Disorders
04:30-06:00 PM  • RC406  • Room: N227  • Skull Base and Nerves
04:30-06:00 PM  • RC408  • Room: E450B  • Stroke Imaging for the Emergency Radiologist (An Interactive Session)

Wednesday, December 04, 2013
08:30-10:00 AM  • MSES41  • Room: S100AB  • Essentials of Neuro Imaging
08:30-10:00 AM  • MSSR41  • Room: S402AB  • RSNA/ERSA Emergency Symposium: General Principles, Pediatric and ENT Emergencies (An Interactive Session)
08:30-10:00 AM  • RC506  • Room: E353C  • Oral Cavity, Pharynx, Larynx
08:30-10:00 AM  • RC552  • Room: E264  • Nerve Ultrasound Based on a Regional Approach: Shoulder and Neck (Hands-on Workshop)
08:30-12:00 PM  • VSNR41  • Room: E451B  • Neuroradiology Series: Stroke
10:30-12:00 PM  • RSNA/ERSA Emergency Symposium: CNS Emergencies (An Interactive Session)
10:30-12:00 PM  • SSK15  • Room: N229  • Neuroradiology/Head and Neck (Head and Neck Tumors)
10:30-12:00 PM  • SSK16  • Room: N230  • Neuroradiology (Advanced Neuroimaging of Alzheimer's Disease)
12:15-12:45 PM  • LL-NRS-WEA  • Room: Lakeside Learning Center  • Neuroradiology/Head and Neck - Wednesday Posters and Exhibits (12:15pm - 12:45pm)
12:45-01:15 PM  • LL-NRS-WEB  • Room: Lakeside Learning Center  • Neuroradiology/Head and Neck - Wednesday Posters and Exhibits (12:45pm - 1:15pm)
03:00-04:00 PM  • SSM14  • Room: N226  • Neuroradiology (Hydrocephalus and Intracranial Hypotension)
03:00-04:00 PM  • SSM15  • Room: S504AB  • Neuroradiology (Neuro-Oncology)
03:00-04:00 PM  • SSM16  • Room: N229  • Neuroradiology (Resting State Functional Brain Imaging)
03:00-06:00 PM  • SPDL41  • Room: E451A  • RSNA Diagnosis Live®: Neuroradiology and Musculoskeletal Radiology
03:40-06:00 PM  • SPSC43  • Room: E353B  • Controversy Session: Controversies in Radiology: Stroke Penumbral Imaging (An Interactive Session)

Thursday, December 05, 2013
08:30-10:00 AM  • MSCN51  • Room: S100AB  • Case-based Review of Neuroradiology: Brain (An Interactive Session)
08:30-10:00 AM  • RC605  • Room: S402AB  • Alzheimer's Disease
08:30-10:00 AM  • RC606  • Room: S402AB  • Neck Imaging
To recognize the dominant hemisphere as well as motor dominance is of paramount importance in surgical planning as well as in the drug and its dosage to control the secondary injury, thus affecting the mortality and disability in ICH population.

The purpose/aim of this study is to:

1) In-situ monitoring of the cerebral ferritin levels and microglia activity of ICH patients using MRI.
2) To develop a non-invasive estimation of cerebral ferritin levels and the activity of microglia in intra cerebral hemorrhagic patients using MRI.

Summary
Noninvasive monitoring of both ferritin levels and the microglia activity using MRI may help the clinician in selecting a proper iron chelating drug and its dosage to control the secondary injury, thus affecting the mortality and disability in ICH population.

The Quest for the Dominant Hemisphere: A Pictorial Review

To recognize the dominant hemisphere as well as motor dominance is of paramount importance in surgical planning as well as in the drug and its dosage to control the secondary injury, thus affecting the mortality and disability in ICH population.

The purpose/aim of this study is to:

1) To identify, characterize and analyze abnormal findings on multimodality neuroimaging.
2) To develop a concise differential diagnosis based on available clinical information and imaging findings.
relationship of brain lesions to explain clinical manifestations and for prognostic purposes. While in the past, invasive methods were applied (i.e. Wada test), we will use magnetic resonance in order to detect the dominant hemisphere.

CONTENT ORGANIZATION
1. Structural review
   a. characteristics of planum temporale, central fissure and lateral ventricle in dominant hemisphere
   b. characteristics of fiber tracts in dominant hemisphere, specially the arcuate fasciculus
2. Functional review
   a. paradigms in fMRI to detect Broca's and Wernicke's areas
   b. resting state fMRI to recognize language areas as well as motor dominance

SUMMARY
Structural image will show larger planum temporale, posterior central fissure, small lateral ventricle, larger arcuate fasciculus in the dominant hemisphere. Functional magnetic resonance using paradigms verbal fluency and word generation will depict Broca's and Wernicke's areas. For resting state fMRI, language centers as well as motor dominance can be found when there is a higher functional connectivity in the selected areas comparing both cerebral hemispheres.

Intracranial Applications of Permeability Imaging with Perfusion Correlate

LL-NRE3123
Sohaa Bazyar, MD
Miguel A Lemus Rosales, MD
Mauricio Castillo, MD
Yueh Z Lee, MD, PhD

PURPOSE/AIM
Blood brain barrier (BBB) disruption is present in any gadolinium enhancing process within the brain. Permeability imaging with MR based dynamic contrast enhancement (DCE) approaches seeks to quantitatively evaluate the degree of BBB break down through parameters such as kTrans, Vp and Ve. The purpose of this educational exhibit is to review the literature on applications of DCE imaging and show clinical examples of permeability parameter maps for intracranial diseases. Perfusion correlates with cerebral blood flow (CBF) and cerebral blood volume (CBV) will also be included.

CONTENT ORGANIZATION
Review of applications of permeability imaging in the Brain
Permeability map examples (with perfusion correlates) on treatment naive lesions
- Primary brain neoplasms
- Metastatic disease
- Infections etiologies
- Inflammatory diseases
Permeability map examples (with perfusion correlates) on post-treatment lesions
- Post surgical changes
- Post chemotherapy
- Post radiation

SUMMARY
The major teaching points of this presentation are:
- All enhancing lesions in the brain have BBB breakdown.
- Quantitative evaluation of the BBB breakdown allows more refined evaluation of these enhancing processes.
- Clinical information of the patient's treatment plays an important role in the interpretation of BBB breakdown.

Third Window Syndrome (TWS): Role of Imaging in Diagnosis and Potential Pitfalls

LL-NRE3125
Hernan D Paez Rueda, MD
Daniel F Gomez Monroy, MD
Sonia Bermudez, MD
Anibal J Morillo, MD

PURPOSE/AIM
The purpose of this exhibit is: 1. To review the basic anatomy of the inner ear 2. To discuss the clinical and imaging findings of third window syndrome 3. To explain the utility of multiplanar reconstructions and particularly poschel view in aiding the detection.

CONTENT ORGANIZATION
1. Basic anatomy of the inner ear 2. Description of the third window syndrome and why is call this way 3. Imaging technique (utility of multiplanar reconstructions and poschel view) 4. Review of the imaging findings. 5. Sample cases and pitfalls 6. Summary

SUMMARY
The major teaching point of this exhibit are: 1. The lost of bone covering in the apex of the superior semicircular canal is the hallmark of TWS. larger defects correlate with worst symptoms 2. Poschel view facilitates the detection of TWS and should be the main projection use in the exploration of the superior semicircular canal to avoid pitfalls.

Relating the Appearances of Thyroiditis on High Resolution Ultrasound to the Natural History of the Condition

LL-NRE3126
Hyeladzira Thahal, MBCh, MRCP
Jonathan C Rodrigues, MBCh, MRCP
John-Luke Cook, MBBS

PURPOSE/AIM
To provide a simplified and structured approach to recognising and characterising the appearances of thyroiditis on ultrasound.

CONTENT ORGANIZATION
1) Introduction: The various categories of thyroiditis 2) The pathophysiology of thyroid inflammation. 3) An overview of autoimmune thyroiditis, concentrating on the common imaging findings on ultrasound and how these correspond with the presentation and stage of the disease. 4) A sonographic pictoral review of timeline of the natural history of thyroiditis, from the hyperacute phase to chronic inflammation, with fibrosis.

SUMMARY
Thyroiditis is common and the appearances are specific, but can be misinterpreted if not understood. The different appearances of the thyroid gland on ultrasound represent different stages in the natural history of this inflammatory process. An understanding of the timeline of evolution of sonographic findings will help reduce confusion and increase confidence in diagnosis.

Lacrimal Duct Imaging Assessment: What Lies beyond X-ray Dacryocystography

LL-NRE3127

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Purpose/Aim
Demonstrate the application of Computed Tomography and Magnetic Resonance Imaging Dacryocystography through diagnostic images, emphasizing the versatility of these methods since they allow different strategies to perform exams, in addition to the use of different contrast media.

Content Organization
X-ray Dacryocystography is the most widely used method for studying the lacrimal duct, but has some disadvantages. Computed Tomography and Magnetic Resonance Imaging Dacryocystography have been introduced as alternative methodologies for studying the lacrimal duct. Such methods have the advantage of allowing both the study of membranous portions of the lacrimal duct and adjacent soft tissues, which eventually may harm these pathologies by contiguity. The option of performing topologic administration of the contrast medium (instillation), as opposed to canalicular catheterization, affords a more physiological analysis of the lacrimal duct, thus adding the potential for diagnosing disorders of functional nature to the method. These aspects are demonstrated by Computed Tomography and Magnetic Resonance imaging tests.

Summary
The major teaching points of this exhibit are: - recognizing CT and MR dacryocystography as reliable methods for evaluating the lacrimal apparatus - learning the techniques and options when performing CT and MR dacryocystography

Imaging in Salivary Duct Disorders

Purpose/Aim

Aim of educational exhibit
- To revisit the radiological anatomy of the major salivary glands and ductal system.
- To understand obstructive and inflammatory salivary duct disorders and their imaging features, with use of case examples.
- To discuss imaging strategies such as conventional sialography, ultrasonography, CT and MRI, with discussion of the pros and cons.

Content Organization

- Radiologic anatomy and useful relations of the major salivary glands and ductal system. - Imaging and clinical manifestations of salivary duct disorders. Sialolithiasis Sialodochitis Sialocele Sjögren's syndrome Sialosis Salivary duct carcinoma Case examples - Imaging strategies Pros and cons Discuss newer imaging modalities such as ultrasonography, cross-sectional CT and MRI. Contemporary imaging: MR sialography Anatomical and functional evaluation of salivary glands.

Summary

Major teaching points
- Familiarisation with the application and interpretation of advanced imaging modalities which have fast replaced conventional sialography as the imaging modality of choice in baseline assessment.
- Knowledge of distinctive imaging features of common obstructive and inflammatory salivary ductal disorders.
- Useful radiological anatomical relations.

Imaging Classification of Cervical Lymph Nodes and Patterns of Nodal Spread of Disease in the Pre-operative and Post-operative Neck - A Pictorial Review

Purpose/Aim

1. To briefly review the imaging based classification of cervical lymph nodes
2. To review the typical pattern of spread of the major head and neck malignancies
3. To review alternative and atypical patterns of nodal spread in the post-operative neck

Content Organization

1. Introduction and review of the imaging based nodal classification system on CT
2. Patterns of spread of nodal metastases based on primary tumor sites including the lip, oral tongue, floor of mouth, retromolar trigone, soft palate, oropharynx, anterior tonsillar pillar, base of tongue, tonsillar fossa, nasopharynx, hypopharynx and larynx as well as thyroid malignancies
3. Evaluation of nodal metastases and recurrence in the post-operative neck

Summary

Evaluation of cervical lymph nodes is essential for proper staging and follow-up of head and neck malignancies. The imaging based classification of cervical lymph nodes is widely used by radiologists and clinicians and has been endorsed by the AJCC. Familiarity with the imaging based classification as well as the pattern of spread of the major head and neck malignancies is essential for radiologists to help with detection and ensure proper staging and follow-up of head and neck malignancies.
Proton MR Spectroscopy of the Head and Neck Lesions; Technical Issues and Initial Experience

**LL-NRE3132**
Kohei Inoue, MD, PhD
Ken Motoori, MD
Hazuki Nakatamari, MD
Hajime Yokota, MD
Takashi Uno

**PURPOSE/AIM**
We aim to summarize our findings, including optimization of protocol and common artifacts encountered, and to discuss the useful information using the proton MR spectroscopy (MRS) of the head and neck lesions.

**CONTENT ORGANIZATION**
1. We will describe the optimized protocol of the MRS of the head and neck lesions.
2. We will show the MRS data of the parotid gland tumor, and reveal what kind of MRS data is useful for these neoplasms.
3. We will discuss the indications, advantages and pitfalls of using MRS in the evaluation of head and neck lesions.

**SUMMARY**
1. We review the actual MRS data of known head and neck lesions, and the role of the MRS in the evaluation of head and neck lesions.
2. We review the common artifacts encountered with the difficulty of taking the MRS data, and discuss the limitations of the MRS of the head and neck lesions.

Pictorial Review of the Anatomy and Pathology of the Descending Corticospinal Tracts

**LL-NRE3133**
Michael Utz, MD
Xiang Liu, MD
Ali H Hussain, MD, FRCR

**PURPOSE/AIM**
The descending corticospinal tracts (DSCTs) are the most important motor pathway in the brain and are well evaluated by conventional MRI as well as diffusion tensor and fractional anisotropy. Primary and secondary degenerative diseases can cause signal abnormalities along the DSCTs. The radiologist will become familiar with the anatomy of the DSCTs and be able to identify patterns of disease in both the acute setting and in follow up.

**CONTENT ORGANIZATION**
The anatomy of the descending corticospinal tracts will be reviewed. Color tract fiber mapping will be used to illustrate the significant motor pathways. Several primary and secondary disorders will be examined, including Wallerian degeneration, amyotrophic and primary lateral sclerosis, crossed cerebellar dischiasis, and hypotrophic olivary degeneration. In each example the findings on conventional MRI, diffusion tensor imaging, and fractional anisotropy will be presented where applicable.

**SUMMARY**
The DSCTs are a common location for disease following insults to both the cerebral hemispheres and brainstem. Multiple disease entities occur along these tracts, some of which have specific findings. It is crucial to recognize the presence of these entities both in the acute setting and in follow up after an acute insult for accurate diagnosis.

"It's Just a Big Bone Island….isn't It?" - Sclerotic Lesions of the Jaws

**LL-NRE3134**
Sarah Constantine, MBBS, FRANZC
Bruce Clark

**PURPOSE/AIM**
To recognize the radiological features of sclerotic lesions occurring in the mandible and maxilla.

**CONTENT ORGANIZATION**
This presentation demonstrates the radiological features of both benign and malignant sclerotic lesions of the mandible and maxilla, and describes the differentiating features of these lesions.

**SUMMARY**
Bone islands are common lesions in the mandible, just as in other bones of the body, but there are several other sclerotic lesions that occur in the jaws, which can be of bony or dental origin. While these lesions are generally rare, the identification of these lesions is important for dental, surgical and orthodontic management, and can also be a diagnostic indicator for systemic disease. Radiologists need to be aware of the spectrum of sclerotic lesions seen in the jaws, and be able to offer an appropriate differential diagnosis in each case.

Thyroid and Perithyroidal Lesions: Imaging, Pathological and Clinical Correlation

**LL-NRE3135**
Yu Sung Yoon, MD
Shin Young Kim
Sang Mi Lee
Sung Yong Kim, PhD
Sun Wook Han

**PURPOSE/AIM**
1. To provide embryology and pathophysiology of various thyroid and perithyroidal lesions with anatomic correlation.
2. To illustrate imaging findings including ultrasonography (US), computed tomography (CT), positron emission tomography/computed tomography (PET/CT), thyroid and parathyroid scan.
3. To emphasize the imaging findings of thyroid and perithyroidal lesions with respect to pathological and clinical features

**CONTENT ORGANIZATION**
Ultrasonography (US) is the primary important modality in making a diagnosis of thyroid and perithyroidal lesions. Today, other radiologic and nuclear medicine imaging modality is increasingly being used to evaluating neck and thyroid lesions, and provide help in correct diagnosis. We present various thyroid and perithyroidal diseases including focal/diffuse thyroiditis, benign/indeterminate thyroid nodule, malignancy (primary thyroid cancer, lymphoma), parathyroid adenoma, metastatic lymph node from thyroid, stomach, breast, schwannoma and traumatic neuroma of lateral neck. Precise US findings are presented in all cases with CT, PET/CT, thyroid and parathyroid scan imaging. Pathognomonic clinical and pathological findings are also provided.

**SUMMARY**
The exact knowledge of imaging, pathological and clinical features of thyroid and perithyroidal lesions may aid in narrow of the differential diagnosis.
Multimodality Imaging of Thyroid Disorders: A Pictorial Review

Sumeet Virmani, MD
Rashmi Virmani, MD
Jagadeesh Singh, MD, FRCR
Amjad Ali, MD

PURPOSE/AIM
Thyroid gland plays a critical role in human metabolism. Recent advances in imaging techniques have considerably improved the diagnostic accuracy, follow up and prognosis of many patients affected with thyroid disorders. This pictorial review highlights the roles of different imaging modalities in the evaluation of thyroid diseases.

CONTENT ORGANIZATION
Pictorial review of: Radionuclide Scintigraphy
- Lingual thyroid
- Congenital organification defect
- Graves disease
- Autonomous thyroid nodule
- Warm nodule
- Cold nodule
- Multinodular gland
- Thyroiditis
- Thyroid carcinoma
- Post thyroidectomy imaging
- Postradioiodine therapy imaging including SPECT CT

PET CT imaging
- Incidental findings and metastasis

Ultrasound
- Thyroid adenoma
- Multinodular goiter
- Papillary cancer
- Follicular cancer
- Medullary cancer
- Anaplastic cancer
- Post thyroidectomy follow up
- Lingual thyroid and thyroglossal cyst
- Hashimotos thyroiditis

CT and MRI:
- Tumor recurrence and cervical metastasis

SUMMARY
The above exhibit with illustrations will help viewers to better understand various available imaging modalities for the management of thyroid diseases. This will help in the selection of appropriate study and aid in patient management.

Embryology and Imaging Features of Maxillofacial Anomalies in Children: A Pictorial Review

Ananth K Ravi, MBBS
Shilpa Hegde, MD
Sumit Singh, MBBS
Manoj Kumar, MD, MBBS
Rohan Samant, MD
Ryan T Fitzgerald, MD
Raghu H Ramakrishnaiah, MBBS, FRCR
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Edgardo J Angtuaco, MD
Charles M Glasier, MD

PURPOSE/AIM
Imaging of congenital maxillofacial anomalies using high resolution maxillofacial CT scan plays a key role in characterization of different bony dysplasia and in presurgical planning. The purpose of this scientific exhibit is to provide a pictorial review of embryogenesis of facial bones with brief discussion of various syndromes associated with maxillofacial anomalies and their associated imaging findings, as well as imaging findings of variable isolated maxillofacial anomalies in children.

CONTENT ORGANIZATION
Imaging studies of children with maxillofacial anomalies will be reviewed through an extensive data base search of a tertiary care pediatric hospital. A pictorial review would include a brief description of relevant embryology followed by a detailed description of characteristic imaging features. Several maxillofacial anomalies and non-syndromic isolated maxillofacial anomalies will be discussed including: Nager syndrome, Pierre Robin syndrome, Parry-Romberg, Pfeiffer syndrome, Treacher Collins syndrome, Crouzon syndrome, Gorlin syndrome, Apert syndrome, external auditory canal atresia, maxillary hypoplasia, bilateral cleft lip.

SUMMARY
1. Maxillofacial anomalies are not infrequently encountered in neuroimaging practice. 2. Key characteristics of various maxillofacial anomalies will be reviewed for a better understanding of these entities.

Diagnosis of Cerebellar Infarcts

Laurens J De Cocker, MD
Anita A Harteveld, MSc
Jeroen Hendrikse, MD

PURPOSE/AIM
To review the pathophysiology and MRI findings of cerebellar infarcts.

CONTENT ORGANIZATION
Pathophysiology: Recent clinical and radiological evidence suggests that both large and small cerebellar infarcts are caused by arterial or arteriolar occlusion. MRI findings: Pattern recognition; large and small cerebellar infarcts have typical imaging patterns helpful for diagnosis. Evolution; acute infarcts are readily diagnosed with DWI, chronic infarcts are easily detected on T2WI and are correlated with high-resolution T1 and FLAIR for confirmation and assessment of cavitation. Mimics; cerebellar infarct mimics may be divided in two groups: (a) fluid-filled structures other than chronic infarcts (fissures, mega cisterna magna, arachnoid cysts, and occipital sulci), and (b) vascular structures (veins and developmental venous anomalies). Radiology report; should include information on the age and location of cerebellar infarcts.

SUMMARY
Recognition of infarct patterns and knowledge of infarct mimics are mandatory for accurate diagnosis of cerebellar infarcts.

Predicting the Spread of Glial Tumors: Lessons from the Insular Cortex

**LL-NRE3140**

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Lakshmi Chavalli, BS*
Claro Ison, MD
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Rivka R Colen, MD
Ashok J Kumar, MD
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**PURPOSE/AIM**
To describe the behavior of gliomas of the insula using confocal reconstructions of MR images and Brodmann nomenclature.

**CONTENT ORGANIZATION**
- 47 cases of glioma involving the insula were retrospectively analyzed. Insular tumor spread via the uncinate fasciculus to the orbitofrontal gyrus and/or temporal pole, and insular tumor spread to ventral prefrontal cortex (BA 44), the transverse Heschel cortex (BA 41/42) and pars triangularis (BA 45) will be exhibited. Representative cases were rendered in 3D volume from confocal viewing using an Anatom-e workstation. Of the 47 cases, 16 tumors were confined to the insula and 15 tumors spread via the uncinate to the orbitofrontal gyrus and/or temporal pole. Spread outside of insular tumor to BA 44 (n= 9), BA 41/42 (n=3), BA 45 (n=4) were also demonstrated.

**SUMMARY**
Surgically important patterns of glial tumor spread are described using Brodmann terminology and are best displayed with confocal reconstructed MR imaging. Insular tumor spread to BA 44, BA 41/42, BA 45 is not widely known.

Imaging Appearance and Spread Pattern of Glial Tumors in the Supplementary Motor Area (Brodmann Area 6)

**LL-NRE3141**

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Jackson D Hamilton, MD*
Lakshmi Chavalli, BS*
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Pattana Wangaryattawanich
Jill V Hunter, MD
Rivka R Colen, MD
Dawid Schellingerhout, MD
Sujit Prabhu, MD
Ashok J Kumar, MD

**PURPOSE/AIM**
1. To describe how to localize a normal central sulcus
2. To elucidate the importance of Brodmann areas in the posterior frontal lobe
3. To illustrate gliomas in Brodmann area 6 (BA 6), and their pattern of spread.

**CONTENT ORGANIZATION**
- Localization of central sulcus using anatomy, fMRI and deformable anatomic template (DAT) in normal cases
- Challenges to localization of central sulcus posed by mass effect
- Description of Brodmann areas in the posterior frontal lobe, anatomically, functionally and cytoarchitecturally, with review of major connecting fiber tracts
  - 6 – supplementary motor cortex
  - 4 – motor cortex
  - 8 – prefrontal cortex
  - 43 – subcentral gyrus
  - 24 – anterior cingulate gyrus
- Boundary of 6 and 4 bisects the lateral, inferior aspect of the precentral gyrus

**SUMMARY**
Major teaching points of this exhibit are: 1. Identification of central sulcus
2. Relevance of Brodmann areas to imaging of gliomas in the supplementary motor cortex
3. Review of connections between functional areas in the posterior frontal lobe

To Treat or Not to Treat¼?: The Promise of Imaging Biomarkers for Patient Triage to Stroke Therapy

**LL-NRE3142**

Shervin Kamalian, MD, MMEdSc*
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Stuart R Pomerantz, MD*
Ramon G Gonzalez, MD, PhD
Joshua A Hirsch, MD*
Albert J Yoo, MD*

**PURPOSE/AIM**
When making treatment decisions, available treatment options with their potential benefits and risks should be considered. In acute stroke
patients, recent randomized clinical trials failed to show the benefit of intra-arterial (IA) therapy over IV- thrombolytic therapy alone. One possible contributing factor might be heterogeneity within study populations with respect to potential treatment effect, which underscores the need for better patient selection criteria. The use of advanced stroke imaging biomarkers may be a key element in this scenario and our purpose is to review advances in stroke imaging and their promise for improved patient triage.

**CONTENT ORGANIZATION**

The significance of acute ischemic stroke subtypes Available acute stroke treatment options by time clock: a) Controversy for IV-tPA beyond 3 hours, and b) Controversy for IA-therapy Imaging biomarkers (triage based on a “tissue” clock): a) Predictors of increased treatment risk, b) Predictors of increased treatment benefit, and c) Predictors of IV-tPA resistance: implication for IA-therapy

**SUMMARY**

Relevant advanced stroke imaging and interpretation can enhance patient selection for revascularization therapy by improving the risk/benefit assessment of IV-tPA and/or IA-therapy and help us to identify patients who may benefit from treatment beyond the pre-specified therapeutic time window.

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**Not all Spinal Fluid Collections Are Epidural: Reviewing Spinal Subdural Collections**

**LL-NRE3144**

Vanessa Lewis, MD
Thomas A Gallagher, MD
Tarek A Hijaz, MD

**PURPOSE/AIM**

The purpose of this exhibit is: 1. To review the normal spinal meningeal anatomy. 2. To exhibit pathology involving the spinal subdural space as demonstrated on myelography, computed tomography, and magnetic resonance imaging.

**CONTENT ORGANIZATION**

Review of the normal spinal meningeal anatomy Imaging and clinical findings of spinal subdural fluid collections

- Differentiate from spinal epidural fluid collections
- Clinical presentation, workup, and management

**Types of pathology (with sample cases and images):**

- Hematomas
- Infected collections
- Inadvertent injections
- Effusions/hygroamas

**SUMMARY**

The major teaching points of this exhibit include: 1. The appearance of the spinal epidural space is modulated by variable meningovertebral ligamentous attachments to the thecal sac. 3. MRI allows for an accurate description of the size and extent of such fluid collections. The signal characteristics and location of a particular collection may offer clues as to its etiology. 4. Distinguishing a subdural spinal fluid collection from the more common and more familiar epidural fluid collection can be challenging. 5. Many subdural fluid collections are asymptomatic and do not require any treatment.

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**How to Avoid Ischemic Spinal Cord Complication after Thoracoabdominal Aortic Surgery: State of the Art Concept, Technique and Radiological Imaging**

**LL-NRE3145**

Hidenobu Takagi, MD
Hideki Ota, MD, PhD
Koki Itoh, MD
Kei Takase
Yoshikatsu Saiki, MD, PhD
Shoki Takahashi, MD

**PURPOSE/AIM**

The purpose of the exhibit is: 1. To learn how to identify the artery of Adamkiewicz (AKA) with current imaging technique. 2. To show various types of collateral arterial pathways to the AKA. 3. To learn what radiologists need to know about current methods of surgery. 4. To show how to utilize image of the AKA to protect spinal cord perfusion.

**CONTENT ORGANIZATION**

A. Review of surgical or endovascular treatment of thoracoabdominal aortic diseases. B. Current surgical innovation to protect spinal cord perfusion during surgery. C. Importance of preoperative localization of the AKA in current surgical procedure. D. Scan and imaging protocols to visualize the AKA in the eras of 3T-MRI and MDCT. E. Various imaging findings of the AKA and its collateral arteries from our 150 cases of thoracoabdominal aortic surgery.

**SUMMARY**

Identification of the AKA using current MDCT and 3T MR angiography gives significant impact on thoracoabdominal aortic surgery. The major teaching points of this exhibit are: 1. Proper use of MDCT and MRA to identify arterial pathways to the AKA. 2. What information to be given to vascular surgeons. 3. Current concept and method of protecting spinal cord during surgery. 4. Clinical application of image findings in the current surgical procedure to avoid postoperative spinal cord ischemia.

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**Imaging of Spinal Vascular Malformations and Its Implications on Patient Management**

**LL-NRE3146**

Shirley Chan, MD
Jeevak Almast, MD
Henry Z Wang, MD, PhD *
Rajiv Mangla, MD

**PURPOSE/AIM**

Spinal vascular malformations are infrequent but important lesions to recognize due to the significant implications on patient morbidity and mortality. Early recognition by the radiologist and diagnosis by clinicians could prompt surgical and medical interventions that could reduce patient incidence of progressive neurological deficits.

**CONTENT ORGANIZATION**

- Review and illustrate the normal and variant spinal vascular anatomy.
- Provide multimodality imaging pertinent to the various types of spinal vascular malformations.
- Elaborate on which imaging modality is most appropriate for each case setting.
- Highlight important findings critical to management.
- Discuss the role of imaging in diagnosis and follow up.

**SUMMARY**

Equipped with a review of relevant radiographic features, education, and experience, a radiologist should recognize spinal vascular malformations and its implications on patient management. Otherwise, significant morbidity and mortality can occur.
Unusual Cases of Non-neoplastic Spinal Pathology: Pictorial Review

 PURPOSE/AIM
We aim to deliver a concise and clear pictorial review of imaging features seen in selected unusual non-neoplastic spinal pathology. The objective is to increase awareness of such conditions amongst the readers.

CONTENT ORGANIZATION
MRI of the spine is one of the most widely used imaging modality in investigation of back pain, weakness and other neurological deficits. Whilst degenerative disease accounts for most of these common symptoms, other less frequently encountered pathologies can also give rise to similar presentations. The exhibit will highlight various imaging features seen in wide spectrum of uncommon spinal pathological condition. These illustrated examples will be accompanied by clear tables of learning points containing basic facts on its pathology, clinical and radiological features. Selected cases for pictorial review will include inflammatory conditions such as sarcoidosis, Guillain-Barré syndrome, chronic recurrent multifocal osteomyelitis, Grisel's syndrome, spinal infection (tuberculosis, schistosomiasis), sub and extra-axial collections of varying aetiologies and vascular malformation including dural fistula.

SUMMARY
Good knowledge of different imaging patterns seen in diverse spinal pathologies together with basic clinical facts will facilitate towards accurate differential diagnosis of uncommon but important spinal pathology.

CT and MR Characteristics of Neurologic Emergencies in the Pregnant and Postpartum Patient

 PURPOSE/AIM
Although neurological disorders in pregnancy are infrequent, they can be associated with significant morbidity. Pregnant and postpartum patients typically present with nonspecific neurological symptoms, which often prompt acquisition of imaging studies. Review of characteristic CT and MR findings of common and rare disorders in this population will be performed, as awareness of these entities and their characteristic radiologic findings can help guide management.

CONTENT ORGANIZATION
Many processes are specific to the pregnant and postpartum state, including postpartum cerebral angiopathy, Sheehan syndrome, and lymphocytic adenohypophysitis. Other processes are exacerbated by or seen more frequently in pregnancy due to hypercoagulability and hormonal changes, including hemorrhagic and ischemic infarctions, cerebral venous sinus thrombosis, posterior reversible encephalopathy syndrome, and subarachnoid hemorrhage. Certain tumors also express rapid growth during pregnancy. Appropriate indications for imaging will be reviewed as well as CT and MR characteristics of these processes.

SUMMARY
Familiarity with the appropriate differential and concomitant imaging characteristics in this unique population is imperative to accurate diagnosis and management, as many of these conditions can be potentially life-threatening.

Recognizing the Many Faces of Neurosarcoïdosis

 PURPOSE/AIM
1. Review common imaging manifestations of neurosarcoïdosis and describe less common but clinically important lesion types. 2. Discuss the differential for each lesion type and characteristic findings which help to differentiate neurosarcoïdosis from lesions with similar morphology. 3. Describe how these findings may dictate further diagnostic measures and treatment.

CONTENT ORGANIZATION
1. Epidemiology, clinical manifestations and histology 2. Case-based review of varied lesion types and locations including the leptomeninges, nerves, calvarium, pituitary, brain parenchyma and spine including differential diagnosis and salient features suggestive for sarcoïd. 3. “Red flag” features requiring immediate clinical attention such as infiltrative or obstructive lesions causing hydrocephalus. 4. Indications for biopsy and imaging features relevant to surgical planning.

SUMMARY
1. Imaging findings in neurosarcoïdosis are highly varied and mimic a number of entities with different treatments. 2. Knowledge of differential and findings characteristic of sarcoïd will aid diagnosis and may determine whether further diagnostic testing is needed. 3. It is important to recognize which lesions require immediate attention and which may be amenable to surgery for the purposes of diagnosis or therapy.

Overview on the Evolution of Intracranial Hemorrhage on Magnetic Resonance Imaging (MRI)

 PURPOSE/AIM

CONTENT ORGANIZATION
Introduction Evolution of Hemorrhagic Degradation Products Hyperacute

- Intracellular Oxyhemoglobin
- Cases

Acute
Intracellular Deoxyhemoglobin Cases

Early Subacute Intracellular Methemoglobin Cases

Late Subacute Extracellular Methemoglobin Cases

Chronic Hemosiderin/Ferritin Cases

Physics and Appearance on MRI Sequences

T1, T2, GRE/SWI, DWI/ADC

Summary

Acute intracranial hemorrhage is a common neurological emergency. The appearance of parenchymal hemorrhage on MRI is highly dependent on the hemoglobin degradation product which is present and age of hemorrhagic material. Knowledge of these common appearances is invaluable for radiologists in the diagnosis of intracranial hemorrhage and interpretation of brain MRI examinations.

From Bad to Worse: Delayed Post-Hypoxic Leukoencephalopathy. A Case Series and Review of the Literature

LL-NRE3152
Matthew J Daily, MD
Mohamed-Ali Babi, MD
Joshua P Nickerson, MD

PURPOSE/AIM
The purpose of this exhibit is to educate the reader on the clinical presentation and imaging findings of delayed post-hypoxic leukoencephalopathy (DPHL) via two illustrative cases and a review of the literature.

CONTENT ORGANIZATION
Clinical presentation of delayed post-hypoxic leukoencephalopathy (DPHL) Two example cases including MR imaging findings
Review of the literature regarding DPHL Proposed pathophysiology of DPHL Imaging recommendations

SUMMARY
1. DPHL is a rare complication of hypoxia that presents with clinical decline following initial recovery. 2. Illustrative cases demonstrate the finding on imaging studies of progressive subcortical white matter damage including T2 prolongation and diffusion restriction. 3. Proposed pathophysiology suggests diffuse demyelination as a result of inflammatory response to the initial injury. 4. Imaging plays a key role in establishment of the diagnosis of DPHL.

Ossicular Chain Disruption Secondary to Tympanic Membrane Trauma, a Case Review

LL-NRE3153
John Canning, FRCR, MRCP
Bert De Foer, MD, PhD
Nicolas Verhaert, MD
Joost Van Dinther, MD
Robert Hermans, MD, PhD

PURPOSE/AIM
To present the imaging findings in a group of 6 patients who presented with otological symptoms following trauma to the tympanic membrane.

CONTENT ORGANIZATION
The mechanism of injury, clinical and imaging findings are outlined in each case. Each patient underwent CT or cone beam CT of the temporal bones.
The mechanisms of injury in this series include penetrating trauma from the stem of a patient’s glasses, from a cotton bud, penetrating injury from a ‘pea shooter’ – a game favoured by teenage boys, and rapid removal of an earplug.
The imaging findings include fracture of the handle of the malleus, incudostapedial dislocation, malleo-incudal separation, displacement of the stapedial suprastructure, fracture of the stapedial footplate and pneumolabyrinth (see Figure 1: The stapes footplate is fractured and angulated medially through the oval window (arrowhead), with resultant pneumolabyrinth (arrows)).

SUMMARY
Ossicular chain disruption is common secondary to blunt skull trauma, usually associated with a longitudinal temporal bone fracture. In this case series we present a range of findings in 6 patients who developed symptoms following direct trauma to the tympanic membrane, an uncommon presentation. Imaging is useful to define the extent of ossicular chain injury and plan surgical reconstruction.

Imaging of Acute Vascular Pathology of the Neck: CTA Neck and Catheter Angiogram Correlations

LL-NRE3154
Krishna K Das, MD
Rahul Nayyar, MD
Sonia Nayyar, MD
Amar S Swarnkar, MD
Rashi I Mehta, MD

PURPOSE/AIM
CT angiography is now considered the first line imaging modality in patient’s presenting with suspected vascular neck pathology. This educational exhibit will review common, including some easily missed and sometimes life-threatening, traumatic injuries on CTA of the neck. We will correlate CTA and catheter angiogram findings. Examples of pathologies we will illustrate include: aneurysm, pseudoaneurysm, partial or complete occlusion, AV fistula, transection, and dissection. The aim of our educational exhibit is to help radiology residents review common traumatic abnormalities on CTA neck, and understand the pros and cons of CTA versus catheter angiogram.

CONTENT ORGANIZATION
1. Introduction to neck vascular pathology and role of CTA in initial work up. 2. Radiographic vascular anatomy of the neck. 3. Review pathology and imaging appearance of commonly diagnosed traumatic abnormalities on CTA neck as discussed above. 4. Strengths and
Cerebral Venous Thrombosis: Incidence, Risk Factors, Presentation, Imaging Findings, and Treatment

LL-NRE3155
Vivek Kalia, MD, MPH
Neil M Borden, MD
Joshua P Nickerson, MD

PURPOSE/AIM
1. Review the presentation of and risk factors for cerebral venous thrombosis (CVT) to aid in expedited recognition and quicker treatment.
2. Review the classic imaging pearls and pitfalls of CT, CTA, MR, and MRA in the diagnosis of CVT.
3. Review current standard of care for treatment of CVT.

CONTENT ORGANIZATION
Cases were drawn from patients who presented to a tertiary referral center with a variety of neurologic complaints. The most revealing cases are chosen to highlight the major risk factors present, clinical findings, imaging findings, and treatment options available for CVT. Featured cases include: 1. a 22 year old female with ulcerative colitis presenting with hemorrhagic left lateral temporal lobe infarct, 2. a 20 year old female on oral contraceptive pills (OCPs) presenting with sudden 10/10 headache found to have extensive CVT in virtually all cerebral veins, and 3. a 33 year old female with history of multiple sclerosis whose CVT was well-defined on susceptibility-weighted imaging.

SUMMARY
Particular attention must be paid by primary care and other healthcare providers to patients with specific, very common risk factors for CVT, such as cancer, pregnancy, surgery, puerperium, and use of oral contraceptive pills. These patients must undergo the right radiologic exam expeditiously for accurate diagnosis and rapid treatment.


LL-NRE3156
Rahul Nayyar, MD
Krishna K Das, MD
Amar S Swarnkar, MD
Rashi I Mehta, MD

PURPOSE/AIM
Illustrate common artifacts and normal variants which can be encountered on CTA head and neck examinations and serve as "pitfalls" for misdiagnosis. Examples of artifacts that were encountered by residents at our institution and will be illustrated include: (Dissection mimickers, Thrombus mimickers, Venous reflux of contrast which can mimic calcification, Asymmetric venous enhancement which can mimic extravasation, Post carotid endarterectomy appearance of vessels which can mimic pathology, Post carotid endarterectomy with patch graft which can mimic the appearance of pseudoaneurysm, Calcification blooming artifact, Flow Artifact, and Artifact related to vascular stents.) We will review abnormal hemodynamics in the setting of vascular pathologies, with reference to the North American Symptomatic Carotid Endarterectomy Trial criteria.

CONTENT ORGANIZATION
1. Overview of CTA protocol and vascular (arterial and venous) anatomy of the head and neck. 2. Review of normal and abnormal hemodynamics; with particular attention at the carotid bifurcation. 3. Normal CTA head and neck imaging. 4. Review basic physics principles applied to flow dynamics (Poiseuille's equation). 5. Imaging examples of common pitfalls discussed above.

SUMMARY
We will review and illustrate the appearance of common artifacts and normal variants which can easily be misinterpreted as pathology.

Manifestation of Head and Neck Vein Abnormalities Using Contrast-enhanced Magnetic Resonance Venography

LL-NRE3157
Kaiyuan Zhang, MD
Yanfang Dai
Kuncheng Li, MD

PURPOSE/AIM
The aims of this exhibit are: 1. To review the utility of different radiological modality in assessment of venous problems in cerebral and neck. 2. Briefly overview the state-of-the-art contrast-enhanced magnetic resonance venography (CE-MRV) for finding the anatomic variations and pathological abnormalities.

CONTENT ORGANIZATION
1. The development process of the techniques of different type of MR venography. 2. The advantage and disadvantage of the different techniques and MR sequences. 3. The CE-MRV is optimal choice of neurologist when facing with intracranial hypertension patients suspected with stenosis or thrombosis of cerebral and internal jugular vein. 4. The CE-MRV can be employed multiple times after the placement of venous stent for the purpose of fellow-up. 5. Exhibition of variety of venous stenosis and thrombosis CE-MRV images.

SUMMARY
The major teaching points of this exhibit are: 1. CE-MRV can be the first choice of doctor to make the diagnosis of cerebral and jugular vein stenosis and thrombosis, especially for children and pregnant women. 2. When facing the patients with unexplained headache, dizziness or head stuffy, we should think of the possible jugular vein problem.

CT Angiography of the Cerebral Venous System: Anatomy, Pathology, and Pitfalls

LL-NRE3158
Jason B Pond, MD
Jason Gins, MD
Richard A Suss, MD
Harold D Scott, MD
David P Chason, MD

PURPOSE/AIM
To demonstrate normal and variant venous anatomy as well as exhibit cases of venous pathology and their mimics as seen on routine head and neck CT Angiography (CTA).

CONTENT ORGANIZATION
1. Discuss optimization of head and neck CTA protocol
   A) Bolus
   B) Data acquisition
   C) Reconstruction and rendering techniques

SUMMARY
The aims of this exhibit are: 1. To review the utility of different radiological modality in assessment of venous problems in cerebral and neck. 2. Briefly overview the state-of-the-art contrast-enhanced magnetic resonance venography (CE-MRV) for finding the anatomic variations and pathological abnormalities.
2. Demonstrate normal venous anatomy and common variants
   A) Variable configuration of the torcular herophili
   B) Asymmetry of the deep and superficial cerebral veins
   C) Variable drainage patterns
3. Illustrate common pathologic conditions of the cerebral venous system
   A) Venous sinus thrombosis
   B) Arteriovenous malformation
   C) Venous varices
   D) Developmental venous anomaly
   E) Vein of Galen malformation
4. Show examples of pathologic mimics, common artifacts and potential interpretive pitfalls in the cerebral venous system
   A) Lack of temporal resolution
   B) Superimposition of opacified arteries, adjacent bone, hemorrhage, etc.
   C) Streak, motion, mottle, and impact of calcification on image reconstruction and interpretation
SUMMARY
Knowledge of cerebral venous anatomy as well as an awareness of its variability, pathology and potential diagnostic pitfalls is imperative for the accurate interpretation of CTA of the head and neck.

### Imaging of Cochlear Implants: State of Art

**LL-NRE4343**

Ahmed Abdel Razek, MD
Suresh K Mukherji, MD

**PURPOSE/AIM**
1- To review basic background about cochlear implants (CI)
2- To review role of imaging in selection of patients candidate for CI
3- To evaluate role of imaging in follow up of children after CI

**CONTENT ORGANIZATION**
1- Background and types of CI devices
2- Idea about surgical procedure of CI
3- Indication of children candidate for CI
4- Tailored technique of CT and MR imaging in children candidate for CI
5- CT and MR imaging of congenital anomalies of inner ear that preclude CI
6- CT and MR imaging of labyrinthine ossification
7- Evaluation of cochlear patency and luminal obstruction
8- Other imaging findings that may complicate surgery and may affect on patient selection for CI
9- Plain radiography and CT scan imaging of electrode position after CI
10- Imaging of other complications after CI
11- MR imaging safety in CI
12- Summary and future directions

**SUMMARY**
The major teaching points of this exhibit are:
1- To be familiar of radiologist with imaging appearance of vestibulocochlear anomalies, cochlear patency and other causes that helps in select children candidate for CI
2- To be familiar of radiologist with imaging of electrode position and other complications after CI

### Cholesteatoma of Petrous Bone: A Pictorial Review

**LL-NRE4344**

Ahmed Abdel Razek, MD

**PURPOSE/AIM**
1- To review basic background about cholesteatoma
2- To illustrate CT reporting and staging system of acquired cholesteatoma of the middle ear
3- To discuss role of imaging in diagnosis and staging of cholesteatoma of the petrous bone

**CONTENT ORGANIZATION**
1- Pathogenesis and pathology of acquired and congenital cholesteatoma
2- Update classification of cholesteatoma of petrous bone
3- Imaging appearance of acquired cholesteatoma of the middle ear cavity
4- Imaging of extension and complications of cholesteatoma of the middle ear
5- CT reporting and staging system of acquired cholesteatoma of middle ear
6- Impact of CT reporting and staging system in selection type of surgery
7- Imaging findings of congenital cholesteatoma of the middle ear
8- Imaging and staging of cholesteatoma of the external ear
9- Imaging of cholesteatoma of the petrous apex
10- Diffusion and contrast MR Imaging of recurrent cholesteatoma
11- Summary and future prospect

**SUMMARY**
The major teaching points of this exhibit are:
1- To be familiar of the radiologist with CT reporting and staging system of acquired cholesteatoma of the middle ear and its impact on type of surgery
2- To highlight imaging findings suggestive of cholesteatoma of the petrous bone
3- Diffusion MR imaging helps in diagnosis of recurrent cholesteatoma

### Connective Tissue Disorders of Head and Neck: Spectrum of Imaging Findings

**LL-NRE4345**

Ahmed Abdel Razek, MD
Dalia Mahfouz, MD

**PURPOSE/AIM**
1- To review basic background about connective tissue disorders of head and neck
2- To review typical and atypical imaging findings of connective tissue disorders at different regions of head and neck

**CONTENT ORGANIZATION**
1- Updated classification, clinical and laboratory findings of connective tissue disorders
2- Imaging appearance of Sjögren syndrome of head and neck
3- Imaging findings of rheumatoid arthritis at head and neck
4- Imaging findings of systemic lupus erythematosus at head and neck
5- Imaging appearance of systemic sclerosis of head and neck
6- Imaging of relapsing polychondritis of head and neck
7- Imaging findings of Behcet’s disease antiphospholipid antibody syndrome and Sneddon’s syndrome of head and neck
8- Imaging findings helps to differentiate connective tissue disorders from other malignancy and inflammatory lesions of head and neck
9- Role of advanced MR imaging such as diffusion MR imaging in assessment of connective tissue disorders

SUMMARY
The major teaching points of this exhibit are:
1- To be familiar of the radiologist with typical and atypical imaging appearance of connective tissue disorders of head and neck.
2- To highlightened imaging findings used to differentiating connective tissue disorders of head and neck from simulating lesions.

Head and Neck Trauma: Key to High-impact Radiological Reporting

LL-NRE4346
Ahmed Abdel Razek, MD
Shefeek Abubacker, MD, FRCR
Hesham Elemam

PURPOSE/AIM
1) To review basic background and classification of head and neck trauma
2) To review typical and atypical imaging findings in patient with head and neck trauma
3) To discus role of advanced imaging in head and neck trauma

CONTENT ORGANIZATION
1- Mechnism, clinical presentation of head and neck trauma
2- Tailored technique for imaging of head and neck trauma
3- Update classification of bony and soft tissue injury of head and neck
4- Skull base injury and CSF leak
5- CT of Nasal bone and frontal fracture
6- Imaging of orbital fracture and associated soft tissue injury
7- Imaging of zygomatic fracture
8- Complex fracture of maxillofacial region
9- Fracture of the mandible
10- Imaging of vascular and soft tissue injury of head and neck
11- Update classification of temporal and temporal bone fracture
12- Imaging of ossicular fracture, facial nerve injury and inner ear injury
13- Impact of imaging findings on treatment planning of patients with trauma
14- Summary and future prospects

SUMMARY
The teaching points of this exhibit are:
1- To be familiar of radiologist with spectrum of bony and soft tissue injury of head and neck
2- To be familiar of radiologist with typical and atypical imaging appearance of bony and soft tissue injury of head and neck

Imaging of Internal Derangement of Temporomandibular Joint

LL-NRE4347
Ahmed Abdel Razek, MD
Suresh K Mukherji, MD

PURPOSE/AIM
1- To illustrate basic background about biomechanics of temporomandibular joint (TMJ).
2- To review clinical classification of internal derangement (ID) of TMJ.
3- To review disc, bony and soft tissue changes in ID of TMJ with MR imaging.
4- To discuss role of other imaging modalities in diagnosis of ID of TMJ.

CONTENT ORGANIZATION
1- Normal anatomy and biomechanics of TMJ.
2- Different pulse sequences of MR imaging of TMJ.
3- Clinical staging of ID of TMJ.
4- Changes in position and shape of disc in ID of TMJ.
5- Retrodiscal abnormalities such as effusion and LPM muscles.
6- Bony changes of condyle and eminence.
7- Role of MR in selection of patient management.
8- Role of advanced MR imaging such as 3 tesla, MR arthrogram and dynamic contrast MR in ID of TMJ.
9- Other lesions simulating ID of TMJ as arthritis, trauma and tumors.
10- Role of panorama, ultrasound and CBCT in ID of TMJ.

SUMMARY
The major teaching points of this exhibit are:
1- To be familiar of radiologist with normal anatomy, technique of MR of TMJ.
2- To be familiar of radiologist for interpretation of disc, retrodiscal soft tissue and bony changes at MR imaging in patients with ID of TMJ.
3- Imaging appearance of other lesions simulating ID of TMJ.

Pre and Post Imaging of Flap of Head and Neck: State of Art

LL-NRE4348
Ahmed Abdel Razek, MD
Suresh K Mukherji, MD

PURPOSE/AIM
1) To illustrate the basic background about biomechanics of temporomandibular joint (TMJ).
2) To review clinical classification of internal derangement (ID) of TMJ.
3) To review disc, bony and soft tissue changes in ID of TMJ with MR imaging.
4) To discuss role of other imaging modalities in diagnosis of ID of TMJ.

CONTENT ORGANIZATION
1- Types and indication of flap of head and neck
2- Imaging modalities used for pre operative planning of flap of head and neck
3- CT and MR Imaging appearance of flap of head and neck
4- Imaging findings of flap viability
5- Imaging findings used to differentiate recurrence from post flap changes
6- Imaging of other complications associated with flap
7- Imaging in follow up of flap surveillance
8- Role of advanced imaging such as diffusion and CTA in pre and post imaging of flap
9- Summary and future directions

SUMMARY
The major teaching points of this exhibit are:
1- To be familiar of radiologist with pre and post imaging of flap of head and neck
2- Imaging helps to differentiate recurrence from post treatment changes and monitoring patient after flap of head and neck.
Fungal Infection of Head and Neck: A Pictorial Review

1. Classification of fungal infection
2. Typical and atypical imaging appearance of invasive and non-invasive fungal infection of head and neck
3. Imaging features used to differentiating fungal infection from simulating lesions

Purpose/Aim

1. To be familiar of radiologist with typical and atypical imaging appearance of invasive and non-invasive fungal infection of head and neck, their staging system and associated complications.
2. To differentiate invasive and non-invasive fungal infection from simulating lesions.

Summary

The major points of this manuscript are:
1. Imaging of congenital anomalies of the temporal bone: State of Art
2. Imaging of thyroid-associated orbitopathy: State of Art
3. Imaging of malformations of midbrain-hind brain: A Pictorial Review

Imaging of Congenital Anomalies of the Temporal Bone: State of Art

Purpose/Aim

1. To illustrate the spectrum of congenital anomalies of the temporal bone.
2. To review embryology, clinical presentation and imaging appearance of congenital anomalies of the temporal bone.

Content Organization

1. Embryology of the ear structures
2. Update classification of congenital anomalies of the ear
3. Technique of CT and MR imaging in child with congenital anomalies of temporal bone
4. Imaging of external auditory canal atresia and imaging scoring system
5. Imaging of ossicles, mastoid and facial nerve anomalies
6. Imaging of congenital anomalies of cochlea and vestibule
7. Imaging of congenital anomalies of semicircular canals and vestibular aqueduct
8. Imaging of anomalies of internal auditory canal and vestibulocochlear nerve
9. Genetic syndromes associated with congenital anomalies of the ear
10. Impact on imaging findings in selection of therapy in congenital anomalies of the ear
11. Role of advanced imaging such as 256-MDCT, diffusion tensor MR and Bold in congenital anomalies of temporal bone
12. Conclusion and future directions

Summary

The major points of this exhibit are:
1. To be familiar of radiologist with imaging appearance of congenital anomalies of the temporal bone.
2. To suspect genetic syndrome in children with congenital anomalies of temporal bone.
3. Imaging has impact on selection of patient therapy.

Imaging of Thyroid-associated Orbitopathy: State of Art

Purpose/Aim

1. To review basic background about thyroid-associated orbitopathy (TAO).
2. To review typical and atypical imaging appearance of TAO with different imaging modalities.
3. To discuss the role of imaging in evaluation state of activity of TAO and follow up after treatment.

Content Organization

1. Pathophysiology, pathology, clinical scores and subtypes of Grave's orbitopathy
2. MR imaging of typical and atypical enlarged extra-ocular muscles and retro-ocular fat in TAO
3. Role of contrast MR and diffusion MR imaging in differentiation of active from inactive disease
4. MR imaging parameters used for diagnosis of associated optic nerve neuropathy
5. MR imaging biomarkers used for monitoring TAO after therapy
6. Imaging of atypical forms of TAO such as unilateral disease, subclinical disease
7. Imaging findings used to differentiate TAO from simulating lesions such as pseudotumor
8. Role of other imaging modalities such as ultrasound, CT and isotope study in TAO

Summary

The teaching points of this exhibit are:
1. To be familiar of radiologists with typical and atypical imaging appearance of TAO at different imaging modalities.
2. MR imaging has a role detect disease activity status, diagnose associated optic neuropathy, suspect atypical forms and monitoring patient after therapy.

Imaging of Malformations of Midbrain-hind Brain: A Pictorial Review

Purpose/Aim

1. To review basic background about development of midbrain-hindbrain (MB-HB).
2. To illustrate recent classification of malformations of MB-HB.
3. To demonstrate MR appearance of malformations of MB-HB.
MR Imaging of Mild Cognitive Impairment: State of Art

Ahmed Abdel Razek, MD
Abdel Halim Tantawy
Mohamed Elsayed

PURPOSE/AIM
1. Basic background about mild cognitive impairment (MCI)
2. To review the anatomical, morphometric and functional changes in MCI
3. To discuss role of MR imaging in patients with MCI

CONTENT ORGANIZATION
1. Consensus criteria and guidelines of MCI
2. Clinical, genetic and CSF biomarkers of MCI
3. Neuropathology and neurobiology of MCI
4. Normal anatomy of hippocampus and temporal region
5. Anatomical and morphometric MR imaging changes in MCI
6. Diffusion MR, perfusion MR and MR spectroscopy findings in MCI
7. MR imaging biomarkers for subtyping of amnestic from non-amnestic MCI
8. MR imaging biomarkers and longitudinal study that predict conversion to Alzheimer disease (AD)
9. MR imaging findings differentiate MCI from other causes of dementia
10. MR imaging of special forms such as MCI with Parkinson and depression
11. Imaging biomarkers used to predict patient response to therapy and outcome
12. Future directions and summary

SUMMARY
The major teaching points of this exhibit are:
1. To be familiar for radiologist with anatomical, morphometric and functional MR changes in MCI
2. MR neuroimaging biomarkers has a role in subtyping of MCI, predict conversion to AD and differentiation from other causes of dementia

Pathologic Conditions of Basal Ganglia System: Involving Patterns, Secondary Changes and Multimodal Findings

Yasutaka Fushimi, MD, PhD
Tomohisa Okada, MD, PhD
Akira Yamamoto, MD, PhD
Mitsunori Kanagaki, MD, PhD
Emiko Morimoto, MD
Takeshi Sawada, MD
Ryo Sakamoto
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Akihiko Sakata, MD
Takahide Kakigi, MD
Toshihiro Inamura
Kaori Togashi, MD, PhD *

PURPOSE/AIM
The purpose of this exhibit is:
1. To review various pathological conditions involving basal ganglia
2. To discuss involving patterns of pathological conditions in the basal ganglia
3. To discuss the importance of involving sites other than basal ganglia and remote effect.
4. To explain effective selection of imaging modality in the diagnosis and realize multimodal imaging findings.

CONTENT ORGANIZATION
1. Imaging patterns of pathological conditions in the basal ganglia.
2. Involving other sites
   Unilateral/Bilateral, surrounding white matter, cerebral cortex, cerebellum, brainstem, CSF space.
3. Review of multi-modal findings and imaging sequences in diagnosis of pathological conditions in the basal ganglia: CT, MR angiography, diffusion weighted imaging, arterial spin labeling, Flow-Sensitive Black Blood, susceptibility weighted imaging; MR spectroscopy, amide proton transfer imaging, PET, and SPECT.

SUMMARY
The major teaching points of this exhibit are:
1. To realize involving patterns and imaging findings of pathological conditions in the basal ganglia will lead to correct diagnosis.
2. To learn of effective selection and/or adding of imaging sequences and modalities might lead to correct diagnosis

Drinking the Kool-Aid: Imaging the Effects of Substance Abuse and Poisoning on the Brain

Ing Berne Yeh, MBBS, FRCR
Raymond Quah, MBBS, BMBS
Edmund Soh, MBBS
Daniel W Chee, MBBS
PURPOSE/AIM
1. Neuroimaging can demonstrate the typical structural changes in the brain caused by substances of abuse and poisons (e.g., bilateral putaminal necrosis from acute methanol poisoning shown in the attached MR image). Imaging thus has an important role in diagnosis and management.
2. Aims of this exhibit:
   a. Illustrate the characteristic imaging changes caused by common substances of abuse and poisons on the brain.
   b. Organize these imaging changes in a format that can aid radiologists in making a diagnosis.

CONTENT ORGANIZATION
1. The typical brain CT and MR imaging findings of the following agents, and pathophysiology behind the imaging appearance, will be covered in pictorial review format: Substances of abuse
   • Ethanol
   • Amphetamines and MDMA (“ecstasy”)
   • Heroin
   • Cocaine
   • Toluene (glue/paint thinner sniffing) Poisons
   • Methanol
   • Carbon monoxide
   • Cyanide
   • Ethylene glycol
   • Heavy metals (lead, arsenic, mercury)
   • Carbon tetrachloride
2. The imaging changes will be summarized in a flowchart that can be used to aid diagnosis.

SUMMARY
Upon completion of this exhibit, the attendee will be able to:
1. Recognize the typical structural imaging changes in the brain caused by common substances of abuse and poisons.
2. With the aid of a flowchart, make a reasonable diagnosis in cases of unknown substance abuse and poisoning.

Eponyms in Neuroradiology: Normal Anatomy, Anatomic Variants, and Their Clinical Significance

Imaging the Cerebral Blood: A Multiparametric Approach Using T2*-based MR Sequences

Vascular Imaging of the Head and Neck for the Non-interventional Neuroradiologist
The objective of this exhibit is to improve the non-interventional neuroradiologist's understanding of arteriopathies affecting the supra-aortic vessels with emphasis on the use of black-blood MRI to assess vessel wall enhancement.

All You Need to Know about the Anatomy and Pathologies of the Parotid Gland

LL-NRE4359
Keith Pettibon, MD
Joel K Cure, MD
Phil Chapman, MD
Pradeep G Bhambhvani, MD
Rasmoni Roy, MD
Asim K Bag, MD
Siddhartha Gaddamanugu, MBBS

PURPOSE/AIM
Numerous pathologies involve the parotid gland. Expectedly, different subspecialty physicians request imaging of the parotid gland to answer unique question(s). Extensive knowledge of the parotid pathologies is the key to successfully answer all those questions. In this educational exhibit we will discuss succinct overview of normal anatomy and different pathologies of the parotid gland and recommend a practical approach that can be easily implemented in day-to-day radiology practice.

CONTENT ORGANIZATION
a) Pictorial depiction of normal anatomy of the gland and relationship with the adjacent structure. b) Succinct discussion of clinical presentation and radiological appearances (mainly on CT and MRI also on sialogram, ultrasound and PET imaging in relevant cases) of different parotid gland pathologies including developmental, inflammatory/infectious, vascular, neoplastic lesions of the gland and ducts. c) Recommendation of algorithm based practical approach that can be easily implemented.

SUMMARY
After careful review of the presentation, the viewer a) will be familiar with normal anatomy of the glandular and duct systems of the parotid gland on CT, MRI and on conventional and MRI sialogram; b) will be familiar with the CT and MRI appearance of the most common parotid pathologies and sialographic, ultrasound and FDG PET appearance in selected pathologies.

Ocular CT Imaging: What Should Radiologists Know in Diagnostic CT Imaging of Ocular Diseases and Incidental Findings of Eyeballs on Head CT Scan

LL-NRE4360
Keizo Tanitame, MD
Nobuyoshi Tanki, MS
Nobuko Tanitame, MD
Wataru Fukumoto
Yukiko Honda, MD
Kazuo Awai, MD *
Yoko Kaichi
Daisuke Komoto, MD
Chihiro Tani, MD
Yuko Nakamura, MD

PURPOSE/AIM
The purpose of this exhibit is to:
1. Review CT images of ocular congenital anomalies and acquired diseases
2. Demonstrate the clinical indication and utility of CT imaging in ocular emergency
3. Show many incidental findings of eyeballs on head CT scan

CONTENT ORGANIZATION
1. Clinical significance of CT scan in ocular emergency: eye rupture, dislocation of the lens, intraocular hemorrhage, and foreign bodies
2. Differential diagnosis of intraocular calcifications: tumors, granulomas, scleral plaques, and others
3. Incidental findings of eyeballs on head CT scan:
   (1) Congenital anomalies: microphthalmus, PHPV, axial myopia, staphyloma, strabismus, and narrow-angle glaucoma
   (2) Acquired diseases: phthisis bulbi, metastases, and detachments
   (3) Post-operative eyes: artificial eye, artificial lens, scleral buckling, silicon oil (or gas) tamponade, and glaucoma drainage device

SUMMARY
1. CT imaging provides useful information for deciding therapeutic strategy in patients with ocular trauma or intraocular foreign bodies.
2. In spite of radiation exposure to the lens, CT imaging is useful for the differential diagnosis of intraocular calcified lesions.
3. As many congenital anomalies, acquired diseases, and post-operative changes of eyeballs are incidentally discovered on head CT scan, radiologists should have enough knowledge of these cases.

Congenital Anomalies of the Internal Acoustic Canal: A Pictorial Review

LL-NRE4361
Bo Arys, MD
Elhamy K Bekhit, MBBS
Surekha Kumbla, FRANZC

PURPOSE/AIM
In children presenting with hearing impairment, cross-sectional imaging has become an integral part of the evaluation. To identify abnormalities that may predict hearing loss prognosis or progression, it is important to be aware of the dimensions of normal structures and the possible abnormalities that can occur.

In this review we specifically focus on the internal acoustic canal.

Since these abnormalities are frequent bilateral and therefore easily overlooked, the purpose of this review is to familiarize readers with the limits of normal and the different abnormal entities that can be encountered so that they are more easily recognized.

CONTENT ORGANIZATION
. Dimensions and morphology of the normal internal acoustic canal (IAC).
. Stenotic IAC
. Stenotic or absent cochlear nerve canal (CNC)
. Duplicated IAC
Intracranial Dangerous Anastomoses?: What the Neuroradiologist Should Know

Frederic Clarencon, MD
Nader Sourour
Federico Di Maria
Jacques Chiras, MD

PURPOSE/AIM
The purpose of this exhibit is: 1. To review the "so-called" intracranial dangerous anastomoses 2. To present clinical cases that highlight these dangerous anastomoses

CONTENT ORGANIZATION
Anatomy and embryology of the ophthalmic artery (AO) and its branches Vascularization of the cranial nerves (CN) Anatomy of the inferolateral trunk and of the meningohypophyseal trunk Review of the main dangerous anastomoses in 3 anatomic areas – Orbital area – Cavernous region – Craniovertebral junction

SUMMARY
The major teaching points of this exhibit are: 1. Knowledge of the intracranial dangerous anastomoses is of tremendous importance to avoid complications during embolization of dural fistula and cranio-cervical tumor lesions. 2. Complete and careful analysis of digital subtraction angiography may help to recognize these dangerous anastomoses.

MR Angiography of the Spine and Spinal Cord: Value and Limitations

Kazuhiro Tsuchiya, MD
Miho Gomyo
Arisa Ohara
Akira Fujikawa, MD

PURPOSE/AIM
1. To know MR angiographic techniques that can be effectively applied to spine and spinal cord diseases. 2. To know spine and spinal cord diseases that can be visualized by MR angiography. 3. To learn advantages and disadvantages of MR angiography of spine and spinal cord diseases when compared with other angiographic methods. 4. Finally to know the clinical value of MR angiography in the diagnosis of spine and spinal cord diseases.

CONTENT ORGANIZATION
1. MR angiographic techniques that can be effectively applied to spine and spinal cord diseases that include 3D time-of-flight MR angiography with or without Gd-based contrast agent, phase-contrast MR angiography, time-resolved contrast-enhanced MR angiography, and others. 2. Visualization of normal spinal vessels by such MR angiographic techniques (This section includes the normal anatomy of spinal vessels). 3. Visualization of pathological abnormal vasculature by such MR angiographic techniques in spinal diseases including dural AVF, perimedullary AVF, intramedullary AVM, hypervascular tumors, and cord ischemia.

SUMMARY
1. MR angiography still remains supplementary in the diagnosis of spine and spinal cord diseases. 2. It should be noted, however, that some diseases could be well visualized and efficiently directed to the final diagnosis by MR angiography.

Noncontrast Time-resolved Cerebral MR Angiography: Initial Clinical Experience

Kazuhiro Tsuchiya, MD
Miho Gomyo
Arisa Ohara

PURPOSE/AIM
1. To know basic principles of noncontrast time-resolved 3D MR angiography based on the arterial spin labeling technique. 2. To know its current status in clinical practice of brain imaging. 3. To learn advantages and disadvantages of the technique when compared with conventional MR angiographic methods.

CONTENT ORGANIZATION
1. A technique of noncontrast time-resolved 3D MR angiography based on the arterial spin labeling technique is presented. 2. Our experience in applying the sequence is illustrated in volunteers and patients with cerebrovascular diseases including major trunk stenosis/occlusion, status after bypass surgery, aneurysm, AVM/AVF, and brain tumor. 3. Discussion is made regarding advantages and disadvantages of the technique as well as future directions.

SUMMARY
1. It has become possible to perform time-resolved 3D MR angiography of the brain without contrast injection by using a technique based on arterial spin labeling. 2. This technique not only visualizes intracranial vessels but also enables assessment of cerebral perfusion in a completely noninvasive manner. 3. This exhibit presents the current status of such an imaging technique in clinical practice.
The major teaching points of this exhibit are:
1. CV is a common occurrence post A-SAH, however not all cases result in DCI.
2. CTA can directly visualize arterial narrowing and demonstrates high sensitivity and specificity in the diagnosis of CV, especially in central vessels.
3. CTP evaluates differences in perfusion parameters to different areas of the brain and demonstrates high sensitivity and specificity in the diagnosis of CV.
4. CTP is better than CTA at predicting which patients require endovascular treatment.

LL-NRE4366
Biao Huang, MD
Wanqun Yang, MD
Hongjun Liu, MD
Shui Xing Zhang, MD
Chang Hong Liang, MD

PURPOSE/AIM
1. To review the spectrum of epidemic encephalitis in the summertime. 2. To review the typical MR imaging appearance of encephalitis commonly found in patients with encephalitis. 3. To illustrate the application of diffusion weighted imaging in patients with encephalitis.

CONTENT ORGANIZATION
1. Brief overview of relevant epidemiological factors of the epidemic encephalitis in the summertime.
2. Clinical/specific laboratory findings in patients with encephalitis.
3. Overview of the most common site for different epidemic encephalitis in the summertime.
4. Pictorial review of MR findings of different epidemic encephalitis in the summertime. The mosquito-borne disease (Japanese encephalitis, West Nile virus encephalitis), the encephalitis in the children (hand-foot-mouth disease combined with encephalitis) and herpes simplex encephalitis are included.
5. The imaging diagnostic role of diffusion weighted imaging on encephalitis is discussed.

SUMMARY
The thalami and basal ganglia are the most common site for the mosquito-borne encephalitis. The medulla oblongata is the most common site for the hand-foot-mouth disease associated with encephalitis. The diffusion weighted imaging has a significant role in assessment of viral encephalitis.

LL-NRE4367
Anna Knobel, MD
Sasan Karimi, MD
Kyung K Peck, PhD
Nicole Petrovich Brennan, BA
John Lyo, MD
Andrei I Holodny, MD*
Robert J Young, MD

PURPOSE/AIM
To review the anatomy of functional motor and language networks using BOLD fMRI.

CONTENT ORGANIZATION
A. BOLD fMRI technique basics
B. Anatomy
C. Case based explanation of BOLD activation sites
D. Applications for preoperative planning
E. Limitations

SUMMARY
The techniques of interpreting BOLD fMRI are presented.
This exhibit will review:
- The basic concepts of BOLD fMRI.
- Common motor and language activation patterns with identification of essential and secondary areas.
- fMRI uses in preoperative planning and its limitations.

LL-NRE4368
Sahar Saleem, MD
Ahmed-Hesham M Said, MD, PhD

PURPOSE/AIM
1. To review the pathophysiology and clinical presentations of PCNSV.
2. To review the current diagnostic criteria of PCNSV: clinical, imaging (angiography, CT, MRI-MRA), and cerebral biopsy.
3. To discuss the MR imaging features of PCNSV.
4. To discuss the MRI features of mimics of PCNSV.

CONTENT ORGANIZATION
1. Review Pathophysiology, classification, clinical presentations of PCNSV
2. Discuss the current diagnostic criteria and specificity of the used clinical and imaging (conventional angiography, CT, MRI) criteria
3. Common MRI findings in PCNSV: using conventional sequences, more recent sequences and MRA
4. Sample of MRI of PCNSV cases and mimics
5. Discuss the current role of MRI in management algorithm of PCNSV
6. Future directions

SUMMARY
1. The current diagnostic criteria of PCNSV are deficient and non-specific and calls for improvement
2. The most common MRI appearances of PCNSV are multifocal rounded supratentorial subcortical, deep white matter and gray matter lesions. Recognizing these findings may help to exclude some mimics of PCNSV
3. Proper MRI study using special MRI sequences (e.g. Diffusion and contrast-enhanced MRA) may potentially help in diagnosis of PCNSV

LL-NRE4369
James Hopkins, MBBS
Saba Hatami, MD, MBBS

PURPOSE/AIM
We aim to provide an overview of parotid mass evaluation to serve as a guide for the general radiologist or radiology registrar/resident. The presentation will provide a refresher in anatomy of the parotid space, a brief review of the most common benign and malignant lesions and their imaging features, information required for surgical management and a summation of available data regarding the utility and limitations of ultrasound guided fine needle aspiration and core biopsy.

CONTENT ORGANIZATION
-Introduction
-Review of parotid space anatomy and important relationships
-Brief overview of the most common benign and malignant parotid lesions and their imaging features
-Radiological information pertinent to surgical management
-Utility/limitations of US guided FNA
The Role of Ultrasonography and DW-MRN in Patients with Non-traumatic Nerve Fascicle Torsion of the Upper Extremity

Hengtao Qi, MA
Guangbin Wang, MD
Zengtao Wang
Lianxin Zhao
Dehua Wang
Xiandong Zhang
Jianbo Teng
Ximing Wang, PhD

PURPOSE/AIM
Peripheral nerve palsy caused by non-traumatic nerve fascicle torsion is rare. Only a few cases have been reported in literatures. The purpose of this study was to evaluate role of ultrasonography and diffusion-weighted MR Neurography (DW-MRN) in the diagnosis of non-traumatic nerve fascicle torsion of the upper extremity.

CONTENT ORGANIZATION
Eleven patients (unilateral upper extremity) who underwent surgical treatment for nerve fascicle torsion were included in this study. Ultrasonography and MRI showed the detailed anatomy of the region well enough to reveal the nerve fascicle torsion, the Characterization and classification (single-segmental or multi-segmental) based on ultrasonography and DW-MRN findings were recorded.

SUMMARY
Ultrasonography and DW-MRN may be valuable in the diagnosis of non-traumatic nerve fascicle torsion of the upper extremity.

Intramedullary Abscess: Key Facts to Achieve a Rapid and Accurate Diagnosis

Hector Vidal Trueba
Sarah Marques Llano
Enrique M De Lucas
Sergio Tapia Concha, MD, Pharm D
Sara Sanchez Bernal
Eduardo Torres Díez
Angelica Lamagrande Obregon

PURPOSE/AIM
The purpose of this exhibit is: - To learn the pathophysiology and most frequent clinical findings of spinal abscess. - To evaluate the main imaging findings and their differential diagnosis. - To analyze the adequate imaging protocol.

CONTENT ORGANIZATION
1. Anatomy of the spinal cord related to spread of intramedullary infection. 2. Pathophysiology of intramedullary abscess. 3. Imaging findings (CT and MRI): best diagnosis clues and imaging recommendations.
   * DTI
   * GRE

4. Clinical Issues and treatment. Follow-up studies. 5. Top differential diagnosis:
   * Intramedullary Neoplasm
   * Acute idiopathic transverse myelitis
   * spinal cord infarction
   * pitfalls

SUMMARY
Intramedullary abscess is a very infrequent but life-threatening disease. Imaging findings must be correlated with clinical and laboratory features to confirm diagnosis. MRI has a key role in the acute management of these patients. DTI permits an accurate diagnosis and facilitate a rapid and accurate diagnosis.

The Cystic Neck Mass

Satpal Kaur, MD
Sylvie Destian, MD
Rashi I Mehta, MD

PURPOSE/AIM
There is a broad differential for cystic neck masses. The goal of this interactive educational exhibit is to present the viewer with a variety of challenging cases that will teach the radiologist how to narrow the differential.

CONTENT ORGANIZATION
An assortment of cystic neck masses will be discussed in an interactive manner with emphasis on the key diagnostic and radiologic features. The cases will be grouped into categories such as congenital/developmental, infectious, and neoplastic, and will include entities such as branchial cleft cyst, ranula, thyroglossal duct cyst, lymphatic malformation, obstructed salivary gland duct, suppulsive nodes, abscess, nodal metastases, nerve sheath tumors and non-Hodgkin’s lymphoma.

SUMMARY
Using a systematic approach, cystic neck masses can be differentiated based on their clinical features, anatomic location and key imaging characteristics.

The Role of MR Imaging in Tongue Cancer Based on Therapeutic Outcomes

Kotaro Sekiya, DDS, PhD
Hirofumi Kuno, MD
Satoshi Fujii, MD
Masaaki Suemitsu, DDS, PhD
Takashi Kaneda, DDS, PhD
Mitsuo Satake, MD

PURPOSE/AIM
The purposes of this educational exhibit are:
1. To review the normal anatomy of the tongue on 3T-MRI in comparison with histopathology.
2. To clarify the patterns of tumor spread in various cases of tongue cancer.
3. To discuss what radiologists need to tell clinicians in order to achieve better therapeutic outcomes.

CONTENT ORGANIZATION
1. Staging of tongue cancer.
2. Normal anatomy of the tongue demonstrated by MR imaging and histopathology.
3. Illustrations of various cases of tongue cancer and patterns of tumor spread related to recurrence and metastasis.
   - a. Focusing on imaging of T4 disease, with deep tumor invasion to tongue muscles (hyoglossus, styloglossus, genioglossus, palatoglossus).
   - b. Focusing on imaging of neurovascular bundle invasion with histopathological correlation.
4. Post-treatment and follow-up imaging.

SUMMARY
Preoperative determination of the extent of tumor invasion into deep structures of the tongue is crucial for clinicians, because treatment can impact heavily on a patient’s quality of life and optimal therapeutic outcome. Radiologists must carefully evaluate deep invasion that may upstage a tumor to T4a, and predict metastasis to lymph nodes. This educational exhibit will present preoperative MR imaging features of commonly occurring extension patterns, along with their histopathological correlates.

Pathology of the External Ear: Spectrum of CT Findings

LL-NRE4374
Swati Deshmukh, MD
David M Yousem, MD *

PURPOSE/AIM
A variety of benign and malignant lesions of the external ear can be identified on CT. The purpose of this exhibit is to expose radiologists to a series of challenging cases in order to help improve the radiologist’s diagnostic accuracy when evaluating the external ear.

CONTENT ORGANIZATION
Cases will be presented in a quiz format. Key differential diagnostic points will be highlighted in the discussion of each case. The list of cases includes: Congenital malformations
- External auditory canal atresia
- 1st Brachial cleft cyst
Infectious/inflammatory
- Medial canal fibrosis
- External otitis/Malignant otitis externa
- Malignant neoplasms
- Squamous cell cancer/basal cell cancer
- Melanoma
Benign lesions
- Cholesteatoma
- Osteoma
- Exostoses
- Keratosis obturans

SUMMARY
The major teaching points of this exhibit are:
1. A variety of benign and malignant pathologies of the external ear can be identified on head CT
2. Characteristic findings and clinical history can help distinguish between different pathologies
3. Suspicious features on head CT may indicate further imaging such as dedicated temporal bone CT or a contrast enhanced exam.

Identifying Primary Motor Cortex on Routine and Advanced Imaging - What the Radiologist Needs to Know

LL-NRE4375
Dhiraj Baruah, MD
Flavius D Raslau, MD
Tushar Chandra, MD
Saurabh Guleria, MD
Andrew P Klein, MD
John L Ulmer, MD *

PURPOSE/AIM
Identifying primary motor cortex (PMC) is critical for integrating patient symptomatology and neurologic disease, and also for pre-surgical planning. The aim of this educational exhibit is to enable the radiologist to accurately and confidently identify PMC on both routine and advanced imaging.

CONTENT ORGANIZATION
In this exhibit, we provide an overview of normal PMC anatomy with corresponding functions on gross anatomic brain specimens. We then discuss normal and variant sulcal anatomy and different anatomical landmarks that aid in the identification of PMC on routine Magnetic Resonance Imaging (MRI). The presentation also includes advanced imaging techniques such as Diffusion Tensor Imaging (DTI) and functional Magnetic Resonance Imaging (fMRI) to help identify PMC. Additionally, pertinent neurologic disease processes involving PMC and a difficult situation in which both routine and advanced imaging were necessary to identify PMC are presented.

SUMMARY
This exhibit will arm the radiologist with strategies to correctly and confidently identify PMC on both routine and advanced imaging exams.

Pearls and Pitfalls: Arterial Spin Labeling in Clinical Practice

LL-NRE4376
Akihiko Wada, MD
Takanoshi Kubo
Akira Hara, RT
Fumio Ohsono, RT
Hirotaka Kitahara
Toshiyuki Okubo, MD

PURPOSE/AIM
To understand the principle, clinical usefulness and and pitfalls of Arterial Spin Labeling MRI.

CONTENT ORGANIZATION
A. Principle of ASL and its advantage on high-field MRI B. Physiological findings C. Pathologic findings D. Statistical analysis (easy to estimate abnormal perfusion ) E. Pitfalls (procedure- / subject- related artifact, pseudo-lesion) : F. Prospects (Can ASL replace brain nuclear medicine?)

SUMMARY
Arterial Spin Labeling is an useful method to evaluate the perfusion abnormality without invasive method. This exhibit reviews, a) the
Posterior Reversible Encephalopathy Syndrome: A Radiologic/Pathologic Correlation

Warren Chang, MD
Andrew J Scarano, MD
Laurence Berg

PURPOSE/AIM
Purpose:
- To review the pathophysiology, epidemiology, and clinical presentation of posterior reversible encephalopathy syndrome (PRES).
- To present a radiologic and pathologic correlation of imaging and post-mortem histologic findings seen in a patient with PRES.
- To discuss the imaging characteristics seen in both PRES and mimics.

CONTENT ORGANIZATION
Patient presentation Review of imaging findings – CT – MRI Radiologic-Pathologic correlation Pathophysiology and epidemiology of PRES Imaging characteristics of PRES The role of diffusion weighted imaging and apparent diffusion coefficient in the diagnosis of PRES and in determining patient prognosis Summary

SUMMARY
Summary:
- PRES presents with signs of vasogenic edema in a hemispheric distribution characteristically including, but not limited to, the occipital/parietal lobes.
- Changes in grey-white distribution on CT and T2 hyperintensity on MRI consistent with diffuse vasogenic edema are imaging findings characteristic of PRES.
- DWI typically reveals isointensity or bright T2 shine through in PRES. Regions with DWI hyperintensity and ADC isointensity (psuedonormalization) are correlated with areas of focal cytotoxic edema overlying large regions of vasogenic edema and also correlated with infarct on post-mortem histopathology.

Beyond the Tumor: CNS Complications in Cancer Patients

Britton J Carter, MD
Brent D Griffith, MD
Nick R Reeser, MD
Rajan Jain, MD*

PURPOSE/AIM
Neuroimaging of cancer patients presents a number of unique challenges, often related to secondary CNS complications caused by either the primary disease or its treatment. Understanding these potential complications is essential for accurate diagnosis, which leads to appropriate clinical management. This exhibit will describe the pathophysiology and imaging appearance of a variety of cancer related CNS complications, and assist the radiologist in making the correct diagnosis.

CONTENT ORGANIZATION
1. Describe the spectrum of CNS complications in cancer patients, including the pathophysiology and imaging appearance.
2. Utilizing a case based-approach, provide examples of these entities, including paraneoplastic syndromes, cerebrovascular complications, and treatment-related effects of radiation and chemotherapy.
3. Discuss management issues related to these CNS complications, including both imaging and clinical follow-up.

SUMMARY
The secondary effects of cancer and cancer related therapies on the CNS have diverse imaging presentations. Unfamiliarity with these complications and their imaging appearance can create confusion for the radiologist, leading to inappropriate or delayed diagnosis. The proposed exhibit will increase awareness of these CNS complications, and assist radiologists in making the appropriate diagnosis to best optimize patient management.

The Systematic Approach to Diagnosing Conductive Hearing Loss in Adults: The Role of Computed Tomography of the Temporal Bone

Yasuyuki Sonoyama
Ai Masukawa, MD
Takayuki Kurinobu, MD
Hitoshi Takeuchi, MD
Junko Araki, MD
Shichiro Katase, MD
Yukari Takada, MD

PURPOSE/AIM
The purposes of this exhibit are:
1) To explain the systematic approach to the temporal bone based on computed tomography (CT) imaging patterns for diagnosing conductive hearing loss in adults
2) To review surgical methods and their indications based on CT of the temporal bone
3) To offer a brief checklist for reporting information an otologic surgeon wants to know

CONTENT ORGANIZATION
1) Flow chart based on CT imaging patterns for diagnosing conductive hearing loss
2) Surgical methods and their indications for operating on the temporal bone
   - mastoidectomy (closed/open cavity)
   - myringoplasty
   - tympanoplasty
   - ossiculoplasty, e. g., Wullstein classification type I-IV
3) Anatomical variations that increase surgical risk
   - high jugular bulb
   - deep sigmoid sinus sulcus
   - low-positioned/absence of tegmen
4) Brief checklist for reporting information required to select appropriate treatment

SUMMARY
Beginning radiologists are unfamiliar with CT of the temporal bone, but understanding a systematic approach to the bone may facilitate diagnosis of conductive hearing loss. In addition, use of checklists can improve imaging reporting and aid appropriate patient management.
Imaging Review of the Causes of Ataxia

Mudassar Kamran, MD
Hilary L Purdy, MD
Michelle M Miller-Thomas, MD

PURPOSE/AIM
Present the imaging strategy for evaluation and the findings of common causes of ataxia.

CONTENT ORGANIZATION
1. Review important causes of ataxia. 2. Discuss differentiating imaging features of the following etiological groups: - Posterior fossa mass lesions - Vascular lesions - Infectious and post-infectious causes - Trauma - Demyelinating disorders - Congenital disorders - Hereditary and idiopathic degenerative processes - Various ataxia associated paroxysmal disorders e.g. epilepsy, migraine etc. - Spinal cord and peripheral nerve related entities - Nutritional deficiency, drugs, and toxins

SUMMARY
Ataxia can arise from disorders involving the nervous system at multiple levels, which may be difficult to localize on the bases of clinical signs and symptoms alone. Consequently imaging assumes a central role. Knowledge of etiological entities, imaging objectives, and the imaging findings associated with specific entities may narrow the differential and often suggest a diagnosis.

It’s Not a Stroke! CT Perfusion Changes in Patients with Stroke Mimic Events

Oscar Sabino Chirife Chaparro, MD
Sebastian Capurro
Antonio Lopez Rueda
Daniel Campodonico
Luis San Roman, MD
Jordi Blasco, MD*
Juan Miguel Macho
Laura Oleaga

PURPOSE/AIM
To review the prevalence and relevance of stroke mimic situations in clinical practice. To present CT perfusion (CTP) findings that can be observed in different conditions that may mimic a stroke in the emergency room (ER).

CONTENT ORGANIZATION
Definition, prevalence and relevance of stroke mimics.
CTP findings in the following conditions:
Seizures.
Tumors.
Migraine.
Hypertensive encephalopathy.
Inflammatory demyelinating diseases.
Others: Metabolic encephalopathies, acute confusional state, conversion disorder.

SUMMARY
Stroke mimics are common and difficult to manage situations on clinical practice. Several conditions that mimic stroke may present with characteristic perfusion changes which can be detected with CTP. CTP is accepted in the initial assessment of acute ischaemic stroke and is useful to differentiate it from other pathologies that may masquerade as acute stroke.

Neuroradiologic Manifestations in Langerhans Cell Histiocytosis

Gabriel J Runner, MD
Anna Nidecker, MD
Peter Shen, MD
Matthew Bobinski, MD, PhD
Paul S Lee, MD
Nafi Aygun, MD

PURPOSE/AIM
The purpose of this exhibit is:
1. To review the pathophysiology and clinical presentation of Langerhans Cell Histiocytosis (LCH).
2. To discuss the various neuroradiologic findings of LCH as seen in a series of 25 patients, while avoiding diagnostic pitfalls.
3. To review the classification of neurologic lesions seen in LCH according to their MRI morphology as discussed in literature.

CONTENT ORGANIZATION
- History and pathophysiology
- Clinical presentation
- Imaging findings
- Radiographs and CT - skull and craniofacial involvement
- MRI - hypothalamic-pituitary involvement, parenchymal and extra-axial lesions, and neurodegenerative patterns
- Review of brain parenchymal manifestations of LCH and classification scheme as discussed in the literature
- Summary

SUMMARY
1. Most common neuroradiologic finding in LCH is the classic lytic bone lesion that typically involves the skull base and petrous bones.
2. Most common CNS manifestation in LCH is infiltration of the hypothalamus and pituitary, with diabetes insipidus as the best recognized clinical presentation.
3. Additional CNS involvement by LCH may appear as mass-like, infiltrative, or degenerative, with symmetric signal abnormalities that can involve the pons, cerebellum and basal ganglia. Occasionally discrete meningeal, choroidal and parenchymal lesions may be seen.

Deep Brain Stimulation: A Practical Guide to Indications, Imaging and Safety

Christine M Glastonbury, MBBS*
Ulrich A Rassner, MD*
Deep brain stimulators (DBS) are largely used for the treatment of movement disorders but have been gathering more interest for the treatment of psychiatric disorders, chronic pain and epilepsy. We present a review of the theory, current clinical indications and perhaps most importantly for the radiologist, the role we must play in imaging patients before, during and after DBS placement.

Purpose/aim

Deep brain stimulators (DBS) are largely used for the treatment of movement disorders but have been gathering more interest for the treatment of psychiatric disorders, chronic pain and epilepsy. We present a review of the theory, current clinical indications and perhaps most importantly for the radiologist, the role we must play in imaging patients before, during and after DBS placement.

Content organization

A: Theory, Equipment and Clinical Indications for DBS
1. Movement Disorders
2. Psychiatric Disorders (Treatment-Resistant Depression, Refractory Obsessive-Compulsive Disorder, Addiction)
3. Chronic Pain
4. Refractory Epilepsy B: Pre-Operative Imaging
1. What radiologists should look for, what surgeons want to know.
2. The operative landmarks C: Intra-Operative MR for Image-Guided Procedures D: Post-Operative Imaging
1. Expected post-operative findings
2. Early and late complications E: MR Safety Concerns
1. Image-guided procedures
2. Post-DBS placement imaging (scan guidelines, tips to reduce SAR)

Summary

This exhibit emphasizes the complexity of imaging DBS patients. The radiologist plays important perioperative roles for placement of the device and in advising clinicians on how these patients can be safely imaged in the MR environment.

'Diffusion Is Negative. Now What?!' Useful Non-DWI MRI Signs in the Ischemic Stroke of the Middle Cerebral Artery at 3T

LL-NRE4384
Silviu Draghici, MD
Aikaterini Fitsiori, MD
Nicoleta Rotaru
Pierre Emmanuel Zorn
Adriana Bogorin
Maher Abu Eid
Jean-Louis Dietemann, MD

Purpose/aim

The purpose of this exhibit is: 1. To identify and demonstrate the signs identified on FLAIR, T2* and Susceptibility-Weighted Imaging which support the stroke diagnosis. 2. To present the pathophysiology behind these signs. 3. To explain the importance of these signs in clinical proven stroke patients with a negative-DWI exam.

Content organization

Mechanisms of stroke compensation Review of imaging findings - FLAIR - T2* - SWI Physiopathology behind imaging findings Sample cases

Summary

The major teaching points of this exhibit are: 1. The Hyperintense Artery sign on FLAIR and Hypointense Deep and Superficial Veins sign and Hypointense Thrombus sign in T2* and SWI are very common findings in the acute stroke patient. 2. Even in the absence of DWI findings, all the above signs can be confidently used to make an acute stroke diagnosis. 3. SWI is much more sensitive than T2* for detecting Hypointense Veins and Thrombus.

Cerebral Venous Thrombosis: Key Signs to Avoid the Underdiagnosis

LL-NRE4385
Cecilia Santos Monton
Ricardo Corrales Pinzon
Jose Manuel Villanueva Rincon
Teresa Gonzalez De La Huebra Labrador
Pilar Sanchez De Medina Alba
Roberto Correa Soto

Purpose/aim

The objective of this exhibit is: 1. To understand the pathophysiology of the cerebral venous thrombosis and to know its typical clinical manifestation. 2. To try to avoid the underdiagnosis or misdiagnosis of cerebral venous thrombosis knowing the imaging findings on the different techniques. 3. To know how to use the optimal radiologic technique to diagnose cerebral venous thrombosis.

Content organization

- Clinical presentation and pathophysiology of the cerebral venous thrombosis
- Imaging techniques and findings
- Common diagnostic pitfalls
- Cases to illustrate the radiologic features

Summary

Cerebral venous thrombosis is an uncommon disorder with nonspecific clinical manifestations. Imaging techniques are essential for its diagnosis: MR imaging, MR venography and CT venography are the most useful techniques. Knowledge of the anatomy, the normal venous variations, the common pitfalls and the key findings will help us achieve an accurate diagnosis and not to underdiagnose cerebral venous thrombosis.

Extraocular Manifestations of Chronic Progressive External Ophthalmoplegia (CPEO): What Radiologists Need to Know?

LL-NRE4386
Nucharin Supakul, MD
Annette C Douglas, MD

Purpose/aim

1. To understand the pathophysiology imaging findings, and natural history of Chronic Progressive External Ophthalmoplegia (CPEO).
2. To recognize extra-ocular manifestations of CPEO on imaging studies.
3. To demonstrate how the presence of extraocular finding may aid in distinguishing CPEO from other clinical.

Content organization

1. Introduction
2. Pathophysiology of CPEO
3. Clinical presentation and differential diagnosis
4. Characteristic imaging findings and differentiation from other etiologies
5. Extra-ocular manifestation of CPEO
6. Pitfalls in image interpretation
7. Natural history and clinical outcomes
8. Sample cases and mimics
9. Summary

SUMMARY
1. CPEO is a clinical syndrome of diverse causes, all sharing the combination of ophthalmoparesis, ptosis of the eyelids, and normal pupils.
2. It is important to differentiate CPEO from other etiologies, especially myasthenia gravis and Graves ophthalmopathy, owing to differences in prognosis and treatment.
3. Neuroradiologists should be familiar and aware of the extra-ocular manifestations in CPEO patients to guide diagnosis in case of uncertain clinical history.

Evaluation of the Pontine Perforators of the Basilar Artery Using Digital Subtraction Angiography in High Resolution and 3D-rotation Technique

LL-NRE4387
Stephanie Lescher, MD
Tanja Samaan
Joachim Berkefeld, MD

PURPOSE/AIM
The purpose of this exhibit is:
- To review the microvascular anatomy of the proximal and the middle portion of the basilar artery
- To discuss the superficial ramifications of the arteries and their points of penetration on brain stem surfaces with similar patterns to the spinal cord vascular supply
- To demonstrate that latest generation of flat panel neuroangiography allows for reliable visualization of the pontine branches of the basilar artery

CONTENT ORGANIZATION
- Diagnostic imaging – analysis of DSA-images and 3D rotational angiography reconstructions obtained on biplane neuroradiological angiography equipment
- Anatomical findings - the microvascular anatomy of the proximal and the middle portion of the basilar artery
- Sample cases - e.g. patients with basilar thrombosis or stenosis
- Future directions and clinical significance

SUMMARY
The major teaching points of this exhibit are:
- Demonstrate that 3D-rotation technique is able to visualize reliable the penetrating branches of the brainstem in vivo
- Show reconstruction tools for visualization the brains stem vessels using 3D-rotation technique on a biplane neuroradiological angiography equipment
- Review basic anatomical patterns of the penetrating branches
- Discuss our findings with descriptions in literature

MD-CT Imaging of Spinal Cord Vascular Network in Pre- and Post- endovascular Repair of the Descending Thoracic Aorta

LL-NRE4388
Umberto Rossi, MD
Paolo Rigamonti, MD
Michele Carmo
Alberto Settembrini
Marco Politi
Carla Uggetti
Maurizio Cariati, MD

PURPOSE/AIM
The aim of this work was to evaluate the spinal cord vascular network changes in pre- and post- endovascular repair of the descending thoracic aorta patient by Multi-Detector Computed Tomography (MD-CT) imaging.

CONTENT ORGANIZATION
In endovascular repair of the descending thoracic aorta, the role of segmental artery occlusion and the changes of blood flow to the spinal cord in postoperative period are not clear. A better understanding of the response of the spinal cord blood supply to segmental artery sacrifice should help us to understand the possible risk of paraplegia after endovascular repair of the descending thoracic aorta. So, the spinal cord vascular network was studied in pre- and post-endovascular repair of descending thoracic aorta patients by MD-CT. Vascular anatomy variants, diameter of segmental artery and possible new vascular networks were evaluated.

SUMMARY
post-endovascular repair of descending thoracic aorta there is a remodeling of the spinal cord blood supply by a complex vascular network. This network is the responsible of the absence of paralegia after endovascular repair of descending thoracic aorta.

Is Magnetic Resonance Imaging of Orbit and Brain Highly Recommendable before Choosing the Right Treatment for Retinoblastoma?

LL-NRE4389
Paolo Galluzzi, MD
Sara Leonini
Sandra Bracco, MD
Sonia De Francesco, MD, PhD
Paola Gennari, MD
Alfonso Cerase, MD
Paolo Toti, MD
Daniela Galimberti, MD
Ignazio Maria Vallone, MD
Lucia Monti, MD
Mauro Caini, MD
Samuele Cioni

PURPOSE/AIM
to evaluate the usefulness of pre-treatment Magnetic Resonance Imaging (MRI) in the final decision of submitting patients to Superselective Ophthalmic Artery Chemotherapy Infusion (SOACI), a recently introduced technique alternative to eye enucleation in retinoblastoma.

CONTENT ORGANIZATION
In endovascular repair of the descending thoracic aorta, the role of segmental artery occlusion and the changes of blood flow to the spinal cord in postoperative period are not clear. A better understanding of the response of the spinal cord blood supply to segmental artery sacrifice should help us to understand the possible risk of paraplegia after endovascular repair of the descending thoracic aorta. So, the spinal cord vascular network was studied in pre- and post-endovascular repair of descending thoracic aorta patients by MD-CT. Vascular anatomy variants, diameter of segmental artery and possible new vascular networks were evaluated.

SUMMARY
post-endovascular repair of descending thoracic aorta there is a remodeling of the spinal cord blood supply by a complex vascular network. This network is the responsible of the absence of paralegia after endovascular repair of descending thoracic aorta.

Is Magnetic Resonance Imaging of Orbit and Brain Highly Recommendable before Choosing the Right Treatment for Retinoblastoma?
findings can facilitate appropriate treatment and prevent potentially devastating complications.

SUMMARY

Magnetic Resonance Imaging of the Ethmoid Sinus; Critical Zone of the Sinonasal Cavity

Jonathan K Park, MD
Bryan Y Yoo, MD
Juan P Villablancana, MD

PURPOSE/AIM
- Briefly review imaging findings of intracranial hypotension from cerebrospinal fluid (CSF) leak from a dural spinal tear - Illustrate a novel imaging method, the 'chalice technique,' for CT localization of CSF leak site - Describe 2 novel techniques for blood patch placement for complex ventral spinal CSF leaks

CONTENT ORGANIZATION
A. Imaging findings of intracranial hypotension due to CSF leak from dural spinal tear (CT, MRI)
B. Review of indications, standard technique of blood patch placement
C. Overview of 'Chalice Technique' for localizing ventral CSF leak
D. Blood patch techniques for complex ventral dural tears
I: Anterior cervical approach
E. Blood patch techniques for complex ventral dural tears
II: CT-Guided transfornaminal approach

Outcomes

SUMMARY

In properly selected patients with complex ventral CSF leaks, utilization of the 'chalice technique' for localization of dural defect, and the novel image-guided transcervical and transfornaminal techniques for ventral blood patching may provide safe and effective alternatives to avoid potentially morbid surgical exploration and repair. This exhibit will review: A. Imaging of intracranial hypotension B. 'Chalice Technique' for CT localization of large ventral CSF leaks C. Novel blood patch techniques for complex ventral dural tears

Magnetic Resonance Imaging of the Pituitary in the Pediatric Population

Rachel Shield, MD
Rajiv Mangla, MD
Jeevak Almast, MD

PURPOSE/AIM
The purpose of this educational exhibit is to: 1. Educate on the normal appearance of the pituitary and common anatomic variations of the pituitary seen in the pediatric population. 2. Provide case based examples to teach the common and rarer forms of pediatric pituitary pathology on MRI.

CONTENT ORGANIZATION
Brief review of pituitary embryology and anatomy. Normal MRI appearance of the pediatric pituitary gland. Overview of pediatric pituitary pathology (adenomas, suprasellar tumors, cystic lesions, systemic conditions, anatomic variations, etc.) with a generalized description of MRI findings. Interesting case based examples of the various forms of pituitary pathology, both common and rare in the pediatric population. Future directions and summary.

SUMMARY

The major teaching points of this exhibit are to: 1. Emphasize the importance of pituitary imaging by MRI in the pediatric population. 2. Provide both common and rare MRI case based examples of pituitary pathology in order to increase the general awareness of pediatric specific disease.

Imaging of the Ethmoid Sinus; Critical Zone of the Sinonasal Cavity

Akihumi Fujita, MD
Hiroyuki Fujii, MD
Yukio Kimura, MD
Edward K Sung, MD
Naoko Saito, MD, PhD
Osamu Sakai, MD, PhD *
Hideharu Sugimoto, MD

PURPOSE/AIM
Although the ethmoid sinus is a very small anatomic region, it is adjacent to many critical structures such as the skull base, orbit, and optic nerve. As such, lesion originating from the ethmoid sinus may be associated with various clinical findings and critical complications. The purpose of this exhibit is to:
1. Review the anatomy and normal variations of the ethmoid sinus.
2. Review the various pathologies that can originate from the ethmoid sinus, and discuss the differential diagnoses based on cross sectional imaging findings.
3. Understand importance of prompt recognition of ethmoid sinus lesions.

CONTENT ORGANIZATION
1. Anatomy
2. Normal variations
3. Inflammatory conditions - mucocele, fungal disease
4. Fibro-osseous lesions
5. Benign and malignant tumors and tumor-like conditions - papilloma, carcinomas, esthesioneuroblastoma, lymphoma, sarcoma, organized hematoma, vasculitis
6. Associated complications - intracranial, orbital, optic neuritis, perineural tumor spread

SUMMARY

Lesions originating from the ethmoid sinus are uncommon, however include various pathologies. Radiologists should be familiar with cross-sectional imaging findings of the normal anatomy and common pathologies the ethmoid sinus, since prompt recognition of critical findings can facilitate appropriate treatment and prevent potentially devastating complications.

Magnetic Resonance Imaging of Optic Nerve

Foram B Gala, MBBS, MD
Kunai B Gala, MBBS, MD
Ankit B Shah, MBBS, RRA

SUMMARY

12 patients were not submitted to endovascular treatment: 10 because of suspicion of optic nerve and/or tunic infiltration leading to enucleation, 2 because of suspicion of trilateral retinoblastoma. Histology confirmed infiltrations in 9 out of 10 eyes.

SUMMARY

MRI of orbits and brain is highly recommendable before submitting patients to endovascular chemotherapy treatment.
## Evaluation of Ring-enhancing Lesions in an Immunocompetent Patient: Getting beyond the MAGIC

**PURPOSE/AIM**
1. To review the anatomy of optic nerve
2. Elaborate optimum MRI techniques
3. Assess various pathologies affecting optic nerve
4. Subtle Imaging clues to arrive at accurate diagnosis

**CONTENT ORGANIZATION**

Anatomy: Optic nerve is divided into 4 segments: intraocular, intraorbital, intracanalicular and intracranial. Acute loss of vision:
1) Inflammatory: optic neuritis - can be first manifestation of multiple sclerosis 2) Pseudotumor - involvement of optic nerve along with retrobulbar fat, extra ocular muscles, uveo-scleral area. 3) Infective - herpes, HIV, mumps, rubella 4) Vascular occlusion: acute anterior ischemic optic neuropathy 5) Raised intracranial hypertension 6) Traumatic


**SUMMARY**

There are multiple pathologies affecting optic nerve resulting in loss of vision/ blurring of vision. Based on duration of symptoms and imaging findings, one can accurately diagnose the pathology.

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## Uncommon TMJ Pathologies: A Pictorial Essay Utilizing CT and MRI

**LL-NRE4394**

**Nick R Reeser**, MD  
**Britton J Carter**, MD  
**Suresh C Patel**, MD  
**Pranav S Doshi**, MD

**PURPOSE/AIM**
1. Review normal TMJ anatomy.
2. Examine the imaging findings and pathologic changes of uncommon lesions involving the TMJ.
3. Demonstrate the appropriate utilization of CT and MRI for imaging such pathological conditions.
4. Increase awareness of these rare, yet important TMJ disorders to improve timely diagnosis and treatment.

**CONTENT ORGANIZATION**

1. CT and MRI appearance of normal TMJ anatomy. 2. Case-based review, including imaging findings and pathological correlation of uncommon TMJ lesions. 3. Examples include but are not limited to Amyloidoma, Synovial Osteochondromatosis, Tenosynovial Giant Cell Tumor, Eosinophilic Granuloma, and Ewing's Sarcoma.

**SUMMARY**

TMJ pathologies are often missed clinically and on diagnostic imaging leading to a delay in diagnosis and appropriate treatment. Presented is a series of cases involving benign and malignant processes with pathological correlation. This will lead to increased awareness of these uncommon conditions resulting in improved diagnosis and patient management.

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## Parathyroid Carcinoma: Diagnostic Pitfalls and Review of the Literature

**LL-NRE4395**

**Kyung Mi Lee**, MD  
**Ji Young An**  
**Woo S Choi**, MD  
**Eui Jong Kim**  
**Chang-Woo Ryu**, MD

**PURPOSE/AIM**
To discuss the comparable imaging features to differentiate parathyroid carcinoma from thyroid nodule or parathyroid adenoma To gain an awareness of the useful clinical features to diagnose the parathyroid carcinoma To learn the ideal imaging modalities to help ascertain the diagnosis and management strategies

**CONTENT ORGANIZATION**

- Review of clinical features of parathyroid carcinoma - patient: age, sex, medical and family history, symptom - laboratory data (serum parathyroid hormone, calcium) - Review of imaging features - lesion location (extrathyroidal vs. intrathyroidal) - US - 99mTc-Sestamibi scan
- CT - Sample cases and mimics - Future directions to help diagnosis and summary

**SUMMARY**

The major teaching points of this exhibit are: 1. Parathyroid carcinoma should be suspected in patients with hypercalcemia, familial hyperparathyroidism, MEN type 1, head and neck radiation history and with invasive sonographic findings. 2. Parathyroid carcinoma located within thyroid gland can be difficult to diagnose and fine needle aspiration is limited value in diagnosing parathyroid carcinoma. 3. A combination of radiological modalities including US with 99mTc-Sestamibi scan need to be utilized.

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## Evaluation of Ring-enhancing Lesions in an Immunocompetent Patient: Getting beyond the MAGIC

**LL-NRE4396**

**Natalia Marks**, MD  
**Irene Hotalen**  
**Evan G Stein**, MD, PhD  
**Jon H Edwards**, MD

**PURPOSE/AIM**
Various entities can manifest as ring-enhancing lesions, including infection, neoplasm, radiation necrosis and demyelinating disease. On imaging, no single feature is pathognomonic but certain considerations such as enhancing wall/central signal characteristics, surrounding edema, and the number/morphology of lesions can help narrow the differential diagnosis. Our objective is to review distinctive characteristics of representative etiologies using conventional imaging techniques and present algorithms which guide the on-call Resident to a shorter differential.

**CONTENT ORGANIZATION**

1. Intro to ring-enhancing lesions
2. Discussion of CT, MRI (T1, T2, GRE, Post-Gad, DWI, ADC) characteristics with representative examples:
   - Primary brain neoplasm: Metastasis; Brain abscess; Tuberculoma; Neurocysticercosis; Demyelinating disease; Radiation necrosis; Infarction
3. Algorithms for differential diagnosis:
   a. Number/size/morphology of lesions
   b. CT/MRI characteristics

**SUMMARY**

Differential diagnosis of ring enhancing lesions can potentially encompass a wide variety of pathology. This educational exhibit will provide the on-call Resident with essential tools to narrow and appropriately rank the differential with a systematic approach using conventional imaging, leading to elimination of unnecessary work-up by the referring physician and facilitation of patient care.
PURPOSE/AIM
Diplopia is a common symptom with multiple etiological factors. We present a series of challenging cases in order to accurately diagnose intracranial causes of diplopia. We also show the approach to be taken while evaluating diplopia.

CONTENT ORGANIZATION
The series of cases include: 1) primary lesions of 3rd, 4th, 6th cranial nerves - schwannoma 2) Tolosa Hunt syndrome, cavernous sinus/parasellar lesions involving 3rd, 4th, 6th cranial nerves 3) extraocular muscles: pseudotumour, myositis, sinusitis, myasthenia gravis, thyroid orbitopathy 4) traumatic blowout fractures of orbit 5) non traumatic dehiscence of medial orbit wall 6) chondrosarcoma compressing cranial nerve 7) optic nerve lesions: multiple sclerosis 8) intracranial lesions: stroke/ infective granulomas

SUMMARY
Numerous pathologies can result in diplopia. Clinical history with examination of cranial nerves serve as a guide to decide the best modality (CT/ MRI). Knowledge of causes of diplopia and anatomy and course of cranial nerves (III, IV, VI) as well as visual pathway help to arrive at correct diagnosis.

Magnetic Resonance Imaging of Intracranial Cystic Lesions

PURPOSE/AIM
We routinely encounter cystic lesions in the brain. Aim of this presentation is: 1. To illustrate the spectrum of intracranial cystic lesions 2. To categorise them and discuss role of MRI in each of them 3. Discuss role of newer sequences and advanced techniques like MR spectroscopy and Perfusion in differentiating them

CONTENT ORGANIZATION
Etiological Classification Normal variant: enlarged perivascular spaces, cavum septum pellucidum, cavum vergae Congenital/Developmental: choroid plexus cyst, dermoid, epidermoid, arachnoid cyst, pineal cyst, colloid cyst, pars intermedia cyst, Rathke's cyst Infective: neurocysticercosis (NCC), tuberculomas, hydatid cyst, abscess Inflammatory: multiple sclerosis, ADEM Post-traumatic or post-infarct cysts: porencephalic, cystic encephalomalacia, leptomeningeal cyst Neoplastic: cystic meningioma, primary glial tumours with necrosis, cystic metastases Certain MRI sequences i.e restricted diffusion in epidermoid differentiates from arachnoid cyst, low ADC in tuberculous lesions as compared to NCC. SWI can identify scolex in NCC. MRS in giant tuberculoma, primary neoplasm. MR perfusion differentiates neoplastic and non-neoplastic lesions.

SUMMARY
Based on location, symptomatology and appearances on conventional sequences and newer MRI techniques accurately characterise and classify the intracranial cystic lesions.

An Anatomical Review of the Muscles of Facial Mimicry with Special Emphasis on the Superficial Musculoaponeurotic System (SMAS)

PURPOSE/AIM
1. Provide an overview of the different layers of the face and elaborate a practical approach to easily identify the individual facial mimic muscles classifying them according to their insertion sites.
2. Discuss the SMAS and its different regionally specific anatomy within the face medial and lateral to nasolabial fold.
3. Compare the superficial fibroadipose tissue and the deep adipose tissue in the different regions of the face.
4. Render a better understanding of the clinical significance of superficial facial anatomy.

CONTENT ORGANIZATION
Our presentation will be organized into groups of facial muscles based on their insertion sites. This will primarily be done using cross-sectional images and atlas drawings.

SUMMARY
Due to their common embryologic origin, the facial muscles are a complex group of closely intertwined structures that allow primarily for facial expression. Superficial facial anatomy is a “terra incognita” on cross-sectional imaging and not a routinely discussed topic during residency training. Having a foundational understanding of normal superficial facial anatomy will allow radiologists to better assist clinicians in the diagnosis of certain disease processes that can potentially affect these structures including cleft palate deformities, face lift rhytidectomy surgeries, denervation, and various tumors.

3D ASL in Clinical Practice: Are You Making Most of It?

PURPOSE/AIM
3D ASL allows us to get non-contrast whole brain perfusion in a minute. It enables us to apply it to various disorders and has been used in
Cross Sectional Imaging of Skull Base Apertures: Small and Tiny But Significantly Important

 LL-NRE4401
 Mar Jimenez De La Pena
 Raquel Cano Alonso
 Antonio Maldonado , MD
 Manuel Recio Rodriguez
 Javier Carrascoso Arranz
 Vicente Martinez De Vega , MD *

 PURPOSE/AIM
 Neurodegenerative diseases are a continuous challenge for both the departments of radiology and neurology. Overlapping clinical findings are commonly found in these cases, and therefore neuroimaging is frequently requested. Although degenerative brain diseases occasionally show some MR imaging structural findings that can lead to a definitive diagnosis, advanced functional imaging (MR-spectroscopy, diffusion tensor imaging, functional MR and FDG-PET) also provide useful information for an early diagnosis of these disorders, and specially for the evaluation of the disease evolution.

 CONTENT ORGANIZATION
 A pictorial review of morphological findings of the most common neurodegenerative diseases is provided, including Alzheimer dementia, multisystem atrophy, hypertrophic olivary degeneration, frontotemporal dementia, amyotrophic lateral sclerosis, Parkinson disease, and Creutzfeld-Jacob disease. We specially focus in the utility of diffusion tensor imaging for the diagnosis of some of these diseases due to the early involvement of the uncinate fasciculus.

 SUMMARY
 We review morphological MR findings obtained from conventional pulse sequences, as well as the spectrum of findings that can be observed in advanced functional imaging in the most commonly found degenerative brain diseases in the daily practice.

 Doctor, What Is Wrong with My Eye? Case-based Approach to Imaging Ophthalmologic Lesions

 LL-NRE4402
 Fabiana C Policeni , MD
 Bruno A Policeni , MD
 Wendy R Smoker , MD

 PURPOSE/AIM
 - Provide a case-based review of varied pathologies that present with ophthalmologic complains.
 - Correlate imaging finding with the clinical presentations.

 CONTENT ORGANIZATION
 Management of ophthalmologic conditions can be a life-saving encounter for the ophthalmologist and radiologist. Imaging is indispensable in several of these presentations. Knowledge of the clinical presentation is very helpful to guide the recommendation and interpretation of imaging studies. We present a series of ophthalmologic clinical presentations, including painful ptosis, painless homonymous hemianopia, bilateral optic disc edema, homonymous hemianopia in a febrile patient, progressive bilateral ophthalmoplegia with mental status change, pupil involving third nerve palsy, proptosis with red eyes, ophthalmoplegia after vomiting, transient monocular visual loss, bitemporal hemianopsia, anisocoria with neck pain, and painful ophthalmoplegia. These cases are formatted in an interactive approach.

 SUMMARY
 Ophthalmologic conditions can present with a wide variety of initial clinical symptoms. Imaging studies are critical for helping the referring clinician arrive at the final diagnosis. Knowledge of these various conditions is important for the general radiologist.

 Cross Sectional Imaging of Skull Base Apertures: Small and Tiny But Significantly Important

 LL-NRE4403
 Foram B Gala , MBBS, MD
 Ankit B Shah , MBBS, RRA
 Kunal B Gala , MBBS, MD
 Darshana Rasalkar , FRCR
 Bharat M Gala , MBBS

 PURPOSE/AIM
 1. To understand the complicated anatomy of skull base.
 2. To correctly identify the foramina, canals and fissures in base of skull on CT and MRI.
 3. To understand the spread of various pathological processes.

 CONTENT ORGANIZATION
 Skull base is formed by ethmoid, sphenoid, occipital and paired temporal and frontal bones. Various Apertures are: 1. ethmoids: cribiform plate 2. sphenoid: optic canal, foramen rotundum, ovale, spinosum, foramen lacerum, vidian canal, superior orbital fissure 3. temporal: internal auditory canal, Eustachian tube, Facial nerve canal, jugular foramen, petrous carotid canal 4. occipital: foramen magnum, hypoglossal canal. We also enumerate various skull base sutures and identify them on CT scan, avoiding misdiagnosing them as fractures. We also describe communications of pterygopalatine fossa as it is important pathway in spread of disease between intracranial and neck spaces.

 SUMMARY
 Skull base apertures allow connections between the cranial cavity and various facial structures i.e. nasal cavity, paranasal sinusus, orbits and nasopharynx. These foramina also communicate with deep spaces of neck i.e. parapyargenal space, masticator space, carotid, retropharyngeal and perivertebral spaces. Knowledge of its anatomy and contents is extremely important to assess the spread of skull base pathologies.

 Cortical Malformations: Simplified Approach to This Complex Spectrum

 LL-NRE4404
 Foram B Gala , MBBS, MD
 Ankit B Shah , MBBS, RRA
 Kunal B Gala , MBBS, MD
**PURPOSE/AIM**
1. To describe recent classification for cortical malformations
2. To understand the pathogenesis of each of these
3. To illustrate MRI findings and describe approach to diagnose them

**CONTENT ORGANIZATION**
Classification: Group I-Malformations Secondary to Abnormal Neuronal and Glial Proliferation or Apoptosis

- Microcephalies
- Megalencephalies
- Cortical dysgeneses with abnormal cell proliferation (hamartomas in tuberous sclerosis, focal cortical dysplasia type II)

Group II-Malformations Secondary to Abnormal Neuronal Migration

- Heterotopia
- Lissencephalies
- Subcortical heterotopia

Group III-Malformations Secondary to Abnormal Postmigrational Development

- Polymicrogyria and Schizencephaly
- Focal cortical dysplasias
- Postmigrational microcephaly

**Imaging Checklist:**
- Outside to in: Size of cranial cavity - small/big
- Cortex: thickened, dysplastic
- Gyri: many (poly), less (agyria) or none (lissencephaly)
- Double cortex - band heterotropia
- Periventricular: nodules, cleft - Schizencephaly
- Associated findings: muscular dystrophies, findings of tuberous sclerosis, congenital cytomegalovirus

**SUMMARY**
MRI can reliably categorise cortical malformations. Knowledge of various MR appearances and correct diagnosis helps the clinician to counsel, assess prognosis and plan therapy.

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**An Imaging Approach to Acute Headaches**

**PURPOSE/AIM**
The purpose/aim of this exhibit is:

1. To describe the approach to an acute presentation of a headache
2. To review the differential diagnosis of an acute headache with focus on serious, life-threatening pathologies
3. To show imaging examples of life-threatening pathologies on Doppler US, CT and MRI

**CONTENT ORGANIZATION**
- Review headache classification
- Review parameters used in clinical assessment of acute headaches (history, physical exam, laboratory findings)
- Differential diagnosis with focus on signs/symptoms indicative of serious, life-threatening pathologies
- Discuss and evaluate the current imaging techniques used in assessing acute headaches
- Image examples of life-threatening pathologies that present as headaches
- Summary and clinical significance/implications

**SUMMARY**
The major teaching points of this exhibit are:

1. Historical and clinical findings indicative of serious pathologies (e.g., first, worst, or sudden onset headache; progressively worsening headache; new onset in immunosuppressed patient)
2. Life-threatening diagnoses for acute headaches (e.g., subarachnoid hemorrhage, cervical artery dissection, cerebral venous thrombosis, giant cell arteritis)
3. Identify characteristic findings of various life-threatening pathologies that present as acute headaches on Doppler US, CT and MRI

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**Neurodermatoradiology**

**PURPOSE/AIM**
The goal of this exhibit is to introduce the niche of ‘neurodermatoradiology’, which consists of depicting skin lesions on neuroimaging studies. Skin lesions may be germane to the imaging study, such as with neurocutaneous syndromes or skin malignancies. Skin lesions may also be detected incidentally on neuroimaging and recommendations for managing these findings will be reviewed. In addition, it is important to recognize the expected post-treatment findings in the head and neck.

**CONTENT ORGANIZATION**
- Anatomy
- Neurocutaneous syndromes - NF 1, NF 2, Tuberous sclerosis, PHACES syndrome
- Neurocutaneous melanosis
- Sturge-Weber
- Basal cell nevus syndrome
- Incontinentia pigmenti
- Skin tumors
- Skin appendage lesions
- Primary malignancies
- Inclusion cyst, pilomatrixoma, cystadenoma
- Metastases
- Trauma
- Lacerations
- Hematomas
- Foreign bodies
- Third-spacing
- Infectious and inflammatory processes
- Cellulitis
- Abscess
- Herpes-Zoster
- Scleroderma
- Perry-Romberg disease
- Post-treatment
- Mohs surgery
- Reconstructive skin flaps and grafts
- Cosmetic facial fillers and implants

**SUMMARY**
Familiarity with the imaging features of dermatological processes and their management is important.

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**Radiological Features of Chemobrain**

**PURPOSE/AIM**
The effects of chemotherapy can have distinct effects on the brain. These effects depend upon the type of chemotherapy agent and can be potentiated by administration of radiation. The various neuroimaging manifestations of chemotherapy and implications for management are reviewed.

**CONTENT ORGANIZATION**
1. The mechanism of action of the following agents will be reviewed: methotrexate, cytarabine, carmustine, cyclophosphamide, cisplatin, bleomycin, avastin, temozolomide, L-asparaginase
2. The imaging features of the following conditions will be depicted:
   - Posterior reversible encephalopathy syndrome
   - Cerebral venous sinus thrombosis predisposed by treatment
Several chemotherapy agents can lead to neurotoxicity, which can have a variety of neuroimaging manifestations. Familiarity of these conditions is essential for management of neuro-oncology patients.
Endovascular Occlusion of Very Small Intracranial Aneurysms—What the Interventional Neuroradiologist Needs to Know

**LL-NRE4411**
Martin Oselkin, MD
Jay Shah, BA, MD
Razvan Buciuc, MD

**PURPOSE/AIM**
Within the past decade, endovascular coiling has proven to be safe and effective and has supplanted neurosurgical clipping as a first line treatment. However, coiling of very small aneurysms (VSA) has been met with concern due to the risk of perforation or incomplete occlusion. Over the past few years, several studies have examined different techniques to address these concerns. The purpose of this presentation is to review and compare the various techniques available for the Interventional Neuroradiologist to successfully occlude VSA.

**CONTENT ORGANIZATION**
1. Introduction
2. Natural history: Rupture and Re-rupture rates.
3. Is it feasible?: Size, Location, Anatomy, Un-ruptured vs ruptured
4. Is it safe?: Complications, Rate of hemorrhage, Patient status, Un-ruptured vs ruptured
5. Techniques: Standard single microcatheter approach, Multiple microcatheters, Balloon assisted, Stent assisted.
6. Indications and Contraindications.
7. Follow-up

**SUMMARY**
1. Occlusion of very small aneurysms have similar long term results as larger aneurysms.
2. Techniques available for the Interventional Neuroradiologist to successfully occlude very small aneurysms.
3. Indications for endovascular occlusion.

Mimics of Hemorrhage on Susceptibility Weighted Imaging (SWI)

**LL-NRE4412**
Taha M Mehemed, MBCh
Akira Yamamoto, MD, PhD
Tomohisa Okada, MD, PhD
Mitsunori Kanagaki, MD, PhD
Yasutaka Fushimi, MD, PhD
Kaori Togashi, MD, PhD*

**PURPOSE/AIM**
To review basic concepts of SWI and discuss the origins of low signal on SWI with emphasis on the importance of the underlying high-pass filtered phase images in differentiating hemorrhage from other causes of low signal.

**CONTENT ORGANIZATION**
1. Basic concepts of SWI
   - T2*WI vs SWI, magnitude and high-pass filtered phase images, minIP SWI images, QSM
2. Clinical image examples of SWI
   - Tumors, Vascular diseases, Degenerative diseases, Inflammatory and infectious diseases
3. Low signal on SWI
   - Diamagnetic vs. paramagnetic causes
4. Methods to differentiate low signal
   - High-pass filtered phase images can differentiate between diamagnetic vs. paramagnetic substances
5. Pitfalls of SWI:
   - Susceptibility artifacts, Orientation within main magnetic field, chemical shift artifacts

**SUMMARY**
The major teaching points of this exhibit are:
1. To offer an easy to understand explanation of SWI basic concepts
2. To shed a spotlight on causes of low signal on SWI other than hemorrhage
3. To offer an easy to use method to differentiate between possible causes of low signal on SWI based on high-pass filtered phase image contrast with no further post processing.

Bilateral Thalamic Lesions: A Pictorial Review

**LL-NRE4413**
Yingming Amy Chen, MD
Walter J Montanera, MD
Aditya Bharatha, MD

**PURPOSE/AIM**
To present the available imaging modalities in assessing the thalamus, and the specific utility of each modality
- To discuss the clinical pathologies that involve bilateral thalami
- To present imaging features specific to each diagnosis, and review the pathophysiology of both common and rare presentations

**CONTENT ORGANIZATION**
- Structural and vascular anatomy of the thalamus
- Imaging modalities and their utility in evaluation of the thalamus: enhanced CT head, MR diffusion weighted imaging, MR angiography, MR venography, MR spectroscopy
- Radiologic differential diagnoses of bilateral thalamic lesions
- Clinical, laboratory and imaging features of 1) acute and 2) chronic pathologies involving bilateral thalami
- Appropriate clinical and radiologic followup
- Available treatment strategies

**SUMMARY**
Bilateral thalamic lesions are often first detected by radiologists on CT or MRI, and represent a spectrum of acute and chronic conditions. Knowledge of the characteristic imaging pattern of specific thalamic lesions, combined with familiarity of the associated clinical and laboratory features, will facilitate prompt diagnosis and direct treatment.
**Susceptibility Imaging in Clinical Neuroradiology: The Key Sequence in an Expanding Group of Diseases**

**PURPOSE/AIM**
1. To demonstrate findings of susceptibility imaging in a wide spectrum of neurological diseases. 2. To provide clinical examples where susceptibility imaging can improve detection of microscopic hemorrhage and thrombus within vessels, which may not be apparent on CT or conventional MRI sequences.

**CONTENT ORGANIZATION**
Cases will be presented with clinical information and key MR images including the dramatic findings on susceptibility sequences. Cases: Fat Emboli, Disseminated Intravascular Coagulation (DIC), Sickle Cell Crisis, Petchel Hemorrhage in Severe Thrombocytopenia, Hemorrhagic Posterior Reversible Encephalopathy (PRES), Cerebral Amyloid Angiopathy, Acute Infarct, Developmental Venous Anomaly, Cavernous Angioma, Capillary Telangiectasia-Brainstem and Supratentorial, Bacterial Meningitis, Hemorrhagic Tumor, Post Radiation Therapy, Superficial Siderosis, Cortical Vein Thrombosis.

**SUMMARY**
Susceptibility imaging is a powerful imaging tool in depicting venous structures, blood products, and calcium or other paramagnetic materials within the brain. We demonstrate a wide spectrum of neurological diseases where susceptibility imaging can provide invaluable diagnostic and in some instances prognostic information that may not be apparent on standard imaging methods.

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**Perfusion Imaging for Patient Surveillance in Brain Tumor Follow-up: A Single Institution Perspective**

**PURPOSE/AIM**
Patient surveillance in neuro-oncologic imaging has traditionally relied on measurement of the contrast enhancing lesion, using either the RECIST or Macdonald criteria. While limitations of these methods due to treatment effects has increased the role of perfusion imaging as an adjunct technique, its use at a single time-point limits its effectiveness as an imaging biomarker. The purpose of this review is to discuss the importance of serial perfusion imaging in patient surveillance, focusing on the benefit of sequential analysis at multiple time-points.

**CONTENT ORGANIZATION**
1. Discuss the role of perfusion imaging in brain tumor evaluation, including as a diagnostic and prognostic biomarker.
2. Discuss the importance of serial perfusion imaging and its advantage over single time-point analysis.
3. Through case examples, demonstrate serial perfusion imaging’s role in aiding clinical decision making, particularly when integrated with clinical factors and cancer genomics.

**SUMMARY**
Perfusion imaging is an important adjunct to conventional MR in patient surveillance, but use at a single time-point limits its effectiveness as an imaging biomarker. This exhibit will show the advantages of serial perfusion imaging, demonstrating how integration with clinical factors has positioned it as an important “comprehensive biomarker” in brain tumor management.

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**Brain Imaging Features of Immune Reconstitution Inflammatory Syndrome (IRIS)**

**PURPOSE/AIM**
Immune reconstitution inflammatory syndrome (IRIS) develops secondary to a dysregulated inflammatory response to antigenic stimuli from dead or latent opportunistic microorganisms or self antigens such as myelin in patients whose suppressed immune systems are reconstituted by treatment. IRIS mostly affects the lungs and liver and CNS involvement is rare. Highly active antiretroviral therapy, MS and systemic malignancies may also develop IRIS if they are infected with opportunistic microorganisms. CNS-IRIS is characterized by a paradoxical deterioration of patient’s neurologic condition while HIV viral load is decreasing, CD4+ T-cell count is increasing. The aim of this study is to describe brain imaging findings of IRIS.

**CONTENT ORGANIZATION**
Pathophysiology of IRIS
The factors underlying IRIS
Clinical data about patients
Review of imaging findings
- Conventional MRI (contrast enhancement patterns, mass effect etc.)
- Diffusion weighted imaging
Sample cases
**SUMMARY**
Multifocal high signal abnormalities on T2/FLAIR images with punctuate and curvilinear contrast enhancement at the edges of white matter lesions without significant mass effect of diffusion restrictions were the common imaging features of CNS IRIS. Presence of these findings in immune compromised patients with recent reconstitution of immunity should prompt the diagnosis of CNS IRIS.

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**Advanced Interpretation of CT Angiography in Acute Ischemic Stroke: Pearls and Pitfalls**

**PURPOSE/AIM**
1. To review the study protocol with multimodal CT of acute stroke, focusing on CT Angiography
2. To underscore the value of a complete and accurate reading of CT Angiography
3. To review the main pathologies we should look for
4. To assess the role of CT angiography in the acute management of these patients
1. To review the study protocol with multimodal CT of acute stroke:
   - Routine unenhanced CT
   - CT Angiography
   - Role of CT Angiography in the management of acute ischemic stroke

2. CT Angiography main findings to be evaluated:
   - Location of occlusion or stenosis
   - Length and density of the thrombus
   - Distal collateral blood flow
   - Assessment of brain parenchyma with CTA source images
   - ASPECTS
   - Road mapping for endovascular treatment

3. Overview the main pathologies of supra-aortic arteries and circle of Willis:
   - Embolism
   - Atherosclerotic disease
   - Arterial dissection (extracranial and intracranial)
   - Fibromuscular dysplasia
   - Moya-Moya disease

4. Pearls and pitfalls:
   - Distal obstruction ICA
   - Cord sign
   - Main dilated vessel sign
   - CTP and clinical correlation
   - Anatomic variants

SUMMARY

CT Angiography has a key role in the acute management of acute ischemic stroke. An accurate knowledge of main findings to look for is crucial to obtain a rapid and useful report.

**Neuroimaging Findings in Migraine and Prognostic Implications**

**LL-NRE4418**
Sarah Marques Llano
Hector Vidal Trueba
Elena Lopez Uzquiza
Eduardo Torres Diez
Natalia Valle San Roman
Enrique M De Lucas, MD
Eva Ruiz Perez

**PURPOSE/AIM**
The purpose of this exhibit is:
1. To analyze the clinical features of migraine, which should suggest the possibility of associated findings in neuroimaging procedures.
2. To review the main neuroimaging findings that can be found in a patient with migraine.
3. To assess the role of MRI in the management of these patients.

**CONTENT ORGANIZATION**
1. Update on clinical management of migraine:
   - Main clinical features
   - Clinical subtypes
2. Imaging study protocol:
   - MRI
   - CT
   - PET
3. Imaging findings of migraine patients:
   - White matter lesions:
     i. assessment of clinical relevance
     ii. correlation with aura duration and number of migraine attacks with aura
     iii. differential diagnosis
     - Ischemic cortical lesions, especially subclinical posterior circulation territory infarcts
     - Hemiplegic migraine
     - Altered cerebral perfusion and neurovascular coupling
     - Functional imaging studies: to advance our understanding of the underlying migraine mechanism
   - Secondary migraines and Mimics: AVMs, neoplasms...
4. Role of imaging findings in the management and follow-up
5. Gallery of cases

**SUMMARY**
It is important to perform an adequate imaging - clinical correlation.
MR is the diagnostic method of choice for evaluation of migraine patients.

**Imaging Marker for Diagnosis of Progressive Supranuclear Palsy**

**LL-NRE4419**
Erika L De La Cruz Reyna, MD
Blanca Kanagusico
Alfonso Gil Valadez

**PURPOSE/AIM**
To identify the characteristic signs by magnetic resonance of supranuclear progressive paralysis and their differential diagnosis because is often underdiagnosed with other atrophic pathologies such as Parkinson's disease.

**CONTENT ORGANIZATION**
1. Description:
   - Neurodegenerative disorder description
   - Clinical characteristics
   - Supranuclear origin
   - Statistical Information
2. Histologic Findings:
   - Main histologic findings
   - Phosphorylated tau protein forming neurofibrilar ball
   - Gliosis and neuronal loss in the basal ganglia regions, midbrain, oculomotor nerves, bulb and dentate nucleus
3. Image Characteristics:
   - Characteristic changes by magnetic resonance
   - Midbrain atrophy flattening and / or concavity
   - Penguin or hummingbird signs
4. Conclusions:
   - Know the image changes for the differential diagnosis by MRI

**SUMMARY**
You must know the image changes for the differential diagnosis by MRI for the progressive supranuclear palsy to make an accurate diagnosis and to avoid underdiagnosed as Parkinson's disease, multiple system atrophy Parkinsonian type, corticobasal degeneration or Lewy bodies dementia.
Assessment of Vascular Wall Thickening on T1-weighted Imaging Is More Reliable than MR Angiography for Grading Severity of Intracranial Arteriosclerosis

Kentaro Akazawa
Kei Yamada, MD
Jun Tazoe, MD
Kaori Nishida
Mariko Goto, MD
Koshi Terayama

PURPOSE/AIM
To test the diagnostic value of conventional T1-weighted imaging (T1WI) for assessing the severity of arteriosclerosis of the intracranial cerebral arteries. Comparison was made with magnetic resonance angiography (MRA).

CONTENT ORGANIZATION
MRA and carotid duplex scanning were performed in 42 patients to investigate cerebrovascular disease and arteriosclerosis. Magnetic resonance imaging (MRI) acquired at 1.5 T was used to evaluate the degree of wall thickening of the basilar artery on conventional T1WI and to evaluate irregularity of the cerebral artery on MRA; the severity of arteriosclerosis was classified into four grades by the consensus reading of two radiologists. We measured maximum intima–media thickness (IMT) of the bilateral common carotid arteries using ultrasound, which was used as the gold standard. Disease severity as judged on MRA did not show correlation with the averaged maximum IMT value \( (P = 0.15) \), but evaluation of arterial wall thickening on T1WI showed meaningful correlation \( (P = 0.030) \).

SUMMARY
It is important to perform combined assessment of the findings of MRA and arterial wall thickening in evaluating arteriosclerosis. When grading the severity of intracranial arteriosclerosis, assessment of vascular wall thickening on T1-weighted imaging is more reliable than MR angiography.

Multiparametric Magnetic Resonance Imaging of Brain Neoplasms: Current State of the Art

Jeffrey Ware, MD
Suyash Mohan, MD
Krishan K Jain, MD
Ronald L Wolf, MD, PhD
Elias R Melhem, MD, PhD

PURPOSE/AIM
Purpose:
1. To review the limitations of conventional MRI in the assessment of brain neoplasms
2. To understand how Multiparametric MRI (MP-MRI) offers the possibility to noninvasively and simultaneously assess multiple different aspects of underlying pathophysiology to assist in diagnosis, grading, and management of brain neoplasms
3. To illustrate, with examples, various clinical implementations of MP-MRI in the evaluation of brain neoplasms

CONTENT ORGANIZATION
Overview of conventional MRI in the assessment of intra-axial brain neoplasms.

1. Contributions
2. Limitations

Review of physiologic neuroimaging techniques pertinent to brain tumors

1. Diffusion MRI
2. Perfusion MRI
3. Proton MR spectroscopy

Evidence-based multiparametric integration and thresholding Clinical applications: Algorithms and examples

1. Acquisition
2. Diagnostic algorithm: Enhancing intra-axial mass
3. Diagnostic algorithm: Non-enhancing intra-axial mass
4. Diagnostic algorithm: Treatment monitoring (pseudoprogression and pseudoresponse)
5. Tumor mimics

SUMMARY
This comprehensive review of MP-MRI provides the reader with an understanding of the contribution of various physiologic imaging parameters in the clinical assessment of brain neoplasms, in addition to knowledge of how to apply them in specific clinical scenarios.

Midline Masses in the Head and Neck: A Location Based Review

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Rabia Arpaci
Yasemin Karaman
Taner Arpaci
Feramuz Demir Apaydin

PURPOSE/AIM
The purpose of this exhibit is

1. To review typical and atypical midline masses of the head and neck excluding intracranial lesions.
2. To discuss clinical and imaging features which allow differential diagnosis.

CONTENT ORGANIZATION
We reviewed midline masses of the head and neck and categorized them according to their location.

Head: cephaloceles, dermoid, sinus pericranii, hemangioma, lipom
Nasal/nasofrontal: dermoid, nasal glioma, nasal septal abscess
Maxilla: nasopalatine ductus cyst
Nasopharynx: adenoid hypertrophy, nasopharynx carcinoma, lymphoma, thornwaldt cyst, antrochonal polip
Tongue/oropharynx: dermoid, lingual tyroid
Hypopharynx: epidermoid carcinoma
Retropharynx: abscess
Anterior neck: thyroglossal ductus cyst, cervical tycm cyst, delphian node
Skull base: chordoma

SUMMARY
Radiological findings along with the patient's age and clinical history are essential for the diagnosis when a mass is encountered in the head or neck. Midline location is a typical feature for a group of pathologies. On the other hand; some lesions may be seen in the midline as an incidental finding. Therefore; location based approach to the common and uncommon midline masses of the head and neck is relatively helpful in guiding appropriate diagnosis.

**Off the Wall: Imaging Intracranial Arteries with Black Blood MRA**

Gerald J Palagallo, MD
Aaron M Rutman, MD
Mahmud Mossa-Basha, MD

**PURPOSE/AIM**
To familiarize the viewer with the technique of performing intracranial black blood MRA (BBMR). To review the pathophysiology of four disease entities that affect the intracranial arteries and explain how it relates to the black blood MRA features of each.

**CONTENT ORGANIZATION**
- Technique - Pathophysiology and imaging features of atherosclerosis, arterial dissection, RCVS, and vasculitis - Cases - Artifacts & Pitfalls

Familiarity with the underlying pathophysiology helps explain the BBMR features of several intracranial arterial disease entities. BBMR can evaluate vessel wall characteristics while luminal imaging (MRA, CTA, DSA) does not, which can help differentiate causes for intracranial arterial stenosis. Differentiating features include patterns and signal characteristics of vessel wall involvement, presence, pattern, and degree of enhancement, and lesion distribution. This technique could limit the number of invasive diagnostic procedures that a patient undergoes (e.g. lumbar puncture, angiography, and brain biopsy), while also guiding very different and potentially harsh treatment regimens. BBMR can also guide biopsies to prevent false negative results by indicating inflamed, enhancing arteries.

**From the Nasal Fossa to the Endocranium: Narrowing the Differential**

Albert Pons Escoda
Monica Cos Domingo, MD
Miguel A Lemus Rosales, MD
Amadeo Muntane Sanchez
Sara C Llanes, MD, PhD
Xavier Gonzalez Compta

**PURPOSE/AIM**
To narrow the differential diagnosis for nasal fossa lesions that can extend to the endocranium.

**CONTENT ORGANIZATION**
The most frequent processes in nasal fossa extending to the endocranium are malignant. They share characteristics, but some clues can help to the diagnostic:
- Carcinomas are non differentiable on imaging. They are heterogeneous, destructive and show intermediate signal on T1 and T2.
- Lymphoma and melanoma tend to be remodelative, homogenous and hyperdense on NECT. Melanoma shows high T1 signal and lymphoma highly restricted diffusion.
- Presence of peripheral cysts in the cranial margin of a lesion must suggest esthesioneuroblastoma.
- The most frequent sarcoma will be chondrosarcoma of the nasal septum.
- Metastasis are exceptional and have unspecific appearance.
There are also benign lesions that can behave similarly:
- Ossified matrix of osteomas makes them easy to recognize.
- Meningiomas clues are avid enhancement, calcifications, dural tail and hyperostosis.
- Aggressive fungal sinusitis is a malignant mimicker with spiculated infiltrating margins. The clue is T2 deeply hypointense core.
- Granulomatous process like sarcoidosis and Wegener are diagnosis of exclusion.

**SUMMARY**
Behavior with bone, MR signal, clinical scenario and epidemiologics; help to narrow the differential of these processes classically hard to elucidate.

**Smoke in the Brain: The Clinical Implications of Imaging Features in Moyamoya Disease**

Sheng Che Hung, MD *
Tze-Chen Yeh *
Feng-Chi Chang *
Wan-Yuo Guo, MD, PhD *
Hsiu-Mei Wu, MD
Cheng-Yen Chang, MD

**PURPOSE/AIM**
The purpose of this exhibit is: 1. To review the pathophysiology of chronic cerebral hypoperfusion 1. To review the key imaging features of moyamoya disease and their clinical implications 2. To discuss new neuroradiological techniques that may be useful in clinical management

**CONTENT ORGANIZATION**

**SUMMARY**
The major teaching points of this exhibit are : 1. To be familiar with the imaging characteristics of moyamoya disease and their clinical implications 2. A comprehensive MR imaging protocol, including carbogen-challenged test, perfusion-weighted imaging, susceptibility-weighted imaging, and diffusion-weighted imaging, can provide hemodynamic assessment and risk stratification of moyamoya disease.

**Visual Assessment of Arterial Spin-labeling MR Imaging (ASL-MRI) for Acute Ischemic Stroke**

Tomoyuki Noguchi
Hiroyuki Irie, MD, PhD
Masashi Nishihara, MD
Tetsuyoshi Hirai, MD
Masanobu Mizuguchi, MD
Yukiko Hara, MD
Non-invasive Assessment of Cerebral Blood Flow and Metabolism by Using Advanced MR Imaging Techniques

LL-NRE4428
Makoto Sasaki, MD *
Kohsuke Kudo, MD
Jonathan Goodwin
Fumio Yamashita, PhD
Satomi Higuchi
Ikuko Uwano, PhD
Kenji Ito, PhD
Taisuke Harada
Kuniaki Ogasawara, MD

PURPOSE/AIM
1. To understand the current concepts underlying neuroimaging for assessment of ischemic penumbra in acute ischemic stroke and misery perfusion in hemodynamic ischemia.
2. To demonstrate advanced MR techniques used to visualize abnormalities in cerebral circulation, perfusion, and metabolism in acute and chronic ischemias.

CONTENT ORGANIZATION
A. Ischemic penumbra in acute stroke and misery perfusion in hemodynamic ischemia
B. Collateral circulation imaging using advanced MR angiography (MRA)
C. Perfusion imaging using perfusion-weighted imaging (PWI) and arterial spin labeling (ASL)
D. Oxygen extraction fraction (OEF) imaging using quantitative susceptibility mapping (QSM)
E. Brain temperature imaging using MR spectroscopy (MRS)
F. pH imaging and hypoxia imaging using other advanced techniques

SUMMARY
Recent advanced MR imaging techniques can non-invasively evaluate impaired cerebral circulation, perfusion, and metabolism in acute and chronic ischemias, which have been assessed by other invasive modalities such as PET, SPECT, and DSA. This exhibit reviews a. Current concepts of ischemic penumbra and misery perfusion b. MR techniques that can visualize abnormalities of cerebral blood flow and metabolism.

Fatty Lesions of the Head and Neck

LL-NRE4429
Sean O’Neill, MD
Michael Letzing, MD
Natalya Nagornaya, MD
Rita G Bhatia, MD

PURPOSE/AIM
Fat-containing lesions are commonly encountered entities in head and neck imaging, both as incidental findings and as the target of imaging in patients with a symptomatic or palpable mass. Although many are benign, there is always the possibility of a low-grade malignancy masquerading as a lipoma—for instance, a well-differentiated liposarcoma. Fortunately, there are established criteria for the evaluation of fatty masses with CT and MR. We will provide a refresher on these criteria and a review of grading in liposarcoma.

CONTENT ORGANIZATION
Participants will be shown a series of cases and offered the chance to determine whether selected cases are most likely benign or malignant. A variety of cases will be presented, including both common and rare fatty lesions from the benign and malignant categories. An emphasis will be placed on the diagnostic criteria for differentiating benign from malignant masses. The participant will again see the case series, with case-by-case explanation of imaging characteristics, grade where appropriate, and final tissue diagnosis.

SUMMARY
Fat-containing masses are common in the head and neck, and should be evaluated closely for malignant features. Using established criteria, the radiologist can provide crucial information regarding the necessity of further follow-up or tissue diagnosis and help prevent unnecessary procedures.

Essential Subcortical Tracts in Language and Reading. 3D-Tractography Correlated with Intraoperative Electrostimulation

LL-NRE4430
Mar Jimenez De La Pena
Santiago Gil Robles
Javier Carrascoso Arranz
Manuel Recio Rodriguez
Carlos Ruiz Ocana
Vicente Martinez De Vega, MD *
Agustin Acevedo Barbera, MD
Federico Gonzalez Gonzalez

PURPOSE/AIM
On the basis of the brain mapping data, specific subcortical tracts seem to be essential for language and reading. These tracts are clearly identified in diffusion tensor imaging (DTI) studies, being situated near the cortical language areas. We review the function and the anatomic relations of these tracts based on the DTI studies. We also provide a correlation of the findings...
from the DTI studies with the subcortical intraoperative mapping in a large serie of patients with lesions near eloquent areas.

**CONTENT ORGANIZATION**

Preoperative fMRI and DTI studies in a serie of 22 patients with tumors located near eloquent language areas, evidenced the anatomic relations of their main subcortical fascicles involved in language and reading. A subcortical intraoperative mapping were performed in these patients, showing a complete anatomic correlation of the stimulated tracts with the information obtained from the DTI data. These main tracts were the arcuate fascicle, the inferior frontooccipital and the inferior longitudinal tracts, the subcallosal fascicle and the optic radiations.

**SUMMARY**

DTI sequences are a powerful preoperative tool in the daily practice to localize the subcortical fasciculus involved in language and reading, as show the good anatomic correlation with the subcortical intraoperative mapping.

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**The Importance of Knowing the Lymphatic Spread Patterns of Head and Neck Cancer for Accurate Nodal Staging on CT: A Practical Schematic Guide**

**LL-NRE4431**

Alba L Reyes Ortiz, MD
Lina M Cruz Hernandez, ARRT
Elena Capilla
Rafael Gonzalez Gutierrez
J. M. Garcia Benassi
Isabel Herrera

**PURPOSE/AIM**

Our aim is to provide a practical guide to improve the knowledge of lymphatic spread patterns of head and neck cancer as a useful tool to interpret lymphadenopathies on computed tomography (CT) images and thus achieve a more accurate nodal staging. We will illustrate this with real cases from our institution, correlating CT images with the results of neck dissection.

**CONTENT ORGANIZATION**

1. Anatomy of the lymph node stations in the neck:
   - Medical illustrations
   - Color code CT images
2. CT signs of pathologic nodes:
   - Medical illustrations
   - Color code CT images
3. Lymphatic drainage patterns of head and neck cancer:
   - Medical illustrations
   - Color code CT images
4. Practical guides for nodal staging
   - Diagnostic algorithms
   - Tables
   - CT images

**SUMMARY**

Viewers of this educational exhibit will learn:
- The anatomy of lymph node stations according to the TNM system and node groups that are not covered by the standard nodal system
- Discuss CT imaging criteria used routinely to detect lymphatic macroscopic disease according to size, shape and density.
- The lymphatic drainage patterns of head and neck cancer.
- The peculiarities of thyroid cancer lymphatic dissemination compared to the other head and neck cancers.
- To make a more precise nodal staging of head and neck cancer on CT by adequate knowledge of the previous items.

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**Head and Neck Paragangliomas - Typical and Atypical Presentations. Pictorial Essay and Literature Review**

**LL-NRE4432**

Maira Sarpi, MD
Leticia S Rocha
Regina L Gomes, MD
Marcio Ricardo T Garcia, MD
ula Passos, MD
Eloisa M Gebrim, MD
Flavia I Cevasco, MD

**PURPOSE/AIM**

To acknowledge typical and atypical (tongue base, orbit, nasal cavity, larynx, tympanic membrane) presentations of head and neck paragangliomas, demonstrated by clinical cases with CT and MRI images, and also with angiographic, endoscopic and pathologic (macroscopy) correlation. One case of malignant paraganglioma will be presented. To review head and neck anatomy modifications related to these tumors, highlighting the recognition through imaging findings of the most common lesions.

**CONTENT ORGANIZATION**

Correlation between the embryologic origin of paragangliomas and its occurrence sites. Correlation between tumor characteristics and imaging findings. Review of the literature with special attention to uncommon / atypical presentation, exemplified by clinical cases.

**SUMMARY**

Paragangliomas are uncommon tumors, with particular imaging characteristics. Typical lesions in head and neck determine anatomic changes that allow differentiation between the three most common sites: carotid body, jugulotympanic and vagal. Although rare, atypical presentation may occur in unexpected sites, and eventually paragangliomas may have imaging features suggestive of malignancy. It is important for the radiologist to recognize these unusual presentations, including them in the differential diagnosis for head and neck high-vascularized lesions.

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**Neuroimaging Findings in Hepatic Encephalopathy**

**LL-NRE4433**

Seyedmehdi Payabvash, MD
Alexander M McKinney, MD *
Gregory L Thalken, MD

**PURPOSE/AIM**

1. To briefly review the pathophysiology of hepatic encephalopathy
2. To describe the neuroimaging findings in patients with hepatic encephalopathy with emphasis on their clinical correlation, pathogenesis, and evolution
3. To discuss the diagnostic/prognostic value of neuroimaging findings

**CONTENT ORGANIZATION**

- Pathogenesis, clinical symptoms, and classification of hepatic encephalopathy
- MRI finding
  - Basal ganglia T1 hyperintensity (and concomitant susceptibility changes)
  - Periventricular and cortical FLAIR hyperintense lesions
  - Increased cerebral ADC
### Diffusion-restricted lesions
- **MR Spectroscopy**
  - Decreased myoinositol and choline in basal ganglia
  - Elevated glutamine and glutamate in basal ganglia
- **fMRI and resting-state fMRI**
- **PET study**
  - FDG PET and 15O PET for evaluation of cerebral blood flow
  - 13N-ammonia PET to assess cerebral ammonia metabolism

### SUMMARY
- Neuroimaging techniques may allow development of tools for objective, reproducible, and noninvasive diagnosis and monitoring of hepatic encephalopathy progression and response to treatment
- Certain neuroimaging findings are associated with neurological sequelae
- There is a difference in resolution time course for different imaging alterations
- The degree of signal abnormality and the volume changes correlate with severity of symptoms in patients with hepatic encephalopathy

### Evaluation of Post-Treatment Intracranial Aneurysms with a Focus on Contrast Enhanced MRA Protocol Optimization and Interpretation Pitfalls

**LL-NRE4434**
- **Kathleen Wooten**, MD
- **Manuel C Fortes**, MD
- **Gaurav Jindal**, MD
- **Dheeraj Gandhi**, MBBS, MD

**PURPOSE/AIM**
- Review the literature related to various diagnostic modalities including CTA, MRA, and catheter based DSA for the evaluation of intracranial aneurysms after treatment
- Review the optimization of post-coiling MRA protocol for reduction of imaging artifacts and present cases to highlight interpretation pitfalls related to aneurysm filling

**CONTENT ORGANIZATION**
- Review the incidence of aneurysm recurrence and rebleed
- Review literature related to optimal post-coiling aneurysm evaluation with a focus on MRA as a preferred modality given its absence of ionizing radiation
- Discuss optimization of MRA protocols using short echo times to reduce coil related imaging artifacts
- Present cases to review potential pitfalls in the interpretation of residual aneurysm filling on MRA exams including enhancing granulation tissue, interstitial flow, thrombus, or enhancing fibrotic scar tissue in the coil cluster
- Discuss need for more data to determine optimal timing of follow-up exams

**SUMMARY**
Contrast Enhanced MRA is the preferred modality for the post-coiling evaluation of intracranial aneurysms, although care must be taken to avoid common interpretation pitfalls and additional data is needed to determine the optimal timing of follow-up exams.

### HIV-related Diffuse Aneurysmal Cerebral Vasculopathy: Four New Cases of This Rare Vascular Disease with Long-term Follow-up and Review of the Literature

**LL-NRE4435**
- **Bruno Law-Ye**, JD
- **Raphael Richard**
- **Frederic Clarencon**, MD
- **Raphael Blanc**, MD
- **Dan Siahou**
- **Clement Wattel**
- **Dominique M Safa**, MD
- **Adrien Felter**
- **Dominique Mompoint**, MD
- **Robert Y Carlier**, MD

**PURPOSE/AIM**
To present four new cases of HIV-related cerebral vasculopathy in a rare diffuse aneurysmal form and depict imaging features
To present the management of these HIV-related complications
To present a comprehensive review of the literature

**CONTENT ORGANIZATION**
- Presentation of four cases of diffuse aneurysmal cerebral vasculopathy with emphasis on imaging features.
- Relation to length of evolution of HIV infection
- Physiopathology hypothesis and histopathologic features
- Main differential diagnosis
- Management of these vascular lesions sometimes requires interventional neuroradiology
- Future understanding of etiopathogenesis: role of Immune Reconstitution Inflammatory Syndrome (IRIS)?

**SUMMARY**
The major teaching points of this presentation are:
- HIV-related cerebral vasculopathy with diffuse fusiform aneurysms is a rare yet previously-reported entity
- Main imaging features include fusiform ectasy of carotid terminus extending to A1 et M1 segments of anterior and middle cerebral arteries but posterior circulation attempts may be observed
- Risk factors may be length of evolution of the infection and high degree of immunosuppression and viral load
- Frequent ischemic and/or hemorrhagic complications are described
- Management of these vascular lesions can require neuroradiological interventional procedures

### Multimodality Imaging of Stellate Ganglion: Can You Identify a Stellate Ganglion?

**LL-NRE4436**
- **Atsuko Fujikawa**, MD
- **Tsuneo Yamashiro**, MD
- **Yoshiko Y Kurihara**
- **Yasuyuki Kurihara**, MD
- **Yasuo Nakajima**, MD
- **Takuya Suzuki**
- **Hirotaka Ikeda**, MD
- **Hayato Tomita**

**PURPOSE/AIM**
Understanding the imaging characteristics of stellate ganglion. This presentation shows the anatomy and imaging characteristics of stellate ganglion on MRI, CT and sonography. People who browse this presentation will be able to identify a stellate ganglion easily.
**Purpose/Aim**

The craniovertebral junction (CVJ) is a collective term that refers to the occiput, atlas, axis and supporting ligaments. It encloses the soft tissue structures of the cervicomedullary junction and lower cranial nerves. We aim to present the CT and MRI spectrum of craniovertebral junction abnormalities.

**Content Organization**

Development of CVJ is complex with contributions from a large number of embryological structures. The abnormalities of the region could be congenital or acquired. A myriad of congenital malformations may involve various bones whereas acquired abnormalities may occur due to trauma, inflammation, infection/neoplastic lesions etc. Congenital anomalies can be reliably evaluated in their exquisite anatomical detail using MRI but MDCT has become the modality of choice to depict all bony details. Similarly developmental anomalies like achondroplasia, osteogenesis imperfecta; rickets, Paget's and traumatic injuries are best detected by MDCT. MRI undoubtedly provides the solution for imaging of infections/inflammation like TB and rheumatoid arthritis involving non osseous components and spinal cord.

**Summary**

We put forth a wide array of CVJ anomalies on CT and MRI laying stress on complementary role of both modalities in detection and complete assessment of the lesions at the CV junction with the plain radiograph playing a role only in primary screening.

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**Radiological Spectrum of Craniovertebral Junctional Abnormalities**

**LL-NRE4437**

**Manish Gupta**, MD  
**Lalendra Upadhyay**, MD  
**Rakesh Gupta**, MBBS, MD  
**Sunil Kumar Puri**, MD  
**Vandana Goel**, MBBS, MD  
**Pranav Gupta**, MBBS

**Purpose/Aim**

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We put forth a wide array of CVJ anomalies on CT and MRI laying stress on complementary role of both modalities in detection and complete assessment of the lesions at the CV junction with the plain radiograph playing a role only in primary screening.

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**The ABC of Visual Disturbances. A Practical Guide of Imaging**

**LL-NRE4438**

**Eleni Testempassi**, MD  
**Vasiliki Vantali**, MD  
**Andreas Simopoulos**, MD, MSc  
**Dimitrios Chondros**

**Purpose/Aim**

Visual disturbances is a common problem for the clinician. There are many types of eye problems and visual disturbances from blurred vision spots and scotomas to the most severe loss of vision and blindness. The purpose of this exhibit is to present the imaging findings of common and uncommon visual disturbances with emphasis on localization of the lesion affecting the visual pathways and function.

**Content Organization**

A broad spectrum of diseases inflammatory neoplastic, vascular, traumatic and systemic diseases are depicted. Optic neuropathies, encephalopathies, central and peripheral tumors and pseudotumors, orbital and cerebral trauma, systemic and vascular diseases and a great variety of diseases affecting direct or indirect the sight are presented.

Practical guidelines for examination of choice and examination protocols for emergency and routine examinations are presented. Suspected location of lesion is emphasized so as to optimize the appropriate examination and interpretation of imaging.

**Summary**

The early anatomic and functional diagnosis is essential in prognosis and treatment of visual disturbances. The key to the correct diagnosis is tailoring the appropriate imaging investigation for the patient's condition and optimizing the imaging modality directed toward the clinical question and anatomical location.

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**Multimodal Imaging Evaluation of Cerebral Vasculitis**

**LL-NRE4439**

**Aaron M Rutman**, MD  
**Gerald J Palagallo**, MD  
**David Tirschwell**, MD, MSc  
**Mahmud Mossa-Basha**, MD  
**Jonathan Weinstein**, MD, PhD

**Purpose/Aim**

The purpose is to educate the viewer on the pathophysiology, clinical markers and multimodality imaging characteristics of cerebral vasculitis, including digital subtraction angiography (DSA), conventional MRI/MRA, contrast susceptibility perfusion (DSC), susceptibility weighted imaging (SWI) and black blood MR imaging (BBMR). We will also show the temporal evolution of conventional and advanced imaging findings of CNS vasculitis with appropriate therapy.

**Content Organization**

A. Pathophysiology and clinical markers of CNS vasculitis B. Sample cases -DSA -CTA -conventional MRI/MRA -DSC -SWI -BBMR C. Longitudinal imaging findings of CNS vasculitis on therapy D. Limitations of imaging for CNS vasculitis

**Summary**

DSA is the gold standard imaging exam for CNS vasculitis. However, a multimodal approach combined with clinical markers is frequently necessary for correct diagnosis and complication evaluation. We will present cases of CNS vasculitis, discussing clinical markers and multimodality imaging findings (conventional MRI/MRA, DSC, BBMR, SWI and DSA), as well as potential imaging limitations. We will also illustrate longitudinal imaging of CNS vasculitis, indicating temporal changes that impact therapy.

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**Imaging of Neuronal and Neuronal-glial Tumors**

**LL-NRE4440**

**Vijay K Mittal**, MD  
**Jeffrey D Poot**, DO  
**Sangam G Kanekar**, MD

**Purpose/Aim**

The major teaching points of this exhibit are: 1. Stellate ganglion resides between the C7 transverse process and the head of the first rib. 2. The signal intensities of stellate ganglion on magnetic resonance imaging (MRI) are similar with nerve root. 3. On computed tomography (CT), a stellate ganglion appears as a nonspecific soft tissue density nodule. 4. Stellate ganglion can be visualized on ultrasound imaging (sonography), if the position of the stellate ganglion is identified previously. 5. Sometimes, stellate ganglion mimics lymphadenopathy. If we know the imaging characteristics of stellate ganglion, we can avoid misdiagnosis.
Goal of this exhibit is to illustrate the imaging findings of neuronal-glial tumors of CNS and correlate them with histopathology findings.

CONTENT ORGANIZATION
Neuroglial tumors make up around 1% adult and about 10% of the childhood CNS tumors. An intractable seizure is one of the common presentation making them clinically very significant. Advent of high resolution imaging, microscopic surgical advances and immunohistochemical techniques have given a very good prognosis and life style to these patients. We retrospectively reviewed the imaging studies from our PACS system of 22 patients surgically proven cases of neuro-glial tumors. Besides routine MR, all the patients also had high resolution T2 and SPGR and post contrast T1W sequence through the whole brain. We classified these lesions using WHO brain tumor classification into: 1) Oligodendroglioma 2) Dysplastic gangliocytoma of cerebellum (Lhermitte-Duclos) 3) Ganglioglioma 4) Anaplastic (malignant) ganglioglioma 5) Desmoplastic infantile ganglioglioma 6) Central neurocytoma 7) Dysembryoplastic neuroepithelial tumor.

SUMMARY
The major teaching points of this exhibit are: 1. To review the various radiological appearances of neuronal-glial tumors. 2. To correlate imaging findings with immunohistochemical (pathology) features.
Radiation-induced Changes in the Central Nervous System

**PURPOSE/AIM**
Radiation therapy is an effective and commonly used treatment for different pathologies of the central nervous system. Radiation-induced complications may result in acute, progressive or chronic symptoms, even months or years after therapy. The purpose of this exhibit is to review the spectrum of adverse effects derived from therapeutic brain radiotherapy.

**CONTENT ORGANIZATION**
1. Parenchimal changes:  
   - White matter changes  
   - Gray matter lesions  
   - Atrophy  
   - Contrast-enhancement lesions  
   - Mass effect  
   - Hemorrhagic foci  
2. Radiation-induced vasculopathies  
3. Radiation-induced tumors  
   - Meningiomas, sarcomas, gliomas, schwannomas  
4. Skull changes  
   - Osteoradionecrosis

**SUMMARY**
The major teaching points of this exhibit are:
1. To show the possible injury to the central nervous system after radiation therapy, including tissue and vascular structures.
2. To refresh the risk of secondary malignancies associated.
3. To exhibit examples of bone changes due to radiation.

Don’t Rack Your Brains!! An Intuitive Introduction to Brain Anatomy

**PURPOSE/AIM**
The purpose of this exhibit is:
- To emphasize the importance of a detailed knowledge of the brain anatomy for a precise localization of pathology.
- To exhibit an intuitive and easy way of learning the brain surface anatomy based on CT and MR reformatted images.

**CONTENT ORGANIZATION**
- Gross brain anatomy.
- Introduction to the main cortical eloquent areas.
- How to obtain surface-reformatted CT and MR images.
- Easy rules for a reliable identification of the main sulci and gyri.
- Sample cases.
- Summary.

**SUMMARY**
Major teaching points:
- Accurate localization of superficial brain lesions is essential for preoperative diagnosis and surgical planning.
- Learning brain anatomy can be turned into an easy and somehow entertaining task based on several intuitive rules. - Reformatted CT and MR imaging are easy to obtain and essential for the comprehension of the main landmarks and rules exposed.

Intracerebral Hemorrhage on MRI: A Teaching Tool to Facilitate Accurate Staging

**PURPOSE/AIM**
1. To present a graphic learning and mnemonic tool that reviews and explains the appearance of intracerebral hemorrhage on MRI and makes recall easy.  
2. To compare and explain the T1 and T2 weighted changes correlating to the hemoglobin breakdown products from hyperacute, acute, subacute, to chronic hematoma.  
3. To review the various causes and mechanisms of injury and provide challenging cases to review practical caveats.

**CONTENT ORGANIZATION**
We review the transformation from oxyhemoglobin, deoxyhemoglobin, methemoglobin, to ferritin on a predictive time course. The macromolecules and charge of iron in blood breakdown products alter T1/T2 behavior in a predictable pattern. Our MR teaching tool is organized into an easy to build and recall “on the fly” matrix. We then incorporate this tool with other considerations to determine the time of the bleed in several vignettes.

**SUMMARY**
Intracerebral hemorrhage may not be a common finding in all practices but the radiologist is challenged to provide a quick, accurate assessment of the time of the bleed in order to appropriately impact patient care. The pattern of changes on MRI of hemorrhage in the brain is well understood, but few have attempted to present it concisely. Here we consolidate the information into a practical form that can be easily learned or referenced by radiologists at any level.

High Resolution Magnetic Resonance Imaging of the Middle Cerebral Artery: Technical Aspect and Clinical Application

**PURPOSE/AIM**
1. To known the advance of technical aspect for high resolution magnetic resonance imaging (HR-MRI) of the middle cerebral artery (MCA).  
2. To demonstrate the basic concepts of analysis of MCA plaque component.  
3. To explain the clinical usefulness of HR-MRI in patients with MCA disease.

**CONTENT ORGANIZATION**
1. Introduction  
2. How to image the MCA arterial wall  
3. Image quality
2) Pulse sequence: Technical consideration of black-blood sequences
3) MR imaging protocol:
   a) Black blood T1, T2, PD.
   b) Black-blood MP-RAGE
3) MR imaging protocol:
   1) Remodeling: Constrictive or Expansible pattern
   2) Eccentric plaque or circumferential plaque
   4. Component analysis of the MCA plaque
   1) Calcification
   2) Intraplaque hemorrhage
   3) Fibrous component
   4) Plaque ruptures
   5) Stable or unstable plaque
   5. MCA dissection
   1) Diagnosis of the MCA dissection: visualization of intimal flap and hemorrhage of false lumen
   2) Comparison of imaging findings: CT angiography and Digital subtraction angiography
6. Limitation of HR-MRI for evaluation of the MCA
SUMMARY
HR-MRI is depicted the lumen and walls of the MCA. Also, HR-MRI may be a useful noninvasive in vivo modality for assessing the morphological features and components of the MCA

Intima Media Thickness Variability (IMTV): What Is This New Parameter?

LL-NRE4448
Luca Saba, MD
Jasjit S Suri
Girish M Fatterpekar, MBBS *
Michele Porcu, MD
Pierpaolo Bassareo, MD
Roberto Montisci, MD

PURPOSE/AIM
Recently a new parameter based to the intima-media-thickness (IMT) was introduced: the so called Intima-Media-Thickness Variability (IMTV). The purpose of this exhibit is to present the mathematical concept of the IMTV and its potential value and application.

CONTENT ORGANIZATION
1) Histology of the carotid artery wall 2) algorithm of the IMTV and mathematical basis 3) difference between IMT and IMTV 4) Limits and pitfalls of the different imaging modalities (US – CT – MR) in the IMTV analysis. 5) Presentation of cases

SUMMARY
It is well demonstrated that the IMT quantification may play an important role, because the increasement of IMT is correlated with coronary and cerebrovascular complications. Some preliminary studies showed that IMTV seems to be a better parameter of IMT in some condition like the cerebrovascular events. In this exhibit will be presented the IMTV concept.

Imaging of the Remodelling of the Carotid Artery Plaque

LL-NRE4449
Luca Saba, MD
Eytan Raz, MD
Pierleone Lucatelli, MD
Eugenio A Genovese, MD
Jasjit S Suri

PURPOSE/AIM
Several investigations have demonstrated that the carotid artery plaques change and it is possible that some determinants of instability are transitory. Moreover, some drugs (such as statins, apolipoprotein) change the composition of the plaque by increasing or reducing its volume. In this exhibit our purpose was to understand the physiopathology of plaque remodelling and to review CT, MR and US imaging findings of this phenomenon.

CONTENT ORGANIZATION
1) To review the concept of carotid artery plaque remodelling 2) histology of the plaque according the AHA classification. 3) The biomechanical effect of plaque eccentricity 4) MR, CT, and US imaging findings of carotid artery plaque follow-up that demonstrate the plaque remodelling. 5) Limits and potentialities of MR, CT and US in the follow-up of the carotid artery plaque 6) The drug-effect: how the therapies may change the plaque in terms of regression and progression. 7) Presentation of relevant cases.

SUMMARY
Currently, imaging techniques can identify and characterize the plaque remodelling and in particular the use of MR allows to precisely distinguish plaque components and characteristics and to identify the plaque’s changes. In the last years it was demonstrated that some dedicated may trigger a regression and progression of the carotid artery plaque and imaging must recognize these changes.

Vascular Supply of the Spinal Cord: What the Radiologist Needs to Know

LL-NRE4450
Joseph D Gabrieli, MD
Frederic Clarencon, MD
Federico Di Maria
Nader Sourour
Evelyne Cormier, MD
Jacques Chiras, MD

PURPOSE/AIM
The purpose of this exhibit is to review: -The anatomy and physiology of the spinal cord arterial supply and its venous drainage. -The advantages and drawbacks of the available imaging methods.

CONTENT ORGANIZATION
The segmental arteries: general anatomy of the segmental arteries and their metameric distribution from the pharyngo-occipital system to the sacral arteries. Focus on the arterial spinal branch: epidural and dural branches, radicular, radiculo-pial and radiculomedullary arteries: pauci- and plurisegmental configurations. Relevant intra- and extraspinal anastomoses. Relevant venous anatomy in brief. Safety and indications of the spinal angiogram; tip and tricks for the identification of the Adamkiewicz artery. The quest to reduce invasiveness: from intra-arterial CT angiography to dynamic magnetic resonance angiography, where should we set the bar?

SUMMARY
This review of the spinal cord vascular supply shows a very efficient system of collateral circulation, but also vulnerable regions at risk of ischemic damage; this knowledge is a prerequisite in the planning of both endovascular and surgical operations.

Temporal Bone Trauma: Imaging Findings, Pitfalls, and Clinical Implications
PURPOSE/AIM
The purpose of this exhibit is to comprehensively review the radiological manifestations of the different types of temporal trauma, potential pitfalls on imaging, and management considerations. Updated classification schemes and treatment options will be emphasized.

CONTENT ORGANIZATION
Types of Traumatic Injury:
- Petrous (Otic capsule sparing versus violating)
- Middle ear fractures and ossicular chain disruption
- Meatal fractures
- Mastoid fractures
- Squamosal fractures
- Styloid process fractures
- Associated complications (hearing loss, facial nerve injury, intracranial hemorrhage, perilymphatic fistulas, CSF leaks, cephaloceles, meningitis, cholesteatoma, carotid artery injury, and venous sinus thrombosis)

Pitfalls: Normal sutures, fissures, and channels

Clinical Management: Medical (observations, steroids, antibiotics, and anti-seizure medications) versus surgical (lumbar drain, CSF and perilymphatic fistula repair, and ossicular chain reconstruction)

SUMMARY
Imaging plays an important role in the evaluation of temporal bone trauma. Familiarity with the patterns of injury, associated complications, and how the imaging findings pertain to management can optimize imaging interpretation.

Parry-Romberg Syndrome: A Pictorial Essay

PURPOSE/AIM
The purpose of this exhibit is:
- To review the pathophysiology of Parry-Romberg syndrome (PRS
- To discuss the relationship between the connective tissue disease, such as scleroderma, and PRS;
- To illustrate head and neck imaging findings;
- To explain the use of CT scan, 3D reconstruction and MRI in the diagnosis;
- To aid radiologists in the correct diagnosis of this pathology.

CONTENT ORGANIZATION
- Pathophysiology of PRS.
- Relevant clinical manifestations.
- Review of imaging findings on CT and MRI.
- Sample cases and mimics.
- Summary

SUMMARY
The major teaching points of this exhibit are:
1. CT scan, three-dimensional reconstruction and MRI clearly demonstrate several findings in Parry Romberg Syndrome: facial asymmetry, hemifacial atrophy of subcutaneous tissue, fat, bone (such as shortening of the mandible and maxilla and volumetric reduction of zygomatic arch), mastigatory muscles atrophy, hipoplasia of submandibular and parotid glands and paranasal sinuses, usually associated with skin lesion ipsilateral 'en coup de sabre' and compatible clinical history.
2. Important neuroradiological findings are white matter gliosis, scattered calcifications, hemorrhage, meningoencephalitis associated vasculitis, enlargement of perivascular spaces and cortical sulci, which are better demonstrated in MRI than CT.

The Use of Imaging in Facial Transplantation - A Radiologist's Primer

PURPOSE/AIM
Facial transplantation has emerged as a medically feasible means to address complex post-traumatic facial deformities in patients for whom conventional surgical techniques have rendered unsatisfactory results. Diagnostic imaging plays an essential role in both pre-operative and post-operative evaluation. To familiarize radiologists with facial transplantation and contribute to the foundation on which future imaging protocols may be based, we report our diagnostic imaging experience with the world's first full facial transplantation.

CONTENT ORGANIZATION
In this exhibit, we present a case report consisting of representative images from various diagnostic imaging procedures used in the pre-operative assessment of both the allograft donor and the recipient, as well as the peri-operative evaluation and nearly one-year post-transplantation follow-up of the recipient. With each example, the clinical questions to be answered by each procedure will be presented. In addition, we will briefly report a review of the medical literature pertaining to facial transplantation.

SUMMARY
This exhibit presents a brief primer of the diagnostic imaging involved with facial transplantation and contributes to the foundation on which imaging of future facial transplant patients may be based.

Percutaneous Treatment of Lumbar and Cervical Intervertebral Disc Herniations with Radiopaque Gelified Ethanol

PURPOSE/AIM
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SUMMARY
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Beyond Eardrum Color: Otoscopic - Radiologic Correlation of Retrotympanic Lesions

CONTENT ORGANIZATION
Pictorial review including indications and contraindications, technical aspects, clinical outcome, and morphostructural changes evaluation at three-month 3D-CT, observed in a population of 56 symptomatic patients (30 females, 26 males, age range at treatment: 33-75 years) with 70 hernias treated with pi-RGE for contained (n=48) or extruded (n=15) lumbar (n=63) and cervical (n=7) disc herniations.

SUMMARY
Chemonucleolysis is an efficient technique for the treatment of back pain; it consists of a percutaneous intradiskal injection that dissolves the nucleus pulposus and lowers intradiskal pressure. RGE is a chemonucleolytic agent introduced in 2007, consisting of a sterile viscous solution containing ethyl alcohol, cellulose derivative product, added to a radiopaque element, tungsten. Efficacy and innocuity of this new substance have been proved. Pi-RGE is safe, presents lower rates of infectious complications and extradiscal tissues' damage. Symptoms' improvement occurred in 85% of treated patients. Nonsignificant intervertebral disc morphastructural changes were noted.

3D Phase Contrast Magnetic Resonance Venography of Brain on 3T MR Scanner: How Does It Compare with Contrast Enhanced MR Venography?

PURPOSE/AIM
To compare efficiency of 3D Phase Contrast MR Venography to 3D Contrast Enhanced MR Venography in delineation of normal cerebral venous anatomy on 3T MRI.

CONTENT ORGANIZATION
Various imaging techniques are developed to study cerebral venous system. Amongst noninvasive techniques, Contrast Enhanced MR venography (CEMRV) is considered as most sensitive. However, it involves injection of a contrast agent while 3D Phase Contrast MR venography (3DPcmRV) does not require any contrast agent injection. The diagnostic accuracy of 3DPcmRV over CEMRV is not yet established. We compare the visualization of normal venous structures of brain on 3DPcmRV with that of CEMRV on 3T MRI. 80 patients who underwent contrast venography on 3T MR scanner for any indication other than cerebral venous sinus thrombosis were included. Our Institutional Review Board had approved the study. Cerebral venous structures were divided into 26 segments. Visualization of these segments was assessed on 3DPcmRV and CEMRV. Diagnostic accuracy, positive predictive value and negative predictive value were evaluated for 3DPcmRV, with CEMRV as reference standard.

SUMMARY
Diagnostic accuracy, positive predictive value and negative predictive value of 3D PCMRV in assessing cerebral venous anatomy is estimated with CEMRV as reference standard.

Non-traumatic Spinal Cord Emergencies: What to Look for?

PURPOSE/AIM
1. List the common nontraumatic causes of spinal cord lesions that may be seen in the emergency setting.
2. Describe the clinical manifestations and review the imaging findings: multidetector computed tomography (MDCT) and magnetic resonance imaging (MRI).
3. To review the anatomy of the spinal cord.
4. Provide an in-depth analysis valuable to both general radiologist and clinicians.

CONTENT ORGANIZATION
1. Overview of the normal anatomy.
2. Pictorial review of the non-traumatic causes of spinal cord lesions, classified according to the clinical manifestations with emphasis on the key radiological findings that will have an impact on treatment:
   a. Compressive (neoplastic, degenerative, congenital).
   b. Inflammatory (spinal infection, abscess).
   c. Vascular syndromes (hematoma, ischemia).

SUMMARY
A wide variety of non-traumatic conditions affecting the spinal cord may present in the emergency setting MDCT and MRI by providing accurate anatomic details and pathological information correctly direct the attention to an acute process in the spine and facilitates patient management.

Beyond Eardrum Color: Otoscopic - Radiologic Correlation of Retrotympanic Lesions

PURPOSE/AIM
The main objective of this communication is to establish a correlation between the clinical and radiological findings for different diseases of the middle ear in which the tympanic membrane remains intact, especially for retrotympanic lesions that are associated with abnormal coloring of the eardrum on otoscopy.

CONTENT ORGANIZATION
In this communication, we illustrate the imaging findings in the different lesions of the middle ear and establish a diagnostic algorithm for the management of retrotympanic masses based on the otologic presentation, the otoscopic images, and the radiological studies. A whitish eardrum usually suggests congenital cholesteatoma; other diagnoses like primary tumors of the middle ear are less common. In cases with a reddish eardrum the paragangliomas are most likely, though vascular malformations are also possible. A bluish eardrum suggests different diagnoses like a dehiscent jugular bulb, a cholesterol granuloma, or meningoencephalocele.

SUMMARY
Analyzing the clinical and otoscopic findings, especially the color of the eardrum, together with the radiological findings is fundamental in
The Interventionalist's Guide to Nonsurgical Management of Lower Back Pain

PURPOSE/AIM
Lower back pain will occur in up to 84% of patients at some point in their lifetimes. Treatment modalities in managing back pain include medical, interventional, and surgical therapies. This exhibit serves to: 1) Review etiologies of back pain on spinal imaging (CT and MRI). 2) Review indications for interventional therapies. 3) Illustrate different therapeutic options available to the interventionalist in the management of lower back pain.

CONTENT ORGANIZATION
1. Anatomy of the lumbosacral spine. 2. Briefly review common etiologies of back pain including disc herniation, facet joint disease, and arthritis (degenerative and inflammatory). 3. Discuss which patients are most likely to benefit from interventional pain management procedures based on clinical history and imaging findings. 4. Discuss medications utilized in a pain management practice. 5. Illustrate technique in performing interventional procedures including epidural, selective nerve root, facet joint, and sacro-iliac joint injections. 6. Patient followup and assessing efficacy of treatment.

SUMMARY
Treatment of patients with lower back pain symptomology can be extremely rewarding for both the patient and practitioner. This exhibit will review the indications and techniques for performing pain management procedures in the lumbosacral spine.

The Value and Pitfalls of Diffusion-weighted MR Imaging Sequence in Differentiating Ring-enhancing Cerebral Lesions

PURPOSE/AIM
At the conclusion of this presentation, the viewer should be able to:
1) Understand basics concepts of diffusion weighted imaging (DWI).
2) Appreciate the benefits of DWI when evaluating ring enhancing brain MRI lesions.
3) Recognize that though DWI is a valuable diagnostic tool, pitfalls do exist; specifically, when differentiating ring-enhancing cerebral lesions.

CONTENT ORGANIZATION
1. Diffusion-Weighted Imaging (DWI)
a. Basic principles
i. Physics of DWI
ii. DWI, ADC, and T2 Shine Through
b. Clinical Application
i. Brain Infarction
ii. Vasogenic Edema
iii. Infection: Pyogenic Abscess and Herpes Encephalitis
iv. Intracranial Masses
v. Demyelinating Lesions 2. Imaging of ring enhancing cerebral lesions: abscess vs tumor
a. Conventional MRI Techniques: T1, T2, and post-contrast
b. DWI sequence
i. Typical appearance
ii. Atypical appearance
a. Presentation of cases: Glioblastoma multiforme, Meningioma, Abscess
b. Pathologic correlation that may explain restricted diffusion seen on diffusion positive tumors and not seen in diffusion negative abscess

SUMMARY
DWI is a valuable diagnostic tool for many clinical entities. It specifically is advantageous in differentiating ring enhancing cerebral lesions as abscess or tumor. However, it must be recognized that the DWI characteristics are not pathognomonic.

No Small Matter: The Evolving Spectrum of Hypoxic Ischemic Injury in the Preterm and Term Infant in the Era of Hypothermia

PURPOSE/AIM
1. Discuss the pathophysiology of hypoxic ischemic injury (HII)
2. Review the imaging findings of both partial and profound HII, both in the premature and term infant, at various stages of evolution.
3. Understand potential mimics of HII, especially inborn errors of metabolism.

CONTENT ORGANIZATION
• Etiologies of hypoxic ischemic injury (HII)
• Presentation of the continuum of HII, including both profound and partial patterns
• Comparison of imaging findings for the acute, subacute, and chronic appearance on ultrasound, CT and MRI.
• Distinguish HII in the premature infant from other hypoxic/hypoperfusion related injury, including white matter injury of prematurity (i.e. PVL)
• Appearance of HII after hypothermic treatment

SUMMARY
Hypoxic ischemic injury (HII) is a significant source of pediatric morbidity and mortality, particularly in premature infants. It is important to be able to distinguish between the two major patterns of profound and partial HII, given the significant differences in outcome. Moreover, as the timing of imaging can drastically change the appearance, it is important to be familiar with the findings in the acute, subacute and chronic phases. In the age of hypothermic treatment, the imaging appearance may be more subtle, making familiarity with the imaging appearance of these injuries even more important.
Imaging Spectrum of Facial Nerve Lesions

Achint K Singh , MD
Girish Bathla , MBBS
Wilson Altmeyer , MD
Bundhit Tantiwongkosi , MD
Carlos Bazan , MD
Maria P Valencia , MD

PURPOSE/AIM
The purpose of this exhibit is to review the imaging appearance of different pathologies involving the facial nerve.

CONTENT ORGANIZATION
- Review of normal imaging anatomy of the facial nerve
- Categorization of facial nerve lesions
- Review of imaging appearance of the lesions involving the facial nerve

SUMMARY
Facial nerve regulates the motor innervation of the face as well as the secretion of lacrimal, submandibular and sublingual glands. Facial nerve may be involved in a variety of lesions including trauma, inflammation or neoplasms. Our goal is to provide the imaging spectrum of facial nerve lesions. After reviewing this exhibit, the viewer will be able to understand the normal imaging anatomy of facial nerve along with imaging findings of different facial nerve pathologies.

Management of Facial Asymmetry; The Radiologist's Role

Daniel Castellon , MD
Noelia Silva , MD
Eloisa A Santos , MD
Julia Calatayud , MD
Maria Gonzalez Vazquez
Judith M Gonzalez
Ana Hernando
Covadonga Del Riego

PURPOSE/AIM
1. To define normal anatomic landmarks and terminology used in maxillofacial surgery. 2. To review the etiology and the structural classification of dentofacial asymmetries. 3. To describe CT techniques and postprocessing tools that can help physicians improve their decision making. 4. To emphasize the most useful imaging findings to look for and their significance. 5. To illustrate the imaging findings in presurgical and postsurgical scans.

CONTENT ORGANIZATION
1. Maxillofacial and orthodontic terms. 2. Etiology and structural classification of dentofacial asymmetries. 3. Data acquisition and postprocessing. 4. Imaging features in pre-surgical and post-surgical CT scans.

SUMMARY
The major points of this exhibit are: 1. Knowledge of orofacial anatomy and orthodontic terminology is required in order to bring the imaging report and what physicians need to know closer. 2. Panoramic, cross-sectional and volume-rendered images provide accurate information about the morphology, size and position of important structures, helping surgeons for a more accurate preoperative assessment. 3. Systematical qualitative and quantitative evaluation of maxilla and mandible is essential to guide the treating physician. 4. A series of challenging cases is presented in order to improve the radiologists’ ability to describe and characterize dentofacial asymmetries.

Review of Hyperintensity in Intracranial Extra-Axial Space on FLAIR: Artifact and Diseases

Tetsuro Sekine
Ryo Takagi , MD
Yasuo Amano , MD
Shinichiro Kumita , MD
Elika Orita

PURPOSE/AIM
1. Demonstrate the techniques of 2D- and 3D- fluid-attenuated inversion recovery (FLAIR) MRI of the neuroimaging.
2. Review case-based illustrations of hyperintensity in intracranial extra-axial space on FLAIR imaging.

CONTENT ORGANIZATION
A. Basic imaging procedures of 2D-FLAIR and 3D-FLAIR.
B. Case presentation
B-1. Artifact: Susceptibility, Motion, CSF flow, Venous flow
B-2. High signal intensity of artery: Intraarterial signal because of arterial occlusion, Ivy sign because of Moyamoya disease
B-3. Hemorrhage: Subarachnoid hemorrhage, Subdural hemorrhage, Venous thrombosis
B-4. Leptomeningeal disease: Meningitis, Leptomeningeal carcinomatosis, Leptomeningeal melanoma, Dural thickening because of intracranial hypotension
B-5. Other: Oxygen inhalation
C. Summary
SUMMARY
FLAIR is sensitive for slow flow and subtle T1 shortening. 3D FLAIR can reduce flow artifact and clearly depict subtle signal change. High signal intensity of artery is significant correlation with prognosis. Radiologist should know these signal changes based on understanding contrast mechanism of FLAIR.

Conventional and Advanced MR Imaging of Parkinson Disease

Koji Kamagata
Yumiko Motoi
Hiroyuki Tomiyama
Masaaki Hori , MD
Atsushi Nakanishi , MD, PhD
Michimasa Suzuki
Keigo Shimoji , MD
Toxic and Metabolites

Brain injuries

Several toxins and metabolites can cause brain damage in a wide spectrum of presentation. Some typical imaging patterns can be highly specific and help narrowing the differential diagnosis. This exhibit aims to illustrate the most common imaging findings related to brain toxicity.

CONTENT ORGANIZATION

1. Toxicity.
3. Autopsic features.

SUMMARY

In conventional MR imaging for PD, there are some classical findings that is a helpful to diagnose PD. DTI studies have shown that FA in the substantia nigra and some white matter tracts is reduced in PD compared to controls. DKI can detect changes in the cerebral white matter and grey matter of PD patients more sensitively than conventional DTI. ASL shows hypoperfusion in the precuneus in patients with PD. By providing a potentially more sensitive marker of brain pathology in PD, DTI, DKI, and ASL may enable improved monitoring of disease progression and more effective treatment planning.

Suitability of Diagnostic Imaging Studies in Parotid Gland Disorders

PURPOSE/AIM

To review the parotid gland’s anatomy and its relationships with important anatomic structures. To increase our knowledge on the different diseases that affect the parotid gland, and the role of imaging studies in the evaluation of parotid gland diseases.

CONTENT ORGANIZATION

1. To review the parotid gland’s anatomy and its relationships with important anatomic structures. To increase our knowledge on the different diseases that affect the parotid gland, and the role of imaging studies in the evaluation of parotid gland diseases.
2. Review of conventional MR imaging of PD.
3. Advanced MR techniques for PD.
4. Review of our results of MR data sets of PD and age matched controls using DTI, DKI, ASL. Analysis of DTI, DKI includes ROI, tractography (tract specific analysis), Tract Based Spatial Statistics (TBSS).

SUMMARY

In conventional MR imaging for PD, there are some classical findings that is a helpful to diagnose PD. DTI studies have shown that FA in the substantia nigra and some white matter tracts is reduced in PD compared to controls. DKI can detect changes in the cerebral white matter and grey matter of PD patients more sensitively than conventional DTI. ASL shows hypoperfusion in the precuneus in patients with PD. By providing a potentially more sensitive marker of brain pathology in PD, DTI, DKI, and ASL may enable improved monitoring of disease progression and more effective treatment planning.

No Better Explanation than Multiple Sclerosis: 'The Third Leg of the Stool'

PURPOSE/AIM

1. To review the diagnostic criteria for multiple sclerosis including clinical and paraclinical aspects. 2. To emphasize the most useful imaging findings and red flags to look for. 3. To review likely alternatives to a multiple sclerosis diagnosis. 4. To analyze the radiologist’s role in exclusion of potential mimics.

CONTENT ORGANIZATION


SUMMARY

The major points of this exhibit are: 1. Knowledge of pathogenesis, natural history and clinical management of multiple sclerosis are required in order to bring the imaging report and what physicians need to know closer together. 2. MR imaging has become an essential tool in providing evidence for dissemination in space and time but radiologist should not forget its potential role in detecting features that are not suggestive of multiple sclerosis (red flags). 3. Alternative diagnosis that can be confused with multiple sclerosis are idiopathic inflammatory demyelinating diseases, other inflammatory conditions, infections, metabolic and genetic disorders and neoplasms. A series of challenging cases is presented in order to alert radiologists to consider the differential diagnosis more extensively.

Toxic and Metabolites

Brain injuries

Several toxins and metabolites can cause brain damage in a wide spectrum of presentation. Some typical imaging patterns can be highly specific and help narrowing the differential diagnosis. This exhibit aims to illustrate the most common imaging findings related to brain toxicity.

CONTENT ORGANIZATION

Differential diagnosis and main MRI features: Drug abuse: alcohol, cocaine, amphetamines and their derivatives such as 3,4-methylenedioxymethamphetamine ("ecstasy") and marijuana Vitamin deficiency: B12, tiamine Gas toxicity: carbon monoxide Metabolic encephalopathies: hypoglycemia, hepatic encephalopathy, osmotic pontine myelinolysis, global hypoxic-ischemic injury
Brain Infection and AIDS: What Is New after the HAART Era?

Eliana Garcia Pita, MD
Analia S Varela, MD
Luis A Miquelini, MD
Jessica Chasi, MD
Elian Garcia Pita, MD

PURPOSE/AIM
The HAART era has contributed for the reduction in opportunistic infections and thus has changed the imaging findings scenario in the brain of HIV infected patients. Despite advances and new MRI sequences, these diagnoses may still be a challenge and often only determined by invasive methods such as biopsies. The purpose of this presentation is to show these new patterns of involvement and how MRI can assist in differential diagnosis.

CONTENT ORGANIZATION
Epidemiology during the past years The role of functional MRI: DWI, spectroscopy, perfusion, permeability Cognitive dysfunction associated with HIV Immune reconstitution inflammatory syndrome (IRIS): IRIS-PML; IRIS-toxoplasmosis; IRIS-cryptococcosis; CNS infections: Toxoplasmosis, tuberculosis, PML, cryptococcosis Differential diagnosis Future perspectives: advanced MRI and post-processing techniques

SUMMARY
The worldwide use of HAART has played an important role in changing the incidence of neurological complications in AIDS patients, such as cryptococcal meningitis, HIV-associated dementia and cerebral toxoplasmosis. Dementia complex is becoming the most common neurologic complication of HIV infection. Although uncommon, IRIS manifestations include new onset or paradoxical worsening of CNS infections, such as PML cryptococcosis, tuberculosis or toxoplasmosis.

Role of Diffusion Tensor Imaging in the Evaluation of Brain Tumors: A Basic Review

Nagamani Peri, MD
Gaurav Jindal, MD
Rafael Rojas, MD

PURPOSE/AIM
Diffusion Tensor Imaging (DTI) is an advanced imaging technique that is increasingly used in the evaluation of brain lesions. The purpose of this exhibit is to describe the basics of DTI techniques including DTI metrics and tractography and the role in the evaluation of different types of brain tumors.

CONTENT ORGANIZATION
The exhibit will be divided into 3 sections (a) Diffusion Tensor Imaging (DTI): Basic physics, DTI Metrics: Mean Diffusivity (MD) and Fractional Anisotropy (FA) parameters and what they mean, DTI tractography- how it is done and what color coding means. (b) DTI metrics in different types of tumors such as glioma, metastases, lymphoma, etc depicting the differences in the MD and FA values tumors in tumor, peritumoral location and contralateral normal appearing parenchyma and how these values can be of value in characterizing the tumors (c) DTI Tractography: Different patterns of involvement of white matter tracts in different tumors such as glioma, metastases, lymphoma, etc-displacement, invasion, etc. Role of Tractography in recurrent tumors and radiation induced changes?

SUMMARY
DTI is an advanced and complex imaging technique and can have an important role in the evaluation of brain tumors. This exhibit will provide a basic review with examples for the trainees and general radiologists, making it simple and easy to understand.

Pre Operative Evaluation of Extension of Sinonasal Malignant Tumors by Computed Tomography and Magnetic Resonance

Jessica Chasi, MD
Luis A Miquelin, MD
Anafia S Varel, MD
Cristina H Besada, MD
Elian Garcia Pita, MD

PURPOSE/AIM
The aim of this study was to assess the extent and commitment of tumors covering the nasal cavities and sinuses, being included in this study primary and secondary lesions source. All cases presented, were reviewed retrospectively from 2009 to 2012 (3 years) in the Department of Radiology of Hospital Italiano de Buenos Aires. We included only 15 cases that underwent surgery.

CONTENT ORGANIZATION
The aim of this study was to assess the extent and commitment of tumors covering the nasal cavities and sinuses, being included in this study primary and secondary lesions source. All cases presented, were reviewed retrospectively from 2009 to 2012 (3 years) in the Department of Radiology of Hospital Italiano de Buenos Aires. We included only 15 cases that underwent surgery.

SUMMARY
Computed tomography (CT) has superior bony definition while magnetic resonance imaging (MRI) better distinguishes tumour versus retained secretions. MRI gives superior soft tissue delineation and in evaluation of perineural, intraorbital and intracranial spread.

Surgical Approaches and Postoperative Analysis of the Temporal Bone-What Radiologists Need to Know. A Pictorial Essay and Literature Review

Maira Sarpi, MD
Alvaro Simoes, MD
Regina L Gomes, MD
Anna Carolina Fonseca, MD
Richardo F. Bento, MD
Eliosa M Gebrim, MD

PURPOSE/AIM
To review the complex anatomy of the temporal bone focusing on anatomic changes due to surgical procedures in combination to preexisting disease.
To demonstrate clinical situations that may lead to surgical procedure of the temporal bone, highlighting the various approaches used and exemplification the application of each one of them based on the nature and extension of the baseline disease.

CONTENT ORGANIZATION
Literature review and description of possible approaches for surgical procedure of the temporal bone using:
- schematic figures;
- CT images from clinical cases;
- CT images obtained from cadaveric anatomic specimens demonstrating these procedures step-by-step. This technique will provide demonstration of all types of procedures that may be performed (simple mastoidectomy, canal-wall-up mastoidectomy - facial recess approach, canal-wall-down mastoidectomy, modified radical mastoidectomy, radical mastoidectomy, translabyrinthine approach and retrosigmoid approach.

SUMMARY
Anatomic structures of the temporal bone and middle ear are key references used to define operative technique as well as extension of resection during surgical procedures of the temporal bone. Acknowledge of these structures and of the variety of procedures that may be performed enables proper preoperative planning and correct postoperative interpretation by the radiologist.

**An Algorithmic Approach towards the Evaluation of Hypoxic-ischemic Encephalopathy (HIE) in Pediatric Patients**

**PURPOSE/AIM**
Develop an algorithm to aid radiologists when evaluating hypoxic-ischemic encephalopathy (HIE) in preterm, term, and postterm pediatric patients.

**CONTENT ORGANIZATION**
Imaging patterns of HIE in neonates and children show substantial variability dependent on brain maturity at the time of insult as well as the severity/duration of the insult. By developing a step-wise approach to aid image interpretation, the radiologist can more easily recognize the major patterns of HIE. This educational exhibit will illustrate each of these patterns in an image-rich fashion utilizing multiple modalities. Our exhibit will highlight pathophysiologic mechanisms underlying HIE and anatomic structures that are uniquely at risk for injury in this age group. Image examples will include advanced MRI techniques such as arterial spin labeled perfusion (ASL), which can elucidate brain injury even in the absence of conventional imaging findings and provide valuable prognostic information. Collectively, this information will be organized into an algorithm, which can be easily referenced and applied at the workstation.

**SUMMARY**
Hypoxic ischemic encephalopathy is a complex entity with variable imaging findings. An algorithmic approach will benefit the radiologist when evaluating HIE in neonates and children, thereby adding value in both identifying and predicting the severity of this entity.

**Alcohol-related Encephalopathies**

**PURPOSE/AIM**
The aim of this exhibit is: 1. To describe the imaging findings of the disorders produced in the central nervous system (CNS) by alcoholism.

**CONTENT ORGANIZATION**
CNS pathophysiology in alcoholism Acute ingestion: hemorrhage, intoxication by methanol Chronic abuse: atrophy, hepatic encephalopathy, Wernicke encephalopathy, Marchiafava-Bignami disease, subacute combined degeneration of spinal cord and central pontine myelinolysis.

**SUMMARY**
The major teaching points of this exhibit are: 1. Alcohol-related encephalopathies are life-threatening conditions which prognosis mostly depends on early treatment. 2. As its clinical presentation is often nonspecific, neuroimaging findings can be very helpful in prompt diagnosis.

**Limbic Encephalitis: Autoimmune Diseases, Paraneoplastic Syndromes and Infections. A Comprehensive Review**

**PURPOSE/AIM**
The purposes of this exhibit are:
1. To describe the classification of limbic encephalitis according to the etiology and pathophysiology.
2. To illustrate the MR imaging findings in different subtypes of limbic encephalitis.
3. To review the differential diagnosis with other causes of temporal lobe involvement.

**CONTENT ORGANIZATION**
- Clinical manifestations, etiology and pathophysiology description of the different types of limbic encephalitis.
- Detailed review of infectious limbic encephalitis.
- Description of the pathological mechanism in autoimmune encephalitis and different antibodies involved in paraneoplastic and non-paraneoplastic disease.
- Reviewing the MRI findings in limbic encephalitis and illustration with some examples.
- Overview of other possible causes of temporal lobe involvement.

**SUMMARY**
Knowledge of the clinical presentation, pathophysiology and immunology of limbic encephalitis is essential the different scenarios where this disease can occur. To be familiar with imaging findings, mainly MRI features of limbic encephalitis, is of great importance to characterize the disease with a timely diagnosis allowing appropriate treatment and better clinical course.

**Need to Know Anatomy for Clinical Functional MRI Interpretation**

**PURPOSE/AIM**
- Clinical manifestations, etiology and pathophysiology description of the different types of limbic encephalitis.
- Detailed review of infectious limbic encephalitis.
- Description of the pathological mechanism in autoimmune encephalitis and different antibodies involved in paraneoplastic and non-paraneoplastic disease.
- Reviewing the MRI findings in limbic encephalitis and illustration with some examples.
- Overview of other possible causes of temporal lobe involvement.

**SUMMARY**
Knowledge of the clinical presentation, pathophysiology and immunology of limbic encephalitis is essential the different scenarios where this disease can occur. To be familiar with imaging findings, mainly MRI features of limbic encephalitis, is of great importance to characterize the disease with a timely diagnosis allowing appropriate treatment and better clinical course.
Anatomical Review of the Craniocervical Junction Ligaments with High Resolution MRI Imaging

PURPOSE/AIM
To present and illustrate an anatomical review of the craniocervical junction ligaments with high resolution MRI imaging

CONTENT ORGANIZATION
1. Illustration and anatomical review of the craniocervical ligaments with high resolution MRI imaging, including technique. This will include an emphasis on alar ligaments with anatomic variation and pathology, as well as the apical ligament, cruciate ligament, anterior atlanto-occipital membrane, tectorial membrane, and posterior atlanto-occipital membrane.
2. Discussion and illustration of variability in alar ligament shape and signal characteristics, and case examples of alar ligament pathology.

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Distinguishing the Superior Parietal Lobule Connections of the Temporoparietal Superior Longitudinal Fasciculus in the Human Brain Using High Resolution Diffusion Tensor Tractography

LL-NRE4476

Arash Kamali, MD
Khader M Hasan, MD, PhD, MSc

PURPOSE/AIM
Inferior parietal lobule connections of the temporoparietal superior longitudinal fasciculus (TP SLF) have been described in the literature. Extensive crossing fibers at the corona radiata at the level of the lateral ventricles as well as lack of adequate imaging sensitivity and spatial resolution, so far, impeded depiction of superior parietal lobule connections of the TP SLF in prior diffusion tensor imaging studies. This work aimed to explore the acuity and feasibility of visualization of the superior parietal lobule connections of the TP SLF using a high resolution diffusion tensor tractography.

CONTENT ORGANIZATION
- To review the prior diffusion tensor tractography studies representing the TP SLF.
- To discuss the importance of the TP SLF and specifically the superior parietal lobule connections of the TP SLF.
- To discuss our imaging data acquisition protocol and data post processing.
- To review the advantages of high resolution diffusion tensor tractography in tracing previously not described fiber pathways such as the superior parietal lobule connections of the TP SLF.
- To detail the technical benefits of high resolution tractography.

SUMMARY
In this report we demonstrate for the first time the feasibility of in vivo tracing the superior parietal lobule connections of the temporoparietal SLF using high resolution diffusion tensor tractography.

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Glioblastoma Multiforme during Treatment with Bevacizumab: A Diversity of Imaging Findings Yet to be Understood - Pictorial Essay and Literature Review

LL-NRE4477

Maira Sarpi, MD
Tatiana G Lyra, MD
Luís F Godoy, MD
Daniel Delgado, MD
Marcos F Docema, MD
Hae W Lee, MD
Maria Martin, MD
Lucas N Silva, MD

PURPOSE/AIM
To depict the variety of imaging findings observed in GBM follow up during the treatment using clinical cases. To discuss their possible correlation with molecular, biochemical and genetic characteristics of the tumor.

CONTENT ORGANIZATION
Molecular, biochemical and genetic characteristics of GBM - correlation with imaging findings before and after treatment.
Description of tumor behavior in MR imaging follow up during target therapy, demonstrated by clinical cases, depicting different patterns of growth and lesions, sometimes present in the same patient.
SUMMARY
Avastin® (bevacizumab) was approved in 2009 by the FDA for the treatment of GBM patients with progressive disease following prior therapy. It is an inhibitor to the activity of human vascular endothelial growth factor and represents a promising optional treatment for these patients, since angiogenesis is a hallmark of high grade tumors (specially GBM). Imaging evaluation of the treatment effects is very interesting – tumors initially responds, but ultimately progress, and it is possible to observe distinct imaging patterns of growth, sometimes multiple in the same patient. As a relatively recent practice there will be a lot to observe and to learn regarding tumor behavior related to this treatment, and imaging is playing a fundamental role in the evaluation of response and prognostic factors.

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Anatomical Review of the Craniocervical Junction Ligaments with High Resolution MRI Imaging

LL-NRE4478

Jennifer Chang, MD
Gabriel J Runner, MD
Peter Shen, MD
Anna Nidecker, MD
Matthew Bobinski, MD, PhD
Paul S Lee, MD

PURPOSE/AIM
To present and illustrate an anatomical review of the craniocervical junction ligaments with high resolution MRI imaging

CONTENT ORGANIZATION
1. Illustration and anatomical review of the craniocervical ligaments with high resolution MRI imaging, including technique. This will include an emphasis on alar ligaments with anatomic variation and pathology, as well as the apical ligament, cruciate ligament, anterior atlanto-occipital membrane, tectorial membrane, and posterior atlanto-occipital membrane.
2. Discussion and illustration of variability in alar ligament shape and signal characteristics, and case examples of alar ligament pathology.
Am I Getting on Your Nerves? Anatomy and Pathology of Nerves in the Infrahyoid Neck

PURPOSE/AIM
1. Learn the location of major nerves in the infrahyoid neck
2. Demonstrate the imaging findings of common lesions affecting the nerves
3. Review clinical findings associated with nerve involvement

CONTENT ORGANIZATION
Information is presented in a quiz format using illustrations and corresponding cross sectional images to provide a comprehensive review of infrahyoid neck nerve anatomy. This is followed by case presentations with emphasis on the location of pathology with reference to nerves, imaging findings and clinical symptoms. Lesions to be discussed include:

- Vagus nerve X-(Nerve sheath tumors, extrinsic compression of the recurrent laryngeal nerve)
- Spinal Accessory nerve XI-(Nerve sheath tumors and secondary involvement)
- Phrenic nerve-(Secondary involvement)
- Brachial plexus-(Nerve sheath tumor, nerve root avulsion)
- Sympathetic plexus-(Nerve sheath tumor, extrinsic compression)

SUMMARY
Knowledge of the location of the nerves in the infrahyoid neck and common pathologies encountered in this region will increase the accuracy of imaging interpretation. Upon completion of this module, the user will have improved their ability to interpret cross-sectional images of the infrahyoid neck including identifying lesions originating in or potentially involving, major nerves. This information is important for surgical planning and may improve patient outcomes.

Hippocampal Volumetry and T2 Relaxometry - Correlation in Mesial Temporal Sclerosis

PURPOSE/AIM
1. To review limitations of conventional MRI sequences in early diagnosis of MTS
2. To outline the advantages of Hippocampal volumetry and T2 Relaxometry in diagnosis of MTS
3. To compare and show the combined strength of these novel techniques

CONTENT ORGANIZATION
- Pathophysiology of Mesial Temporal Sclerosis
- Review of imaging findings
  - Conventional MRI
  - Hippocampal Volumetry: Techniques and interpretation
  - T2-Relaxometry
- Sample cases and mimics
- Future directions and summary

SUMMARY
Radiotherapy in the Treatment of CNS Tumors. Friend or Foe?

PURPOSE/AIM
1. To review the broad spectrum of complications in the radiotherapy treatment of CNS tumors. 2. To describe the imaging findings and explain the utility of conventional MRI, advanced MR techniques (perfusion MR, spectroscopy MR) and nuclear medicine techniques (PET, SPECT) in the differential diagnosis between radiation-induced lesions and persistent or recurrent tumor.

CONTENT ORGANIZATION
- Variables which influence the radiation-induced tissue damage.
- Physiopathology of the radiation induced tissue damage.
- Classification of the radiation induced injury in CNS. Acute Subacute Cronic 4. Imaging findings in this complications using conventional MRI, advanced MRI techniques such as perfusion MR and spectroscopy MR and nuclear medicine techniques such as PET and SPECT.

SUMMARY
Neuroimaging techniques are nowadays a powerful tool that allows us in most cases the differential diagnosis between radiation-induced lesions and persistent or recurrent tumor.

**Clinical Application of Double Inversion Recovery Sequence in Central Nervous System Diseases**

**PURPOSE/AIM**
1. To review the principle of double inversion recovery (DIR) and its up-to-date development in scanning protocol.
2. To summarize the clinical application of DIR in neurological diseases associated with cortical gray matter (GM) changes such as multiple sclerosis (MS), neuromyelitis optica (NMO), tuberous sclerosis, and epilepsy.

**CONTENT ORGANIZATION**
1. The history of the development of DIR sequence, and the advantage of DIR comparing with other MRI sequences.
2. The clinical application of DIR in neurological diseases associated with cortical lesions.
3. The future practical applications and directions.

**SUMMARY**
1. DIR can detect more brain lesions especially in cortical areas.
2. DIR increases definition when assessing mixed white matter–gray matter lesions.
3. Differentiate NMO from MS according to their brain lesion distribution pattern.

**Lumps and Bumps: Lesions of the Scalp and Calvarium**

**PURPOSE/AIM**
By reviewing this module the reader will learn: 1. The gross anatomy and imaging appearance of the scalp and calvarium 2. Lesions commonly encountered in the radiographically discernible layers of the scalp and calvarium 3. Pertinent anatomic considerations for predicting disease spread and surgical planning

**CONTENT ORGANIZATION**
Following a review of normal anatomy and the imaging appearance of the scalp and calvarium, pathology located in each of the radiologically discernible layers of the scalp and calvarium is presented. Cases presented in each location include: Skin: Cancer, epidermoid cysts, skin tags, calcifications Subcutaneous layer: Lipoma, hemangioma, plexiform neurofibroma, angiosarcoma Galea/subgaleal/periosteal complex: Cephalohematoma, dermoid Bone: Intraosseous (epidermoid tumor, hemangioma, meningioma, lipoma lytic (plasmacytoma, metastases, hyperparathyroidism cortical thickening (hyperostosis, osteoma diploic space widening (Paget disease, fibrous dysplasia, thalassemia, osteopetrosis)

**SUMMARY**
After viewing this module, the reader will understand the six layers of the scalp, four of which can be identified on cross sectional imaging. Localization of pathology in these layers, and familiarity with lesions commonly encountered in each, enhances image interpretation and can aid in the detection of disease spread.

**Dynamic Contrast MR Angiography of the Spine: Multiple Applications Complementing the Use of Catheter Angiography**

**PURPOSE/AIM**
To review the indications, diagnostic imaging, and pitfalls of dynamic contrast enhanced MR angiography of the spine.

**CONTENT ORGANIZATION**
Anatomy: Pitfalls of identifying the artery of Adamkiewicz and distinguishing between the great anterior radicular vein as well as timing of arterial peak imaging, mixed phase and venous imaging. Technique: Using dynamic MRA on a 3T Magnet in conjunction with isometric high resolution postcontrast imaging. Indication: 1. Identifying the artery of Adamkiewicz in preoperative thoracic abdominal aortic aneurysm (TAAA) repair to supplement evoked potential testing for artery reimplantation. 2. Identifying arterial supply for dural arteriovenous fistulas (dAVF) covering the entire thecal sac as we present a case where the supply arises from S2. 3. Identifying atypical venous anatomy and preoperative localization as we present a case demonstrating a dAVF with an epidural venous pouch. 4. Using dynamic MRA to follow up posttreatment changes in arteriovenous malformations. Future directions in spine dynamic MR angiography.

**SUMMARY**
MR angiography imaging needs both time resolved and high spatial resolution imaging to identify anatomic structures for preoperative TAAA repair, follow up of posttreatment vascular malformations, narrowing the scope of catheter angiography, as well useful preoperative planning.

**Structural and Functional 3T MR Imaging of Glioma**

**PURPOSE/AIM**
This exhibit aims to present a review of the imaging features of gliomas at 3T MRI with emphasis on functional techniques and their role in recognizing tumor grade (WHO II, III or IV), tumor response to treatment and treatment planning.

**CONTENT ORGANIZATION**
1. MR Imaging Techniques
   1.1. Structural assessment: high-resolution T2W, Flair, MPR, SWI.
2. Glioma grading
3. Main MRI characteristics of WHO II, III and IV gliomas on various MR techniques
4. Predictive value of multimodality MRI in detecting anaplastic transformation
5. Value of functional MRI techniques in detecting pseudoprogression and pseudoresponse
6. Differential diagnosis
7. Treatment planning

SUMMARY
The major teaching points of this exhibit are:
1. Understanding the spectrum of key image characteristics of glioma at various 3T MR functional techniques.
2. Conjunct interpretation of structural and functional MR imaging findings helps in recognizing glioma grade, tumor tendency for progression (upgrading) and tumor respond after therapy.
3. Choosing a multimodality MRI approach assists biopsy and surgery planning.

Clival Encephalocele-A Rare Developmental Anomaly

LL-NRE4487
Sri Hari Sundararajan, MD
Pranay C Uppuluri, MD
Sudipta Roychowdhury, MD *

PURPOSE/AIM
The purpose of the exhibit is to:
1. Discuss the case of a premature newborn presenting with a cystic mass in the oropharynx
2. Address the diagnostic imaging paradigm confirming the diagnosis as a clival encephalocele
3. Highlight general imaging findings of encephaloceles and associated patient demographics
4. Recognize the rarity of a clival encephalocele

CONTENT ORGANIZATION
1. Case
   a. History, premature, poor feeding, lesion in oropharynx
   b. CT Head – mass in oropharynx, dysplastic rotated cerebellum
   c. MRI Neck – T2 hyperintense mass, midline clival defect
2. Diagnosis
   a. Lumbar Myelography followed by CT and MR examination
   b. Confirmed midline clival defect as meningocele
   c. MRI Brain Myelogram – partial herniation of pons, compatible with encephalocele
3. Case Management
   a. Encourage weight-gain
   b. To attempt surgical correction
4. Encephaloceles
   a. Imaging characteristics on CT/MR/Ultrasound
   b. Associated developmental anomalies
   c. Management
   d. Differential Diagnosis
   e. Clival encephalocele, rare, only one other case report (Pubmed ID 10969956)

SUMMARY
This exhibit reviews:
1. Diagnosis of clival encephalocele, a rare developmental anomaly
2. How a clival encephalocele presents on CT and MR
3. General concepts regarding encephaloceles and associated anomalies, differential diagnosis, and management

Functional Diffusion Maps: Diffusing Function into a Workstation Near You

LL-NRE4488
Jonathan R Young, MD
Jocelyn A Young
Benjamin M Ellingson, MS, PhD *
Whitney B Pope, MD, PhD *

PURPOSE/AIM
1. Review how to generate functional diffusion maps (fDMs). 2. Review the utility of fDMs in:
   A. Predicting overall survival in patients with newly diagnosed glioblastoma (GBM) treated with radiochemotherapy
   B. Predicting overall survival in patients with recurrent GBM treated with anti-angiogenic agents.

CONTENT ORGANIZATION
1. Current MRI Assessment of Gliomas and the Need for Functional Imaging
2. Functional Diffusion Maps (fDMs)
   A. Technique for Acquiring and Calculating fDMs
   B. Clinical Utility of fDMs

SUMMARY
GBM is the most aggressive type of glioma, with a median survival of 12-15 months. While conventional approaches to assessing treatment response have relied upon strictly anatomic measurements, recent efforts have focused on identifying physiologic biomarkers that accurately measure response shortly after treatment initiation to allow for earlier treatment decisions, saving patients from the adverse effects of ineffective therapies while allowing them to try alternative therapies sooner. Functional diffusion maps (fDMs), which examine voxel-wise changes in the apparent diffusion coefficient over time, have been shown to potentially detect treatment effects before changes in tumor size are evident. This education exhibit will review how to generate fDMs and explore the utility of fDMs as a tumor response biomarker in GBM.

Identifying Cranial Neuropathies Made Easy: A Neuroimaging Guide for Evaluation of Cranial Nerves

LL-NRE4489
Pavani Adapa, MD
Arash Kamali, MD
Matthew F Omojola, MD
Matthew L White, MD *
Mark D Keiper, MD

PURPOSE/AIM
To review the anatomy of all the twelve cranial nerves with the help of high resolution CT and MRI. To describe the various pathologic conditions affecting the cranial nerves and discuss the appropriate neuroimaging approach.

CONTENT ORGANIZATION
Understanding the normal functional anatomy and anatomical landmarks is important in localizing various cranial neuropathies. This knowledge is very essential in accurate radiologic localization of the abnormalities. We will discuss various clinical conditions affecting the cranial nerves. As neuroimaging techniques continue to advance, so does their role in precise diagnosis of perineural tumoral spread. With the help of high resolution CT and MRI, including specific sequences and 3D formats we will provide a pictorial essay of imaging of all the cranial nerves. Emphasis will be made on easily missed findings and key areas to focus in search patterns to help better patient management. Imaging algorithms for localization of lesions will also be discussed.

SUMMARY
Cranial neuropathies can be a result of both benign and malignant etiologies. Knowledge of functional neuroanatomy combined with appropriate imaging is necessary to help avoid missing pathologies which can alter patient management.

The Brain on HIV/AIDS: Pests and Overgrowths Affecting the CNS

LL-NRE4490
Gabriella B Tantilto, BA
Sean Maldonado, BS
Cedric W Pluguez-Turull, MD
Richard Zack-Guasp
Melisa Rivera
Guido E Santacana-Laffitte, MD
Cristina Quintero, BA
Eduardo J Labat, MD

PURPOSE/AIM
Approximately one third of AIDS patients will develop neurological complications. Opportunistic infections and neoplasms of the CNS continue to be a prevalent manifestation of HIV/AIDS and are often the first key to diagnosis. This exhibit will review the pathophysiology, clinical presentation, and characterization imaging findings for HIV-associated CNS infections and neoplasms.

CONTENT ORGANIZATION
This educational exhibit will review the major CNS pathologies affecting patients with HIV/AIDS, with an emphasis on two main areas: 1) Opportunistic infections: including parasitic, fungal, bacterial, tubercular, and viral, PML, and 2) CNS neoplasms: including CNS lymphoma. Clinical history, immunological staging, and physical exam will be correlated with imaging findings drawn from adult patients from a PACS database at our institution. Particular attention will be paid to the differential diagnosis from CT and MRI findings vis-a-vis their clinical interpretation.

SUMMARY
Opportunistic infections and neoplasms occurring secondary to immunodeficiency are the largest cause of morbidity among HIV patients; however, proper differentiation among these pathologies can be difficult. Radiologists must be able to use neuroimaging in conjunction with clinical and physical exam information to obtain the best possible diagnosis to guide subsequent therapy.

Teeth: Anatomy and Spectrum of Diseases on CT

LL-NRE4491
Maider Bringas Veiga
Olivia Rodriguez San Vicente
Aina Dolado Llorente, MEd
Ander Garcia Etxebarría
Nerea Hormaza, MD
Juliana Mesa

PURPOSE/AIM
The purpose of this exhibit is: 1) to review basic dental anatomy 2) to know the imaging appearance of common dental diseases, using example cases 3) To differentiate normal variants from real diseases.

CONTENT ORGANIZATION
Disease of the teeth is a frequent situation; moreover, dental pathology is often incidentally seen at head and neck imaging studies performed for nontooth-related indications. We show several cases of dental disease, such as tooth trauma, periodontal disease, periapical disease, caries, hyperdontia and hypodontia, impacted teeth, oroantral fistula, odontogenic sinusitis, deep neck infections and odontogenic tumors, explaining differential diagnosis and key diagnosis of each entity.

SUMMARY
Recognition of normal variants and the typical radiological features of diseases of the teeth assumes prime importance to discern more serious conditions and, moreover, to allow timely referral to a dental specialist and early definitive treatment to prevent pain, morbidity, and tooth loss.

Head and Neck Rhabdomyosarcoma in Children and Adolescents: Imaging, Clinical, and Pathological Assessment

LL-NRE4492
Bing Wang, MD
Alfred L Weber, MD
Hugh D Curtin, MD
Paul A Caruso, MD

PURPOSE/AIM
To demonstrate the clinical, imaging, and pathological findings of rhabdomyosarcoma in children and adolescents.

CONTENT ORGANIZATION
Method:
We evaluated 30 cases of rhabdomyosarcoma (RMS) in 2-20 year-old. All cases were studied with CT and/or MRI, and in some cases PET-CT. Representative cases of RMS in different locations will be selected and illustrated along with extension of these tumors. Pertinent differential diagnosis will be presented at the conclusion of the case presentations. Findings:

On CT the densities were homogeneous showing only slight enhancement. The MRI findings revealed low signal intensities relative to muscle on T1-WI, increased signal intensities on T2-WI, and marked enhancement on post-Gadolinium images. PET-CT was helpful in determining the activity of residual tumor after therapy and local and distant metastases. Tumor necrosis was not a prominent feature. The location of RMS was as follows: orbit(8), parapharyngeal space (PPS)(5), nasopharynx (NP)(4), oral cavity/oropharynx(4), paranasal sinuses/nasal cavity including nasal bones(4), temporal bone(2), neck(2), and temporal fossa(1).

SUMMARY
We present the imaging findings of Head and Neck RMS seen at MD Anderson, MGH and MEEL in last 10 years and evaluated these tumors for size, shape, margins, location, extent, bony erosion, multiplicity and local and distant metastases.

Granuloma or Glioma? Get the Answer from SW Imaging with 3.0 T

LL-NRE4493
Ankur Shah, MD
PURPOSE/AIM
The aims of this exhibit are:
- To discuss the basics and physics of susceptibility weighted imaging
- To show the advantages of high strength magnet in SW imaging
- To know about intratumoral susceptibility signals and their grading
- To show the applications of susceptibility weighted images in differentiation of granuloma from glioma and other neoplastic lesions

CONTENT ORGANIZATION
- Basics and Physics of susceptibility weighted imaging
- Understanding of phase, magnitude and MinIP SW images and their importance
- Understanding of intratumoral susceptibility signals (ITSS) and their grading
- Differentiation of calcification from hemorrhage with the help of SW imaging
- Appearances of granuloma and neoplastic lesions on SW images and their differentiation based on imaging characteristics and intratumoral susceptibility signals
- Limitations of SW imaging

SUMMARY
- SW imaging is a complex new technique of neuroimaging
- Superior signal to noise ratio with 3.0 T MRI machine results in excellent SW images
- SW imaging is a novel tool that helps in differentiation of granuloma from glioma and other neoplastic lesions

Differentiating Intraventricular Brain Tumors in Children and Adults: A Pictorial Review and Diagnostic Algorithm

LL-NRE4494
Jordan N Kavanaugh, MD
Matthias H Schmidt, MD, MSc

PURPOSE/AIM
The purpose of this exhibit is to educate the reader on the most commonly encountered intraventricular brain tumors in children and adults. After reviewing our display, the reader will be able to list and describe the most commonly encountered intraventricular brain tumors, including important imaging features and WHO grading, as well as provide a short differential diagnosis using our diagnostic flowchart.

CONTENT ORGANIZATION
1. Brief review of ventricle anatomy, histology of the ependyma and choroid plexus. 2. Epidemiology of intraventricular tumors. 3. Brief description of common intraventricular tumors. 4. Description of our recently developed diagnostic flowchart which helps the radiologist narrow the differential diagnosis for any given intraventricular tumor. 5. Local sample cases of different types of intraventricular tumors with review of imaging findings.

SUMMARY
Intraventricular brain tumors are rare. Histopathologically, they comprise a heterogeneous group of neoplasms, and their biological behavior ranges from indolent to aggressive. In this exhibit, the major teaching points are: ventricle and ependymal anatomy and clinical and imaging features of common intraventricular tumors. We will also educate the reader on how to narrow the differential diagnosis for any given intraventricular tumor using our recently developed diagnostic flowchart.

Vascular Imaging of the Head and Neck: Imaging Technique and Limitations

LL-NRE4495
Michael Hakky, MD
Daniel E Marrero, MD
Sami H Erbay, MD

PURPOSE/AIM
The radiologist has at their disposal a multitude of techniques for vascular neuroradiologic imaging. The appropriate selection of techniques allows for effective diagnosis of pathology. The purpose of this exhibit is to expose radiologists to a series of challenging cases demonstrating the application of neuroradiologic vascular imaging to help improve recognition and diagnostic accuracy.

CONTENT ORGANIZATION
Real life cases will be presented in quiz format with pertinent images. Radiologists will be compelled to manage cases in real time. Key differential diagnostic points and vital imaging sequences will be highlighted and explained. Cases would compel the radiologist to make decisions between:
- Carotid - dissection vs ulceration
- Parenchymal bleed - hypertension vs underlying lesion
- Carotid stenosis - screening vs grading
- Aneurysm - detection vs post-treatment screening
- Headache - with presence or absence of hemorrhage

SUMMARY
A number of powerful techniques have been increasingly utilized for vascular imaging in neuroradiology. Understanding the technical background and limitations of various techniques is vital to success in patient management. Each test has specific advantages and disadvantages. Understanding these factors may help radiologists to maximize the utility of each test.

Quantifying the Structural and Functional Abnormalities in Alzheimerâ€™s Disease

LL-NRE4496
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Christopher H Hunt, MD
Geoffrey B Johnson, MD, PhD
Patrick J Peller, MD *

PURPOSE/AIM
Alzheimer’s disease (AD) is the most common and progressive neurodegenerative illness and is often unrecognized in its early stages.
1. Review MR and PET qualitative and quantitative evaluation of the brain
2. Review multimodality imaging and quantitative biomarkers in asymptomatic to clinically apparent AD.

CONTENT ORGANIZATION
1. Quantitative imaging techniques
   A. MR
   1. Hippocampal volume: manual, automated
   2. Voxel base morphology
SUMMARY
AD has pathological amyloid depositions, structural atrophy and metabolic alterations in the brain identified by MR and PET. At present, several imaging biomarkers have proved useful to classify and quantify AD and more importantly its prodromal stages. The combined use of quantitative MR and PET holds the promise of early, certain and specific identification of patients afflicted with Alzheimer’s disease.

Pictorial Essay of Non-invasive Multi-modal CT and MR Imaging Findings of Dural Arteriovenous Fistulas

PURPOSE/AIM
This exhibit will demonstrate:
- Non-invasive multimodal CT/MR imaging findings of dural arteriovenous fistulas (DAVFs).
- Imaging features most associated with aggressive DAVFs.
- Correlation of DAVFs non-invasive imaging features with catheter angiography.

CONTENT ORGANIZATION
DAVFs are rare intra-cranial vascular abnormalities that can cause cerebral edema/hemorrhage. Though at times subtle, DAVFs have findings that may be detected on non-invasive imaging. We will show abnormalities of DAVFs that can be seen on CT, CT angiography (CTA), MR, MR angiography (MRA), dynamic 4D MRA/CTA, and CT/MR perfusion studies. In addition, we will illustrate findings that are particularly associated with aggressive DAVFs. Examples include: enlargement of external carotid artery branches, abnormal venous structures on MRA, abnormal enhancement of engorged parenchymal veins, abnormal cluster of flow voids in the subarachnoid space, engorgement of the cavernous sinuses, enlargement of the superior ophthalmic vein, parenchymal hemorrhage/edema, hydrocephalus, direct visualization of the DAVFs on 4D CTA/MRA, and alterations on whole brain MR and CT perfusion.

SUMMARY
DAVFs, although rare, are potentially fatal conditions that can be easily missed on MR/CT. Awareness of non-invasive imaging findings is crucial for prompt diagnosis and treatment of this curable disease.

Go with the Flow: Employing Arteries and Veins in the Face and Neck to Predict Lesion Origin

PURPOSE/AIM
After viewing this module the reviewer will be able to: 1. Identify major vascular structures in the face and neck. 2. Correlate vascular anatomy to surgical landmarks in the face and neck. 3. Identify typical patterns of vascular displacement associated with commonly encountered lesions of the face and neck.

CONTENT ORGANIZATION
Normal anatomy of the major arteries and veins in the face and neck is reviewed, emphasizing the relationship of vessels to glands, major nerves and muscles. Representative cases, presented in a quiz format, demonstrate patterns of vascular displacements produced by common neoplastic and nonneoplastic processes. Cases emphasize the utility of vascular anatomy in the detection of pathology involving the parotid duct, submandibular gland, inferior trunk of the brachial plexus and thoracic duct. Typical patterns of vascular displacement encountered with lesions arising from the vagus nerve, carotid body, thyroid gland, sympathetic chain, cervical nerves and components of the brachial plexus are presented. Ancillary imaging findings that aid in interpretation are discussed.

SUMMARY
Correct identification of major vascular structures is essential prior to surgical intervention. Understanding vascular displacements assists in developing an appropriate differential diagnosis.

Cortical Gyral Anatomy: Speaking the Clinicians’ Language

PURPOSE/AIM
The goal of this interactive educational exhibit is to provide a detailed review of the gyral anatomy of the brain. The cerebral anatomy will be depicted both with neuroimaging (CT and MRI) and gross pathologic photography. Educational goals are reinforced with a self-assessment module at the conclusion of the anatomy review. The knowledge gained is expected to improve lesion localization in the radiology report and streamline communication with ordering clinicians.

CONTENT ORGANIZATION
An interactive powerpoint presentation delineates cerebral gyral anatomy on cadaveric photographs followed by MRI/CT correlation. The layout is designed for stepwise learning of anatomical detail and radiological anatomy. The presentation is available for learning at each individual’s own pace. Integrated review slides allow consolidation of previous information before moving on to the next learning objective. Finally, a dedicated self-assessment module provides an exercise in knowledge application.
The educational exhibit will provide an interactive review of the gyral anatomy of the brain with radiologic-pathologic correlation, allowing the radiologist to better localize pathology and augment communication with ordering clinicians.

**High Five! All about Trigeminal Nerve MR Imaging**

**LL-NRE4500**
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Hemant T Patel, MD
Ankur Shah, MD
Mrunali I Shah, MBBS
Nishat Goyal, MBBS, DMRD

**PURPOSE/AIM**
1. To learn the normal anatomy of the fifth nerve and its branches on the cross sectional imaging.
2. Illustrate the imaging appearance of wide spectrum of pathologies primarily or secondarily involving the nerve and its branches.
3. Discuss the differential diagnosis based on the segmental involvement of the nerve.

**CONTENT ORGANIZATION**
1. MRI anatomy: Brain stem nuclei and Peripheral course
2. Standard MR imaging protocol, newer 3D sequences and gadolinium enhanced scans
3. Pathologic conditions: segmental approach of interpretation: Brain and brain stem; Cisternal segment; Skull base; Peripheral course (Ophthalmic, Maxillary and Mandibular nerve)

**SUMMARY**
The Major Teaching points of this exhibits are:
- Simplified learning for the fifth nerve anatomy and pathology.
- Highlighting the importance of newer 3D sequences in imaging of fifth nerve.
- This will help radiologists to interpret various pathological appearances of trigeminal nerve.

**Brain Metastasis: Following the Clues through Paths and Holes Inside the Brain**

**LL-NRE4501**
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Pedro N Castro, MD
Raquel R Batista, MD
Thamara Perrone
Joana Fagundes Pinto, MD

**PURPOSE/AIM**
Brain metastases are considered the most common intracranial neoplasia, presenting with well defined patterns of spread according to the route of dissemination and primary tumor of origin. Our aim is to illustrate, through didactic schemes, hematogenous, periventricular, perineural and liquoric pathways of dissemination, and correlate with imaging findings in MRI simplifying reach the differential diagnosis.

**CONTENT ORGANIZATION**
Each topic below will be according discussed and illustrated: -Epidemiology and main causes of each pattern of brain metastasis -MRI imaging protocol for brain metastases evaluation -Simple didactic schemes showing the pathways of metatasis inside the brain, specially: perineural dissemination of cystic carcinoma adenomatoyd, periventricular/liquoric infiltration of GBM, hematogenous metastasis of breast/pulmonary primary malignance -MRI imaging appearance of the most relevant lesions and when to suspect the primary site according to: hematogenous, through liquor, periventricular and perineural pathways of dissemination

**SUMMARY**
The pattern of dissemination of metastasis within the brain may characterize the primary tumor. Through easy schemes we try to illustrate aspects of imaging that characterize these routes of dissemination, favouring the right diagnosis.

**Mimickers of Thyroid Nodules and Postoperative Recurred Tumors on Thyroid Ultrasonography**

**LL-NRE4502**
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Seung Hong Choi, MD, PhD
Tae Jin Yun, MD
Ji-Hoon Kim, MD
Chul-Ho Sohn, MD
Jisang Park, MD
Koung Mi Kang
Eun Kyoungh Lee, MD
Soo Chin Kim, MD

**PURPOSE/AIM**
The purpose of this exhibit is:
1. To review the clinical utility of thyroid ultrasonography (USG) in thyroid nodule work up and postoperative (postop) follow up.
2. To review various thyroid or non-thyroidal lesions mimicking true thyroid nodules on thyroid USG.
3. To review postop changes or non-thyroidal lesions mimicking recurred tumor on postop USG.

**CONTENT ORGANIZATION**
1. Overview of thyroid USG in thyroid nodule work up and postop follow up.
2. Thyroid nodule mimickers
   1) Thyroid lesions
   2) focal thyroiditis
   3) thyroid lymphoma
   4) Thyroid abscess
3) Non-thyroidal lesions
   1) parasthagheal diverticulum
   2) parathryoid nodules (adenoma, hyperplasia)
   3) 4th branchial cleft cyst
   4) Sympathetic ganglion
3) Tumor recurrence mimickers
   1) Postop changes
   2) Postop granuoloma
   3) Postop neumora
3) Partially resected SCM
   2) Non-thyroidal lesions
   1) Paraganghial diverticulum
   2) Calcified LN such as Tb lymphadenopathy
   3) Cervical sympathetic ganglion
   4) Thoracic duct venous angle
The major teaching points of this exhibit are:
1. USG is routinely used in evaluating thyroid nodules and postop follow up.
2. Various non-neoplastic thyroid lesions, non-thyroidal lesions can mimic thyroid nodule on thyroid USG.
3. Various postop changes, non-thyroidal lesions can mimic postop recurrence on postop USG.

Purpose/Aim
The purpose of this exhibit is:
1. To discuss MR acquisition techniques in evaluating the lumbosacral plexus and sciatic nerve.
2. To demonstrate normal anatomy and most common variants of the lumbosacral plexus and sciatic nerve.
3. To demonstrate a spectrum of common pathologic entities encountered in lumbosacral plexus and sciatic nerve imaging.

Content Organization
- MR Imaging Techniques
- Anatomy of the lumbosacral plexus and sciatic nerve and common variants
- Common disease state imaging findings, culled from a series of cases from UC Davis Medical Center
- Congenital/acquired – (e.g. hypertrophy, neuropathy)
- Trauma (e.g. contusion, compartment syndrome and ischemia)
- Neoplasm, benign and malignant (e.g. schwannoma, neuraoma, synovial sarcoma and metastases)
- Infection
- Mechanical (e.g. piriformis syndrome, hamstring avulsion and tendinopathy)
- Autoimmune/Demyelinating
- Summary

Summary
The major teaching points of this exhibit are:
1. Review normal and variant anatomy of the lumbosacral plexus and sciatic nerve as seen on MR imaging.
2. Demonstrate common pathologic diagnoses encountered in imaging the lumbosacral plexus and sciatic nerve.
PURPOSE/AIM
Tinnitus refers to rhythmic sound heard, is a common complaint. This may be synchronous to the radial pulse or non-synchronous. Synchronous or pulsatile tinnitus is a condition which is of radiological significance as imaging plays a vital role in diagnosis. Furthermore, Interventional radiology aids in management of few.

CONTENT ORGANIZATION
Causes of pulsatile tinnitus can be differentiated into normal vascular variants and pathological causes. Normal vascular variants include: Arterial: Aberrant carotid artery, persistent stapedial artery and trigeminal artery. Venous: large jugular bulb. Pathological causes include: Arterial: Carotid artery dissection, aneurysms, FMD. Arteriovenous: Glomus tympanicum/jugulare, AVMs, Dural AVFs, Otosclerosis, cholesterolomas. Venous: Pregnancy, anemia. In cases of non-pulsatile tinnitus the most important diagnosis to be considered are CP angle tumors such as Vestibular Schwannomas. Various imaging modalities are used in evaluation as per the individual merit of the case and clinical suspicion such as CT, MRI and DSA.

SUMMARY
Tinnitus being an important symptom should be evaluated appropriately. Radiology not only helps in identification of the cause but also in management of few. Understanding of the various causes of this severe symptom and their imaging appearances are pertinent for accurate diagnosis and management.

Cortical Convexity Subarachnoid Hemorrhage: Various Causes and Imaging Appearances

PURPOSE/AIM
Computed tomography (CT) and magnetic resonance imaging (MRI) has made it relatively easy to diagnose cortical convexity subarachnoid hemorrhages in the acute setting however, the evaluation of these hemorrhages should not be limited to size and location. It is imperative that possible underlying etiologies be identified so that clinicians may properly treat and prevent this potentially catastrophic event. The goal of this exhibit is to review etiologies of cortical convexity subarachnoid hemorrhages, from common causes such as cerebral amyloid angiopathy to less common causes such as reversible cerebral vasoconstriction syndrome and moyamoya, so that the radiologist may properly aid in the diagnosis of the underlying cause.

CONTENT ORGANIZATION
This exhibit will be organized in a case based format describing the clinical presentation and imaging findings of etiologies of cortical convexity subarachnoid hemorrhages. The cases will be further classified based on the typical age of presentation.

SUMMARY
Cortical convexity subarachnoid hemorrhages are potentially catastrophic events that have a variety of etiologies. This exhibit will propose a diagnostic work-up that will cover the spectrum of potential underlying causes and review the specific findings of each etiology that may be responsible for these hemorrhages.

4D Flow MRI: A Conceptual Change in the Understanding of Neurovascular Diseases

PURPOSE/AIM
The purpose of this exhibit is: 1. To review the basic technical considerations of 4D flow MRI 2. To discuss the neurovascular applications of 4D PC-MRI 3. To explain the utility of both qualitative analysis of Flow and quantitative measurements.

CONTENT ORGANIZATION
Basic technical considerations of 4D flow MRI Qualitative analysis: Review of different applications of flow-tracking mapping - Arteriovenous malformations - Dural arteriovenous fistulas - Intra-aneurysmal flow pattern - Arterial stenotic or occlusive pathologies and flow compensation by the circle of willis - Venous system (idiopathic intra cranial hypertension and venous stenosis) Quantitative analysis: - Measurement of velocity, flow, pressure, wall shear stress, oscillatory shear index - Application in neurovascular disorders: towards new potential rupture risk criteria

SUMMARY
The major teaching points of this exhibit are: 1. 4D Flow MR Imaging applied to neurovascular disorders provides comprehensive insights into pathophysiology. 2. Qualitative analysis allows selective flow tracking mapping, useful for in Vivo comprehension of neurovascular disorders as well as pre and post embolization follow-up. 3. Quantitative analysis offers a better comprehension of interaction between morphology and function.

Aging Effect on Cerebral Blood Flow Measurements in Brain Perfusion Imaging with 3D Arterial Spin Labeling

PURPOSE/AIM
To reveal the aging effect on cerebral blood flow (CBF) measurements with 3D arterial spin labeling (ASL) images. 3D ASL images may be
Influenced by age-related various factors such as hemodynamic compromise and brain atrophy.

CONTENT ORGANIZATION
SUMMARY
The figure showed the mean CBF values in each group. There were no significant differences of regional CBF values among groups though in younger group lentiform nucleus and thalamic CBF values tended to be lower and PWR CBF values tended to be larger.

It is important to know the aging effect on CBF measurements, especially in evaluating CBF distribution in the neurodegenerative and cerebrovascular diseases.

**Differentiation among Glioblastoma Multiforme, Primary Cerebral Lymphoma and Solitary Brain Metastasis Using DWI, PWI and MRS: Faith, Doubts and Certainties**

**LL-NRE4510**
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Emma Gangemi
Emilio Lozupone, MD
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PURPOSE/AIM
Differentiation of glioblastoma multiforme (GBM), primary cerebral lymphoma (PCL) and solitary brain metastasis (SBM) with conventional MRI alone remains challenging, as these tumors show similar appearance on structural MR. If on one hand the use of advanced MR sequences (DWI, PWI and MRS) improve the diagnostic accuracy of conventional MRI, on the other hand they can represent confounding tools more than problem solving. The purpose of the exhibit is to: underline potential and limit of each non-morphological modality; highlight the importance of the integration of morphological and non-morphological MR features; improve radiologist’s diagnostic accuracy in difficult cases

CONTENT ORGANIZATION
Primer of DWI, PWI and MRS
Epidemiology, natural history and radiological presentation of GBM, PCL and SBM
Case series presented in a quiz format. Key diagnostic points highlighted in the discussion of each case: added value of each techniques and their combination, how to get the most out of DWI, PWI and MRS, clinical/radiological setting that decrease their reliability, (still) essential role of MR morphological features

SUMMARY
Non-morphological imaging modalities represent powerful tools in the differential diagnosis between GBM, PCL and SBM. It is important to be aware about the potential and limit of each modality, to use/weight their results "cum grano salis".

**A Parapharyngeal Space Odyssey**

**LL-NRE4511**
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Nicholas F Bassett, MBBS
Mark Alexander
Prasad Kothari
Thayahlan Iyngkaran, MBChB

PURPOSE/AIM
1. To review the normal anatomy of the parapharyngeal space on CT and MRI
2. To demonstrate the different types of disease processes that occur in this space, how the different imaging modalities are used in making the diagnosis and aid in further management.

CONTENT ORGANIZATION
The parapharyngeal space is a small but complex head and neck region. The types of diseases affecting this area include congenital lesions, infections, benign and malignant tumours. Specific diseases include branchial cleft cysts, pleomorphic adenoma and neurogenic tumours. It is also a potential space for disease processes spreading from the surrounding spaces such as the post-nasal space, retropharyngeal space and the parotid space.

This exhibit will review: 1) the normal anatomical boundaries of the parapharyngeal space on CT and MRI 2) the different types of disease processes that originate from within this space 3) the use of different imaging modalities, including diffusion weighted MR imaging in aiding diagnosis 4) and the histopathological correlation.

SUMMARY
We present an overview of the parapharyngeal space, its anatomical boundaries, the different types of disease processes and their imaging appearances.

**MR Features of Infections Affecting Basal Ganglia and Thalami**

**LL-NRE4512**
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Rahul M Nikam, MBBS, DMRD
Sonal Garg, MBBS
Shrinivas B Desai, MD
Rashmi S Badhe

PURPOSE/AIM
To illustrate MRI findings of infections affecting basal ganglia and thalami.

CONTENT ORGANIZATION
Symmetric thalamic hyperintensities was most commonly associated with cerebral malaria in our series with or without associated hemorrhages and cerebellar involvement. Japanese B encephalitis and dengue emerged as viral infections affecting these sites. A child with severe influenza infection of the respiratory tract developed encephalitis showed similar CNS finding. Bilateral strial necrosis was seen in patients with mycoplasma pneumoniae infection. 1 patient with salmonella septicaemia showed basal ganglia involvement, extensive cortical and white matter enhancing lesions. Ring like enhancing lesions with haemorrhages the result of toxplasmosis and aspergillosis was common in immunocompromised patients. Tuberculous affection was more the result of vasculitic infarcts than granulomas. Chronic infections like HIV encephalopathy and Creutzfeld Jacob disease also lead to symmetric affection but the clinical presentation and rest of imaging features help distinguish these entities.

SUMMARY
A variety of bacterial, viral, fungal and parasitic agents affect the basal ganglia and thalami. Knowledge of imaging features in conjunction with clinical and laboratory findings aid in appropriate diagnosis and help management.
**Purpose/Aim**

The purpose of this exhibit is:

1. To discuss the fundamental viscoelastic properties of the brain.
2. To review the components of MRE including the driver, pulse sequence and inversion techniques.
3. To explain the clinical applications of this novel method including Alzheimer’s, a diffuse disease, and meningiomas, a focal disease.

**Content Organization**

**Brain MR Elastography**

**Viscoelastic properties of the brain:**
- Compression waves contrasted with shear waves.
- Storage modulus and loss modulus of tissue stiffness.

**MR Elastography method:**
- Soft pillow driver to generate wave propagation.
- Phase contrast single-shot spin-echo EPI sequence to image waves.
- 3D inversion algorithm to generate tissue stiffness maps called elastograms.

**Clinical applications:**
- Alzheimer’s disease causes association areas of the brain to become stiffer before generalized softening.

Unlocking the Imaging of the Temporomandibular Joint

**Purpose/Aim**

Temporomandibular joint (TMJ) dysfunction is common, seen in up to 28% of the population. TMJ can be affected by abnormal dynamics of the disc-condyle complex, degenerative arthritis, inflammatory arthritis, and crystal arthropathy. Knowledge of the normal imaging appearance of the TMJ, appearance of pathology, and interventional techniques is useful for providing a meaningful radiological contribution. The exhibit goals are to review normal TMJ anatomy, demonstrate normal ultrasound, computed tomography, and magnetic resonance imaging appearances, provide case based examples of abnormal TMJs, and illustrate image guided therapeutic TMJ injection.

**Content Organization**

Illustrations with MRI, US, and CT correlates of the anatomy of the meniscal disc, capsule, condyle, pterygoids, and surrounding structures will be provided. Movies of the TMJ in open and closed mouth motion will be shown. Example pathology will include juvenile inflammatory arthritis, rheumatoid arthritis, osteoarthritis, CPPD arthropathy, and disc degeneration and displacement. Image guided injection approach, medications, and complications will be detailed.

**Summary**

After viewing this exhibit the reader will have improved knowledge of normal anatomy, expected cross-sectional imaging appearance, pathological appearance, and therapeutic techniques in management of patients with TMJ dysfunction.
Meningiomas demonstrate a spectrum of stiffness with MRE that correlates with surgical findings.

**SUMMARY**
The major teaching points of this exhibit are:
1. To introduce the principles of MR Elastography, a new technology for characterizing the viscoelastic properties or stiffness of brain.
2. To present clinical applications of MR Elastography which provides unique tissue information previously unavailable with standard imaging techniques.

**The Devil’s in the Details - Use of Small Field-of-View MR Imaging in the Evaluation of Laryngeal and Hypopharyngeal Neoplasms**

**Purpose/Aim**
To highlight the utility of small field of view (SFOV) MR imaging in the evaluation of laryngeal and hypopharyngeal neoplasms.

**Content Organization**
Poor soft tissue contrast and identification of laryngeal cartilage erosion limit CT in the evaluation of laryngeal and hypopharyngeal neoplasms. Dedicated SFOV MR imaging using surface coils is now possible with improved coil and MR software technology, providing superior anatomic depiction and disease delineation.

This exhibit demonstrates how SFOV MR:
1. provides improved anatomic depiction of soft tissues and cartilage in the laryngopharyngeal region, compared to CT and LFOV MR;
2. better demonstrates locoregional invasion by neoplasms of the larynx and hypopharynx compared to LFOV MR and improves treatment planning;

We will focus on T3 and T4 tumours, as T1 and T2 laryngeal and hypopharyngeal tumours are not routinely imaged in our department.

**Summary**
SFOV MR is superior to CT in the detailed evaluation of loco-regional invasion by laryngeal and hypopharyngeal neoplasms.

**Radiologic Evaluation of Congenital Aural Dysplasia: Spectrum and Associated Abnormalities**

**Purpose/Aim**
To present an interactive display exhibiting the spectrum of congenital aural dysplasia as well as the complex cross-sectional anatomy of associated middle ear, mastoid, and inner ear anomalies.

**Content Organization**
Congenital aural dysplasia occurs on a spectrum, ranging from mild deformities of the pinna to complete absence of the external canal with severe associated middle and inner ear defects. Due to the concurrent embryologic development of the first and second branchial arches, associated abnormalities of the middle ear and mastoid are common. Evaluation of the inner ear, ossicular chain, course of the facial nerve, and degree of pneumatization of the tympanic cavity and mastoid antrum are crucial in pre-operative assessment. Understanding these associations and their appearance on high resolution CT is required for full appreciation of the extent of abnormalities, and to recognize those which are critical in managing the patient.

**Summary**
Evaluation of congenital aural dysplasia requires an understanding of the disease spectrum and known associated congenital abnormalities.

**MRI and CT Imaging Spectrum of Odontoid Abnormalities: Pictorial Essay**

**Purpose/Aim**
To review embryogenesis and various abnormalities of the odontoid process.

**CONTENT ORGANIZATION**
Odontoid process of axis acts as the central pivot of craniovertebral junction (CVJ). It develops from 1st and 2nd cervical sclerotome by enchondrial ossification. A myriad of congenital and acquired anomalies may affect odontoid process which present with varying signs and symptoms. Congenital anomalies include aplasia/hypoplasia, disturbance of odontoid synchondrosis (os odontoideum and os terminale), os avis, bifid dens. Acquired odontoid lesions include trauma, infections (tuberculosis), inflammatory conditions (Rheumatoid arthritis, JRA, Reiter's syndrome, ankylosing spondylitis) and tumours (osteoblastoma, eosinophilic granuloma, GCT, metastasis and neurofibromas). The various parameters assessed on CT and MRI to characterise these anomalies are Odontoid morphology, topographical relation of odontoid to basion and anterior arch of atlas, CVJ craniometry for assessment of coexisting CVJ abnormalities, spinal cord status, predental soft tissue, ligamentous morphology, vertebral artery course and calibre and atlantoaxial stability with dynamic MRI.

**Summary**
MRI and CT are essential tools in characterisation of odontoid abnormalities and thus facilitate accurate diagnosis and management.

**â€˜A Dangerous Pearl in the Earâ€™-Illustrative Review of Cholesteatomas and Associated Complications**

**Purpose/Aim**
This exhibit aims to:

1. Demonstrate the spectrum of cross-sectional imaging findings of both congenital and acquired cholesteatomas, and their complications.
1. Overview of normal temporal bone anatomy with reference to pathogenesis.
2. Classification based on pathogenesis and location.
3. Clinical features.
4. Pictorial review of the spectrum of imaging findings of cholesteatoma and associated complications on HRCT and MR. Examples to include the following:
   - Oscillar and tegmen tympani erosion
   - Erosion of the tympanic segment of the facial canal
   - Labyrinthine fistula
   - Dural sinus thrombosis
   - Encephalocoele
   - Secondary oval window perforation
   - Intracranial abscess and subdural empyema
   - Differential diagnosis (paraganglioma and cholesterol granuloma)

5. Evaluation of post-operative ear for residual/recurrent disease using DWI and delayed contrast imaging.

SUMMARY
At the end of this exhibit, a radiologist will gain a comprehensive understanding of the pathogenesis, classification, imaging features and complications of cholesteatomas. The importance of diffusion imaging in evaluating residual/recurrent disease is highlighted with illustrative examples.

The Perihippocampal Fissures: Radiological Importance and Potential Pitfalls

LL-NRE4521
Amit Gupta, MD
Tushar Chandra, MD
Manish Bajaj, MBBS, MD
Ravishankar Pillenahalli Maheshwarappa, MBBS
Manraj K Gill, MD
Rachit Harjai, MBBS

PURPOSE/AIM
1) Normal MR anatomy of the CSF spaces surrounding the hippocampus also known as perihippocampal fissures (PHFs)
2) How to differentiate between various conditions involving medial temporal lobes based on changes in PHFs.
3) The importance of CT scan (especially reverse angle CT) in evaluating these conditions.
4) The common pitfalls encountered in interpretation of above imaging findings.

CONTENT ORGANIZATION
• Normal MR anatomy of PHFs
• Concept of reverse angled CT.
• Various conditions involving the mesial temporal lobe will be presented in form of a quiz with proper differential considerations as under:
  1. Alzheimer's disease vs normal pressure hydrocephalus.
  2. Hydrocephalus vs hippocampal atrophy.
  3. Intra axial tumour vs extra axial tumour.

• Commonly encountered pitfalls:
  1. Choroid fissure cyst mimicking hippocampal sclerosis.
  2. Asymmetric choroid plexus mimicking an enhancing lesion.
  3. Asymmetry in lateral ventricular size mimicking hippocampal atrophy.

• Summary

SUMMARY
Understanding of normal anatomy of perihippocampal fissures is a must for evaluating mesial temporal lobe pathologies.
Although MR is modality of choice but CT scan can provide useful initial clue and aid in diagnosis.
A knowledge of normal imaging variants and interpretative pitfalls can further enhance diagnostic accuracy.

Understanding the Link between Body and Mind: MR Evaluation of Congenital Craniovertebral Junction Anomalies

LL-NRE4522
Amit Gupta, MD
Tushar Chandra, MD
Manish Bajaj, MBBS, MD
Ravishankar Pillenahalli Maheshwarappa, MBBS
Manraj K Gill, MD
Rachit Harjai, MBBS

PURPOSE/AIM
The aim of this exhibit is to:
1. Review normal anatomy and development of the structures constituting craniovertebral junction (CVJ).
2. Discuss the role of craniometry in assessment of CVJ abnormalities.
3. Emphasize the role of MR imaging as a useful alternative to CT for evaluation of various CVJ anomalies encountered in clinical practice.

CONTENT ORGANIZATION
• Anatomy landmarks and development of structures forming CVJ (occiput, clivus, atlas and axis).
• Basic craniometric measurements
  1. Lines: Chamberlain line, Wackenheim clivus baseline, McGregor's line, McRae's line, Ranawat's line.
  2. Angles: Welcher basal angle, and atlantooccipital joint axis angle.
• Status of MRI in comparison to CT scan.
• CVJ evaluation on MRI with sample cases.
• Imaging Mimics and differentials
  1. Fractures
  2. Infective/Inflammatory processes.
Bone diseases

3. Final Words.

SUMMARY

- Complexity of CVJ poses a challenge to radiologist and makes it difficult to interpret, especially on MR imaging.
- With thorough understanding of anatomy and craniometry, MR imaging can prove to be a useful alternative to CT for evaluating CVJ anomalies.
- With MR imaging, additional valuable information regarding the status of cervical cord and the hind brain can be obtained in the same study.

**Diverse Brainstem Pathologies: A Case-based Presentation**

**LL-NRE4523**

Prakash Asokan, DMRD, MBBS
Sunitha P Kumaran, MBBS, MD
Zarina Aziz, MD
Sanjaya Viswamitra, MD

**PURPOSE/AIM**

To illustrate the gamut of brain stem lesions including inherited, infective, inflammatory, vascular, neoplastic and degenerative brainstem pathologies clinical and histopathological correlation where applicable and case based approach to discuss the MRI findings.

**CONTENT ORGANIZATION**

The brainstem is the central railway station of the brain. Ascending and descending pathways and 10 out of the 12 cranial nerves nuclei are present in this location. Therefore, a small lesion could produce severe and mixed deficits. 61 patients scanned between 2009 to 2013 on 1.5T MRI had brainstem pathologies. The following are showcased in our presentation with clinical correlation: Wilson disease, Hallervorden spatz disease, adrenoleukodystrophy, olivopontocerebellar atrophy, spinocerebellar ataxia type 2, tuberculomas, neurocysticercosis, acute disseminated encephalomyelitis, Bickerstaff's encephalitis, multiple sclerosis, infarcts, cavernomas, arteriovenous malformation, glioma, neurofibromatosis-type1, central pontine myelinolysis, multisystem atrophy, amyotrophic lateral sclerosis.

**SUMMARY**

The purpose of this educational exhibit is to present diverse brainstem pathologies with a case based approach with relevant clinical history, imaging findings and appropriate differentials wherever necessary.

**The Many Faces of Intracranial Lymphoma in Non-HIV Population: Emphasis on Non Classical Presentation**

**LL-NRE4524**

Sunitha P Kumaran, MBBS, MD
Zarina A Assis, MBBS, MD
Sanjaya Viswamitra, MD
Nandita Ghosal, MD

**PURPOSE/AIM**

To demonstrate the typical and atypical appearances in our observation of 30 histopathologically proved intracranial lymphomas in non-HIV population

**CONTENT ORGANIZATION**

Primary CNS lymphoma in non HIV patients is rare, constitutes approximately 1% of all primary brain tumors. These present classically as non-hemorrhagic/ non-calcific, hypointense on T2 WI, involving deep gray matter, in periventricular region, corpus callosum with homogeneous enhancement and show restricted diffusion.

In addition to classical imaging we present uncommon features that include dural based location, subependymal nodules, leptomeningeal enhancement, concentric ring enhancement, multiplicity, , intraventricular location, cerebellar folli enhancement, and involvement of adjacent frontal sinus tract mimicking a fungal granuloma, and those with necrosis. Unusual locations like hypothalamus and vermis in pediatric age are included. Imaging variations such as lack of restricted diffusion and T2 hyperintense lesions are presented.

**SUMMARY**

We present a spectrum of imaging findings in non-HIV intracranial lymphomas, familiarity of which helps in pre-operative diagnosis avoiding on-table surprises.

**Congenital Cystic Abnormalities of the Posterior Fossa, Embryological and Imaging Correlation**

**LL-NRE4525**

Felipe B Nascimento, MD
Ana Carolina M Vaz, MD
Alcino Alves Barbosa, MD
Yoshino T Sameshima, MD
Edson Amaro, MD, PhD
Marcelo B Funari, MD

**PURPOSE/AIM**

To discuss the embryological and imaging aspects of the congenital cystic abnormalities of the posterior fossa

**CONTENT ORGANIZATION**

We discuss the embryological aspects of the cystic malformation of the posterior fossa (including mega cisterna magna, persisting Blake’s pouch, Dandy-Walker variant and Dandy-Walker malformation) through comprehensive schematic draws, correlating with the imaging signs that help in their differentiation. We also discuss other congenital cystic abnormalities of the posterior fossa, including arachnoid, neurenteric, dermoid and epidermoid cysts correlating with their embryology. We use images from different patients aged between 0 and 30 years, acquired on ultrasound, computed tomography and magnetic resonance imaging at our institution over the past 10 years.

**SUMMARY**

Understanding the embryology of congenital cystic abnormalities of the posterior fossa helps in their differentiation, being essential for diagnosis and follow-up (or management) of the patients. Since these abnormalities, as a group, are not so uncommon on a day-to-day practice, it is crucial for the radiologist to be able to differentiate them. This presentation seeks to clarify these issues correlating them with radiological signs.

**Common and Rare Neurocutaneous Syndromes- Case Based Approach to the Diagnosis**

**LL-NRE4526**

Sunitha P Kumaran, MBBS, MD
Zarina A Assis, MBBS, MD
Sanjaya Viswamitra, MD

**PURPOSE/AIM**
To demonstrate the spectrum of MRI findings in common and rare Neurocutaneous syndromes.

CONTENT ORGANIZATION
MRI plays a critical role in diagnosis, staging and management of patients with Neurocutaneous syndromes. Retrospective review of MRIs performed from 2007 to 2013 showed 50 patients who had some form of Neurocutaneous syndromes. Imaging was performed on 1.5 T GE MRI unit with relevant sequences. The diagnosis was arrived in all cases with a strong clinical correlation. Out of 72 cases, 14 were Neurofibromatosis I, 20 were Neurofibromatosis type II and 1 case of Neurofibromatosis type III. There was also 1 case of Neurofibromatosis type I with MPNST with lung metastasis, 12 cases of Tubercous sclerosis with typical and atypical appearances, 10 cases of Sturge Weber syndrome, 5 cases of Von-Hippel Lindau syndrome and 2 cases of Ataxia Telangiectasia. We also encountered some rare Neurocutaneous syndromes, 1 case each of Neurocutaneous Melanosis, Encephalocerebral cutaneous lipomatosis ( ECCL), Craniofacial venous metamerica syndrome, 2 cases each of Meningioangiomatosis and Klippel Trenaunay Weber syndrome.

SUMMARY
We present imaging findings in tabular format, working knowledge of which helps radiologist and clinician to be aware of imaging findings of these entities. Also emphasis on rare syndromes is made to educate and increase their familiarity.

**Imaging Superficial Siderosis of the Central Nervous System: Doâ€™s and Donâ€™ts**

**Purpose/Aim**
The Purpose of this exhibits is: to offer a brief introduction to superficial siderosis (SS): definition, epidemiology, neurological manifestations, etiopathology; to define the appropriate state-of-art MRI protocol, and when CT or CT myelogram is indicated; to suggest where and what to look for on MRI exams in the research of SS causes, through a MRI pictorial essay of the most common and uncommon causes of superficial siderosis.

**Content Organization**
Definition, epidemiology, neurological manifestations, etiopathology of SS. Imaging SS: updated MRI protocols (with emphasis on susceptibility-weighted imaging, and on “tailored” imaging protocols), and appropriate use of CT/Myelo-CT. Pictorial essay of idiopathic and secondary SS, including most common (CNS tumors, head or back trauma, arteriovenous malformations/aneurysms) and less common (surgeries, brachial plexus injury, amyloid angiopathy, chronic subdural hematomas, spinal cord herniation) causes of SS.

**Summary**
Superficial Siderosis is a condition easily to detect with appropriate MRI sequences, also as incidental finding. Despite the etiology is not always identified, MRI examination should not be limited to the evaluation of the characteristic findings of SS, but should also investigate the source of bleeding with "suitable" imaging of the entire neuraxis.

**Lesion in the Splenium of the Corpus Callosum: MR Imaging and Differential Considerations in Cancer Patients**

**Purpose/Aim**
- To review the differential diagnosis of the focal and diffuse lesions of corpus callosum in the cancer patient.
- To increase awareness and recognition of uncommon lesions.
- To illustrate the imaging features of such lesions.

**Content Organization**
- Normal anatomy of corpus callosum
- Radiological feature of the corpus callosum in a cancer patient, categorized into five groups:
  1. Neoplastic involvement: - lymphoma and glioma
  2. Therapeutic toxicity (radio necrosis, PRESS, Xeloda and methotrexate toxicity).
  3. Demyelination and infection (ADEM, PML and CMV).
  5. Incidental lesions (heamatoma, infarction)

**Summary**
Corpus callosum is made up of dense myelinated fibers that interconnect homologous territories of the two cerebral hemispheres. The dense compact nature of the white matter tracts makes it a barrier to the flow of interstitial edema and tumor spread. Thus only aggressive tumors, such as glioblastoma multiforme and lymphoma, typically cross or involve it. Because it is composed predominantly of myelinated axons, demyelinating processes can affect the corpus callosum. Lesions of corpus callosum, both diffuse and focal, in a cancer patient encompass wide range of differential diagnosis; MRI plays a major role in addition to clinical and laboratory data in the accurate diagnosis.

**Spectrum of Corpus Callosal Pathologies with Clinically Relevant Cases: A Quiz Based Approach**

**Purpose/Aim**
- To discuss the MR imaging features of various pathologies involving corpus callosum (CC).
- To categorize lesions under congenital, inflammatory, infective, vascular, neoplastic pathologies involving the corpus callosum and discuss them with relevant cases.

**Content Organization**
A quiz based approach to understanding pathology of the CC is presented from our experience of 60 pathologies of the CC: imaged on MRI between Jan 2009 and 2013. We present from a wide variety of cases that include complete and partial agenesis of corpus callosum, corpus callosal lipoma, commissural agenesis with meningeal dysplastic cyst, multiple sclerosis, tumefactive demyelination, Metachromatic Leucodystrophy, Vander Knaps disease, tuberculoma, PML, acute infarcts, AVMs, cavernoma, Marchiafava Bignami disease, GBM, anaplastic astrocytoma, anaplastic oligodendroglioma, extracellular neurocytoma, lymphomas and metastases. The above are presented and categorized as congenital, inflammatory, infective, vascular, neoplastic lesions to help improved descriptions of differential diagnosis.

**Summary**
We present all the pathologies of corpus callosum in a quiz format with the clinical history, key imaging points and set of differentials when required.
Neurovascular Conflict in 3 Tesla MRI: Is there a Conflict of Interest?

PURPOSE/AIM
The aim of this exhibit is:
1. To review the imaging features of neurovascular conflict (NVC) in 3 Tesla MRI device, focusing on the up to date imaging protocols.
2. To present our experience with a protocol using a fusion reconstruction algorithm of high spatial resolution 3D T2 weighted sequence (FIESTA) and Time-Of-Flight (TOF) angiography sequence.
3. To demonstrate the tips and tricks a neuroradiologist should keep in mind in order to obtain an adequate preoperative study.

CONTENT ORGANIZATION
Mechanisms of neurovascular conflicts in the cisternal portion of cranial nerves (most frequently involving trigeminal, but also other cranial nerves) Presentation of the key imaging findings in:
- High spatial resolution 3D T2 sequence alone
- TOF sequence alone
- Combination of these two sequences in fusion

Demonstration of sample cases

SUMMARY
The major teaching points of this exhibit are:
1. Magnetic Resonance Imaging is currently considered as the method of choice for imaging of NVC.
2. Routine protocols for NVC study include high resolution 3D T2 sequence alone or in combination with a TOF sequence.
3. High-resolution 3D T2-weighted imaging in fusion with TOF can be a very helpful tool for neuroradiologists, optimizing the detection of NVC and thus playing a crucial role in decision-making for the optimal therapeutic approach.

Diffusion-weighted Imaging of Usual and Unusual Tumors and Tumor-like Lesions in the Spine

PURPOSE/AIM
We address the utility of diffusion-weighted imaging along with the corresponding apparent diffusion coefficient maps in the evaluation of spinal lesions by assessing individual cases across a wide range of pathologies. By assessing primary bone tumors, metastatic tumors, and tumor-like lesions, we show that DWI can be a helpful tool in lesion detection, assessment, and determination of likelihood of malignancy.

CONTENT ORGANIZATION
Brief review of Diffusion weighted imaging and ADC map technique A broad spectrum of spinal pathologies are presented along with their DWI and ADC maps. Pathologies are grouped into primary bone tumors, metastatic tumors, and tumor-like conditions. The usefulness of DWI and ADC is addressed with each example pathology. Brief review of some potential pitfalls in DWI and ADC imaging such as nearby presence of fat or dense bone. General conclusions about the utility of DWI and ADC are presented with respect to malignant versus benign, lesion cellularity, and type of tissues included.

SUMMARY
We show how DWI and ADC provide utility in spinal lesion evaluation. These sequences aid in initial detection of lesions, determination of malignancy likelihood, and distinguishing between malignant and benign processes that otherwise appear similar. We demonstrate this utility via case examples of a variety of spinal lesions.

Acquired Diseases of the Corpus Callosum: A Review of the Anatomy, MR Imaging Appearances and Differential Considerations

PURPOSE/AIM
1. To review the anatomy and vascular supply of the corpus callosum
2. To discuss the clinical manifestations of acquired diseases affecting the corpus callosum
3. To demonstrate the MR findings of corpus callosal pathology

CONTENT ORGANIZATION
1. Review of corpus callosal composition, function and anatomy,
2. Discussion of the common and uncommon acquired diseases of the corpus callosum including the following entities:
   - Neoplastic diseases: Glioblastoma multiforme, gliomatosis cerebri, lymphoma
   - Inflammatory diseases: Multiple sclerosis and acute disseminated encephalomyelitis
   - Vascular disorders: Infarction, Susac syndrome
   - Traumatic Disorder: Diffuse axonal Injury
   - Toxic disorder: Marchiafava-Bignami disease
   - HIV associated disease: Progressive multifocal leukoencephalopathy
   - Miscellaneous lesions: Frontotemporal dementia (Pick's Disease), transient splenial lesion, hydrocephalus

SUMMARY
Particular pathologic entities have a predilection for the corpus callosum and often can present a diagnostic dilemma, both for the radiologist and the clinician. This review is designed to provide radiologists with the tools to confidently diagnosis the common and uncommon pathologies affecting the corpus callosum, thereby improving disease management and patient outcomes.
Imaging of Acute Stroke and New Concepts

**LL-NRE4533**
Elizabeth H Du, BA, BSc
Teresa Liang, MD, BSc
Graeme J McNeill, MRCP, FFRRCSI
Savvas Nicolaou, MD

**PURPOSE/AIM**
- Review acute stroke pathophysiology and clinical manifestations
- Discuss imaging modalities used for diagnosis of acute stroke and new directions
- Describe spectrum of imaging findings of acute stroke and therapeutic implications

**CONTENT ORGANIZATION**
- Review acute stroke pathophysiology and clinical presentation; indications, spectrum of imaging findings, relative utility and practical considerations of acute stroke imaging modalities; imaging examples of pitfalls and mimics
- Discuss a simplified approach to and interpretation of acute stroke CT perfusion analysis; introduce a new cardiogenic embolic stroke protocol
- Discuss and demonstrate imaging examples of new MDCT techniques: whole brain perfusion CT assessment incl. shuttle technique and volumetric acquisition, dual energy CT (DECT) differentiation between intracranial hemorrhage and iodinated contrast staining post-thrombolysis
- Dose-reduction iterative reconstruction with new chip detector technology

**SUMMARY**
- Nonenhanced CT is the gold standard for excluding acute intracranial hemorrhage
- MRI can provide information on presence, location, size and extent of acute ischemic stroke and brain tissue at risk
- New MDCT techniques and DECT allow formation of whole brain blood volume/blood flow maps, identification of brain penumbra and differentiation of hemorrhage vs. contrast to help provide accurate and rapid diagnosis of acute stroke

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Supra-aortic Trunks and Circle of Willis Abnormalities and Related Vascular Pathology

**LL-NRE4534**
Magaly M Padilla Deza, MD
Lucia Aja, MD
Daniel Rodriguez Bejarano
Paloma Mora, MD
Miguel A Lemus Rosales, MD
Amadeo Muntane Sanchez

**PURPOSE/AIM**
To illustrate with multidetector angiography CT and digital subtraction angiography (DSA), the spectrum of abnormalities in the supra-aortic trunks (SAT) and Circle of Willis (CW) and its relationship with some vascular lesions and diseases in a large series (n=604) of patients.

**CONTENT ORGANIZATION**
CT and conventional angiography are most important techniques for the evaluation of the cervical and intracranial circulation in case of vascular disease or preoperative settings. We reviewed all the CT angiography performed at the Department of Neuroradiology and reported by neuroradiologists, during the period between October 2011 and October 2012. We classify findings by anatomical situation in two big groups: TSA or CW. In each group we review normal vascular variants and illustrate most relevant vascular abnormalities. Special attention is paid when these abnormalities have implications involving associated pathology or when they have implications in the surgical planning or in interventional setting.

**SUMMARY**
This pictorial review illustrates frequent vascular abnormalities and most relevant cases reported in our institution during one-year period. Our results match in with available literature. Recognition of vascular variants and abnormalities by the radiologist is important in the diagnosis and management planning.

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Application of Different Acquisition Techniques for Radiation Dose Lowering on Neck CTA Studies

**LL-NRE4535**
Diego A Lira, MD
Javier M Romero, MD
Ramon G Gonzalez, MD, PhD
Atul Padole, MD
Mannudeep K Kalra, MD *
Sarabjeet Singh, MD
Ranish D Khawaja, MBBS, MD
Sarvenaz Pourjabbar, MD

**PURPOSE/AIM**
Application of different acquisition parameter changes: Tube voltage, tube current, pitch factor and slice thickness, allow for significant lowering of radiation dose without compromising image quality.

**CONTENT ORGANIZATION**
1. Illustration of current parameters for neck CTA at standard dose
2. Explanation of rationale behind attempts at dose reduction
3. Effect of tube voltage change on images
4. Effect of tube current change on images
5. Effect of pitch factor and slice thickness change on images
6. Clinical examples addressing the expected and actual changes with impact on image diagnostic capabilities

**SUMMARY**
Modification of scan acquisition parameters can help lower the radiation dose in neck CTA studies while maintaining adequate image quality and diagnostic capability. We illustrate how changes of each of the described parameters affect the final image. We also address the issue of expected changes that would arise with parameter modification, compared to higher, standard doses.

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Oral Cavity and Oropharynx Post-surgical Imaging: What the Radiologist Needs to Know

**LL-NRE4536**
Marcio Ricardo T Garcia, MD
Henrique B Zuppani, MD
Tamara A Ezzedine, MD
Ula Passos, MD
Regina L Gomes, MD
Eloisa M Gebrim, MD

**PURPOSE/AIM**
The oral cavity and oropharynx are common locations of neoplastic lesions and several patients are treated with surgical procedures, whose follow-up are made with computed tomography (CT) and magnetic resonance (MR) imaging. Consequently normal cervical anatomy and its relations are altered with specific patterns according to the distinct surgical techniques applied.
The resulting cervical anatomical alterations will be presented with images of CT and MR with multiplanar reconstruction, along with schematic illustrations of the most common procedures performed (such as glossectomy, pelvectomy and mandibulectomy).

**SUMMARY**

The post-surgical findings are important factors of misinterpretation and confusion on CT and MR imaging, making the identification of tumor recurrence or new lesions difficult. It is the radiologist's role to recognize and differentiate these situations to avoid false negative and false positive results.

Knowledge of the post-surgical findings is essential for analysis of the complex techniques of reconstruction of the oral cavity and oropharynx and allows early diagnosis of tumor recurrence or usual complications.

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### Radiologist On-call: Maxillofacial Fractures and Associated Injuries in Major Trauma Patients at ER

**PURPOSE/AIM**

To illustrate the spectrum of fractures and related injuries found in the maxillofacial region in a large series (n=580) of blunt trauma patients using whole-body multidetector (CT). To review facial skeletal anatomy, its common traumatic patterns and clinically relevant fractures and soft tissue associated lesions that may require immediate care or surgery.

**CONTENT ORGANIZATION**

Whole-body CT is used as the standard initial imaging tool for major trauma patients in many institutions. It allows an accurate evaluation, especially rapid diagnosis of life-threatening injuries. We reviewed all whole-body CT performed for major trauma patients at the Department of Emergency Radiology in our institution, during the period of three years. We have focussed on maxillofacial findings.

We use an anatomical approach by regions, buttresses and struts, to describe traumatic injuries. We classify findings in two separated groups: single lesions or multiple lesions (complex injuries). Special attention is paid in patterns with implications in urgent care or requiring emergency surgery.

**SUMMARY**

This pictorial review illustrates the most frequent and relevant maxillofacial injuries founded in whole-body CT performed in major trauma patients. Recognition of these lesions by the radiologist in emergency department is important for diagnosis and management planning.

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### Common Congenital Craniovertebral/Cranio cervical Junction Abnormalities: Imaging Features and Clinical Significance

**PURPOSE/AIM**

The craniovertebral / cranio cervical junction, comprised of the occiput, atlas, and axis, is subject to multiple developmental anomalies that can result in numerous regional congenital malformations. We review normal anatomy, common congenital anomalies, and their sequelae.

**CONTENT ORGANIZATION**

Present methods to assess normal of the craniovertebral / cranio cervical junction anatomy. Review and present examples of common congenital anomalies: Klippel–Feil syndrome, Down’s syndrome, achondroplasia, mucopolysaccharidoses, congenital rickets, and osteogenesis imperfecta.

**SUMMARY**

Unrecognized and untreated craniovertebral / cranio cervical junction congenital abnormalities may progress and cause joint instability, obstructive hydrocephalus, and myelopathy. Klippel–Feil syndrome is characterized by congenital failure of segmentation of the cervical vertebrae. C1 hypoplasia, os odontoideum, and ligamentous laxity lead to cranio cervical junction instability in Down’s syndrome. Lyososomal storage diseases result in dysplastic odontoid processes with surrounding non-ossified fibrocartilage. Bone-softening diseases, including congenital rickets and osteogenesis imperfect, may result in basilar invagination.

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### Sarcomas of Head and Neck: Who Are They?

**PURPOSE/AIM**

Sarcomas are rare mesenchymal neoplasms with distinct peculiarities and survival rate. They constitute 1% of all malignancies, being 4-10% in the head and neck. The purpose of this exhibit is to show imaging findings of head and neck sarcomas.

**CONTENT ORGANIZATION**

Computed tomography (CT), magnetic resonance (MR) and positron emission tomography with computed tomography (PET/CT) are essential for characterization of tumor composition, extension and preoperative grading. However, imaging characteristics of many such tumors are nonspecific.

Pertinent patient data including previous radiotherapy and physical examination provide helpful clues for diagnosis. Specific genetic alterations inherited have been associated with increased risk of soft tissue sarcomas.

The WHO classification of soft tissue tumors is based on tissue type and biologic behavior. We report sarcomas of multiple locations of the head and neck, including liposarcoma, fibrosarcoma, chondrosarcomas, undifferentiated pleomorphic sarcoma, rhabdomyosarcoma, leiomiosarcoma, carcinosarcoma, angiosarcoma, alveolar soft part sarcoma, osteosarcoma, synovial sarcoma and ewing sarcoma.

**SUMMARY**

Clinical presentation and imaging findings contribute for sarcomas diagnosis and therapeutic planning. Radiologists should be familiar with the most common manifestations of these tumors.

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### Imaging Findings in Postsurgical Brain: Get with It!!!

**PURPOSE/AIM**

The post-surgical findings are important factors of misinterpretation and confusion on CT and MR imaging, making the identification of tumor recurrence or new lesions difficult. It is the radiologist’s role to recognize and differentiate these situations to avoid false negative and false positive results.

Knowledge of the post-surgical findings is essential for analysis of the complex techniques of reconstruction of the oral cavity and oropharynx and allows early diagnosis of tumor recurrence or usual complications.
Elena Fajardo Pico

PURPOSE/AIM
To review normal radiological findings and the broad spectrum of postoperative complications in CNS’s tumors surgery.

CONTENT ORGANIZATION

2. **Pathological findings**: • Scalp: hematomas, soft-tissue infection. • Skull: bone-flap infections, complications after craniectomy. • Meningeal layers: tension pneumocephalus, hematomas, meningitis, cerebrospinal fluid fistula. • Parenchyma: surgical site bleeding, ischemia, infection, intracranial herniation syndrome. • Ventricles: hydrocephalus, ventriculitis.

SUMMARY
In our experience, surgical wound infection is the most frequent complication. Computed tomography is fast, cost effective, and easily accessible for first-line imaging. Magnetic resonance imaging has higher sensitivity for detecting postoperative infection and ischemia, but diffusion-weighted imaging may be less reliable for detecting postoperative infections. It’s important to differentiate between normal findings and life-threatening complication, which require urgent intervention to improve better clinical outcome.

**Imaging of Intracranial Aneurysm: State of Art**

**LL-NRE4541**
Ahmed Abdel Razek, MD
Lamia Elsorogy, MD, PhD

PURPOSE/AIM
1-To review basic background about intracranial aneurysm
2-To review imaging techniques and imaging appearance of intracranial aneurysm
3-to discuss the role of imaging in patients with intracranial aneurysm

CONTENT ORGANIZATION
1-Pathophysiology and hemodynamics of intracranial aneurysm
2-CTA, MRA and angiography of intracranial aneurysm
3-Detection of aneurysm with different imaging modalities
4-Imaging findings predictor of aneurysm rupture
5-Role of imaging in selection of appropriate management of aneurysms
6-Imaging of hemodynamic flow of aneurysm
7-Imaging of atypical aneurysms and associated or coexistence lesions
8-Interventional procedures used for treatment of aneurysm
9-Follow-up imaging after surgical clipping or endovascular therapy
10-Role of advanced imaging such as tricks and 4D MRA and CTA in aneurysm
11-Summary and future prospects

SUMMARY
The major teaching points of this exhibit are:
1) To be familiar the radiologist with imaging findings of intracranial aneurysms
2) Imaging is essential for detection, prediction of rupture and monitoring of aneurysms after therapy

**18F-FDG Brain PET/MRI Outperforms Each Modality Alone in Evaluation of Neurodegenerative Diseases, including Parkinsonism Syndromes**

**LL-NRE4542**
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Tadeu T Kubo, MSc
Emerson L Gasparetto, MD
Carlos A Buchpiguel, MD
Romeu C Domingues, MD
Roberto C Domingues, MD
Lea M Fonseca, MD, PhD

PURPOSE/AIM
To understand how the FDG-PET/MRI hybrid modality can be synergic, increasing the diagnostic confidence of neurodegenerative diseases, such as dementia and movement disorder.

CONTENT ORGANIZATION
1. How to integrate PET and MRI modalities
2. Understand why the mild cognitive impairment syndrome is clinically challenge and how FDG-PET/MRI can aid its management
3. Illustrate how FDG-PET/MRI can better differentiate dementias types by structural and functional changes, including MR spectroscopy
4. Understand why atypical parkinsonism syndromes can be challenge, even for a neurologist specialized in movement disorder, and how FDG-PET/MRI can improve the correct diagnosis

SUMMARY
The FDG-PET/MRI of the brain seems to be superior to each modality alone in the evaluation of neurodegenerative diseases, as synergy information from both methods are achieved. This exhibit reviews: 
1. How to integrate PET and MRI modalities
2. Structural and functional changes seen on FDG-PET/MRI of different types of dementia
3. How FDG-PET/MRI can better differentiate atypical parkinsonism syndromes.

**Neurological Involvement in Hereditary Hemorrhagic Telangiectasia**

**LL-NRE4543**
Paul-Emile Labeyrie
Patrick Courtheoux, MD
Herve F Huet, MD
Emmanuel Babin, MD
Fausto Viader, MD
Jean-Pierre J Pelage, MD, PhD *

PURPOSE/AIM
Review the epidemiology and presenting symptoms of HHT patients with neurological involvement. To summarize the imaging features in patients with cerebral or spinal arteriovenous fistulae To discuss the role of embolization to treat pulmonary arteriovenous malformations accounting for brain abscess or stroke To review the technique of embolization for cerebral arteriovenous malformations or epistaxis

CONTENT ORGANIZATION
1. Epidemiology and symptoms - Congenital disease with dominant autosomal transmission - Organs affected Neurological involvement - Cerebral imaging with focus on arteriovenous malformations - Spinal imaging - Lung imaging with focus on neurological complications induced by paradoxical embolism Endovascular techniques - arterial embolization for arteriovenous malformations - arterial embolization for epistaxis

SUMMARY
Hereditary hemorrhagic telangiectasia is a rare congenital disease. This diagnosis should be made in patients with known family history,
cutaneous-mucous telangiectases and recurrent nose-bleeds. Prevention of neurological complications in patients with pulmonary arteriovenous malformations should be obtained with the use of embolization. Embolization is also an effective treatment in the management of intractable epistaxis or in case of cerebral or spinal arteriovenous malformations.

Imaging of Cavernous Sinus: Anatomy and Differential Diagnosis of Common Lesions

Elena Garcia Garrigos, MD, PhD
Juan Arenas, MBBS
Irene Monjas Canovas
Jesus Julian Cortes Vela, MD
Carlos Martinez Gomez
Yanne Aviles Vistorte, DSc

PURPOSE/AIM
Review the anatomy and imaging findings of relative common lesions involving the cavernous sinus, making emphasis on those clinic and radiologic features that allow to formulate a reasonable differential diagnosis.

CONTENT ORGANIZATION
Introduction of the complex anatomy of cavernous sinus and its relationships in order to provide better understanding of the pathology. Review the clinical features, imaging appearances and common cavernous sinus conditions including neoplastic, inflammatory, infectious and vascular lesions. Emphasize radiologic key findings of cavernous sinus lesions and their origin to narrow the differential diagnosis and guiding diagnostic and therapeutic approaches.

SUMMARY
The cavernous sinus contains vital neurovascular structures that may be affected by a wide variety of pathologies arising in the cavernous sinus itself or via extension from adjacent intra and extracranial regions. Knowledge of its anatomy and relationships together with clinic and radiologic features of common cavernous sinus diseases is relevant to suggest an accurate diagnosis and a consequent appropriate management.

Chew on This: Foreign Bodies of the Head and Neck

Shreya Sood, MD
Alexander J Adduci, MD, PhD

PURPOSE/AIM
Ingested comestible items and foreign bodies such as dental or cosmetic implants and piercings are often encountered in head/neck imaging. Textbooks, literature and radiology attendings rarely address the imaging appearance of these lesions. Efforts should be made to educate residents on deciphering benign incidental findings from true pathology in the oral cavity.

CONTENT ORGANIZATION
1) Ingested items: case examples of ingested items mimicking intraoral lesions and ex vivo imaging appearance of commonly encountered items. Radiologic signs and mucosal recesses that suggest comestible items will be discussed. 2) Implants: cosmetic and surgical implant imaging with correlating photographs. 3) Foreign bodies/piercings: ornamental body piercing has become increasingly popular and can vary in location and method of application. Examples will be given with photo correlation.

SUMMARY
Radiologists should be aware of the large array of items that can be incidentally found on routine head and neck imaging. Simple questioning of the patient can avoid a costly work up of an incidental finding.

A Small, But a Very Important Sinus - Imaging Anatomy and Pathology Affecting the Cavernous Sinus

Marwa G Elsayed, MBBS
Tanzilah A Barrow, MBCh
Christopher Coutinho
Sachin Mathur, MBBS, FRCR

PURPOSE/AIM
The purpose of this exhibit is to:

- Understand the anatomy of cavernous sinus with imaging correlation.
- Illustrate comprehensively clinico-radiological features of common and rare conditions affecting the cavernous sinus.

CONTENT ORGANIZATION
1. Detailed anatomical overview with imaging correlation.
2. Clinical features and pathogenesis of cavernous sinus syndrome.
3. Pictorial review of a spectrum of pathologies affecting the cavernous sinus. Some of the examples include the following:
   - Tumours – Pituitary adenoma, Meningioma, Metastasis, schwannoma, nasopharyngeal cancers, chordomas
   - Infections
   - Inflammatory - Tolosa-Hunt syndrome
   - Vascular - Cavernous haemangioma, cavernous sinus thrombosis, Aneurysms and carotid-cavernous fistulas.
   - Epidermoid

SUMMARY
The cavernous sinuses are small, but complex anatomical structures with a multitude of pathologies affecting them. Imaging plays a vital role in making the correct diagnosis and aid appropriate management. At the end of this exhibit, the viewer will gain a sound knowledge of the anatomy and clinico-radiological features of both common and rare conditions affecting the cavernous sinuses.

The Not So Beautiful Skin Deep: Micro-coil MRI for the Evaluation of Nasofacial Neoplasms

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Phey M Yeap, MBChB
Richard D White, MBChB, FRCR
Shelley Waugh, MSc
Ian A Zealley, MD

PURPOSE/AIM
Discuss a 6-year experience of performing microscopy coil magnetic resonance (MCMR) imaging for the pre- and post-operative evaluation of skin tumors

Describe protocols followed by our institution utilizing the microscopy coil

Depict the normal anatomy of the skin with schematic illustrations, normal histology and representative MCMR images

Provide examples of various pathologies as seen on MCMR with clinical and pathological correlation where available, highlighting interpretive pearls and pitfalls

CONTENT ORGANIZATION

79 cases of nasofacial MCMR performed over a 6-year period were reviewed. From these, selected cases which best illustrate the normal anatomy and a spectrum of pathologies are used, with clinical and pathological correlation where available. Reference to microsurgical techniques is made to emphasize the importance of reporting technique and margin significance for pre-operative planning and excision outcomes.

SUMMARY

Micro-coil MR is a powerful tool for the regional staging of selected nasofacial cutaneous tumors. It plays a central role in determining management, surgical planning and predicting operative resection outcomes. This exhibit provides key information needed to establish an MCMR service in a multidisciplinary setting and should increase the confidence of the reporting radiologist in evaluating these tumors.

### Syndromes and Symptoms: Variations in Meningioma Presentations

**LL-NRE4548**

Vikash Singh, MD
Lev Bangiyev, DO
Ankur Shah, MD
David Chen, MD
Craig N Linden, MD

**PURPOSE/AIM**

1. Discuss various clinical syndromes and symptoms associated with meningioma presentations due to anatomic locations. 2. Review different imaging features of common and uncommon types of meningioma. 3. Highlight imaging pitfalls encountered with atypical presentations.

**CONTENT ORGANIZATION**

This electronic exhibit presented in a quiz format, discusses varying clinical presentations of both typical and atypical meningiomas. CT and MR correlation will be provided to emphasize imaging findings and common pitfalls in imaging interpretation. Clinical syndromes discussed will include: Gerstmann Syndrome, Lhermitte’s sign, Parinaud’s syndrome, Parkinsonisms, and Horner syndrome. Lesions illustrated are organized based on location to stress key anatomy and imaging analysis of involved structures. Cases presented will include: common meningiomas (anterior skull base, cavernous sinus, frontal, intraventricular, orbital, posterior fossa, sphenoid wing, and suprasellar), multiple meningiomas associated with NF2, and uncommon meningiomas (cystic, en plaque, ectopic, intraosseous, lipomatous, microcystic, optic, and spinal).

**SUMMARY**

Meningiomas are a common non-glial neoplasm, with varying presentations, which can involve many areas of the CNS. Familiarity with its many clinical presentations and imaging findings will enhance the user’s interpretation of cross sectional images.

### Open to Closed: The Complex World of Spinal Dysraphim Made Simple

**LL-NRE4549**

Joshua T Kyle, MD
Neel Madan, MD *

**PURPOSE/AIM**

1. Review the pathophysiology and spectrum of spinal dysraphism.
2. Present the imaging findings, both in utero and postnatal, with implications for pre-operative planning.
3. Discuss the role of post-operative imaging in spinal dysraphism.

**CONTENT ORGANIZATION**

- Introduction and classification of spinal dysraphism (open versus closed).
- Spina bifida aperta/cystica associated with a visible skin defect, including meningocele, myelcele, and myelomenigocele.
- Occult spinal dysraphisms, including meningocele, diastematomyelia, lipomeningocele with associated intraspinal lipomas or fibrolipoma of the filum terminale, dermal sinus tract with associated dermoid/epidermoid cysts, tethered cord, and myelocystocele.
- Related spinal cord disorders, including caudal regression syndrome and sacrococcygeal teratoma.
- Potential post-operative complications.

**SUMMARY**

Spinal dysraphism represents a spectrum of disorders, arising from a failure of neural tube closure. These represent one of the most common congenital abnormalities of the CNS. Knowledge of the embryology behind these disorders is crucial to understanding the clinical presentation and imaging findings of the various presented cases. Both surgical and conservative management require follow-up imaging in order to monitor for complications, the most common of which will be discussed.

### AJCC Classification of Head and Neck Squamous Cell Carcinoma: What the Radiologist Needs to Know

**LL-NRE4550**

Azita S Khorsandi, MD
H. Charles Pfaff, MD
Benjamin Abiri
Kenneth S Hu, MD *
Roy A Holliday, MD
James E Silberzweig, MD

**PURPOSE/AIM**

Imaging techniques including CT, MRI, PET, and sonography are utilized to improve the accuracy of staging of head and neck squamous cell carcinoma. We will review the T, N, M staging of head and neck squamous cell carcinoma with case correlation.

**CONTENT ORGANIZATION**

The presentation will first review notations required by AJCC 7th Edition as prognostic indicators. The T and N staging of the nasopharynx will be then be presented, followed by T and N staging of the remainder of the portions of the aerodigestive tract following AJCC 7th Edition classification. The presentation will demonstrate the use of staging for specific cases.

**SUMMARY**

For a patient with head and neck squamous cell carcinoma of the aerodigestive tract, staging has significant treatment and prognostic implications.
It's Not Exactly Brain Surgery, or Is It? How Neuroimaging Is Changing the Landscape of Brain Tumor Management

Dhiraj Baruah, MD  
Harish Poptani, PhD  
Tushar Chandra, MD  
Ashok Srinivasan, MD  
Suyash Mohan, MD

PURPOSE/AIM

Purpose:
1. To discuss advances in neuroimaging techniques relevant to neurosurgical oncology
2. To highlight the role of faster and thinner (including 3D) sequences with the advent of functional neuronavigation
3. To address the role of imaging in clinical trial design, immunotherapy, and functional genomics

CONTENT ORGANIZATION

Neuroimaging perspective
- Pre-operative: Faster sequences and the generation of physiologic information
- Intra-operative: Stealth-guided surgery

Neurosurgical perspective
- Improvement of neurosurgical techniques: From trepanation to awake craniotomy, and cortical mapping
- Cerebral localization techniques
- Functional connectivity
- Future directions

Ultra high field MR imaging (7 Tesla)
- Genomic mapping
- Imaging biomarkers
- Immunotherapy

SUMMARY

Advanced neuroimaging is becoming a vital component in diagnosis, treatment planning, and monitoring of treatment response. Morphological assessment using conventional MRI remains the workhorse of tumor detection and diagnosis; however, functional imaging modalities assessing tissue microstructure, metabolism, and physiology have increased the scope of clinical imaging. Use of morphologic or functional imaging features as biomarkers is a rapidly growing field of active clinical interest in this era of personalized medicine.

Review of Different Neuroimaging Ancillary Tests Used in Confirmation of Brain Death with Focus on CT Perfusion

Jordan N Kavanaugh, MD  
Jai Shankar

PURPOSE/AIM

The purpose of this exhibit is to review the different neuroimaging tests which aid in the diagnosis of brain death. We will review clinical criteria for diagnosis of brain death, including Canadian guidelines for diagnosis of brain death, describe ancillary neuroimaging tests used to aid in the diagnosis of brain death with focus on CT perfusion as a relatively new and valuable ancillary test with great potential.

CONTENT ORGANIZATION

1. Clinical criteria for diagnosis of brain death, including Canadian guidelines
2. Prerequisite conditions that must be met before ancillary testing
3. Ancillary neuroimaging tests for diagnosis of brain death including: conventional cerebral angio, radionuclide cerebral blood flow imaging, CT angio, CT Perfusion imaging
4. Emphasize CT perfusion imaging of the brainstem as a valuable tool to aid in the diagnosis

SUMMARY

The diagnosis of brain death is made on the basis of clinical findings and neurologic examination, including deep unresponsive coma, no brain stem function, and no spontaneous ventilation. In difficult cases, such as in the setting of CNS depressants, neuroimaging ancillary tests are used to help confirm the diagnosis. In this exhibit we review the common neuroimaging ancillary tests for confirmation of brain death, with emphasis on CT perfusion of the brainstem as a relatively new and valuable tool.

Perfusion Weighted Imaging as a Post-Treatment Imaging in the Brain Tumor

Sohyun Jo  
Ho Sung Kim  
Chong Hyun Suh, MD  
Hee Mang Yoon, MD  
Young Jun Choi, MD  
Dae Yoon Kim  
Namkug Kim, PhD  
Choong Gon Choi, MD  
Sang Joon Kim, MD

PURPOSE/AIM

1. To understand tumor microenvironment in brain tumor.
2. To present a systematic review of literature on current perfusion imaging studies for treatment response in brain tumor.

CONTENT ORGANIZATION

1. Tumor microenvironment
2. Predict treatment response by imaging tumor microenvironment
3. Current perfusion imaging studies for treatment response

(1) Single parameter study
- Dynamic contrast-enhanced permeability
- Intravoxel incoherent motion
- Bimodal histogram
- Tumor perfusion volume fraction

(2) Parametric response study
- Percent change of skewness and kurtosis of cerebral blood volume (CBV) histogram

(3) Multiparametric study
- Tumor clustering using multiple imaging variables
Therapeutic strategies are needed that depend on both interpretation of MR imaging findings and clinical manifestations.

1. We assessed histogram shape (kurtosis) and asymmetry (skewness) derived from the normalized CBV for entire contrast-enhanced lesions can be used to differentiate pseudoprogression from early tumor progression.

2. We also assessed the added value and diagnostic performance of arterial spin-labeling perfusion MR imaging to distinguish early tumor progression and pseudoprogession, compared with the histogram parameters derived from dynamic susceptibility contrast perfusion MR imaging.

### Advanced MR Imaging in Perirolandic Brain Tumors

**LL-NRE4554**

Lorena Lourhance M Vidal, MD  
Chaitra A Badve, MD, MBBS  
Sunil Manjila, MD  
Nicholas Bambakidis, MD  
Kristine Blackham, MD *  
Jeffrey L Sunshine, MD, PhD *

**PURPOSE/AIM**

To describe role of advanced MRI techniques such as functional magnetic resonance (fMRI), diffusion tensor imaging (DTI) tractography and intraoperative MRI (IO-MRI) in evaluation of perirolandic tumors.

**CONTENT ORGANIZATION**

- fMRI and DTI identify the motor cortex and critical white matter tracts and have a significant impact on selection of therapeutic options for frontoparietal lobe tumors. IO-MRI plays a critical role in navigation in resection of eloquent cortex lesions. These techniques enable a greater margin of safety and help estimate post surgical functional deficit. We will present a short discussion on motor cortex anatomy followed by a review of indications for using advanced imaging techniques. Then we will present an interactive case series of pre-surgical lesions involving the primary motor cortex that were assessed by at least one of these modalities and where the imaging findings aided in therapeutic planning. Finally, the viewer will be offered an interactive quiz that will revise salient teaching points of the exhibit.

**SUMMARY**

We present a case based educational exhibit on applications of advanced MRI techniques in the surgical planning of perirolandic tumors. This exhibit will be an engaging self-learning exercise for the viewers who will familiarize themselves with typical imaging findings of these unique techniques.

### Spinal Dysraphism: A Structured Reporting Approach

**LL-NRE4555**

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Sunitha P Kumaran, MBBS, MD  
Zarina A Assis, MBBS, MD  
Sanjaya Viswamitra, MD

**PURPOSE/AIM**

1) To understand and discuss the variety of dysraphic spinal anomalies.
2) To provide structured approach to report a case of spinal dysraphism.

**CONTENT ORGANIZATION**

- Spinal dysraphism comprises array of congenital anomalies of neural tube development.
- We retrospectively reviewed MRI of 96 non-operated patients with spinal dysraphism between 2009 till date on a 1.5 T MRI scanner.
- An extensive review of a wide variety of abnormalities ranging from common entities like tethered cord, myelomeningocele, lipomyelomeningocele, diastomatomyelia, dorsal dermal sinuses to uncommon ones like caudal regression syndrome, intramedullary dermoid and epidermoid is presented. Details like status of the vertebral elements, appearance of cord, level of conus medullaris, morphology of filum terminale, location of the junction between neural placode and fat, dural sac morphology, presence of syrinx, posterior soft tissue appearance, overlying skin continuity, CVJ morphology, presence of hydroureteronephrosis are considered.

**SUMMARY**

We present a detailed structured reporting format in a case of spinal dysraphism to the radiologists, so that all the major relevant as well as ancillary findings are mentioned, thereby helping the physician/surgeon in a better patient management.

### Intracranial Hemorrhagic Mass Manifesting as Spontaneous Intracranial Hemorrhage

**LL-NRE4556**

Seung Hwan Baek  
In Kyu Yu  
Jin Young Kim, MD

**PURPOSE/AIM**

To introduce spectrum of brain masses causing spontaneous intracranial hemorrhage and explain differentiating image features of hemorrhage induced by primary brain masses and other common causes.

**CONTENT ORGANIZATION**

1. Intracranial hemorrhage from intracranial masses are exceedingly rare.
2. They have distinguishing features from other bleeding cause in CT and MR images.
3. It is important to interpret images about intracranial hemorrhage, whether hidden provokers such as brain tumors, other masses.

### Imaging Manifestations of Radiation Induced Brain Injury

**LL-NRE4557**

Li Li, MD, PhD  
Shunji Mugikura, MD, PhD  
Takaki Murata, MD  
Yasuko Tatewaki, MD  
Daddy Mata Mbemba, MD, PhD  
Shoki Takahashi, MD

**PURPOSE/AIM**

Radiation induced brain injury is generally regarded as a progressive and irreversible process, including radiation necrosis, focal/diffuse white matter injury, optic neuropathy, cystic changes, dystrophic calcification due to mineralizing microangiopathy, large vessel
vasculopathy and secondary moyamoya syndrome, cryptic vascular malformation, and secondary tumors. The purpose of this exhibit is:
1. To review the characteristic imaging features of radiation induced brain injury
2. To assess the value of advanced MR imaging techniques in diagnosis (such as differentiation between radiation necrosis and recurrent tumor)

CONTENT ORGANIZATION
Case-based review of radiation induced brain injury
- Clinical presentation
  - CT and conventional MR findings
  - Advanced MR imaging including diffusion-weighted imaging (DWI) and apparent diffusion coefficient (ADC) assessment, T2*-weighted imaging (T2*WI), susceptibility-weighted imaging (SWI), 1H-MR spectroscopy, diffusion tensor imaging (DTI), MR angiography, and perfusion MRI

Characteristic imaging findings and additional information provided by advanced MR imaging

SUMMARY
The major teaching points of this exhibit are to review conventional / advanced imaging features of radiation induced brain injury and discuss future challenges in the field of advanced imaging.

Cranial Emissary Veins: Definition, Embryology, Classification, Anatomical and Pathological Significance

LL-NRE4558
Prabath K Mondel, MBBS, MD
Ashlesha S Udare, MBBS, MD
Uday Limaye

PURPOSE/AIM
1. To describe the embryology, definition & anatomy of emissary foramina of skull highlighting the importance of emissary veins
2. To describe the physiological and pathological role of emissary veins
3. The illustrate the CT, MRI & DSA features of pathologically enlarged emissary veins and their surgical importance

CONTENT ORGANIZATION
The emissary foramina in skull are channels that transmit emissary veins. Emissary veins are veins that connect the extracranial veins with dural sinuses and meningeal veins. Emissary veins can be classified based on location into: Cranial Vault – parietal Cranial Base – Anterior – foramen cecum Middle – foramen ovale Posterior – posterior condylar. On CT and MRI, the normal emissary foramina are osseous canals 1 mm in size. The foramina are enlarged by emissary veins in pathologies like sinus pericranii, DAVF, CVT, raised ICT due to craniostenosis, achondroplasia etc., idiopathic intracranial hypertension, dural sinus malformations with B/L jugular venous atresia or stenosis, CCF and VOGM.

SUMMARY
1. A knowledge of the emissary venous anatomy is essential to understand the underlying pathophysiology of numerous neurological diseases. 2. Emissary veins are important outlet for intracranial venous blood in pathologies that obstruct or impair the normal dural venous outflow.

Astroblastoma: A Rare Star in the Galaxy of Glial Tumors?

LL-NRE4559
Malay Bhatt
Julie A Ratino, MD
Lei Shao, MD
Lisa H Lowe, MD
Natasha R Acosta, MD

PURPOSE/AIM
Astroblastoma, a rare glial tumor with histopathologic similarities with other glial tumors, is challenging to correctly diagnose. Unique imaging findings can be instrumental in the diagnosis and treatment of astroblastoma. The purpose of this exhibit is to illustrate and discuss key imaging features useful to distinguish astroblastoma from other glial tumors and their correlation with histopathology.

CONTENT ORGANIZATION
SUMMARY
The major teaching points of this exhibit are: 1. Limitations of histopathology in differentiating astroblastoma from other glial tumors. 2. Reviewing the characteristic MR findings of astroblastoma. 3. Correlating MR findings with histopathology.

Iatrogenic Injury to Craniocervical Arteries and Veins - Etiology, Clinical Features, Cross Sectional and Angiographic Features with Their Endovascular Management

LL-NRE4560
Prabath K Mondel, MBBS, MD
Ashlesha S Udare, MBBS, MD
Uday Limaye

PURPOSE/AIM
1. To discuss the etiology, clinical & imaging features of iatrogenic head & neck vessel injuries
2. To illustrate the endovascular management of iatrogenic head & neck vessel injuries

CONTENT ORGANIZATION
Iatrogenic vascular injury is on the rise because of an increase in diagnostic and therapeutic interventions. The vessels in head & neck region are in major operative fields, are crowded & have variable anatomic disposition. Iatrogenic injuries can be classified into 1. Blunt & 2. Penetrating Injury. We reviewed the clinical and imaging findings of 55 patients with iatrogenic injury to head & neck vessels. Etiology - Open Surgical Injuries, Catheterization, Fine-needle aspiration, Abscess Drainage, Radiation Injury Commonest Cause – Interventional Cardiology & radiological procedures. Hemorrhage – Vessel wall irregularity & change in caliber of vessel Imaging – Occlusion, Bleeding, Narrowing, Dissection, Pseudoaneurysm, Arteriovenous Fistula. CT Angiography is the investigation of choice. Endovascular Therapy – Coils & glue embolization, stent grafts, stents & balloon.

SUMMARY
Iatrogenic injuries to neck vessels are potentially life threatening complications of diagnostic & therapeutic procedures. Endovascular therapy of iatrogenic neck vessel injuries is rapid, safe and highly effective.

Diffusional Kurtosis Imaging (DKI) of White Matter Lesion Featuring Infection, Toxic and Traumatic Diseases

LL-NRE4561
Toshihito Miyasaka, MD
Toshiaki Taoka, MD*
Tomoko Ochi
Toshiaki Akashi, MD
Focal Cortical Dysplasia: New ILAE Consensus Classification System with Illustrative Cases

Hirohito Nakagawa, MD
Kimihiko Kichikawa, MD
Takeshi Wada, MD
Masahiko Sakamoto, MD
Saeka Hori

PURPOSE/AIM
To brush up the knowledge on the image findings of the disease that occurred by infection, toxic and traumatic causes on diffusion kurtosis imaging (DKI), which reflects non-Gaussian behavior of water diffusion. The presentation will show variety of diseases focusing on the assessment of the change of white matter by DKI.

CONTENT ORGANIZATION
1. Brief introduction of technique of DKI.
2. Illustrative cases with infection, toxic and traumatic diseases to show the utility of DKI, comparing with diffusion imaging and conventional imaging.
3. To review the pros and cons of DKI images in the initial assessment and follow-up examinations.

SUMMARY
The major teaching points are: 1. DKI can demonstrate the changes in the motion of water molecules, to detect tissue damage of white matter sensitively. 2. DKI can be a novel method to provide new information of tissue microstructure of the brain. 3. DKI can have clinical potential to detect subtle tissue damage of the disease that occurred by infection, toxic and traumatic causes, in addition to cerebral infarctions and multiple sclerosis, which have been reported formally.

Modern Imaging Techniques in Neurodegenerative Diseases

Elcin Zan, MD
Alin Chirindel, MD
David M Yousem, MD
Rathan M Subramaniam, MD, PhD

PURPOSE/AIM
The purpose of this exhibit is to provide a pictorial review between the correlations of ultrasonography (US) imaging findings of suspicious neck nodules with the resultant pathologic results following sonographic guided fine needle aspiration cytology (FNAC). The goal is to familiarize radiologists with the specific characteristics of US findings that may predict malignancy and their need for further study.

CONTENT ORGANIZATION
The exhibit will focus on suspicious neck nodules that were identified at our institution using US and that were subsequently sent for FNAC. These will include thyroid nodules, lymph nodes, and other nodules within the neck region. For each neck nodule, a side by side comparison of the US imaging findings along with the corresponding FNAC slide will be provided. Emphasis on the characteristics that are associated with an increase probability for malignancy will be discussed.

SUMMARY
US is the method of choice to evaluate nodules within the neck region. A radiologist must be able to accurately identify the sonographic characteristics of these nodules and determined the likelihood of malignancy. By providing detailed descriptions of US imaging findings between benign and malignant nodules, this educational exhibit intends to help the radiologist determine which of these nodules need further study through sonographic guided FNAC.

Focal Cortical Dysplasia: New ILAE Consensus Classification System with Illustrative Cases

Judith A Gadde, DO
Erin S Schwartz, MD

PURPOSE/AIM
The purpose of the exhibit is: 1. To increase awareness among the radiology community of the new International League Against Epilepsy (ILAE) classification system. 2. To review illustrative cases of the MRI appearances of focal cortical dysplasia (FCD) described in the new ILAE consensus classification system.

CONTENT ORGANIZATION
Brief introduction to FCD. Review of prior and current classification schemes, including the previous standard, the Palmini classification. The most pertinent change from prior systems is the new separation of cortical lamination abnormalities that are associated with other lesions into Type 3. This includes lamination abnormalities associated with hippocampal sclerosis, as well as those adjacent to a neoplasm, vascular...
An Interactive eBook for Learning Neuroanatomy, Using Tractography MRIs, as an Example of the Use of New Technologies in eBook Creation, beyond the iBooks Author Software

LL-NRE4565

Andres Vasquez, MD
Sonia Bermudez, MD
Jose Vega, MD
Jorge A Abreu, MD
Alicia Londono, MSc
Juliana Ocampo, MD
Anibal J Morillo, MD

PURPOSE/AIM
The new generations of doctors are native users of information technology. Because of this, the easiest way of approaching this generation is producing contents using the latest available technology. The purpose of this work is to present an interactive atlas of neurological tracts taken from MRI tractography maps using the advanced tools for ebook creation, beyond the ibooks author software.

CONTENT ORGANIZATION
- How tractographies can be useful for learning neuroanatomy
- An interactive atlas of tractography MRIs for iPad
- Clinical application of tractography MRIs
- New tools for creating e-books
- The Learning games in ebooks
- Our experience in a neuroanatomy model

SUMMARY
Learning can be enhanced by the use of new technologies, particularly in the new generations of doctors. We present an example of an ebook made using advanced tools of ebook creation, beyond the ibooks author software, showing neurological tracts taken from MRI tractographies in an interactive way that can enhance the learning experience.

Demyelinating Lesions: Multiple Sclerosis (MS), Neuromyelitis Optica (NMO), Tumefactive Demyelinating Lesions (TDL) and beyond. Differential Diagnosis and Pictorial Review

LL-NRE4566

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PURPOSE/AIM
1. Review the differential diagnosis of solitary and multiple white matter lesions.
2. Present CT and MRI examples of these entities and discuss important features correlated with clinical presentation.
3. Discuss utility of advanced imaging in diagnosis and evaluation of demyelinating disease.

CONTENT ORGANIZATION
Differential diagnosis of multiple white matter lesions.
- Vasculitis, Sarcoidosis, PRES
- Subacute Combined Degeneration
- Small vessel ischemic disease Pictorial review of MS and its variants and mimics.
  - Classic clinical and radiologic manifestations of MS
  - Atypical variants of MS
  - Opticospinal MS
  - Balo Concentric Sclerosis
- Optimal imaging and diagnostic criteria of MS Pictorial review of other common demyelinating disorders.
  - ADEM
  - NMO
  - TDL
  - PMD
  - HIV encephalopathy Utility of advanced imaging in evaluation of MS and in differentiation of TDL from neoplasm.

SUMMARY
Knowledge of differential diagnosis and radiologic manifestations of demyelinating disorders is essential for accurate diagnosis. When a Tumefactive Demyelinating Lesion (TDL) is suspected, MR perfusion and MR spectroscopy can be useful in confirming the diagnosis. While conventional MRI underestimates involvement of grey and white matter in MS, DTI and MR spectroscopy can detect involvement of normal appearing white matter.

Anatomical Bases of Trigeminal Nerve Denervation Patterns

LL-NRE4567

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Claudia Cotes, MD
Hugo H Cuellar, MD
Rafael Rojas, MD
Ramon E Figueroa, MD
Andrew Chow, MD
Enrique Palacios, MD

PURPOSE/AIM
Show the Intra- and intracranial anatomy of the trigeminal Nerve Demonstrate the how patterns of denervation vary with location of the lesion. Review the MR characteristics of the chronicity of denervation.

CONTENT ORGANIZATION
Anatomy of the Trigeminal Nerve - Brain Stem - Cisternal - Meckel's Cave - Foraminal - Extracranial Patterns of Denervation - Intracranial injury - Extracranial injuries * Proximal * Mid * Distal MRI patterns - Acute - Subacute - Chronic Summary

SUMMARY
The inferior branch of the trigeminal carries the motor information to eight muscles. Understanding the anatomy of the trigeminal nerve is essential to determine its lesion. The radiological appearance of trigeminal denervation permits the establishment of the temporality of the lesion. Depending on the portion of the nerve involved in the lesion, you involve all or only part of the muscles innervated. When muscular...
atrophy is found, the entire nerve pathway should be studied to try to find the cause of the atrophy.

Sinonasal MR Imaging; Diagnostic Algorithm for T2-hypointense Lesions

**PURPOSE/AIM**
A relatively small number of sinonasal cavity lesions demonstrate low signal on T2-weighted MR imaging. T2W hypointense sinonasal lesions can represent a broad category of diseases, including hemorrhage, fibrous tissue, high protein content, calcification, and high cellularity. Familiarity with the various imaging appearances may lead to a specific diagnosis.

The purpose of this exhibit is to:
1. Review various sinonasal pathologies that demonstrate hypointensity on T2-weighted MR imaging and discuss the differential diagnoses.
2. Propose a diagnostic algorithm of the evaluation of T2-hypointense sinonasal lesions.
3. Understand when further imaging with CT is required.

**CONTENT ORGANIZATION**
1. Inflammatory diseases-mucocele, fungal disease
2. Fibro-osseous lesions
3. Benign tumors
4. Malignant tumors
5. Tumor-like conditions-organized hematoma, vasculitis, IgG4-related disease
6. Diagnostic algorithm to evaluate T2-hypointense sinonasal lesions

**SUMMARY**
Although most sinonasal cavity diseases demonstrate high signal on T2-weighted MR imaging, commonly representing acute sinusitis and retention cysts, T2 hypointense lesions are not very uncommon. Familiarity with these diseases/conditions and their imaging appearances is important in reaching a specific diagnosis. Radiologists should understand when CT is required for further evaluation.

Pediatric Maxillomandibular Lesions

**PURPOSE/AIM**
The purposes of this exhibit are 1) to demonstrate normal anatomy of the pediatric maxilla and mandible using conventional radiography, CT, and MRI, 2) to discuss technical aspects of each imaging modality and potential pitfalls, 3) to review imaging findings of various pathologies in the maxilla and mandible using pathologic correlation, and 4) to discuss the differential diagnosis.

**CONTENT ORGANIZATION**
Case materials include 120 cysts, 47 tumors, 21 dysplasias and 24 osteomyelitis of the maxilla and mandible. CT and MRI were useful to define the extent of the lesions within the maxilla and mandible as well as in the soft tissue and provided useful information to establish the differential diagnosis. They were also useful in investigating suspected recurrence. The goal of this exhibit is to discuss the imaging features of the pediatric maxilla and mandible, differential diagnosis, technical aspects and advantages and limitations using conventional radiography, CT, MRI.

**SUMMARY**
Learning objectives: 1) To understand normal anatomy and characteristic imaging findings of various pediatric pathologies (common/rare and benign/malignant) of the maxilla and mandible using conventional radiography, CT and MRI, 2) To discuss technical aspect of each imaging modalities, 3) To learn how to organize the differential diagnosis based on imaging findings.

"D.M.T.E.S."?: Useful Categorization of Various Diseases Involving Splenium of the Corpus Callosum

**PURPOSE/AIM**
The purpose of this exhibit is:
1. To present various MR imaging features of diseases that are involving splenium of the corpus callosum(SCC).
2. To suggest useful categorization of diseases that are involving SCC.

**CONTENT ORGANIZATION**
Review of various MR image features of various diseases that are involving SCC.
- Conventional MRI, Diffusion weighted imaging Categorization of various diseases that are involving SCC into 5 groups according to the first letter of their causes, so called "D.M.T.E.S." : 'D' (Including Drugs such as antiepileptics, antiemetics, Demyelinating disease such as multiple sclerosis) 'M' (including Metabolic etiology such as vitamin B12 deficiency, hyper and hypoparathyreminia, hypoglycemia) 'T' (including Toxic, Trauma such as diffuse axonal injury, Tumor such as lymphoma, meningioma) 'E' (including Encephalopathy or Encephalitis with a reversible (isolated SCC) lesion), ADEM(Acute Disseminated Encephalomyelitis), PRES(Posterior reversible encephalopathy syndrome), japanese encephalitis) 'S' (including Seizure, Stroke)

**SUMMARY**
1. This review is very useful to broaden the entities of variable diseases that can involve SCC and to get knowledge of image features of them.
2. It is ease to memorize various diseases that can involve SCC with categorization called "D.M.T.E.S."
Cervical Thymic Anomalies: A Pictorial Review

PURPOSE/AIM
To highlight the importance of venous structures in interpreting routine neuroimaging. Review normal intracranial venous anatomy through catheter based angiography and cross-sectional imaging. Illustrate how various pathologic conditions alter normal venous drainage, and how appreciation of particular venous pathways can lead to specific diagnoses. Correlate observed venous drainage pathways with underlying clinical conditions, and recognize potential treatment implications.

CONTENT ORGANIZATION

SUMMARY
Raising awareness of the importance of venous drainage pathways.

Flow Diverters in the Management of Intracranial Aneurysms: A Paradigm Shift or Technical Adjunct?

LL-NRE4572
Choi Yan Yau, MBChB, BSc
Peter Cowley, MBChB, FRCR

PURPOSE/AIM
This exhibit aims to present the evidence for flow diverters (FDs) in the treatment of intracranial aneurysms through a full literature review where we will combine the data from all the individual case studies. In addition we will demonstrate and discuss our current practice with this state of the art technology through our case base.

CONTENT ORGANIZATION
Pipeline Embolization Devices (PED) and the SILK flow diverters (SFD) are currently the most common FDs used. Evidence from 13 published case series amounting to 868 treated aneurysms in 758 patients will be reviewed. Pooling of the combined data reveals complete occlusion rates of approximately 80%, mortality rate of 2% and long-term permanent neurological morbidity of approximately 4%. We will present the current technology, discuss the applications, and demonstrate the deployment technique, radiological outcomes and potential complications of FDs. We have recently deployed the new FDs; Surpass and FRED and these will also be presented in this exhibit.

SUMMARY
The use of FDs is evolving and represents a promising new approach to the treatment of intracranial aneurysms. Currently the main indication is in difficult to treat elective aneurysms, however use in acutely ruptured aneurysms remains controversial and the future direction of FD technology awaits further research.

Cervical Thymic Anomalies: A Pictorial Review

LL-NRE4573
Sandra M Tochetto, MD
Osman C Saito, MD, PhD
Julia D Zavariz
Rodolfo D Franca, MD
Miguel Francisco Neto, MD
Maria Cristina Chammas, MD

PURPOSE/AIM
1. To review the imaging findings (US, CT and MR) of the ectopic cervical thymic tissue, anomalies related to thymoparyngeal remnants and the superior cervical extension of the thymus. 2. To help differentiate these entities from other cervical mass.

CONTENT ORGANIZATION
1. To review the embryological development of the thymus (the origin in the third pharyngeal pouch, the thymopharyngeal duct and its descend path from the angle of mandible to the superior mediastinum). 2. To review the appearance and report our experience with ectopic cervical thymus at US, CT and MR imaging. 3. To show examples of ectopic cervical thymic tissue, anomalies related to thymoparyngeal remnants and the superior cervical extension of the thymus. 4. To discuss the differential diagnosis and the management of cervical masses.

SUMMARY
Ectopic cervical thymus is an uncommon cause of neck mass, often identify during childhood. Ultrasound is the initial imaging modality of choice; CT and MR can be used to complement US. This entity should be considered in the differential diagnosis of infantile neck masses to prevent inadvertent total thymectomy. If ectopic thymus causes symptoms, due to compression or pressure in the neighboring structures, surgery might be recommended. In this situation, it is important to confirm the presence of thymic tissue in the upper mediastinum.

Imaging of the Oral Cavity and Oropharynx Non-SCC (Squamous Cell Carcinoma) Tumors: An Overview

LL-NRE4574
Antonino G Guerrisi, MD
Antaiellelelavidia, MD
Silvia Pugliese, MD
Francesca Piludu, MD
Renato Covello
Valentina Manciocco
Giuseppe Spriano, MD

PURPOSE/AIM
The purpose of this exhibit is; 1. To review the less common tumors (non-SCC) may occur in the oral cavity and oropharynx. 2. To discuss the differential diagnosis of these tumors with a reference to SCC. 3. To explain the utility of CT, MRI and MR diffusion-weighted imaging (DWI) in the diagnosis of non-SCC head and neck tumors.

CONTENT ORGANIZATION
Content Organization 1. A Brief of anatomy of Oral cavity and Oropharynx. 2. A description of the imaging techniques. 3. Full description of less common tumors occurring in the oral cavity and oropharynx -general description (i.e., etiopathogenesis...)- all imaging findings - added value of new techniques (i.e. DWI) - full imaging overview correlated by images of MR, CT, histopathologic exams. 4. Future directions and summary.

SUMMARY
Conclusion: The major teaching points of this exhibit are: 1. To recognize imaging less common tumors may occur in the oral cavity and oropharynx, understanding their site of origin, characteristics (morphology, signal intensity...), appearance after contrast medium administration and DWI behaviour. 2. Differential diagnosis of these tumors, particularly highlightening the imaging differences between them and the most common SCC.
PURPOSE/AIM
1) To understand the anatomy of masticator space, and its adjacent structures focusing on CT/MR imaging findings.
2) To know pearls and pitfalls of CT/MR imaging findings in order to improve the radiologists’ diagnostic accuracy.

CONTENT ORGANIZATION
1) Introduction:
2) Normal anatomy:
   a) An organized approach for the anatomy of masticator space and surrounding structures based on CT/MR imaging.
   b) The movement of masticationwhich affects clinical significances on 3T cine MR imaging.
3) Case presentation: CT/MR imaging pearls containing unique anatomical insights and problem solving tips.
   a) Vascular lesions and mimics
      Venous malformation, lymphangioma
   b) Inflammation
      Abscess, osteomyelitis, fungal infection
   c) Tumor
      Trigeminal neurinoma, schwannoma, Castleman` s disease, tumor invasion and perineural spread of ACCa/SCCa, rhabdomyosarcoma, lymphoma, osteosarcoma, chondorosarcoma, rhabdomyosarcoma, metastasis, ameloblastoma, myeloma and plasmacytoma
   d) Trauma
      Fracture with lethal hemorrhage
   e) Others
      Asymmetrical denervation atrophy of masticator muscles

SUMMARY
Focusing on CT and MR imaging findings based on the anatomy of masticator space, we will discuss the cross sectional imaging findings emphasizing on the important landmarks and their clinical significances in pathological states.

Sincipital Encephalocele: A Case Series

PURPOSE/AIM
To evaluate sinicipital encephalocele using different imaging modalities
To subtype the sinicipital encephaloceles
To find out associated anomalies
Post operative follow up

CONTENT ORGANIZATION
USG screening ,CT scan with 3D reconstruction,MRI (1.5T)
A prospective study (2007-2010)
Intra-operative findings ,HPE correlation was done. Patients were followed up for evaluation of prognosis.RESULTS: Total number of cases = 8,1 Interfrontal,2 Frontonasal,3 Naso-ethmoidal,2 Naso-orbital.ASSOCIATED ANOMALIES: Colpocephaly,frontal horn protruding into the cephalocele,hypogenesis of corpus callosum,forencephalic cysts,cleft lip and cleft palate

SUMMARY
Sincipital Encephaloceles are rare anomalies - But the most frequent form of encephaloceles encountered in Assam,a province in north east India.Interestingly all cases belong to TEA GARDEN community.
USG is a good cost effective screening modality to differentiate meningocele from meningoencephalocele
CT scan with 3d reconstruction is the basis of subtyping- helps the surgeon for better understanding of pathoanatomy.
MRI can identify associated congenital anomaly.MRA,MRV detect vascular displacement into the cephalocele
Sincipital encephlalocele is less commonly associated with severe congenital brain anomaly and has a good prognosis

Diffusion Neurography in Clinical Imaging Practice: Applications, Pearls: What a Beginner Should Know

PURPOSE/AIM
learning objectives to describe the basics Principles,Technique and parameters for optimisation of Diffusion MR Neurography technique using DWIBS and it’s clinical applications To highlight the advantages and pitfalls of this technique as compared to other Sequences used for MRN. To show case clinical use of Whole body Diffusion MR Neurography in diagnostic characterisation of Herditory Poly neuropathies and other types of Poly neuropathies.

CONTENT ORGANIZATION
normal appearance of Peripheral nerves in DWIBS sequence and post processing techniques for visualisation of Brachial plexus and Lumbar Plexus and Peripheral nerves of limbs illustrated with examples. neuropathological correlates of Diffusion MRN coresponding to nerve thickening,inflammation Nerve enema loss of normal architecture and abnormal ADC values,course deviation,Focal mass lesions are described with clinical applications. technical aspects of basic parameter optimisation,fat suppression and unidirectional encoding and Post processing . role of DwIBS MRN in neurogenic tumors,Trauma, mechanical nerve compression, and Inflammatory processes is highlighted Including whole bodyMRN

SUMMARY
this exhibit gives a one stop shop Ponts to Practice session on Diffusion MR Neurography,its technique,optimisation and Clinical applications and it’s overall in an Ideal nerve imaging .
Non-Cystic Cervical Mass: How to Make the Differential Diagnosis

Sandra M Tochetto, MD
Osmar C Saito, MD, PhD
Mario B D’Avila, MD
María Cristina Chammas, MD

PURPOSE/AIM
The purpose of this exhibit is: 1. To review the ultrasound (US), computed tomography (CT) and magnetic resonance (MR) findings of non-cystic cervical masses. 2. To describe the radiological and anatomical findings that can be helpful in their diagnosis.

CONTENT ORGANIZATION
1. To review the imaging findings of the most common non-cystic cervical masses according to an algorithm base on their location: midline, anterior neck triangle and posterior neck triangle. 2. To show examples of: inflammatory, infectious and neoplastic adenopathy, salivary gland tumors, complicated (infectious and neoplastic) thyroglossal duct cyst, ectopic thyroid tissue, thyroid enlargement, parathyroid masses, cervical thymus, laryngocele, paragangliomas, lipoma, osseous tumor and tumor of neural origin. 3. The discussion will emphasize the differential diagnosis with anatomopathological correlation.

SUMMARY
A neck mass might come to attention as either a symptomatic abnormality or an additional finding identified at radiological imaging for other reasons. These masses may represent a variety of conditions having a congenital, acquired inflammatory, neoplastic or vascular origin. An approach based on anatomical location associated with the knowledge of the radiologic appearance may help to achieve an accurate diagnosis.

Imaging Techniques for Moya-Moya Disease: Evaluation of Disease, Treatment Planning and Follow Up

Masato Takahashi
Toshiaki Taoka, MD *
Toshiaki Akashi, MD
Tomoko Ochi
Saeka Hori
Kimihiko Kichikawa, MD
Toshiteru Miyasaka, MD
Masahiko Sakamoto, MD
Takeshi Wada, MD

PURPOSE/AIM
The goal of this exhibit is to familiarize the viewer with the image diagnosis of moyamoya disease, image for treatment planning and image for follow up of the disease. Both pre-surgical and post-surgical findings of bypass surgery will be described and illustrated. The role of advanced imaging modalities will be emphasized.

CONTENT ORGANIZATION
Characteristics and findings of pre- and post-surgery for Moya-moya disease by the following image technique will be reviewed:
• CT
CT angiography
CT perfusion
• MR
MR angiography
FLAIR
SWI
Dynamic contrast-enhanced MR perfusion
Arterial spin labeling (ASL) MR perfusion
• RI
123I SPECT
99mTc SPECT
• DSA
SUMMARY
For the cases of Moya-moya disease, imaging plays an important role in the diagnosis, treatment and follows up. There are wide varieties of techniques for evaluation of the disease and each technique has its own advantages. For example, despite time consuming, ASL perfusion image with multiple TI is necessary for evaluation of brain perfusion with delayed circulation. Appropriate uses of these imaging techniques are essential for better clinical outcome and the quality of life of the patients.

Neurovascular Anatomy and Pathology of the Spine

Prabath K Mondel, MBBS, MD
Ashlesha S Udare, MBBS, MD
Uday Limaye

PURPOSE/AIM
1. To describe the embryological development, normal anatomy & anatomical variations of the vascular supply to the spine 2. To discuss the cross sectional and angiographic anatomy of congenital & acquired vascular malformations of the spine

CONTENT ORGANIZATION
The adult spine is derived from the notochord & recieves segmental supply from a number of arteries. The segmental arteries have a basic organisation I. Paravertebral musculature & other neural crest derivatives II. Vertebral Body III. Nerve root & spinal canal - radicular IV. Dura and its derivatives - radiculomeningeal V. Spinal Cord – radiculomedullary or radiculopial Venous drainage of the cord I. Intrinsinc system – sulcal & radial veins, longitudinal veins II. External system – anterior median & posterolateral spinal veins Venous drainage of the spine I. External plexus II. Internal plexus III. Basivertebral veins The detailed cross sectional & angiographic anatomy of spinal vascular malformations will be illustrated with examples

SUMMARY
1. The thorough knowledge of the spinal vascular anatomy is essential in understanding the pathophysiology of spinal disorders. 2. A detailed cross sectional & angiographic study of the spine is an essential prelude in the management of spinal diseases.

MR Findings in Brain Metastasis after Advanced Treatments

Toshiaki Akashi, MD
Toshiaki Taoka, MD *
Saeka Hori
Tomoko Ochi
Masahiko Sakamoto, MD
Prenatal MR Imaging in Fetal Cerebellar Abnormalities

LL-NRE4582
Elida Vazquez , MD
Ignacio Delgado , MD
Angel Sanchez-Montanez
Alfons Macaya
Veronica Del Prete
Elena Carreras , MD

PURPOSE/AIM
- To review the different US and MRI findings in fetal posterior fossa anomalies that can assess a certain diagnosis. - To highlight the importance of establishing an early diagnosis for prognostic relevance and adequate management of gestation.

SUMMARY
Optional use of fetal MR imaging will be best achieved through continued multidisciplinary collaborative efforts. MRI is a highly useful tool for evaluating posterior fossa anomalies in the fetus, although the early gestational age (before 24 weeks) is the most decisive factor in false positive or negative diagnosis.

Advanced MRI Techniques for the Evaluation of Demyelinating Diseases: Spinal Cord Analysis

LL-NRE4583
Fernanda C Lopes , MD
Joao R Costa
Emerson L Gasparetto , MD

PURPOSE/AIM
Advanced MRI techniques play an essential role in the evaluation of demyelinating diseases. Post-processing programs allows the analysis of the white and gray matter and the normal-appearing white matter damage, and also to quantify brain atrophy. Our exhibit aims to illustrate the advanced MRI techniques utilities in clinical practice and research management of spinal cord demyelinated diseases.

SUMMARY
Advanced MRI techniques and post-processing methods play an essential role in the differential diagnosis of demyelinated lesions and improve the diagnosis and monitoring of disease progression. These techniques are of great utility in clinical practice and research management of spinal cord demyelinated diseases.

The Next Frontier in Iterative Reconstruction Techniques: Clinical Impact of Iterative Model Reconstruction (IMR) for CT Brain Examinations

LL-NRE4584
 Takeshi Nakaura , MD
 Schinichi Tokuyasu , RT *
 Masakuni Kidoh
 Ryo Itatani
 Kazunori Harada
 Yasuyuki Yamashita , MD *

PURPOSE/AIM
Image noise is a serious problem in brain CT because of requirements for low contrast resolution. Additionally, CT scanners generally minimize beam hardening effect from the cranial bone by calibration correction and iterative beam hardening correction software; however, these techniques easily perform the over- or under-correction due to the complicated patient anatomy. The recent introduced iterative model reconstruction (IMR, Philips Healthcare) dramatically reduces image noise, offers accurate CT attenuation, and enables improvement in low-contrast detectability. We aim to explain the utility of IMR in brain examinations.

SUMMARY
1. Common features of metastases with or without conventional chemotherapy. 2) Features of metastases after radiation therapy. 3) Unusual features of metastases treated with molecular target therapy including gefitinib, bevacizumab, and crizotinib.

SUMMARY
1) Common features of metastases with or without conventional chemotherapy. 2) Features of metastases after radiation therapy. 3) Unusual features of metastases treated with molecular target therapy including gefitinib, bevacizumab, and crizotinib.
Functional and Imaging Anatomy of Tentorial Sinus: A Pictorial Review

**PURPOSE/AIM**
The purpose of this exhibit is:

1. To review the functional and imaging anatomy of *tentorial sinus* (TS)
2. To illustrate *angiographic findings of vascular lesions* involving TS
3. To demonstrate the *transcatheter treatments for vascular lesions* involving TS

**CONTENT ORGANIZATION**

A. Functional anatomy of tentorial sinus (TS)
   
   - Normal anatomy and variations
   - Embryology

B. Imaging appearance of TS in normal and pathologic conditions
   
   - Normal angioarchitectures and variations of TS on CT, MR and angiography
   - Imaging findings of pathological conditions involving TS and its tributaries

C. Endovascular treatment
   
   - Embolization for tentorial dural arteriovenous fistula
   - Embolization for transverse-sigmoid dural arteriovenous fistula with reference to TS

**SUMMARY**

*The tentorial sinus (TS)* can be classified into 4 types which receive the venous blood flow from cerebellum, temporo-occipital lobe, deep venous system, and tentorial veins. There is a variety of drainage patterns in these venous flows, and they can be involved by neoplastic and vascular lesions. The knowledge and assessment of drainage patterns is important for endovascular treatment as well as surgery. The purpose of this exhibit is to demonstrate functional and imaging anatomy, and endovascular treatments involving TS and its tributaries.

Magnetic Resonance Imaging Findings of Lumbar Puncture Complications

**PURPOSE/AIM**
To pictorially review the magnetic resonance (MR) imaging findings of lumbar puncture (LP) complications.

**CONTENT ORGANIZATION**
Lumbar puncture is frequently performed in medical emergencies and anesthesia. It is a relatively safe procedure and despite uncommon, minor and major complications can occur. Post LP headache is the most common complication, related with intracranial hypotension. Direct or indirect sign of dural fistula can be seen in some patients. Cerebral and spinal herniation, cranial neuropathies, nerve root irritation, low back pain, infections and hemorrhage are also reported following a LP.

**SUMMARY**
LP is generally an innocuous procedure and little has been written about imaging findings of LP complications. Familiarity with MR imaging findings of complications may facilitate the diagnosis, improve patient management and avoid catastrophic consequences.

Acute Exophthalmos Pictorial Essay

**PURPOSE/AIM**
To show different pathologies of the orbit causing acute exophthalmos

**CONTENT ORGANIZATION**
CT scan and/or MRI performed on patients with post-traumatic carotid-cavernous fistula, thrombosis of the superior ophthalmic vein, burkitt lymphoma, acute panophthalmitis, dacrocyctitis, trauma, hemorrhage on melanoma, hemorrhage on schwannoma, retroorbital abscess, varix, hemangioma, periorbital cellulitis, Grave’s disease.

**SUMMARY**
Acute onset of exophthalmos presents with severe pain, chemosis and proptosis. Different medical conditions may cause exophthalmos however acute status is relatively uncommon. This condition may lead to compression of the optic nerve, as the most serious local complication, which if not treated rapidly may cause blindness. Ophthalmology clinical evaluation is required to confirm the diagnosis. Interventional neurovascular procedures, antibiotic therapy or surgical decompression may be needed. Generally exophthalmos presents as a progressive, usually bilateral clinical manifestation of different pathologies. There are some reports in the literature of other less common causes of acute exophthalmos, such as Hashimoto’s ophtalmopathy or orbital hematoma following delivery.
**Purpose/Aim**
To show different types of penetrating foreign bodies on neuro imaging

**Content Organization**
Non enhanced helical CT scan of the brain and spine, in 14 patients between 2005 and 2012 presented to our Emergency Department. We present different type of foreign bodies, including fragment of bullets, branches of wood, nails, knives, construction nails located on the head and spine.

**Summary**
Penetrating injuries are generally referred to high speed projectiles. Other high speed injuries can be seen on construction workers, accidently inflicted by using pneumatic nail hammers, however may be used on self-inflicted in suicidal attempts. Seasonal workers due to lack of protection may present with serious injuries by pieces of wood or branches. In order to plan surgical removal of the foreign bodies patients must be adequately imaged. Vascular or neurological compromise and infection represent the most serious complications. For surgical planning, noncontrast CT followed by CTA is extremely important to determine the relationship with vessels for preoperative planning. However conventional angiography may be needed for further evaluation or interventional treatment. Major complications in short and long term due to these injuries include infection, CSF leak, neurological compromise, disability and death.

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**Infrahyoid Neck: The Nerves on Dedicated CT and MR Images of Adult Neck**

**Purpose/Aim**
The purpose of this exhibit is:
1. To present the normal imaging anatomy and imaging landmarks of the nerves in the infrahyoid neck
2. To discuss relevant clinical symptoms and prognosis according to the each diseased nerves and their adjacent anatomical structures
3. To present the representative pathologies of the regarding nerves in their typical locations

**Content Organization**
*anatomy, position variation, symptoms, imaging findings of pathologies for 1, 2, and 3.  
1. Vagus nerve and its branches in the neck
   - position variation, symptoms, imaging findings of pathologies
   i. Vagus nerve ii. Superior laryngeal nerve iii. Recurrent laryngeal nerve
2. Spinal accessory nerve
3. Cervical sympathetic trunk
   - i. Superior cervical sympathetic ganglion ii. Middle cervical sympathetic ganglion iii. Inferior cervical sympathetic ganglion
4. Brachial plexus

**Summary**
The major teaching points of this exhibit are: 
1. Pathologies involving the vagus nerve, spinal accessory nerve, cervical sympathetic trunk, or brachial plexus results in unique clinical symptoms according to their location.
2. Being familiar with the imaging anatomy and anatomical landmarks of the neural structures in the infrahyoid neck is crucial for accurate imaging diagnosis and proper management of patients with neural pathologies.

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**Cerebral Microvascular Disease. Clinical Presentation and Imaging**

**Purpose/Aim**
To review the congenital and acquired diseases, including arteriosclerosis, neoplastic, metabolic, autoinmune, and other etiologies, related to microvascular angiopathy, capable to cause neurological disorders in children, young adults and the elderly. To review the imaging characteristics, mostly MRI findings, in the appropriate clinical settings.

**Content Organization**
*General discussion of microvascular disease, etiology and imaging. Hereditary / metabolic diseases. -Children presentation -Adult presentation Autoimmune disorders Neoplastic diseases, chemo/radiotherapy effects. Arteriosclerosis Diabetes and hypertension

**Summary**
Teaching goals of this presentation: Focus in the clinical aspects and imaging findings of microvascular disease of the brain, and its role in dementia and other neurological disorders. Review specific disorders such as CADASIL, mitochondrial vasculopathy, retino-cerebral vasculopathy (Susac's syndrome), toxemic vasculopathy, arteriosclerosis, amyloid angiopathy, and other vaculopathies. Discuss the findings that may help in the diagnosis of these entities, which may have common imaging characteristics.

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**A View from Within-Virtual Flythrough Software as a Novel Method of Visualizing Head and Neck Pathology**

**Purpose/Aim**
To take advantage of modern multidetector computed tomography and virtual flythrough 3D reconstruction software to examine head and neck pathology in unconventional ways.

**Content Organization**
1. Location of the lesion
While evaluating the lesion one has to stress on the following points

SUMMARY
8. Main points to remember while reporting such cases so as to avoid making mistakes
6. Evaluation of differential diagnosis with stress on important points which help in differentiating.
5. Areas where a radiologist or a resident may get confused
4. Evaluation of subtle and non-characteristic findings on computed tomography
3. Computed Tomography Evaluation of characteristic findings of each entity
2. Pathophysiologic process of each condition in brief
1. Conditions presenting as cystic jaw lesions
2. Size of the lesion
3. Contents of the lesion
4. Relationship with adjacent teeth
5. Relationship of the lesion margin with cemento-enamel junction
6. Type of lesion margin
7. Integrity of the bone cortex
**Beyond Baby Blues**: A Review of Central Nervous System Abnormalities in the Peri- and Postpartum Period

**Purpose/Aim**
Aside from the initial challenges of parenthood - which are formidable enough - there are a diverse set of CNS conditions that may arise in the peri- and postpartum period. The conditions may be specific to pregnancy, or reflect an increased incidence of pathologies that would otherwise be rare in a young patient. These conditions may be cerebrovascular, endocrine, or neoplastic, and an understand of their incidence and appearance is critical. This educational exhibit aims to review these etiologies.

**Content Organization**
The five classic questions of journalism will be addressed for each etiology. This includes who, what (radiographic findings), when, where, and why (pathophysiology).

**Summary**
There are a diverse set of conditions that may arise in the peri and postpartum period, which may be cerebrovascular, endocrine, or neoplastic. Because many of the etiologies are unique - or rare in a young person - recognition of the incidence, context, and appearance is crucial.

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**New Radiological Techniques in Exploring Lumbar Interbody Fusion for Better Reduction of the Metallic Artifacts**

**Purpose/Aim**
To present the necessary knowledge for the radiological reduction of artifacts related to interbody fused spine, to better evaluate the potential complications.

**Content Organization**
The goal of the lumbar interbody fusion is to obtain an integrated osseous fusion. Early complications could be mechanical (screw malposition, cage migration) or non-mechanical (hematoma, dural sac injury, infection). Delayed complications, such as pseudarthrosis, cage migration, mechanical conflict with nerve roots, consequences on adjacent levels due to lost mobility and additional stress (fracture, degenerative discopathy), could limit the clinical benefit. X-ray exams are essential for proper position and post-operative check-up of the hardware. CT and MR are usually artifacted by the metallic hardware, limiting the correct visualisation of complications. Our focus is to discuss new CT (iterative reconstructions, dual-energy, frequency split metal artifact reduction) and MR (metal artifact reduction sequence, slice encoding for metal artifact correction, multicquisition variable-resonance image combination etc) techniques that allow better depicting of bone, intervertebral disc and adjacent soft tissue.

**Summary**
New radiological techniques, both for CT and MR, allow for diminishing the metallic artifacts classically associated to lumbar interbody fusion.

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**Neuroimaging of Langerhans Cell Histiocytosis**

**Purpose/Aim**
Langerhans cell histiocytosis (LCH), or eosinophilic granuloma, has many more imaging manifestations than just lytic calvarial lesions. We review orbital, temporal, skull base, and spinal manifestations.

**Content Organization**
- Briefly review what is known about the pathophysiology of LCH.
- Present case examples of LCH including orbital sphenoid wing lesions, periorbital soft tissue masses, thickening of the pituitary infundibulum, lytic/destructive temporal bone lesions with associated soft tissue masses, and vertebra plana.
- “Beveled edges” and “button sequestrum” are classic findings associated with LCH.
- Demonstrate examples of near complete resolution of temporal bone and spinal lesions, highlighting the importance to not biopsy spinal lesions, especially in pediatric populations.
- LCH should be suspected in children presenting with calvarial lesions, exophthalmos or pituitary/hypothalamic dysfunction.

**Summary**
1. Head and neck is the most commonly involved area in LCH.
2. Although LCH lesions can appear very aggressive with extensive bony destruction, prognosis is variable, sometimes having near complete resolution.
3. If LCH in the spine is suspected, biopsy should be deferred to medical treatment.

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**Watch It Move? : Dynamic Evaluation of the Subarachnoid Spaces with Cine Steady State Free Precession MRI**

**Purpose/Aim**
High resolution MRI allows the accurate assessment of the anatomy of upper thoracic outlet.

**Content Organization**
Functional MRI provides new information to tumor and neurovascular diseases involving this complicated anatomical region, increasing diagnostic accuracy in different pathological scenarios.
(To review the physics of cardiac gated cine steady state free precession imaging (SSFP). Also known as balanced fast field echo (bFFE).

To explain the utility of cine SSFP MRI in evaluation of patients with Chiari malformation, syringomyelia, and suspected arachnoid cysts or arachnoid adhesions.

Demonstrate the additional benefits of cine SSFP MRI over conventional MRI sequences and CSF flow studies.

Chiari malformation - pre op or post posterior fossa decompression surgery

Syringomyelia

Suspected arachnoid cysts - intracranial or intraspinal

Tethered cord: suspected arachnoid adhesions

Compare findings of cine SSFP with conventional MRI and CSF flow studies Sample cases Future directions

The major teaching points of this exhibit are:

1. Cine SSFP provides real time visualisation of the movement of the brain and spinal cord within the subarachnoid spaces

2. This technique is useful in certain conditions such as Chiari malformation, syringomyelia and suspected tethered cord or arachnoid cyst

3. It provides additional information over conventional MRI and CSF flow studies to guide the neurosurgeon's management decisions.

Spectrum of CNS Pathologies and Normal Structures with Restricted Diffusion Signal on DWI/ADC Imaging

Dynamic CT Myelography in the Age of MRI: When We Do It, and How We Do It?

Double Vision: The Observation Points on CT and MRI
of diplopia. Radiologists should be familiar with the location and findings of these pathologic points.

Content Organization; Eye movement is controlled by III, IV and VI cranial nerves. MRI and CT are effective to detect the disorders of the nuclei and nerve tracts of them within the midbrain and the pons. On this exhibit, these specific locations on MRI and CT are demonstrated with schemata and some typical pathological changes are presented. The locations of those nerves in the cisterns and skull base are also specific. Each of those anatomical positions and diseases affecting them are indicated. Abnormalities of extraocular muscles, malposition of eyeballs are other causes of the diplopia. Demonstrated pathological changes include cerebrovascular disease, demyelination, aneurysm, inflammation, neoplasm, trauma, metabolic disease, uncal herniation and so on.

Summary; The readings point to find the cause of diplopia and the typical abnormalities are systematically presented to understand intelligibly.

Bilateral Temporal Abnormalities: To Herpes and Beyond\[Cr];

LL-NRE4606
Francis J Cloran, MD, MS
Joel M Stein, MD, PhD
Suyash Mohan, MD

Purpose/Aim
1. To present an algorithmic approach for solving the mystery of bilateral temporal lobe lesions
2. To present in an interactive manner a series of challenging cases with relevant clinical data in order to help improve the radiologist’s diagnostic accuracy

Content Organization
Review of normal temporal cross-sectional anatomy
Integration of clinical and laboratory knowledge with imaging
Algorithmic approach to differential diagnosis of bitemporal lesions
Interactive case review:
The images will be presented with relevant clinical data, key differentials and therapeutic options in a case-based format. Some of the cases that will be discussed include:
• Herpes Simplex Encephalitis
• Human Herpes Virus-6 Encephalitis
• Hyperammonemia
• Status Epilepticus
• Hypoxic ischemic injury
• CADASIL
• Transient global amnesia
• Mesial Temporal Sclerosis
• Gliomatosis
• Drop metastases
• Radiation necrosis

Summary
This interactive case based review of bi-temporal abnormalities provides the participant with an algorithmic approach for the diagnosis and a comprehensive overview of the clinical and pathophysiological features in these diseases.

Symmetrical Deep Grey Matter Lesions - Differentiation Based on Imaging and Clinical History

LL-NRE4607
Jaykumar R Nair, MD
Sunila T Jaggi, MD
Carlos I Torres, MD
Jeffrey Chankowsky, MD
Sonali Shah, MD, MBBS
Inderraj A Talwar, MD
Raquel Del Carpio-O'donovan, MD

Purpose/Aim
To develop imaging and clinical based pattern recognition for symmetrical deep grey-matter lesions with special emphasis on various Magnetic Resonance Imaging (MRI) sequences including Diffusion Weighted Imaging (DWI).

Content Organization
2) Analyze the cause of affection of deep grey nuclei making them vulnerable to metabolic, systemic or generalized disease processes
3) Illustration of 20 different pathologies based on imaging findings and clinical history
4) Role and importance of clinical information include age of the patient, mode of presentation (acute vs chronic), any specific history or event (exposure to toxins, alcohol abuse, malnutrition, rapid correction of hyponatremia, hypoxic event, immune status), family history (inherited or familial diseases) and laboratory investigation to arrive at a definitive diagnosis

Summary
1) Symmetrical deep grey matter lesions constitute a heterogeneous group, which includes metabolic, vascular, toxic and generalized disease process. Using MRI characteristics, differentiation between the various entities is possible in most cases. 2) Knowledge of the typical MRI and clinical findings allows a more specific diagnosis to be made, which is essential for appropriate management and treatment.

Intracranial Manifestations of Cerebral Amyloid Angiopathy: From Prototypical Appearances to Bizarre Manifestations

LL-NRE4608
Francis J Cloran, MD, MS
Joel M Stein, MD, PhD
Suyash Mohan, MD

Purpose/Aim
1. To illustrate the spectrum of imaging manifestations via an interactive case based review of cerebral amyloid angiopathy including typical and atypical imaging manifestations
2. To provide an approach for differentiating cerebral amyloid angiopathy from other mimicking pathology.

Content Organization
Review of pathophysiology of cerebral amyloid angiopathy.
Interactive case based review:
The images will be presented with relevant clinical data, key differentials in a case-based format. Some of the cases that will be discussed include:
1. Incidental subcortical microhemorrhages
2. Leukoencephalopathy with microhemorrhages
3. Siderosis
4. Lobar hemorrhage
5. Lobar and extraaxial (i.e., subdural and/or subarachnoid) hemorrhage
6. Extravasating lobar and extraaxial hemorrhage
7. Cerebral amyloid inflammatory vasculopathy

Disease mimics of amyloid angiopathy with emphasis on discriminating features (clinical and radiologic).

SUMMARY
This interactive case based review of cerebral amyloid angiopathy provides the participant with an overview of its imaging findings via a case-based format and discusses common mimicking conditions. This review also illustrates atypical imaging features of amyloid angiopathy which may be confused for other disease entities.

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Emergency Department Acute Low Back Pain, Lumbar MRIs, and the â€œRealâ€½? Cauda Equina Syndrome

LL-NRE4634
Matthew R Minor , MD
Paul M Sherman , MD

PURPOSE/AIM
1. To review the pertinent MRI anatomy of the lumbar spine. 2. To provide radiology residents and radiologists a review of the Cauda Equina Syndrome and common lumbar spine emergencies. 3. To review the key points of the ACP Clinical Practice Guidelines for low back pain. 4. To present cases that highlight on-call lumbar spine emergencies.

CONTENT ORGANIZATION
1. MRI anatomy of the lumbar spine
2. Cauda Equina Syndrome
   a. Physical Exam “Red Flags”
   b. Pathogenesis
3. Common Lumbar Spine Emergencies
   a. Epidural Abscess
   b. Discitis/Osteomyelitis
   c. Epidural Hematoma
   d. Septic Facet Joint
   e. Lumbar Spine Trauma
4. Key Points from ACP Clinical Practice Guidelines: Low Back Pain

SUMMARY
Emergency Department visits for acute LBP are extremely common and as MRI availability improves, radiologists will play a vital role in triaging patients. A strong grasp of the key MRI findings associated with lumbar emergencies will be essential in accurately and efficiently assisting our ED colleagues. This exhibit will provide radiology residents and radiologists with key findings, an overview of lumbar spine emergencies, specifically Cauda Equina Syndrome, and the clinical practice guidelines referring providers use to evaluate LBP.

Pediatric Radiology Series: Pediatric Neuroimaging I

Sunday, 10:30 AM - 12:00 PM  •  S100AB

VSPD11 • AMA PRA Category 1 Credit ™:3.75  •  ARRT Category A+ Credit:4
Moderator
Marvin D Nelson , MD
Moderator
Sanjay P Prabhu , MBBS

VSPD11-01 • MR Imaging of the Neonatal Brain
Marvin D Nelson MD (Presenter)

LEARNING OBJECTIVES
1) To review the common adversities and reactions to such in the fetal and neonatal brain. 2) To demonstrate the use of various imaging techniques for assessing acquired fetal and neonatal brain lesions. 3) To highlight the importance of the placenta on normal brain development.

VSPD11-02 • Impaired Preoperative Global and Regional Cerebral Perfusion in Newborns with Complex Congenital Heart Disease
Usa D Nagaraj MD (Presenter) ; Iordanis Evangelou DPhil ; Mary Donofrio ; Gilbert Vezina MD ; Catherine Limperopoulos PhD

PURPOSE
To compare global and regional cerebral perfusion in neonates with congenital heart disease (CHD) versus healthy controls using arterial spin labelling (ASL) MRI.

METHOD AND MATERIALS
ASL is a non-invasive technique for evaluating cerebral perfusion without the use of an exogenous contrast agent. We performed brain MRIs in 73 newborns (30 with complex CHD, 43 controls) prior to open heart surgery on a 3T scanner. 3D FSE Pseudo-continuous ASL sequence was utilized. Post-acquisition image processing was undertaken on a Linux workstation using FSL software. All cases were reviewed by a board certified radiologist (UN) who was blinded to clinical parameters and case/control status. Mean whole brain cerebral blood flow (CBF) was calculated using the scanner software and recorded in mL/100g/min. CBF ASL images were linearly co-registered to the axial T2 images for anatomic delineation and selection of regions of interest to further evaluate regional blood flow using ITK-SNAP software. Areas studied included the frontal white matter, posterior white matter, thalamus and basal ganglia.

RESULTS
Mean gestational age at MRI of the neonates studied was 40.9 weeks. Mean birth weight in reported neonates was 3174 grams. Affected newborns represented a variety of CHD diagnoses including hypoplastic left heart syndrome, tetralogy of Fallot, transposition of the great vessels and ventricular septal defects. Average whole brain CBF in the controls (20.1 +/-4.6 mL/100g/min) was significantly higher than in the newborns with CHD (17.4 +/- 4.1 mL/100g/min, p=0.01). Average regional perfusion in the occipital white matter of the controls (13.9 +/- 5.1 mL/100g/min) was also significantly higher than in the patients with CHD (11.3 +/- 3.8 mL/100g/min, p=0.02). Regional CBF in the frontal white matter, thalamus and basal ganglia did not demonstrate a statistically significant difference between the controls and CHD newborns.

CONCLUSION
...
ASL MRI demonstrates differences in cerebral perfusion between newborns with CHD versus normal healthy controls. Our data suggests that newborns with CHD may have decreased whole brain perfusion and a regional vulnerability in the occipital white matter prior to open heart surgery.

CLINICAL RELEVANCE/APPLICATION
ASL MRI is a promising non-invasive tool for evaluating changes in cerebral perfusion resulting from abnormal hemodynamics in neonates with complex congenital heart disease.

VSPD11-03 • Abnormal Glutamatergic Metabolism during Cooling Correlates with Poor Outcome in Neonates Undergoing Hypothermia Therapy

JESSICA L WISNOWSKI PhD (Presenter); TAI-WEI WU; IDA ASHOORI; MARVIN D NELSON MD; ISTVAN SERI MD, PhD *; ASHOK PANIGRAHY MD; STEFAN BLUMI PhD

PURPOSE
To study glutamatergic metabolism in neonates undergoing hypothermia therapy (HT) for suspected hypoxic-ischemic injury (HII)

METHOD AND MATERIALS

RESULTS
Neonates with poor outcome had lower creatine (? 24%), N-acetyl-aspartate (? 27%) and myo-inositol (? 11%) and higher lactate (Lac; ? 285%) and glutamine (Gln; ? 184%) during HT (see Figure). Glutamate (Glu) concentration during HT did not distinguish outcome groups; however, after HT, Glu was lower in neonates with poor outcome. Finally, as predicted from models, Glu concentration was lower (? 20%) during HT compared to after.

CONCLUSION
HII affects 3-5/1000 neonates and nearly half face death or severe disability despite therapy. Glutamate excitotoxicity in the setting of energy failure is widely hypothesized to be a key mechanism of cell death following HII. We found elevated glutamine in the neonates with poor outcome, and it is possible that this is indicative of excitotoxic injury as well as some ongoing capacity for astrocytes to detoxify excessive glutamate, albeit ultimately at a level insufficient to prevent poor outcome. However, it is important to consider that glutamine is not only synthesized from glutamate in astrocytes, but also that glutamine can be used as an energy metabolite. More research is needed to map the metabolic fate of glutamate and glutamine in neonates with HII.

CLINICAL RELEVANCE/APPLICATION
MR examinations during HT may not only aid clinical management but also the development of adjuvant therapies that aim to alleviate glutamate excitotoxicity.

VSPD11-04 • Longitudinal Changes in Diffusion Properties in White Matter Pathways in Patients with Tuberous Sclerosis Complex

JAE W SONG MD, MS (Presenter); FIONA BAUMER MD; PAUL D MITCHELL MS; RUDOLPH PIENAAR PhD; MUSTAFA SAHIN MD, PhD; ELLEN GRANT MD; EMI TAKAHASHI PhD

PURPOSE
The purpose of this study was to identify predictors of longitudinal changes in diffusion properties of white matter tracts of projection, association and commissural fibers in patients diagnosed with Tuberous Sclerosis Complex.

METHOD AND MATERIALS

RESULTS
Multiple linear regression analyses showed gender to be a significant predictor of mean change in ADC in TSC subjects in the left internal capsule, right and left cingulum, and corpus callosum, adjusting for initial ADC scan measures. Gender was only a significant predictor of mean change in FA in the corpus callosum. Adjusting for initial ADC or FA scan measures, seizure disorder also emerged as a significant predictor of mean change in ADC, but not for mean change in FA, in the left internal capsule. ASD did not emerge as a significant predictor in either the mean change in ADC or FA in the studied white matter tract pathways.

CONCLUSION
Gender and seizure disorder were independent predictors of mean change in ADC or FA in some white matter tract pathways in TSC subjects. Gender was the only significant predictor of mean change in FA in the corpus callosum. Adjusting for initial ADC or FA scan measures, seizure disorder also emerged as a significant predictor of mean change in ADC, but not for mean change in FA, in the left internal capsule. ASD did not emerge as a significant predictor in either the mean change in ADC or FA in the studied white matter tract pathways.

CLINICAL RELEVANCE/APPLICATION
Effects of new therapies for TSC are being evaluated by changes seen on neuroimaging. Thus, understanding how specific patient characteristics differentially affects neuroimaging in TSC is recommended.

VSPD11-05 • Posterior Fossa Morphometry and Volumetric Analysis in Three Different Groups of Pediatric Patients: Congenital Chiari Type 1 Malformation, Posterior Craniosynostosis and Costello Syndrome

ROSALINDA CALANDRELLI; GABRIELLA D’APOLITO MD (Presenter); MARIAVALENTINA TUMINO; LUIGI M PEDONE MD; SIMONA GAUDINO MD; CESARE COLOSIMO MD

PURPOSE
Cerebellar tonsils herniation is caused by heterogeneous group of disorders with different pathogenic origins and it may occur early or late in childhood. In order to better evaluate the mechanism of herniation we performed a morphometric and volumetric analysis of the posterior cranial fossa in three different groups of pediatric patients in which cerebellar tonsil herniation occurs: children with congenital Chiari I malformation, children with posterior craniosynostosis and children with Costello Syndrome.

METHOD AND MATERIALS
Volumes of the posterior cranial fossa (PCFV) and cerebellum (CV) were assessed on axial T2-weighted MR images in 26 children with congenital Chiari I malformation (average 60 ± 24 months), 6 children with Costello Syndrome (average 32 ± 22 months) and 10 children with posterior craniosynostosis (average 12 ± 11 months). The ratio of PCFV and CV was calculated to obtain the proportion of the PCFV occupied by the CV and to reduce the variability among the different groups. Each group was compared with an age matched control group. Volumetric measurements were correlated with diameter of the foramen magnum, tentorial angle, supraocciput and basiociput lengths.

RESULTS
In children with congenital Chiari type I malformation, PCFV/CV ratio, antero-posterior diameter of the foramen magnum, supraocciput and basiociput lengths were found significantly reduced (p < 0.05) in children with Costello Syndrome, PCFV/CV ratio, PCFV, antero-posterior and latero-lateral diameters of the foramen magnum and basiociput length were found significantly reduced, while tentorial angle was found significantly increased (p < 0.05) in children with posterior craniosynostosis, PCFV, CV, latero-lateral diameter of the foramen magnum,
CONCLUSION
Our findings support the theory that reduction of PCFV plays an important role in developing cerebellar tonsillar herniation but other factors like foramen magnum diameters, supraocciput and basiocciput lengths and tentorial angle, contribute to explain the mechanism of cerebellar tonsils herniation.

CLINICAL RELEVANCE/APPLICATION
Morphometry and volumetric analysis of the posterior fossa are helpful to understand cerebellar tonsillar herniation mechanism guiding clinical or surgical approach.

VSPD11-06 • MRI Findings of Hypertrophic Olivary Degeneration after Surgery for Posterior Fossa Tumors in Children

Tommaso Tartaglione MD (Presenter); Annibale Botto; Andrea M Alexandre MD; Giana Izzo MD; Mariacarmela Sciandra MD; Simona Gaudino MD; Cesare Colosimo MD

PURPOSE
Hypertrophic olivary degeneration (HOD) is a possible consequence of injuries along dento-rubo-olivary pathway. The purpose of our study was: 1) To evaluate the incidence of HOD after surgery for posterior fossa pediatric tumors. 2) To show the typical MRI findings of HOD. 3) To analyze time correlation between surgery and MRI evidence of HOD.

METHOD AND MATERIALS
We based our study on a retrospective evaluation of 57 patients surgically treated for posterior fossa tumors in our institution between 2007 and 2012. For each patient Magnetic Resonance (MR) examination was performed before surgery. Every patient underwent clinical and radiological follow-up by serial MR examinations with variable time interval from surgery date (from 1 week to 5 years). All examinations included conventional MRI sequences before and after gadolinium injection and DWI images. For each exam we evaluated: 1) signal intensity of inferior olivary nucleus (ION) 2) dimensions of ION (normal, enlarged, atrophic) 3) signal intensity along the dento-rubo-olivary pathway (red nucleus, dentate nucleus, central tegmental tract, inferior and superior cerebellar peduncles) that could explain HOD. 4) evidence of haemorrhagic lesions. Findings were correlate with time interval between surgery and MR examination

RESULTS
HOD was diagnosed in 18/57 patients (31 %). In all the 18 patients, MRI showed high signal intensity on T2w images in ION and lesions in dentate nuclei (mono- or bilaterally), with subsequent contralateral or bilateral HOD. Enlargement of ION (hypertrophy) was found in only 3/18 cases, with variable time delay from surgery (from 1 to 5 months). In 2 cases of bilateral HOD we observed hyperintensity on T2w images in both superior cerebellar peduncles. DWI and contrast enhanced T1w images did not show alterations of ION.

CONCLUSION
1) Hyperintensity on T2w MRI images in the ION was the most common finding in HOD, and was often associated to lesions in contralateral dentate nucleus. 2) Enlargement of ION was not always present and time interval between surgery and its MRI evidence was variable. 3) The low incidence of ION enlargement could be related to the absence of hemorrhagic lesions in our population

CLINICAL RELEVANCE/APPLICATION
MRI changes in HOD were frequently assessed after posterior fossa surgery for pediatric tumors.

VSPD11-07 • MRI of Pediatric White Matter Disease

Sanjay P Prabhu MBBS (Presenter)

LEARNING OBJECTIVES
1) To become familiar with the spectrum of white matter disease in children including demyelination, dysmyelination and neurometabolic disorders. 2) To provide a step-wise algorithm for approaching imaging studies with white matter abnormality and use a pattern-recognition approach to narrow the differential diagnosis. 3) To illustrate examples of conditions with characteristic imaging findings and elaborate use of advanced imaging techniques in refining the diagnosis.

ABSTRACT

Neuroradiology/Head and Neck (Temporal Bones)

Sunday, 10:45 AM - 12:15 PM • N226

NRA15 • AAMA PRA Category 1 Credit™:1.5 • ARRT Category A+ Credit:1.5

Moderator
Richard H Wiggins , MD

Moderator
Ashley H Aiken , MD *

S2A15-01 • Image Quality and Radiation Dose Assessment in Temporal Bone CT Using an Ultra High Resolution Mode and an Iterative Reconstruction Algorithm Temporal Bone CT: Improved Image Quality and Potential for Decreased Radiation Dose Using an Ultra High Resol

Shuai Leng PhD (Presenter); John I Lane MD; Kelly K Koeller MD; Felix E Diehn MD; Robert J Witte MD; Michael R Brusewitz; Thomas J Vrieze RT; Cynthia H McCollough PhD *

PURPOSE
To assess spatial resolution and image noise for a temporal bone CT imaging method that uses an ultra-high resolution (UHR) scan mode combined with iterative reconstruction (IR), and to compare to a protocol with reduced dose efficiency due to use of z-axis collimation (zUHR).

METHOD AND MATERIALS
Patients with prior temporal bone CT scans acquired using a zUHR protocol who received a follow-up scan using the UHR+IR technique were identified. Left and right side of temporal bone images were reconstructed in axial, coronal and Poschl planes. Spatial resolution was evaluated independently by 3 neuroradiologists with focus on the following structures: round and oval windows, incudomallear joint, incudostapedial joint, spiral lamina in the basal turn, and scutum. The zUHR and UHR+IR images were displayed side by side, with the order randomized and blinded to the readers. The following grading scale was applied to the UHR+IR images (relative to the zUHR images): 1=superior resolution, 2=slightly inferior resolution, not affect visualization, 3=equivalent, 4=slightly superior resolution, not affect visualization, 5=superior resolution, improves visualization. Image noise was measured in regions of interest over the posterior fossa and compared.

RESULTS
8 patients with 16 sets (left and right side) of temporal bones were identified, of which 3 sets were excluded due to surgery between the two exams (13 left). The average scores across readers for spatial resolution on the UHR+IR images compared to zUHR were 3.4, 3.5 and 2.9 in axial, coronal and Poschl planes, respectively, indicating comparable or slightly better spatial resolution using the UHR+IR technique. Wilcoxon signed-rank test showed significant differences (p
CONCLUSION
The UHR+IR scan mode has similar or slightly better resolution relative to the zUHR mode, but significantly lower (32%) image noise. An estimated 50% dose reduction may be achievable using the UHR+IR mode.

CLINICAL RELEVANCE/APPLICATION
Substantial dose reduction can likely be achieved for temporal bone CT imaging using the investigated combined UHR+IR technique.

SSA15-02 • The Dehiscent Bony Wall of Dural Sinus in Patients Presenting with Pulsatile Tinnitus: The Evaluation with CT Angiography and Venography

Pengfei Zhao MD (Presenter) ; Zhenchang Wang MD, PhD ; Junfang Xian MD ; Fei Yan ; Zhaohui Liu MD ; Hong Jiang MD ; Cheng Dong ; Han Lv ; Xiaoyi Han

PURPOSE
To assess the imaging characteristics about dehiscent wall of dura sinus in patients presenting with pulsatile tinnitus (PT) on CT angiography and venography (CTA+V)

METHOD AND MATERIALS
Following approval of the institutional review board, we reviewed all hospitalized patients with PT from 2008 to 2013 who underwent thoracic and abdominal CT angiography. Patients were included if they had pulsatile tinnitus with reported symptoms of at least 3 months duration and met criteria for sigmoid plate dehiscence. The areas of sigmoid plate dehiscence were identified based on the location, extent, and morphology of the bony dehiscence. Patients were excluded if they had a history of head or neck trauma, previous surgery, or any other condition that could affect the dural sinus. The study was approved by the institutional review board.

RESULTS
The dehiscent dural sinus was found in 25 out of the 100 patients (25%). The dehiscence was predominantly located in the transverse and sigmoid sinuses. The dehiscence was confirmed on at least two planes. The dehiscent dural sinus was found to be associated with a central vein and a dominant venous system.

CONCLUSION
The dehiscent dural sinus was found in 25% of the patients with pulsatile tinnitus. The dehiscence was predominantly located in the transverse and sigmoid sinuses. The dehiscence was confirmed on at least two planes. The dehiscent dural sinus was found to be associated with a central vein and a dominant venous system.

CLINICAL RELEVANCE/APPLICATION
The dehiscent dural sinus was found to be associated with a central vein and a dominant venous system. This finding may have implications for the surgical treatment of pulsatile tinnitus.

SSA15-03 • Sigmoid Plate Dehiscence: The Prevalence as an Incidental Finding in Patients without Pulsatile Tinnitus

Christopher Trimble MD, MBA (Presenter) ; David Eisenman MD ; Dheeraj Gandhi MBBS, MD ; Robert E Morales MD

PURPOSE
Dehiscence of the sigmoid plate overlying the sigmoid sinus has been reported as a surgically treatable cause of pulsatile tinnitus. We investigated the incidence of this as an incidental finding in patients without a documented history of pulsatile tinnitus.

METHOD AND MATERIALS
Using a retrospective review, we evaluated thin section (1 mm slice thickness) temporal bone CT scans of 125 consecutive trauma patients (102 male and 23 female, with an average age of 39 years) imaged according to a standard institutional trauma protocol during a 9 month period. Sigmoid plate dehiscence was defined as an imperceptible well defined osseous barrier between the sigmoid sinus and adjacent pneumatized mastoid air cells on at least three consecutive images reconstructed in the axial plane, parallel to the hard palate. This finding was confirmed on a second plane. Patients with temporal bone fractures were excluded.

RESULTS
Twenty-five patients in the series were excluded due to temporal bone fractures. Of the 100 remaining patients, 5 (3 male and 2 female) met criteria for sigmoid plate dehiscence. The areas of sigmoid plate dehiscence exclusively involved the junction of the transverse and sigmoid sinuses on the right side. The average dehiscence diameter was 3.8 mm (range 2.8 mm to 5.0 mm).

CONCLUSION
Though the prevalence of pulsatile tinnitus attributable to sigmoid plate dehiscence has been estimated at 20%, the prevalence of this finding in the asymptomatic population has not been previously reported. Using our diagnostic criteria, surveying 100 trauma patients, we found the prevalence to be 5%. At least one patient in our series demonstrated dehiscence exclusively on the right side and located at the junction of the transverse and sigmoid sinuses.

CLINICAL RELEVANCE/APPLICATION
The prevalence of sigmoid plate dehiscence in the asymptomatic population appears quite low; its CT diagnosis in evaluating pulsatile tinnitus is key because surgical treatment has high success rates.

SSA15-04 • Patterns of Ossification in Patients with Labyrinthitis Ossificans

Karen Buch MD (Presenter) ; Alex Gutierrez ; Akifumi Fujita MD ; Anand Devalia MD ; Osamu Sakai MD, PhD *

PURPOSE
Labyrinthitis ossificans (LO) is a pathologic process involving ossification of the membranous labyrinth leading to hearing loss. Prior studies describe multiple causes of LO including infection, inflammation, trauma, surgery, and hematologic etiologies. However, no prior study describes the pattern of ossification in patients with LO.

METHOD AND MATERIALS
Following IRB approval, temporal bone CT scans of 34 LO patients were identified from scans done between November 2005-January 2012. Membranous labyrinth structures were evaluated for the degree of ossification and were assigned a grading score from 0-4 based on degree of ossification (0: no ossification, 1: 75%). Medical records were reviewed for etiology of LO.

RESULTS
Of the 34 patients with LO: 19 patients had local infection/inflammation or surgery, 6 had history of meningitis, 4 had sickle cell disease, and 5 had other etiologies. Overall, the lateral semicircular canal had the highest degree of ossification and the vestibule had the least. In cases of local infection/inflammation all of the semicircular canals were most severely affected followed by the basal cochlea, middle cochlea, apical cochlea, and lastly, the vestibule. In cases of meningitis, the posterior and superior semicircular canals were most affected followed by the lateral semicircular canal, and lastly, the vestibule. In cases of LO, the lateral semicircular canal was most severely affected, then followed by the other structures in the membranous labyrinth with an equal distribution.

CONCLUSION
LO results in specific patterns of membranous labyrinth involvement. Overall, the lateral semicircular canals were most severely affected and the vestibules were the least affected. Different causes of LO may result in different ossification patterns.

CLINICAL RELEVANCE/APPLICATION
Etiology specific patterns of ossification appear to occur in LO. These findings may identify an underlying cause or predict progression of ossification in patients with labyrinthitis ossificans.

SSA15-05 • MR Imaging of Inner Ear Endo-perilynphatic Spaces at 3 Tesla after Intratympanic Contrast Agent Administration in...
Definite Meniere’s Disease

Marco Colasurdo MD; Simone Salice MD (Presenter); Antonella Centonze; Giampiero Neri; Armando Tartaro MD

PURPOSE
MRI findings in Meniere’s disease are not yet defined. The purpose of this study was to determine the main findings of endo-perilymphatic spaces in patients affected by Definite Meniere’s disease using Magnetic Imaging (MRI) with intratympanic administration of contrast agent.

METHOD AND MATERIALS
Twelve patients with Definite Meniere’s disease underwent 3 Tesla MRI. 3D FLAIR and 3D T2 SE sequences were acquired 24 hours after intratympanic administration of 0.4-0.5 ml of gadobutrol diluted eightfold with saline. Contrast agent was injected through the tympanic membrane with a 25 G needle. Multi Planar Reconstructed (MPR) images were analyzed. According to literature, vestibular endolymphatic hydrops was graded considering the ratio of the area of the endolymphatic space to the vestibular fluid space (sum of the endolymphatic space and perilymphatic space). Patients with no hydrops had a ratio of one third or less, those with mild hydrops had between one-third and a half and those with severe hydrops had a ratio of more than 50%. Cochlear and semicircular canals endolymphatic hydrops was defined as positive when a MRI signal void was detected.

RESULTS
No adverse events due to contrast agent administration were observed. Three patients did not show perilymphatic enhancement thereby they were not considered for data analysis. Vestibular endolymphatic hydrops was observed in 100% of patients and it was severe in 7 out of 9 patients and mild in 2 out of 9. Whereas posterior semicircular canal endolymphatic hydrops was observed only in 5 out of 9 patients; lateral and superior semicircular canals endolymphatic hydrops was observed only in 4 out of 9 patients; cochlear endolymphatic hydrops was observed only in 5 out of 9 patients.

CONCLUSION
Our study confirms that endolymphatic hydrops can be detected at 3T MR images after intratympanic contrast agent administration and is the main finding in patients with Definite Meniere’s disease. Moreover, our preliminary results seem to suggest that endolymphatic hydrops may affect more often the vestibule than cochlea or semicircular canals.

CLINICAL RELEVANCE/APPLICATION
3T MRI with intratympanic administration of contrast agent might open the door to objective evaluation of endolymphatic space and reveal Meniere’s disease pathophysiology improving diagnostic efficacy.

SSA15-06 • Correlation of Ear Symptoms with Increased Cochlear Fluid-attenuated Inversion Recovery Signal in Patients with Acoustic Neuroma

Dae Yoon Kim (Presenter); Jeong Hyun Lee MD, PhD; Won-Jung Chung; Young Jun Choi MD; Sohyun Jo; Jung Hwan Baek; Ka-Gyoung Yoon MD

PURPOSE
It is well-known that cochlear fluid-attenuated inversion recovery (FLAIR) signal is increased in patients with acoustic neuroma (AN). The purpose of this study was to investigate if cochlear FLAIR signal in patients with AN correlates with ear symptoms or audiometric findings, and if there is any difference in the cochlear signal according to the extent of AN in a large series.

METHOD AND MATERIALS
This retrospective study enrolled 102 patients with surgically confirmed or radiologically diagnosed AN from 2008 to 2012. There were 22 patients (M:F = 10:12; mean age: 50 ± 13.2 years) with AN confined to the internal auditory canal (AN IAC) and 80 (M:F = 48:32; mean age: 49.9 ± 13.3 years) with AN located in the cerebellopontine angle cistern as well as in the IAC (AN CPA). We quantitatively measured the signal intensity (SI) of the entire volume of the cochlea on the affected side by placing ROIs semi-automatically drawn on 3D T2-VISTA images of the same slices. We compared the SI ratios (rSI) of the cochlea to the brainstem with ear symptoms including tinnitus, hearing disturbance or vertigo and with the audiometric findings in AN IAC and AN CPA patients, respectively.

RESULTS
The rSI of the cochlea was positively correlated with the audiometric findings in AN IAC (r = 0.471; p=0.027), but showed no correlation in AN CPA (r = 0.427). The rSI of the cochlea was significantly higher with the presence of hearing disturbance or tinnitus only in patients with AN IAC (p = 0.001 and p = 0.004, respectively). There was no correlation between the rSI of the cochlea and the presence of hearing disturbance or tinnitus in patients with AN CPA (p = 0.600 and p = 0.506, respectively). Both AN IAC and AN CPA did not show any difference of the rSI of the cochlea whether they had vertigo or not (p = 0.082, p = 0.782, respectively).

CONCLUSION
Cochlear FLAIR signal is significantly higher with the presence of hearing disturbance or tinnitus and shows positive correlation with the audiometric findings only in patients with AN limited to the IAC.

CLINICAL RELEVANCE/APPLICATION
The results of this study suggest that functional evaluation of the cochlea could be possible with FLAIR images in patients with acoustic neuroma limited to the IAC.

SSA15-07 • Imaging of the Inner Ear in Meniere’s Disease: Round and Oval Window Pathology as Possible Influential Factors for Restricted Contrast Medium Permeability

Wilhelm H Flatz MD (Presenter); Robert Guerkov; Maximilian F Reiser MD; Birgit B Ertl-Wagner MD *

PURPOSE
To prospectively evaluate MRI- and CT-findings of the temporal bone, including the middle and inner ear as well as adjacent soft tissue, as potential causes for restricted diffusion of Gd-DTPA into the inner ear.

METHOD AND MATERIALS
We retrospectively evaluated 32 patients with suspected Meniere’s disease who underwent both multislice-CT- and locally enhanced MR imaging of the temporal bone. 24 hours prior to the MRI scan intratympanic Gd-DTPA was administrated. In addition to structural MR-imaging of the brain, CISS-, FLAIR- and IR-sequences of the temporal bone were acquired on a 3 T MR scanner using a 32 channel head coil. Slice thickness of FLAIR- and IR-images was 0.5 mm and 0.6 mm respectively. Signal intensities of the endolymphatic spaces of the basal turn of the cochlea were evaluated using ROI-based analysis. CT images were reviewed by two blinded radiologists with regard to temporal bone pathology including sclerosis of the round and oval window membrane, middle ear findings and soft tissue assessment. Thickening/sclerosis of the round and oval windows membrane were evaluated using a 6-point scale with 1 being no sclerosis and 6 high grade sclerosis.

RESULTS
In 9 respectively 13 patients CT-analysis of the round window respectively oval window was not possible due to acquired slice thickness. 11 of 19 patients demonstrated sclerotic changes of the round window (grades 2 to 6). 8 of 23 patients showed sclerotic changes of the round window (grade 2 to 6). Significant differences were observed between measured signal intensities of perilymphatic spaces of the basal turn of the cochlea and degree of oval window sclerosis (P=0.0143), but not between sclerotic changes of the round window and signal intensities of the endolymphatic spaces of the basal turn of the cochlea.

CONCLUSION
Sclerotic changes of the oval window may be responsible for a restricted diffusion of contrast medium from the middle ear into the inner ear.
SSA15-08 • Volumetric Assessment of the Membranous Vestibular System in Patients Presenting with Vertigo

Nagy N Naguib MSc (Presenter); Ahmed F Emam MBCh; Nour-Eldin A Nour-Eldin MD, MSc; Tatjana Gruber-Rohu; Boris Bodelle MD; Thomas Lehner MD; Renate M Hammersting MD; Stefan Zangos MD; Katrin Eichler MD; Thomas J Vogl MD, PhD

PURPOSE
To assess the volume of membranous vestibular system in patients presenting with vertigo and to compare the volume with the vestibular system volume in patients with normal vestibular function using three dimensional (3D) reconstruction of the high resolution MR Imaging sequences.

METHOD AND MATERIALS
The study was retrospectively performed on 153 patients (74 females and 79 males) with a mean age of 48.9 year (standard deviation: 25.4, range: 5 month - 88 year). Of the 153 patients 61 patients presented with vertigo and 92 patients presented with other diseases of the ear and normal vestibular function. High resolution MR Imaging was performed using a T2-weighted SPACE sequence with 0.6 mm slice thickness. 3D reconstructions were performed using Advantage Workstation for diagnostic imaging. Assessed were the volumes of the semicircular canals and the volume of vestibule. The difference between the volumes in patients with and without vertigo (normal vestibular function) was tested using the Two-Sample t-Test.

RESULTS
Three dimensional reconstructions were successfully performed in all patients. In patients with vertigo the mean volume of the semicircular canals was 0.258 mm³ (SD: 0.061, Range: 0.130 ± 0.430 mm³) and the mean volume of the vestibule was 0.069 mm³ (SD: 0.013, Range: 0.040 ± 0.110 mm³). In patients with no vertigo (normal vestibular function) the mean volume of the semicircular canals was 0.306 mm³ (SD: 0.074, Range: 0.180 ± 0.550 mm³) and the mean volume of the vestibule was 0.075 mm³ (SD: 0.016, Range: 0.040 ± 0.13 mm³). There was a statistically significant difference between the semicircular canal volume and the vestibular volume in patients with and without vertigo (normal vestibular function) (p < 0.0001 and p = 0.0019 respectively).

CONCLUSION
Patients presenting with vertigo show a statistically significant smaller volume of the semicircular canals and vestibule compared to patients not presenting with vestibular dysfunction or vertigo.

SSA15-09 • New Grading System for Patients with Congenital Aural Atresia Scheduled for Active Middle Ear Implants

Henning Frenzel MD, PhD (Presenter); Gerlig Widmann; Dirk Petersen MD; Barbara Wollenberg; Christian Mohr MD

PURPOSE
Active middle ear implants (aMEI) are being increasingly used for hearing restoration in congenital aural atresia. The existing gradings used for CT findings do not meet the requirements for these implants. Some items are expendable, whereas other important imaging factors are missing. We aimed to create a new grading system that could describe the extent of the malformation and predict the viability and challenges of implanting an aMEI as well as the hearing outcome.

METHOD AND MATERIALS
103 malformed ears were evaluated using HRCT of the temporal bone. The qualitative items middle ear and mastoid pneumatization, oval window, stapes, round window, tegmen mastoideum displacement and facial nerve displacement were included. An anterior- and posterior round window corridor, oval window and stapes corridor were quantified and novelly included. They describe the size of the surgical field and the sight towards the windows. 35 ears were implanted and evaluated for hearing outcome.

RESULTS
The ears were graded on a 16-point scale (16-13 easy, 12-9 moderate, 8-5 difficult, 4-0 high risk). The strength of agreement between the calculated score and the performed implantations with regard to the level of difficulty of the implantation was good. The comparison of the new 16-point scale with the Jahrsdoerfer score showed that both were able to conclusively detect the high-risk group; however the new 16-point scale was able to further determine which malformed ears were favorable for aMEI, which the Jahrsdoerfer score could not do. There was no correlation between the new 16-point scale and the hearing outcome using stapes attachment. The round window attachment in difficult cases may lead to inferior results.

CONCLUSION
The Active Middle Ear Implant Score for Aural Atresia (aMEI-score) allows more precise risk stratification and decision making regarding the implantation. The use of operative corridors seems to have significantly better prognostic accuracy than the Jahrsdoerfer score. The hearing outcome does not rely on the severity of deformation, once a successful coupling of the implant is achieved. The aMEI-score represents the likelihood of achieving a successful implantation.

CLINICAL RELEVANCE/APPLICATION
The Active Middle Ear Implant Score for Aural Atresia (aMEI-score) satisfies the new requirements for diagnostic imaging of congenital aural atresia with regard to active middle ear implants.

Neuroradiology/Head and Neck (Vascular Disease of the Head and Neck)

SSA16 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

Moderator
Majda M Thurnher, MD

SSA16-01 • Dose Savings and Image Quality in CT of the Neck Using Automated Selection of Tube Potential

Boris Bodelle MD (Presenter); Martin Beeres MD; Sebastian Scheithauer; Claudia Frellesen; Boris Schulz MD; Firas Al-Butmeh; Nagy N Naguib MSc; Ralf W Bauer MD *; Thomas Lehner MD; Thomas J Vogl MD, PhD

PURPOSE
To investigate the impact of automated attenuation-based tube potential selection on image quality and radiation dose in patients undergoing CT of the neck.

METHOD AND MATERIALS
360 patients [median age 52 years (range 4 ± 89)] underwent 128-slice CT of the neck. First group (n=40) was examined with fixed 120 kV with 180 ref.mAs and automated exposure control (AEC) modulating only mA output. The second group (n=320) underwent CT with...
Atherosclerotic Plaque in the Left Carotid Artery Is More Vulnerable than at the Contralateral Side

Christopher Maroules MD (Presenter) ; Kevin S King MD ; Colby Ayers MS ; Ronald M Peshock MD ; Jarett Berry MD

PURPOSE
To investigate the relationship between objective measures of carotid bifurcation geometry and carotid atherosclerosis within asymptomatic individuals using MRI.

METHODOLOGY AND MATERIALS
We included 80 participants from the Dallas Heart Study (mean age 53 ± 9 years, 46% females) free of cardiovascular disease who underwent multi-sequence MRI of the distal common carotid artery (CCA), carotid bulb, and proximal internal and external carotid arteries (ICA and ECA, respectively) at 3 Tesla. Semiautomated techniques were used to define vessel wall contours, lipid-rich necrotic core (LRNC) volume, and the 3D geometry of the carotid bifurcation. We examined associations between carotid artery geometric parameters and both wall thickness and the presence of LRNC using Spearman correlation and multivariable logistic regression.

RESULTS
LRNC was identified in 11 participants (13.8%). After controlling for age, sex, hypertension, diabetes, and body mass index, LRNC was associated with a lower ICA planarity [OR 95% CI: 13.3 (1.8-100.0) per SD, p < 0.01] and a lower ICA/CCA ratio [6.7 (1.1-33.3) per SD, p = 0.03]. LRNC was not associated with a lower bifurcation angle after multivariable adjustment [OR 95% CI: 2.2 (0.5-9.1) per SD, p = 0.3]. Total LRNC volume within the carotid artery correlated with ICA/CCA diameter ratio (r= -0.32, p = 0.03). Carotid bulb wall thickness correlated with ECA/CCA diameter ratio (r= -0.49, p < 0.05).

CONCLUSION
Objective geometric measures of the carotid bifurcation by MRI are associated with carotid atherosclerosis and the presence of lipid rich necrotic core within carotid plaque. These findings support a geometric risk for carotid atherosclerosis.

CLINICAL RELEVANCE/APPLICATION
Variations in carotid bifurcation geometry by MRI are independently associated with carotid atherosclerosis, supporting a ‘geometric risk’ for atherosclerosis.

Atherosclerotic Plaque in the Left Carotid Artery Is More Vulnerable than at the Contralateral Side

Mariana Selwaness MD (Presenter) ; Quirijn v Bouwhuijsen ; Albert Hofman MD, PhD ; Oscar H Franco ; Jolanda J Wentzel PhD ; Aad Van Der Lugt MD, PhD

PURPOSE
Ischemic cerebrovascular events are most frequently reported in the left hemisphere compared to the right side. Whether this is related to an asymmetry in atherosclerotic plaque frequency and morphology in the carotid arteries is unknown. We investigated plaque distribution and composition in the left and right carotid artery in healthy individuals.

METHODOLOGY AND MATERIALS
1501 participants (≥45 years) from The Rotterdam Study, a population-based cohort, with atherosclerotic plaque present on carotid ultrasound were selected. We used 1.5T Magnetic Resonance Imaging (MRI) with standard multisequence scanning protocol to assess plaque prevalence, thickness and predominant component: lipid core, intraplaque haemorrhage (IPH), calcification or fibrous tissue. Differences between left and right side were tested using Pearson chi-square test and Generalized Estimating Equations analyses adjusted for age, gender and carotid wall thickness.

RESULTS
Carotid MRI revealed 2775 atherosclerotic plaques, (bilateral 1274; right 76; left 151) corresponding with 5% higher prevalence of unilateral plaques left than right (P<0.05). Total LRNC volume within the carotid artery correlated with ICA/CCA ratio [6.7 (1.1-33.3) per SD, p = 0.03]. LRNC was not associated with a lower bifurcation angle after multivariable adjustment [OR 95% CI: 2.2 (0.5-9.1) per SD, p = 0.3]. Total LRNC volume within the carotid artery correlated with ICA/CCA diameter ratio (r= -0.32, p = 0.03). Carotid bulb wall thickness correlated with ECA/CCA diameter ratio (r= -0.49, p < 0.05).

CONCLUSION
Objective geometric measures of the carotid bifurcation by MRI are associated with carotid atherosclerosis and the presence of lipid rich necrotic core within carotid plaque. These findings support a geometric risk for carotid atherosclerosis.
We found an unequal distribution of atherosclerotic plaque size and composition in the carotid arteries.IPH and fibrous tissue were more frequently observed in the left carotid artery, whereas calcification was more often present in the right. Our findings suggest that the predilection of cerebrovascular disease to the left side may be explained by the vulnerable phenotype of plaques in the left carotid artery.

CLINICAL RELEVANCE/APPLICATION
We show for the first time that left and right plaque composition differ in carotid arteries. Understanding distribution patterns of atherosclerosis is important for stroke recognition and management.

SSA16-05 • Automated Interpretation of Carotid Plaque Composition Identifies High-risk Lesions: A Prospective MRI Study

Daniel S Hippe MS (Presenter) *; Xin Pu; Hunter R Underhill MD, PhD; Jie Sun; William S Kerwin PhD *; Wei Yu MD; Yan Song MD, PhD; Jianming Cai MD; Xihaizhao; J. Kevin Demarco MD *; Chun Yuan PhD *; Thomas S Hatsuacki MD *

PURPOSE
Carotid MRI is an effective modality for quantifying atherosclerotic plaque composition and identifying lesions associated with stroke/TIA. However, complexity of manual image interpretation and limited prospective data has hindered translation of carotid MRI into clinical practice. In this study we developed an automated technique for stratifying lesion severity and subsequently conducted a prospective study to determine if the algorithm predicts lesion growth or development of vulnerable features.

METHOD AND MATERIALS
Participants (N=536) from 17 institutions and centers in the US and China were imaged with an established multi-contrast carotid MRI protocol. A histologically-validated segmentation algorithm was applied to the MR images to automatically measure lipid-rich necrotic core (LRNC) and calcification (CA). Associations between manually identified high-risk features (i.e. intraplaque hemorrhage, IPH; and fibrous cap rupture, FCR) and clinical risk factors, plaque morphology, and composition were investigated to develop an optimized, automated carotid atherosclerosis score (ACAS) for stratifying lesion severity. Subsequently, ACAS was evaluated prospectively using an independent cohort of 73 asymptomatic subjects that underwent serial carotid MRI over a 3 year period.

RESULTS
During systematic analysis of potential risk factors, the most effective metric to detect lesions with IPH or FCR was percent size of LRNC (AUC=0.89). This metric was used to define ACAS from low to high risk: 1) LRNC absent; 2) LRNC < 30%; 3) LRNC 30-50%; and 4) LRNC > 50%. Applied prospectively, ACAS was associated with new FCR (AUC=0.84, p<0.1).

CONCLUSION
Automated plaque interpretation is an effective strategy for stratifying lesion severity that predicts lesion growth and development of FCR & a key risk factor associated with stroke/TIA. Automated plaque analysis is expected to simplify carotid MRI interpretation, enabling the translation to clinical practice for improved management of patients with carotid atherosclerotic disease regardless of stenotic severity.

CLINICAL RELEVANCE/APPLICATION
The automated plaque interpretation technique developed is predictive of carotid plaque growth and fibrous cap rupture so utilization may improve management of patients over carotid stenosis alone.

SSA16-06 • Analysis of Association between Carotid Artery Plaque Volume and Cerebral Microbleeds

Luca Saba MD (Presenter); Michele Anzidei MD; Lorenzo Mannelli MD, PhD; Jasjit S Suri; Michele Di Martino; Mario Piga

PURPOSE
Cerebral microbleeds (CMBs), have become increasingly recognised with the widespread use of MRI techniques that are sensitive to iron deposits. The purpose of this work was to explore the association between carotid plaque volume (total and the sub-components) and CMBs.

METHOD AND MATERIALS
72 consecutive (males 53; median age 64) patients were prospectively analyzed. Carotid arteries were studied by using a 16-detector row CT scanner whereas brain was explored with a 1.5 Tesla system. CMBs were studied using a T2*-weighted gradient-recalled echo (GRE) sequence. Microbleeds were classified as absent (grade 1), mild (grade 2; total number of microbleeds, 1-2), moderate (grade 3; total number of microbleeds, >10), and severe (grade 4; total number of microbleeds, >10). Component types of the carotid plaque were defined according the following HU ranges: lipid < 60 HU; fibrous tissue from 60-130 HU; calcification > 130 HU and plaque volumes of each component was calculated. Each carotid artery was analyzed by 2 observers. Chi square, multiple logistic regression analysis as well as ROC was calculated.

RESULTS
The prevalence of CMBs was 35.3%. A statistically significant difference was observed between symptomatic (40%) and asymptomatic (11%) patients (p value = 0.001; OR = 6.07). Linear regression analysis demonstrated an association between the number of CMB and the symptoms (p = 0.0018). A statistically significant correlation was observed between the increase of the volume of the fatty component and CMBs (rho = 0.89; p = 0.001).

CONCLUSION
Results of this study confirm the association between CMBs and symptoms and that there is an increased number of CMBs in symptomatic patients. Moreover we found that an increased volume of the fatty component is associated the presence and number of CMB.

CLINICAL RELEVANCE/APPLICATION
The presence of fatty components in the carotid artery plaque are associated with an increased prevalence of cerebral microbleeds.

SSA16-07 • Dual Energy Computed Tomography Quantification of Carotid Plaque Calcification: Comparison between Monochromatic and Polychromatic Energies with Pathology Correlation

Lorenzo Mannelli MD, PhD (Presenter); Lawrence MacDonald PhD; Marina Ferguson MS; Dongxiang Xu PhD; William P Shuman MD *; Chun Yuan PhD *; Lee M Mitsumori MD, MS *

PURPOSE
To compare the size and number of carotid plaque calcifications identified on monochromatic spectral CT and polychromatic CT images with a pathological reference standard.

METHOD AND MATERIALS
Ex vivo carotid endarterectomy specimens were imaged with spectral and conventional CT. Monochromatic CT images were reconstructed at 40, 60, 80, 100, 120, and 140 kVp. Conventional polychromatic images were acquired using 80, 100, 120, and 140 kVp. Cross-sectional area of the plaque calcifications was measured. The histological calcium areas were measured on digitized images of Toluidine Blue/Basic-Fuchsin stained plastic sections. The CT images and corresponding histology sections were matched. Pearson’s correlation coefficient for a linear relationship was calculated between the results from pathology and CT, and between different CT techniques. We also calculated the mean percent error (bias) and root-mean-square error (RMSE) in CT calcification size, taking pathology measurements as the gold standard. The mean percent error was calculated as △CTsize PathologyYsize)/(PathologyYsize) averaged over the calcifications found by the CT technique of interest.

RESULTS
116 pathologic sections were evaluated, the calcification area per section ranged between 0.20 mm² and 26.4 mm². Fig. 1 is a scatter plot of calcification sizes measured by pathology and CT for three CT image types (40 keV, 140 keV, and 120 kVp). Fig. 2 shows that when compared to pathology, the amount of plaque calcifications identified with spectral CT decreased with higher reconstructed energy.
level: at 80 keV 90% were found, at 100 keV only 77%; on polychromatic 120 kVp CT images 95% of the calcifications were found. Fig. 2 also shows the Pearson correlation coefficient. The RMSE and average percent error are shown in figure 3; there is an overestimation in calcification size by CT for lower monochromatic CT images, decreasing to an underestimation for higher keV monochromatic CT images and polychromatic CT images. Monochromatic 80 keV and 100 keV images show the lowest RMSE and %error.

CONCLUSION
The size and number of plaque calcifications detected by CT depends upon the energy level used for the image acquisition and reconstruction. Monochromatic 80 keV images were the most comparable to histology.

CLINICAL RELEVANCE/APPLICATION
80 keV monochromatic images allow for a better evaluation of atherosclerotic calcifications; this may help characterizing the whole atherosclerotic plaque.

SSA16-08 • Radiological Assessment of Thoracic Outlet Syndrome: Four Years of Institutional Experience
Dean Donahue; Omid Khalilzadeh MD, MPH; Julien Dinkel MD; Gaetano T Pastena MD; Martin Torriani MD; Rajiv Gupta PhD, MD (Presenter)

PURPOSE
Imaging studies play a significant role in assessment of thoracic outlet syndrome (TOS). In this study, we reviewed the spectrum of CT and MR imaging findings in patients with TOS in our institution, over a period of four years.

METHOD AND MATERIALS
Our study included a total of 349 consecutive TOS patients, referred to our hospital between December 2008 and December 2012. Patients with non-specific symptoms were excluded. All patients underwent a biphasic contrast-enhanced CT angiography of the thoracic outlet using a TOS-optimized protocol and an MR scan with a postural maneuver. A single radiologist (RG) assessed all the scans. The findings associated with TOS were classified under the categories of vascular (venous or arterial), neurologic (due to soft tissue, bone or anatomical space abnormalities causing mass effect on the brachial plexus) and a combination of the two, i.e., neurovascular (typically secondary to post-operative or traumatic insult).

RESULTS
Positive CT or MR findings were seen in 78.5% of patients. Overall, 6% of patients had vascular TOS (2% venous and 4% arterial), 7.4% had neurovascular, and 86% had neurogenic TOS. Bone abnormalities were the most common cause of neurogenic TOS. Narrowing of anatomic compartments (inter-scalene triangle and costoclavicular space) was seen in 43.7% of patients with neural TOS. C7 transverse process variations were the most common bone abnormality (67.9%). Fibrous bands were the most common soft tissue abnormalities associated with neurogenic TOS.

CONCLUSION
This study describes the range of CT and MR findings associated with TOS. Based on our experience, a combination of CT angiography and MR imaging (with a postural maneuver) effectively demonstrate TOS abnormalities.

CLINICAL RELEVANCE/APPLICATION
A combination of biphasic contrast-enhanced CT angiography and MR imaging (with a postural maneuver) effectively demonstrate TOS abnormalities.

SSA16-09 • Bilateral Inferior Petrosal Sinus Sampling Using Desmopressin: A Single Center Experience
Amy R Deipolyi MD, PhD (Presenter); Bailin Alexander BA; Junsung Rho BSc; Zubin Irani MD; Stephan Wicky MD; Rahmi Oklu MD, PhD

PURPOSE
Bilateral inferior petrosal sinus sampling (BIPSS) following corticotropin-releasing hormone (CRH) stimulation is the current gold standard technique in the diagnosis of Cushing disease. However, as a result of CRH shortage, desmopressin (DDAVP) has become the replacement of choice for BIPSS. We present a single tertiary care center experience using the DDAVP protocol.

METHOD AND MATERIALS
This IRB approved, HIPAA compliant study involved using the radiology department's electronic database to identify BIPSS procedures performed at our institution using DDAVP. Electronic medical records and imaging studies were reviewed. Clinical history, demographics, endocrine test results, complications of BIPSS and patient outcome was recorded. BIPSS data was analyzed for centralization (3:1, central to peripheral ACTH gradient) and lateralization (1.4:1 ACTH gradient).

RESULTS
We identified 17 BIPSS cases (14 female, mean age 37.9 years (range 13-64)) performed using DDAVP between 2012 and 2013. The 17 cases demonstrated conventional, bilateral IPS anatomy and were successfully cannulated bilaterally. 16 patients met the criteria for both centralization and lateralization. 14 of the 17 patients had undergone a transphenoidal tumor resection, 1 patient was lost to follow up and 2 had not yet been surgically treated. All 14 patients demonstrated ACTH secreting adenoma on pathology review and all 14 were concordant with lateralization predicted by BIPSS. There were no complications resulting from the use of DDAVP, specifically thromboembolic events.

CONCLUSION
DDAVP is a safe alternative to CRH producing satisfactory diagnostic results.

CLINICAL RELEVANCE/APPLICATION
BIPSS is the current gold standard technique in the diagnosis of Cushing disease. Given the shortage of CRH, desmopressin has been safe and demonstrates similar diagnostic results.

Neuroradiology (Parkinson’s Disease)

Sunday, 10:45 AM - 12:15 PM • N229

SSA17 • AMA PRA Category 1 Credit ™•1.5 • ARRT Category A+ Credit:1.5
Moderator
Christopher P Hess , MD, PhD *

SSA17-01 • Dopaminergic Neurodegeneration in Nigrostriatal System of the MPTP-treated Parkinsonian Marmoset Monkey Detected by Voxel-based Analysis of Longitudinal MRI
Keigo Hikishima PhD, MS (Presenter); Kiyoshi Ando; Yuji Komaki; Kenji Kawai; Takashi Inoue; Masayuki Yamada; Toshio Itoh; Suketaka Momoshima MD; Hirotaka I Okano; Hideyuki Okano MD, PhD

PURPOSE
The evaluation of substantia nigra (SN) and nigrostriatal fiber is essential to assess the severity of degeneration and efficacy of treatment protocols in Parkinson's disease (PD). The purpose of the present preclinical study was to investigate dopaminergic neurodegeneration by
METHOD AND MATERIALS
The common marmosets (n=6) received 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) at the daily dose of 2, 2 and 1 mg/kg, s.c., respectively, for 3 consecutive days were used for the present imaging study. These marmosets showed long lasting and stable Parkinsonism such as moving tremor, immobility measured objectively as decreased locomotion counts, etc. Before and after several weeks after the MPTP administration, 3D T1WI (isotropic resolution of 200µm) and 2D DTI (in-plane resolution of 200µm and slice thickness of 1mm) were performed. After the acquisitions of longitudinal MRI, ex vivo microscopic DTI (isotropic resolution of 60µm) and histological examination with Kluver-Barrera and tyrosine hydroxylase (TH) staining were also performed to the fixed brains (n=4). VBM and diffusion tensor tractography (DTT) were obtained with SPM8 and TrackVis software, respectively.

RESULTS
Volume decreases in SN were observed by longitudinal VBM with positive correlation with decreased locomotion counts, a central PD sign (P<0.05).

CONCLUSION
The present longitudinal MRI neuroimaging using DTI and VBM on the nigrostriatal system has an invaluable ability in the preclinical studies for developing new treatments and understanding the mechanism of PD, and possibly in the clinical evaluation of PD patients.

CLINICAL RELEVANCE/APPLICATION
By using voxel-based analysis of longitudinal MRI at 7T, we may have a new noninvasive tool to diagnose the nigrostriatal system for Parkinson’s disease.

SSA17-02 • Longitudinal Monitoring of Intrastriatal Transplanted Retinal Pigment Epithelial Cells Survival In Vivo by 18F-P3BZA PET/CT
Lihong Bu MD, PhD (Presenter) ; Renfei Li MD, PhD ; Hongguang Liu PhD ; Bao-Zhong Shen ; Zhen Cheng PhD

PURPOSE
To understand the anti-Parkinson disease (PD) efficacy of human retinal pigment epithelial (hRPE) cells implantation, we hypothesized that the melanin targeted probe, N-(2-(diethylamino)ethyl)-18F-5-fluoropicolinamide (18F-P3BZA), could be used for monitoring and trafficking the implanted cells because of its high melanin contents.

METHOD AND MATERIALS
18F-P3BZA was prepared by direct radiofluorination of the bromopicolinamide precursor using no-carrier-added 18F-fluoride. In vitro cell uptake assay were performed by incubation 18F-P3BZA with melanotic porcine RPE (pRPE) cells or control ARPE-19 cells for different incubation time. To assess the in vivo brain uptake and clearance of 18F-P3BZA in normal rat, dynamic small animal PET/CT scans were initiated immediately after administration of the probe and terminated 60 min later. To validate the capability of 18F-P3BZA for monitoring the long-term survival of implanted RPE cells in vivo, normal rats were intrastratally injected with pRPE-GM, control ARPE-19-GM or GM, and longitudinal 10 min-static PET/CT scans were acquired at day 2, 7 and 14 days after implantation. Postmortem analysis was performed subsequently.

RESULTS
Cell uptake studies demonstrated that 18F-P3BZA accumulated effectively in pRPE cells, but not in control ARPE-19 cells. Further melanin assay confirmed that the amount of melanin in pRPE was 6-folder higher than that in ARPE-19 cells. Time-brain activity curve from dynamic PET/CT demonstrated that 18F-P3BZA could pass through blood brain barrier and accumulated in the brain rapidly, and then gradually decreased to background level 17 min post injection. 18F-P3BZA-PET could clearly visualize the implanted pRPE cells, and the accumulation of the probe in the pRPE-GM was much higher than that of ARPE-19-GM or GM. Furthermore, longitudinal PET/CT scans revealed that little pRPE-GM cells survived long-term after transplantation, as evident by the significant reduced uptake of 18F-P3BZA in the pRPE-GM transplantation sites. Lastly, autoradiography, HandE and Fontana-Masson staining further confirmed the in vivo imaging results.

CONCLUSION
18F-P3BZA-PET/CT could visualize, characterize and detect the long-term survival of implanted RPE cells via melanin targeting mechanism.

CLINICAL RELEVANCE/APPLICATION
This study provides neurologists with high sensitive, high signal to background ratio probe targeting to melanin for tracking the implanted RPE cells.

SSA17-03 • A Preliminary Study of Global Resting-state Activations in PD Patients from Postural Instability and Gait Difficulty Group
Quanquan Gu MD, PhD (Presenter) ; Peiyu Huang ; Min Xuan ; Xiaojun Xu ; Wei Luo ; Minming Zhang MD, PhD

PURPOSE
In Parkinson disease (PD), postural instability and gait difficulty (PIGD) is regarded as a refractory issue because of its bad prognosis. According to these motor signs, PD patients are grouped into PIGD-group and non-PIGD-group. In our study, we used the resting-state fMRI to explore different brain activation patterns of PIGD-group as distinctive to non-PIGD-group patients.

METHOD AND MATERIALS
24 PD patients and 22 healthy controls (HC) were recruited in this study. All the patients were drug-naïve or off medications for 12 hours, divided into PIGD group (12 patients, F/M=4/8) and non-PIGD group (12 patients, F/M=5/7). Resting-state fMRI imaging and T1-weighted data were performed using a 3T MRI scanner (GE Signa EXCITE HD). All data was processed with SPM8, spatially normalized into the MNI template. Significant signal changes were considered for P<0.05.

RESULTS
As compared to HC, patients from both PD subgroups had a wide-spread increase of activations in bilateral superior frontal and middle gyrus, parietal gyrus and mid-cingulate cortex, specially dominant in PIGD group (Fig.1A, 1B). Compared to non-PIGD group, PIGD group showed a remarkable activation medial to the left superior frontal gyrus (SFG) (Fig.1C).

CONCLUSION
PIGD-group showed greater activation than non-PIGD group as referred to HC, mainly covering areas participating in premotor planning, vestibular, attention for action and regulations for skeleton motor. As to intrasubgroup comparison, left SFG has been found associate to visual hallucination, imaginary motor, self-awareness and sensory organization. Thus, our study indicated that although PIGD-group patients behave abnormal posture and gait, the non-motor mental functions rather than motor functions should be responsible for those clinical performance.

CLINICAL RELEVANCE/APPLICATION
It is indicated that although PIGD-group patients behave abnormal posture and gait, the non-motor mental functions (i.e., vision, cognition, sensory, etc.) rather than motor functions should be noted.

SSA17-04 • Resting-state Causal Connectivity in Parkinson’s Disease with Depression: Aberrant within-network and between-network Pathways
Peipeng Liang (Presenter) ; Kuncheng Li MD

PURPOSE
Depression is a common problem in patients with Parkinson’s disease, but its neural mechanism is poorly understood. The goal of this study was to examine the neural network of PD patients with and without depression using fMRI.
METHOD AND MATERIALS
Sixteen patients with DPD, twenty patients of PD with no depression (NDPD), twenty-two patients with major depression (MD), and twenty-one healthy controls underwent 8-min fMRI scans while resting quietly. Correlation-purged Granger causality analysis was performed, based on four basic functional networks: default mode network (DMN), dorsal attention network (DAN), motor network (MN), and emotion network (EN), to compare the group differences.

RESULTS
It was found that the causal connectivity in patients with DPD are significantly altered, as compared to NDPD, MD and healthy controls, with some causal pathways decreased (e.g., Hy70FC/vACC) and some others increased (e.g., R DLPFC>R ITc). Some alterations are significantly correlated with neuropsychological measures.

CONCLUSION
The present study demonstrates the coexistence of causal disconnection and compensation in PD patients, and suggest that PD has different neural substrates from NDPD, MD and HC.

CLINICAL RELEVANCE/APPLICATION
These findings might provide insights into biological mechanism of the disease.

SSA17-05 • Fractional Amplitude of Low-frequency Fluctuation Study of Resting-state fMRI in Parkinson’s Disease Patients with and without Resting Tremor

Min Xuan (Presenter) ; Peiyu Huang ; Quanquan Gu MD, PhD ; Xiaojun Xu ; Wei Luo ; Minming Zhang MD, PhD

PURPOSE
Resting tremor (RT) is present in 75-100% of Parkinson’s disease (PD) patients, but the explanation of this symptom still remains poorly known. Here we investigate how the functional changes happen in brains of PD patients with and without resting tremor, and whether these changes relate to the severity of resting tremor.

METHOD AND MATERIALS
15 PD patients with resting tremor (RT group), and 18 gender-, age-, duration-matched patients without resting tremor (non-RT group) participated in the resting-state functional magnetic resonance imaging (fMRI) analysis. We measured the fractional amplitude of low-frequency fluctuation (fALFF) between the two groups and investigated the correlation between RT scores and fALFF in the regions displaying significant group differences.

RESULTS
The RT group demonstrated an increased fALFF in the right supplementary motor area (SMA), and bilateral prefrontal cortex compared to non-RT group. There was no significant correlation between RT rating and fALFF in right SMA.

CONCLUSION
Our results suggest that the generation of resting tremor may be related to the decreased brain activity of right SMA, but the severity of resting tremor may not.

CLINICAL RELEVANCE/APPLICATION
Used to help understand the causes of resting tremor of PD, may eventually contribute to the treatment of this symptom.

SSA17-06 • Alternation of Functional Connectivity and Global Disturbance of FNC of Parkinson’s Disease by Resting-state fMRI

Haibo Xu (Presenter) ; Yuhui Wang ; Dongling Jiang ; Cheng Luo ; Dan Zhang

PURPOSE
The aim was to estimate the alteration of brain functional connectivity in Parkinson’s disease (PD) during resting state of brain by resting-state fMRI.

METHOD AND MATERIALS
A total of 16 right-handed patients with PD diagnosed according to the UK Parkinson’s Disease Society Brain Bank diagnostic criteria, and 14 gender- and age-matched right-handed healthy controls were carried out on resting-state fMRI for two levels of analyses, that is functional connectivity within resting state networks (RSNs) and functional network connectivity (FNC) analysis. Using group independent component analysis, sixteen RSNs were identified, and selected for assessment of the difference of functional connectivity within RSNs and FNC between groups.

RESULTS
Compared with HC, the patients with PD showed decreased significant functional connectivity within the regions in the putamen network, thalamus network, cerebellum network, attention network and self-referential network in bilateral putamen, bilateral thalamus, left cerebellum, right superior frontal gyrus, left medial frontal gyrus (orbitofrontal area), left anterior cingulated. The execution network was the only one revealing increased functional connectivity in bilateral paracentral lobule (P < 0.01). Furthermore, the results showed significant functional connectivity disturbance within RSNs in patients with PD. The PD had a trend to show increased functional connectivity within most of RSNs and decreased functional connectivity within a small part of RSNs. The caudate network showed increased functional connectivity with anterior DMN network and execution network and decreased functional connectivity with cerebellum network. Functional connectivity with execution network was significantly increased in DMN network, motion network, self-referential network and primary auditory network. The posterior DMN network showed decreased functional connectivity with thalamus network.

CONCLUSION
Our findings might suggest that decreased resting state functional connectivity and global disturbance of FNC are two remarkable characteristics of Parkinson’s disease.

CLINICAL RELEVANCE/APPLICATION
The multi-perspective analysis based on RSNs may be a valuable means to understand the underlying neuro-pathophysiological mechanism of PD.

SSA17-07 • Dysfunction of Central Olfactory Network in the Parkinson’s Disease

Kaiyuan Zhang MD (Presenter) ; Xuemin Wu ; Kuncheng Li MD ; Qing X Yang PhD ; Jianli Wang

PURPOSE
Olfactory dysfunction is prevalent in majority of idiopathic Parkinson’s disease (PD) patients. Even though typical PD pathology, Lewy pathology, has been found in the olfactory structures, the cause of olfactory deficits in PD is still not clear. We hypothesized that in PD patients, the central olfactory network (CON) is deteriorated. In this study, we applied task related and resting state fMRI (rsfMRI) methods to study the functional deficit of the CON in the PD brain.

METHOD AND MATERIALS
Nineteen PD patients (Handy stage 1-4) and ten age-/gender-matched healthy controls (HC) received respiration-triggered olfactory fMRI with lavender odor as the stimulant and rsfMRI on a 3T scanner. The olfactory function was evaluated with University of Pennsylvania Smell Identification Test (UPSIT). The PD patient’s clinical status was evaluated with Unified Parkinson’s Disease Rating Scale (UPDRS). During the imaging protocol, there were no cues provided to the subjects and no tasks for the subjects to do. The olfactory fMRI data were preprocessed with qMRI V2.1 and then analyzed using general linear model approach with SPM8. The rsfMRI data were processed...
RESULTS
In response to the odorant stimulation, significant activation was shown in the POC and secondary olfactory structures of the HC brains (e.g., orbitofrontal and insular cortex), but not in the PD brains. Significant decrease of FC with POC was observed in the anterior cingulate and right inferior temporal cortex (two-sample t-test with age effect corrected, p < 0.05). The FC decrease within the CON contributes to the olfactory deficit in PD, and the connectivity change worsens when PD progresses.

CONCLUSION
The findings in this study improve our understanding of olfactory deficits in Parkinson’s disease and provide a foundation for further clinical research in its diagnosis and treatment.

**SSA17-08 • Quantitative Assessment of Iron Deposition in Parkinson’s Disease Using Quantitative Susceptibility Mapping at 3T: An In Vivo MR Study**

Minako Azuma (Presenter); Toshinori Hirai MD; Kazumichi Yamada; Tian Liu PhD; Yasuyuki Yamashita MD *; Yi Wang PhD

PURPOSE
To evaluate the usefulness of assessing brain iron deposition in patients with Parkinson’s disease (PD) by quantitative susceptibility mapping (QSM).

METHOD AND MATERIALS
All MRI studies were performed with a multi-echo gradient-echo sequence on a 3.0 T Siemens scanner. We studied 8 PD patients (5 females, 3 males; age range 54-75 years, mean age 67 years) and 8 age-matched healthy controls. For QSM we used both the magnitude and phase components from all TEs in the morphology-enabled dipole inversion method. The mean susceptibility values (MSVs) of the bilateral substantia nigra (SN), red nucleus (RN), caudate nucleus (CN), globus pallidus (GP), and putamen (PT) was measured on QSM images. To place the region of interest (ROI) in the SN while avoiding contamination of the subthalamic nuclei we used coronal multiplanar reconstruction images with reference to the Schaltenbrand and Wahren atlas. Measurements were in the anteromedial and posterolateral (aSN, pSN) areas of the SN. Axial images were used for measurements in the other structures. In each patient, the most and least affected side was identified using the Unified Parkinson’s Disease Rating Scale motor score (UPDRS-III). Measurement differences were assessed with the paired and independent t test; P < 0.05 was considered to indicate a statistically significant difference.

RESULTS
In healthy subjects the MSVs of both hemispheres for the GP, aSN, pSN, RN, PT, and CN were 157 ± 34, 152 ± 49, 94 ± 31, 122 ± 38, 82 ± 24, and 74 ± 14 ppb, respectively. In PD patients the MSVs of the aSN and pSN on the most affected side were 148 ± 54 and 130 ± 60 ppb, and on the least affected side were 126 ± 58 and 185 ± 65 ppb, respectively. On both sides of healthy subjects and on the least affected side of PD patients, the MSV was significantly higher in the aSN than pSN (P < 0.01). There was no significant difference between the aSN and pSN on the most affected side of PD patients. The MSV in the pSN on the least affected side of PD patients was significantly higher than the controls (P < 0.01); the difference was not statistically significant in the other structures between the two groups.

CONCLUSION
Our QSM study suggests that the iron deposition in the SN in PD patients is different from that in healthy subjects.

**SSA17-09 • Difference in Phase Value of Putamen on SWI between Parkinsonian Syndrome and Age Matched Control**

Jin Hee Jang MD (Presenter); Hyun Seok Choi MD; Bum-Soo Kim MD; Kookjin Ahn MD, PhD; So L Jung; Bom-Yi Kim MD

PURPOSE
Susceptibility weighted image (SWI) is sensitive to paramagnetic material such as iron. Iron deposition is considered not only as phenotype of neurodegenerative disease but also as normal aging. Decreased uptake of putamen on FP-CIT PET has been known as one of imaging biomarkers of Parkinson disease. The purpose of this study is to evaluate difference in phase value of putamen between patient with Parkinsonian syndrome and age matched control.

METHOD AND MATERIALS
We retrospectively enrolled patients of three groups with idiopathic Parkinson disease (IPD) (n=20), atypical Parkinsonian syndrome or 2ndary Parkinsonism (n=14), and age matched control (n=16). SWI were taken from all the enrolled subjects (n=50). Region of interest (ROI) was drawn to measure phase values of bilateral caudate head and putamen on the axial images at the level of foramen of Monro. Patient with IPD (n=20) and atypical Parkinsonian syndrome or 2ndary Parkinsonism (n=14) underwent F-18 FP-CIT PET/CT. Tracer activity of ROI was measured in caudate, putamen and a reference region of occipital cortex. Statistical analyses were performed to compare phase values and tracer activity between groups.

RESULTS
Mean age was 64.7±8.3 year-old in idiopathic Parkinson disease; 66.1±1.5 year-old, in atypical Parkinsonian syndrome or 2ndary Parkinsonism; and 65.7±6.0 year-old, in control. The mean ages were not different among 3 groups. The phase values of right and left putamen in IPD (0.068±0.038, 0.062±0.031 radian) were higher than those of age matched control (0.030±0.030, 0.037±0.032 radian). The phase values of atypical Parkinsonian syndrome or 2ndary Parkinsonism (0.079±0.039, 0.084±0.039 radian) were higher than those of age matched control. There was no difference of phase value between IPD and atypical Parkinsonian syndrome or 2ndary Parkinsonism. However, normalized FP-CIT tracer activity of right and left putamen in IPD (3.1±0.6, 2.9±0.5) were lower than those of atypical Parkinsonian syndrome or 2ndary Parkinsonism (3.9±1.2, 3.9±1.2).

CONCLUSION
Phase value of Parkinsonian syndrome was higher than that of age matched control. Further investigation of phase value is needed with larger population.

CLINICAL RELEVANCE/APPLICATION
Iron deposition and metabolism of normal aging brain and neurodegenerative disease has been poorly understood. Phase value of SWI is a quantifiable variable which can be obtained from SWI.
MR Evaluation of Brain and Laryngeal Edema during Anaphylactic Hypotension: An Experimental Study

Ichiro Toyota MD, PhD (Presenter) ; Hisao Tonami MD ; Toshishige Shibamoto MD

PURPOSE
Anaphylactic shock is sometimes accompanied by local interstitial edema due to increased permeability. We performed examination of magnetic resonance (MR) imaging to detect edema in the larynx and brain during anaphylactic hypotension in anesthetized rats, with comparison of that during vasodilator-induced hypotension.

METHOD AND MATERIALS
Male Sprague Dawley rats were subjected to hypotension induced by the ovalbumin antigen (n=8) and a vasodilator sodium nitroprusside (n=8). Apparent diffusion coefficient and T2-relaxation time were quantified on MR imaging performed repeatedly for up to 68 min after an injection of either agent. The presence of laryngeal edema was also examined by histological examination. Separately, the occurrence of brain edema was assessed by measuring brain water content using the wet/dry method in the rats with anaphylaxis (n=5) or sodium nitroprusside (n=5), and the non-hypotensive control rats (n=5). Mast cells in the hypothalamus were morphologically examined.

RESULTS
Mean arterial blood pressure similarly decreased to 35 mmHg after an injection of the antigen or sodium nitroprusside. Hyperintensity on T2-weighted images, as reflected by elevated T2-relaxation time, was found in the larynx as early as 13 min after an injection of the antigen but not sodium nitroprusside. Postmortem histological examination revealed epiglottic edema in the rats with anaphylaxis, but not sodium nitroprusside. In contrast, no significant changes in T2-relaxation time or apparent diffusion coefficient were detectable in the brain of any rats studied. In separate experiments, brain water content quantified was not increased in either anaphylaxis or sodium nitroprusside rats, as compared with the non-hypotensive control rats. The number of mast cells was similar in the hypothalamus of rats with anaphylaxis and sodium nitroprusside, suggesting absence of anaphylactic reaction in the brain.

CONCLUSION
MR imaging elucidates presence of edema in larynx, but not brain, during anaphylactic hypotension in experimental study.

CLINICAL RELEVANCE/APPLICATION
MR evaluation by T2-relaxation time as well as apparent diffusion coefficient elucidates presence of edema in larynx, but not brain, during anaphylactic hypotension.

Dual Energy CT Imaging of the Brain and Neck

Jeffrey Hu (Presenter) ; Niv Khorrami ; Behrang Homayoon MD ; Dave Russell MD ; Paul I Mallinson MBChB ; George Papachristopoulos MD ; Savvas Nicolaou MD

PURPOSE/AIM
1. Review the characteristic findings and indications for computed tomography (CT) of the brain and neck
2. Discuss advantages of dual energy (DE)/spectral CT in adding to the clinical utility of CT in head and neck imaging

CONTENT ORGANIZATION
1. Indications for CT of the brain and neck
   1. Intra/extracranial vessel stenosis and aneurysms
   2. Intracranial haemorrhage
   3. Intracranial and neck masses
2. Principles, technical aspects, and physics of DE/spectral imaging
3. Clinical applications of DECT
   1. Radiation dose reduction
   2. Improved bone/plaque removal reconstructions
   3. Plaque analysis
   4. Differentiating iodine from haemorrhage post thrombolysis
   5. Greater grey/white differentiation and reduction of beam hardening artifacts in the posterior fossa
   6. Material quantification of abnormal enhancement neoplasms
4. Clinical utility evaluating/staging neck masses
5. Current limitations of DE/spectral CT in head and neck imaging
6. Cases of DE/spectral CT imaging of the brain, intra/extracranial vessels, and neck from our institution with a discussion of characteristic findings and clinical applicability

SUMMARY
1. CT is valuable in many indications in head and neck imaging
2. DECT has significant clinical advantages over single energy CT in the evaluation of the brain, neck, and intra/extracranial vessels

MR Evaluation of Brain and Laryngeal Edema during Anaphylactic Hypotension: An Experimental Study

Ulysses S Torres MD ; Eduardo P De Oliveira (Presenter) ; Fernanda D Braojos Braga MD ; Horacio J Ramalho ; Antonio S Souza MD ; Jose Roberto I Ferraz-Filho

PURPOSE/AIM
This education exhibit aims to: 1) Discuss the spectrum of neurological complications related to immunosuppression in the setting of solid organ transplantation (SOT). 2) Categorize these complications in major groups according their clinical and radiological manifestations, facilitating the diagnostic approach by radiologists. 3) Illustrate the main neuroimaging findings of confirmed cases of immunosuppression-related complications occurring in SOT recipients.

CONTENT ORGANIZATION
This exhibit will address the spectrum of immunosuppression-related neurological complications after SOT (mainly kidney and liver transplants) in a case-based format. Representative cases will include calcineurin-inhibitors’ neurotoxicity, neurotoxoplasmosis, neurocryptococcosis, cerebral aspergillosis, cerebral pyogenic abscesses, encephalitis due to Chagas' disease reactivation, cerebral lymphomas, among others.

SUMMARY
Immunosuppression has improved graft survival in SOT recipients, but it leaves the patient susceptible to a gamut of CNS complications occurring within a few days to several years after the procedure. Neuroimaging has a pivotal role in characterizing these complications. After reviewing this exhibit, radiologists should be able to recognize the main correspondent imaging findings in this setting and to formulate appropriate differential diagnoses.
Correlation with 18F-FDG PET Imaging Work-up

Sean W Wilson MD (Presenter); Matthew R Plunk MD; James R Fink MD *; Annemarie Relyea-Chew

PURPOSE
Hemorrhage into the brain parenchyma can have devastating clinical consequences. While hemorrhage into the basal ganglia is overwhelmingly due to hypertension, hemorrhage in a lobar distribution is more likely to have an underlying vascular or malignant etiology. While it has been recognized that hemorrhage can potentially obscure an underlying lesion in the acute setting, the frequency with which this occurs is not well established. Our goal was to quantify how often repeat imaging in patients with spontaneous, idiopathic lobar hemorrhage reveals an underlying etiology.

METHOD AND MATERIALS
Institutional Review Board approval was obtained. A retrospective review was conducted over 54 months to identify patients with lobar distribution intracranial hemorrhage. Imaging and chart review was conducted for individuals with lobar hemorrhage who were evaluated with a combination of CT, MRI, and/or catheter angiography and had subsequent imaging and clinical follow-up within the University of Washington system. Exclusion criteria included patients less than 18 years old, preceding trauma, hemorrhagic transformation of known infarct, and subarachnoid hemorrhage as the predominant feature.

RESULTS
A cohort of 327 patients with spontaneous lobar hemorrhage was identified. A causative etiology was identified on initial imaging in 67 patients (23%). 170 patients (52%) either expired or were lost to follow up before adequate imaging work up was completed. Of the remaining 90 patients who had negative initial imaging and adequate clinical/imaging follow up (mean/median 475 and 354 days) an underlying lesion was discovered in 10 patients (11%).

CONCLUSION
Repeat imaging was able to reveal an underlying etiology in approximately 11% of patients whose initial exams were negative. This is about half the rate with which the initial imaging for patients with new lobar hemorrhage is able to identify an etiology; routine follow up imaging should be considered when there is a concern for an underlying etiology in patients with spontaneous lobar hemorrhage.

CLINICAL RELEVANCE/APPLICATION
This information on the yield of follow up imaging in idiopathic lobar intracranial hemorrhage would be valuable for clinicians and radiologists in managing these patients.
To assess the feasibility of Color-Doppler US and ultrasound strain elastography (USE) to better characterize carotid plaque composition and vulnerability as compared with high-resolution magnetic resonance imaging (MRI) or CTA.

METHOD AND MATERIALS
55 patients (38 males, 17 females) with 50 % or greater carotid stenosis underwent color-doppler US and USE and at least one of second imaging modality such as high-resolution MRI (N: 30) or CTA (40) of internal carotid arteries. US-color-map elastographic US evaluations of segmented plaques were achieved. On MRI or CTA, corresponding plaques and components were segmented and quantified. Associations between strain parameters, plaque composition and clinical presentation were estimated with curve-fitting regressions and Mann-Whitney tests.

RESULTS
2 patients were excluded from the study since strain-US elastography did not provide sufficient informations. In the remaining patients, no significant difference was found in determining the mean stenosis between color-doppler US and second imaging modalities. Among 53 plaques, 15 were symptomatic, 17 contained lipid and 8 were vulnerable on MRI or CTA. Strains were significantly lower in plaques containing a lipid core compared with those without lipid, with 90 % sensitivity and 85 % specificity. A statistically significant correlation was found between strain and lipid content (P?

CONCLUSION
Color-doppler US and ultrasound strain elastography (USE) is feasible in patients with significant carotid stenosis and can detect the presence of soft plaque with high sensitivity and moderate specificity.

CLINICAL RELEVANCE/APPLICATION
Us-strain elastography provides additional information to vascular ultrasound since may help to better characterize carotid plaque

PURPOSE/AIM
-Review the definition of vertigo and dizziness
-Review the differential diagnosis for patients presenting with these symptoms
-Discuss the role of imaging in diagnosis and management of such diseases

CONTENT ORGANIZATION
Review anatomy, clinical presentation, pathophysiology, and imaging findings
-Vertigo and dizziness are symptoms of a broad scope of diseases affecting the vestibular system
-Neuroimaging is particularly valuable in cases demonstrating neurologic signs/symptoms, cerebrovascular risk factors, or progressive unilateral hearing loss
-Frequent overlap in symptomatology necessitates multidisciplinary approach towards diagnosis and management of these patients

SUMMARY
Vito Cantisani MD; Pietro Lodise; Mattia Di Segni MD; Cristina Fioravanti; Sarah Montechiarella MD; Paolo Ricci MD; Ferdinando D’Ambrosio; Carlo Catalano MD; Hektor Grazhdani (Presenter)

PURPOSE
- To review embryogenesis of orbit and correlate abnormal embryological pathways with anatomy of congenital ocular anomalies. - To review imaging findings of congenital ocular & orbital anomalies. - To discuss the implication on management.

CONTENT ORGANIZATION
Normal embryogenesis of orbit. Embryological basis of congenital ocular anomalies including microphthalmos, anophthalmos, meningoencephalocele, congenital ocular tumours, clefting syndromes etc. Imaging findings of congenital ocular anomalies. Systemic syndromes associated with congenital ocular anomalies like crouzon’s syndrome, apert’s syndrome.

SUMMARY
Congenital ocular & orbital abnormalities present with varied imaging and clinical manifestations. Understanding the anomalous embryogenesis enable radiologist to detect primary ocular abnormalities and systemic syndromes associated with them. Imaging plays a crucial role in the diagnosis and management of these abnormalities.
SUMMARY

and silent sinus syndrome.

nosologic classification of sinus diseases based on pathophysiology including postsurgical, infection, inflammatory, cocaine, neoplastic, distinguishing imaging findings - cortical remodeling, osseous destruction, hyperdense material, and enhancement patterns.

CONTENT ORGANIZATION

Opacifications of the paranasal sinuses are frequently dismissed as just "sinus disease" without careful evaluation of features that may suggest pathology more nefarious than simple rhinosinusitus. We present an imaging-based approach based on osseous changes, presence of hyperdense material, and enhancement patterns.

PURPOSE/AIM

To demonstrate the hemodynamic mechanisms involved with effective intracranial aneurysm treatment and common pitfalls, tips and tricks for effective deployment of the Pipeline Embolization Device (PED) in the treatment of intracranial aneurysms.

CONTENT ORGANIZATION

1. Demonstrate key concepts of the flow diversion mechanism
2. Review of Indications and contraindications as well as patient selection
3. Parent vessel access
4. Accurate PED diameter-length selection
5. Deployment technique
6. Common pitfalls, tips and tricks during PED deployment
7. Outcomes after treatment

SUMMARY

1. Understanding the hemodynamic mechanisms and common pitfalls of PED will increase the rate of successful treatments.
2. Learning tips and tricks for proper deployment will maximize success rates and will improve patient care.

LL-NRE-SU7B • Neoplastic and Non-Neoplastic Lesions of the Pineal Region: What the Surgeon Wants to Know

Forrester Lensing MD (Presenter); Travis A Abele MD; Lubdha M Shah MD; Walavan Sivakumar MD; Phil Taussky; Karen L Salzman MD *

PURPOSE/AIM

The purpose of this exhibit is: 1. To illustrate the relevant surgical anatomy of the pineal region. 2. To discuss different surgical approaches to the pineal region. 3. To review the spectrum of tumors and masses that occur in the pineal region. 4. To define specific imaging features of pineal region masses and tumors that dictate or alter neurosurgical management.

CONTENT ORGANIZATION

Surgical Anatomy of the Pineal Region Neurosurgical Approaches to the Pineal Region Imaging Review of Pineal Region Masses and Tumors

1. Pineal Cysts
2. Pineal Region Tumors
3. Pineal Region Tumor-Like Masses

Surgical Planning and Pre-Operative Considerations

SUMMARY

Teaching Points:
1. Specific imaging features can guide the radiologist in generating a differential diagnosis for lesions of the pineal region.
2. In consultation with the neurosurgeon, the radiologist plays a critical role in determining the operative plan and neurosurgical approach to the pineal region.

LL-NRE-SU8B • Imaging of Sinus Disease(s)

Vivek B Kalra MD (Presenter); Kyle E Pfeifer MD; Haatal B Dave MD, MS; Ajay Malhotra MD

PURPOSE/AIM

Opacifications of the paranasal sinuses are frequently dismissed as just "sinus disease" without careful evaluation of features that may suggest pathology more nefarious than simple rhinosinusitus. We present an imaging-based approach based on osseous changes, presence of hyperdense material, and enhancement patterns.

CONTENT ORGANIZATION

Briefly review relevant imaging anatomy of the paranasal air sinuses and appropriate imaging criteria Highlight assessment of distinguishing imaging findings - cortical remodeling, osseous destruction, hyperdense material, and enhancement patterns. Present nosologic classification of sinus diseases based on pathophysiology including post-surgical, infection, inflammatory, cocaine, neoplastic, and silent sinus syndrome.
1. Cortical thickening suggests chronic sinusitis, as defined as greater than 12 weeks, most commonly presents with benign nodules from mucus retention pseudocysts and nasal polyps.
2. Osseous erosion can be seen in Wegener, invasive fungal sinusitis, malignancy, cocaine, sarcoidosis, or EG.
3. High density material may suggest fungal sinusitis, with invasiveness suggested by perimaxillary fat infiltration or vascular occlusion.
4. Peripheral enhancement is benign (polyp), cerebromeningeal enhancement is potentially malignant (inverted papilloma), and central enhancement is malignant.

**LL-NRE-SU9B ● The Role of Multidetector CT Imaging of the Parathyroid: What the Radiologist Needs to Know to Perform and Interpret the Exam**

Douglas S Drumsta MD (Presenter); Susan K Hobbs MD, PhD; Jacob Moalem MD

**PURPOSE/AIM**
Four dimensional computed tomography (4D-CT) is a relatively new technique for the localization of parathyroid adenomas. This technique has become more popular for preoperative localization of parathyroid adenomas in patients with inconclusive standard imaging studies, failed surgical neck exploration and those undergoing minimally invasive parathyroidectomy. The purpose of this exhibit is to review the technique of 4D-CT for parathyroid detection, parathyroid anatomy, and parathyroid CT characteristics, including cases that illustrate the pearls and pitfalls of 4D-CT for preoperative localization of parathyroid adenomas.

**CONTENT ORGANIZATION**
First, this exhibit will describe the technique and indications for 4D-CT. Parathyroid anatomy and imaging characteristics will then be described with illustrations and CT case based examples demonstrating normal and abnormal appearances as well as the pearls and pitfalls of the imaging technique.

**SUMMARY**
Four dimensional computed tomography (4D-CT) is becoming increasingly popular for the localization of parathyroid adenomas. This exhibit will review the technique of 4D-CT for parathyroid detection, parathyroid anatomy, and parathyroid CT characteristics, including cases that illustrate the pearls and pitfalls of 4D-CT for preoperative parathyroid localization.

**LL-NRE-SU10B ● Development Malformations of the Striatum: A Series of Six Cases and a Review of Embryologic and Anatomic Aspects**

Luiz A Ferreira Filho MD (Presenter); Bruno E Cabral; James H Yared MD; Fabio L Castro MD; Ademar Lucas MD; Nelson F Ferreira MD; Henrique B Zuppiani MD; Andre E Torres; Carlos A Martinelli Pereira MD; Clarissa B Pinto MD

**PURPOSE/AIM**
Striatum developmental abnormalities are rare with few published data. Our proposal is to present detailed description of MRI findings and clinical data of children with striatum malformations and to review embryological and anatomical aspects of these structures.

**CONTENT ORGANIZATION**
Six cases were collected in our institution between 2012 and 2013. By qualitative analysis, we observed malalignment and asymmetries of the caudate nucleus, putamen and thalamus with areas of reduced and enlarged volume. Fusion of the caudate’s head with the putamen was also noticed. Associated malformations were found in some cases and will be described as well.

**SUMMARY**
Caudate and putamen have common embryological and phylogenetic origin, and also various connective circuits related to cortex and other basal ganglia. These nuclei are widely involved in the movement control and limbic system modulation. The changes described are most probably due to developmental malformations of the forebrain. The absence of signal intensity alteration of the structures evaluated in the reported cases, the similarity of some findings among patients and lack of compatible clinical history argue against the hypothesis of acquired disorders. Moreover, several cases showed others associated malformations.

**LL-NRE-SU11B ● Beyond Sinusitis: An Approach to MR and CT Evaluation of Common and Unusual Maxillary Sinus Lesions**

Jiamin J Zheng MD (Presenter); Prasad B Hanagandi MBBS, MD; Jaron Chong MD; Jeffrey Chankowsky MD; Carlos I Torres MD; Raquel Del Carpio-O’donovan MD; Eric S Bartlett MD, MPH

**PURPOSE/AIM**
1) To review usual and rare maxillary sinus pathologies presenting with common sinonasal clinical symptoms.
2) To present a systematic approach to differential diagnosis based on distinguishing MR features complemented with CT findings.
3) To advise on appropriate imaging algorithm based on the clinical query.

**CONTENT ORGANIZATION**
- Anatomy of the sinuses.
- Common sites/tissues of origin and routes of invasion/extension for lesions.
- Imaging protocols for MR and CT.
- Pictorial review of cases (lymphoma, chloma, melanoma, plasmacytoma, neurofibroma, squamous cell and adenocarcinoma, adenoid cystic carcinoma, esthesioneuroblastoma, hemangioma, fungal infections, Wegener’s granulomatosis, dientogenic cyst, inverted papilloma, schwannoma, acute and chronic inflammatory sinusitis, polyposis and fibro-osseous lesions).
- Algorithm towards differential based on morphology, the presence of calcifications, effect on adjacent bone, T1 and T2 hypointensity, T2 hyperintensity, along with CT correlation.

**SUMMARY**
A variety of inflammatory, infectious, neoplastic, fibro-osseous and congenital pathologies can mimic sinusitis and vice-versa. The radiologist should be familiar with these conditions to avoid diagnostic delay and complications.

**LL-NRE3124-SUB ● PET/MR: Applications in Neurroradiology**

Brice A Kessler BS (Presenter); Benjamin Y Huang MD, MPH; Bhishamjit Chera MD; Arif Sheikh MD; Weili Lin PhD; Mauricio Castillo MD; Yueh Z Lee MD, PhD

**PURPOSE/AIM**
Simultaneous PET/MR enables the acquisition of both functional and anatomic imaging during the same session. This tool is especially powerful in neurroradiology, where MR soft tissue discrimination is especially important for radiological diagnosis. The aim of this presentation is to review the available literature on PET/MR applications in neurroradiology and present educational cases. Corresponding PET/CT studies will also be shown for comparison.

**CONTENT ORGANIZATION**
Review published neurroradiology applications of the PET/MR. Educational Cases of the PET/MR with corresponding PET/CT.

- Brain neoplasms
- Head and neck neoplasms
- Spine Imaging
- Brachial plexus imaging
- Advanced imaging applications
LL-NRS-SU1B • CT Perfusion Imaging in Predicting Delayed Cerebral Ischemia in Patients with Aneurysmal Subarachnoid Hemorrhage: A Systematic Review

Danial I Mir (Presenter); Ajay Gupta MD; Luis A Puchi BS; Christopher Robinson; Allison Dunning; Pina C Sanelli MD

PURPOSE
To identify and critically analyze prospective and retrospective English language published manuscripts evaluating the utility of CT perfusion (CTP) in predicting measures related to delayed cerebral ischemia (DCI) in patients with aneurysmal subarachnoid hemorrhage (ASAH).

METHOD AND MATERIALS
An experienced medical librarian conducted a comprehensive literature search to identify studies that evaluated the use of CTP in identifying patients with any of the following outcomes of DCI: 1. clinical deterioration sufficiently judged to be due to DCI, 2. secondary cerebral infarction identified on follow-up CT or MR imaging or 3. functional disability related to DCI. Search results were preliminary screened via title and abstract information by a single reader with shortlisted manuscripts reviewed in full by two independent readers for inclusion. Disagreements were resolved by consensus. Using a standardized data collection template, study characteristics including baseline patient demographics, CTP test characteristics, and detailed DCI outcome data was collected by two independent readers with disagreements resolved by a third reader.

RESULTS
Search results yielded 218 studies of which 8 cohort studies met our inclusion criteria. Together these studies encompass 381 patients. After CTP, 196 subjects (51%) were included in the DCI group and 185 (49%) in the non-DCI group. Admission disease severity was comparable across all groups. In only 4 studies were test characteristics reported or data presented from which they could be tabulated. Despite differences in CTP methodology, these studies demonstrated similar diagnostic accuracy in predicting DCI outcomes. The weighted averages and range of the extracted/tabulated sensitivities and specificities of CTP in predicting DCI outcomes from these studies are 0.80 (0.7 - 0.93) and 0.78 (0.66 - 0.82), respectively.

CONCLUSION
Despite significant differences in patient populations studied and imaging techniques utilized, our systematic review demonstrates that CTP is a useful imaging modality in identifying those patients most at risk for developing DCI in patients with ASAH.

CLINICAL RELEVANCE/APPLICATION
Because DCI is often diagnosed after significant and irreversible morbidity has occurred, treatment is often of limited efficacy. CTP may predict impending DCI and allow for pre-emptive intervention.

LL-NRS-SU2B • 4D Flow MR Imaging after IC Ligation for Giant Aneurysm and High Flow EC-IC Bypass Surgery: Comparison with TOF MRA, CT Angiography and CT Perfusion

Ryo Takagi MD (Presenter); Tetsuro Sekine; Yasuo Amano MD; Yasuo Murai MD; Erika Orita; Akio Morita MD, PhD; Shinichiro Kumita MD

PURPOSE
Time resolved 3D phase-contrast (4D-flow) MRI is a promising tool for blood flow evaluation in cerebrovascular disease. The purpose of this study is to demonstrate the clinical feasibility of 4D-flow MRI in the evaluation of hemodynamics in patients after both ICA ligation for Aneurysm and extracranial/intracranial (EC/IC) bypass surgery using a radial artery graft.

METHOD AND MATERIALS
Seven patients (6 females and one male, mean age; 68 years) with 6 giant aneurysms (size; 15-30mm, mean 21mm) and one carotid cavernous fistula were treated with ICA ligation and EC/IC bypass surgery using a radial artery graft. We performed CT Angiography (CTA) and CT perfusion (CTP) using 64-slice multi-detector (MD)-CT, TOF-MRA and 4D-flow MRI at 3T after surgery. The date of 4D flow MRI was transported to another personal computer with 4D flow visualization software (GT-Flow; GyroTools). Time-resolved 3D-flow mapping images of EC/IC bypass graft and cerebral artery were generated. The patency, stenosis and bending of radial artery graft were evaluated independently on CTA, TOF-MRA and 4D-flow MRI. 4D-flow MRI and CTP were evaluated for the perfusion of MCA territory.

RESULTS
Bypass surgery was successful in all patients. The acquisition time of 4D-flow MRI data was about less than 10 minutes. 4D-flow MRI visualized the arterial flow from radial artery graft to MCA successfully. TOF-MRA demonstrated narrowing of graft-side MCA in all patients and stenosis of 5 locations (severe; 1, moderate; 2, mild; 2) of graft in 4 patients. 4D-flow MRI showed stenosis of 5 locations (severe; 0, moderate; 1, mild; 4). CTA showed stenosis of 4 locations (severe; 0, moderate; 0, mild; 4). CTP demonstrated symmetrical perfusion of MCA territory in all patients. On the other side, 4D-flow MRI demonstrated flow delay of MCA M1 portion in 6 patients and could not depict flow of M1 by the artifact of aneurismal clip in one patient.

CONCLUSION
4D-flow MRI is a promising tool that visualizes flow graft and intracranial arterial hemodynamic in patients after IC ligation for aneurysm and EC/IC bypass surgery.

CLINICAL RELEVANCE/APPLICATION
Time resolved 3D phase-contrast (4D-flow) MRI is a promising tool that visualizes cerebral blood flow and graft patency after both ICA ligation for giant aneurysm and high flow EC/IC bypass surgery.

LL-NRS-SU3B • MSCT-Criteria for Assessment of the Temporal Bone Structures before Stapes Surgery

Irina Bodrova MD, PhD (Presenter); Larisa Kulakova; Nina V Gagarina MD; Sergey K Ternovoy MD, PhD; Ekaterina Fominikh; Andrey Lopatin

PURPOSE
To determine MSCT capabilities in detection of anatomical and topographical characteristics of the vestibular window region before stapes surgery.

METHOD AND MATERIALS
32 persons (53 ears) with otosclerosis participated in the study. Average age was 35.6±1.7 years. All patients have been examined by microtopy, audiologic tests, MSCT. 9 patients had unilateral disease and 22-bilateral. The CT study was conducted using a program of bone reconstruction with slice thickness of 0.5mm. The niche of vestibular window was assessed in all ears on the following criteria: the width and form of the niche, the presence and absence of overhanging of facial nerve canal over the vestibular window (similar for promontorium), the width of the stapes footplate, stapes cruses width, distance to the internal wall of vestibule. All 53 ears underwent stapes surgery.
RESULTS
The proposed MSCT-criteria allows to estimate the complexity of the surgery, thoroughly plan for the surgery, to predict the outcome.

CLINICAL RELEVANCE/APPLICATION
Using of MSCT allowed to choose plan of operation, the special instruments and implants, to avoid frequent complications.

LL-NRS-SU4B • Regional Specificity of fMRI, DTI, and MRS Data in Substantia Nigra (SN) for Characteristics of the Level of Cognitive Impairment (CI) in Patients with Parkinson’s Disease (PD)

Zina Z Rozhková PhD, DSc (Presenter) ; Oleksii Omelchenko MSc

PURPOSE
We try to find biomarkers for characteristic of the regional specificity of the fMRI, DTI, and MRS data in patients with PD and different level of CI.

METHOD AND MATERIALS
Three groups of patients are studied by fMRI, DTI, and MRS with 1.5T SIGNA (GE). The 1st group (DPDG) consists of 13 PD-patients with dementia (MMSE/MMSE=25). The 3rd group (NPDG) includes 18 patients with normal cognitive function (MMSE>30). Resting state fMRI data and simple unilateral finger tapping task are used for the acquisition of blocked design fMRI data. fMRI images are obtained using: TR/TE=3000/60ms. The analyses were carried out with GLM and ICA (FSL5.0 software package); FEAT, and MELODIC. DTI (25 directions) are obtained in ROI=2x2x2mm in the anterior, medial, and posterior SN (ASN, MSN, PSN). Spectra are recorded with the SSVSSTEAM: TR/TE=1500/144ms.

RESULTS
In the NPDG connections between the APCG and PPCG, and inferior parietal gyrus bilaterally were found. In the NPDG activation of the anterior (APCG), and of the posterior portion of cingulate gyrus (PPCG) decreased, but connectivity patterns persisted. In CIPDG activated clusters were found precentrally. In DPDG no activation in PPCG were found. Mean diffusivity (MD) are: (0.82+-0.05)x10^-3mm^2/s, (0.74+-0.05)x10^-3mm^2/s, (0.71+-0.05)x10^-3mm^2/s in DPDG, CIPDG, NPDG. The MD changes are most pronounced in APSN. Fractional anisotropy (FA) are: (0.41+-0.05), (0.43+-0.05), (0.47+-0.05) in DPDG, CIPDG, NPDG. FA have non-significant tendency to decrease in patients with various level of CI. In anterior part of SN (APSN) the mean values of NAA/Cr in DPDG, CIPDG, and NPDG: (1.68+-0.02), (2.04+-0.03), (2.32+-0.05), and Cho/Cr: (0.84+-0.02), (0.81+-0.05), (0.53+-0.03). In posterior part of SN (PPSN) the mean values NAA/Cr in DPDG, CIPDG, and NPDG are: (1.14+-0.12), (1.81+-0.02), (1.98+-0.04), and Cho/Cr: (0.96+-0.02), (0.77+-0.03), (0.68+-0.03). Progressive decreasing NAA/Cr in the PPSN and increasing of Cho/Cr for the patient of NPDG, CIPDG, DPDG are found, that is associated with poorer cognitive function.

CONCLUSION
fMRI, DTI, and MRS-data give us new approach for understanding pathophysiological changes in PD-patients associated with CI.

CLINICAL RELEVANCE/APPLICATION
Bringing together resting state and simple unilateral finger tapping fMRI, regional DTI-, and MRS-data in SN we obtain biomarkers of neuronal dysfunction in patients with PD and different level of CI.
MRI in Acute Spine Trauma: What and When?

LEARNING OBJECTIVES
1) Recognize commonly seen abnormalities of the globe, including effects of trauma, infection, and congenital malformation. 2) Should be familiar with the appearance of intraocular tumors, particularly retinoblastoma, and diseases that mimic retinoblastoma. 3) Should be able to identify the most common causes of optic neuropathy, and identify radiographic features which point to a specific diagnosis in patients with optic neuropathy.

Orbital Tumors

LEARNING OBJECTIVES
1) Be familiar with the anatomical and spatial composition of the orbit and related organs. 2) Develop differential diagnoses of orbital lesions based on spatial, pathological, demographic, and imaging features. 3) Discuss the cross-sectional imaging strategy for evaluation of the orbit, and describe the CT and MR appearance of common and uncommon orbital lesions.

Orbital Inflammation

LEARNING OBJECTIVES
1) To recognize the CT and MR imaging features of orbital infection and inflammatory diseases. 2) To recognize orbital inflammatory disease based upon imaging appearance and clinical scenario in order to offer a limited differential diagnosis and guide biopsy in select cases. 3) To understand important complications associated with orbital infection and inflammation.

Imaging of the Traumatized Spine (Traditional) (An Interactive Session)

LEARNING OBJECTIVES
1) To understand benefits and limitations of MRI and CT evaluation of spinal trauma. 2) To review current MR and CT imaging protocols in cervical spine trauma. 3) To review the most common MRI findings in cervical spine trauma and how these affect treatment. 4) To become aware of potential complications from imaging. 5) To review the utility of MR and CT in soft tissue injuries including: ligaments, discs, cord, and blood vessels.

ABSTRACT
This presentation addresses the benefits/drawbacks of MRI vs. CT in the setting of acute cervical spine trauma. MRI has a higher sensitivity and specificity in detecting soft tissue and ligament injuries than CT and radiographs. MRI can also substitute dynamic fluoroscopy to assess instability. Although controversial, MRI is also considered by many the ;gold; standard in obtunded patients and children. Because of concern of radiation exposure in children, CT is recommended only in special situations and the evaluation of these patients begins with radiographs and is followed by MRI. The use of MRI in evaluating the integrity of the transverse ligaments in patients with Jefferson injuries identifies those for whom surgery is required and in Hangman fractures those with compressive and/or intrinsic cord lesions. When moving these patients to an MR unit it should be remembered that there is an increased risk of secondary brain injury, increased intracranial pressure, and aspiration. Nearly 50% of patients with significant cervical trauma will have herniated discs visible only by MRI. Many patients also show epidural and/or subdural spinal hematomas and MR depicts each type making the surgeon aware of the need for more extensive and difficult surgery when the blood clot is in the subdural space. Evacuation of the hematoma is imperative to prevent cord damage. The term ;SCIWORA; refers to a damaged cord in absence of bone and ligamentous injuries. It occurs in young children and elders with degenerative disease. MRI shows cord hemorrhage and edema and also helps confirm the clinical diagnosis of central cord syndrome. Transections of the cord are clearly assessed with the level of the upper stump determining level of function. Lastly, MRI is critical in assessing acute and subacute vertebral artery dissections. MRI permits direct evaluation of the 3 findings that determine patients neurological outcome: maximum cord compression, cord hemorrhage, and cord swelling.
RC111 • FDG PET-CT Findings in Differential Diagnosis of Dementia
Alexander Drzezga MD (Presenter) *

LEARNING OBJECTIVES
1) Principle of FDG-PET imaging of cerebral glucose mechanism. 2) Physiological and pathophysiological background. 3) Methodological aspects of FDG-PET imaging in the brain. 4) Differential diagnosis of non-neurodegenerative disorders leading to cognitive impairment. 5) Differential diagnosis between different forms of neurodegenerative disorders. 6) Combination of FDG-PET with other neuroimaging procedures (multimodal imaging).

RC118 • Amyloid PET Findings in Alzheimer's Disease and Related Disorders
Nicholaas I Bohnen MD (Presenter)

LEARNING OBJECTIVES
1) To discuss methodological aspects of fibrillary beta-amyloid PET imaging. 2) To learn about practical interpretation of fibrillary beta-amyloid PET imaging. 3) To understand the long duration of prodromal phase of amyloidopathy and its importance of correlating it with clinical symptoms when reporting on amyloid PET studies. 4) To review the presence of amyloidopathy in non-Alzheimer dementias. 5) The discuss appropriate use criteria for amyloid PET in clinical practice.

RC111C • Dopamine Transporter SPECT Findings in Parkinson's Disease and Related Disorders
Satoshi Minoshima MD, PhD (Presenter) *

LEARNING OBJECTIVES
1) To describe mechanisms of dopamine transporter SPECT imaging. 2) To explain dopamine transporter SPECT procedure. 3) To discuss dopamine transporter SPECT findings in various movement disorders.

RC111D • MRI Findings Commonly Seen in Dementia Patients
Yoshimi Anzai MD (Presenter)

Interactive Game: Interactive Quiz Cases in Neuro-oncologic Imaging

RC118 • Spine
James C Anderson MD (Presenter)

LEARNING OBJECTIVES
This interactive session will use RSNA Diagnosis Live®. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

RC118A • Head and Neck/ENT
Suresh K Mukherji MD (Presenter)

LEARNING OBJECTIVES
1) Review common head and neck tumors. 2) Identify pertinent imaging findings that show how imaging affects staging. 3) Highlight specific imaging findings that will affect staging, treatment and management.

RC118B • Brain
Megan K Strother MD (Presenter)

LEARNING OBJECTIVES
1) Identify basic anatomic, pathologic, and physiologic principles as they apply to neuro-oncologic imaging of the brain.

ABSTRACT
Five interactive neuro-oncologic cases will be presented in an interactive format. Participants will review basic knowledge and skills that are relevant to the clinical practice of neuroradiology, while evaluating the results of the latest research in neuro-oncologic imaging.
LEARNING OBJECTIVES
1) Discuss the expected radiographic findings following radiation therapy including radiosurgery. 2) Discuss the occurrence of radiation necrosis following radiosurgery including risk factors and imaging findings. 3) Discuss the role of Avastin in the management of gliomas and radiation necrosis. 4) Discuss the phenomena of pseudoprogression including imaging analysis and clinical management.

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**Hot Topic Session: Concussion and Traumatic Brain Injury**

**Monday, 07:15 AM - 08:15 AM • E451B**

**LEARNING OBJECTIVES**
1) To understand the potential of magnetoencephalography (MEG) for better diagnosis in mild traumatic brain injury (TBI). 2) To review the current best practices for imaging of sports concussions and the findings of recent imaging research studies of athletes. 3) To provide an overview of blast injury and other special characteristics of TBI in military populations, with the most recent results from imaging studies.

**SHPH20 • MEG of Mild Traumatic Brain Injury: A New Frontier**
- **Mingxiong Huang**, PhD (Presenter)

**LEARNING OBJECTIVES**
View learning objectives under main course title.

**SHPH20B • Imaging of Sports Concussion**
- **Michael M Zeineh**, PhD, MD (Presenter)

**LEARNING OBJECTIVES**
View learning objectives under main course title.

**SHPH20C • Imaging of Military TBI**
- **Gerard Riedy**, PhD, MD (Presenter)

**LEARNING OBJECTIVES**
View learning objectives under main course title.

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**BOOST: Head and Neck-Anatomy and Contouring (An Interactive Session)**

**Monday, 08:30 AM - 10:00 AM • S103AB**

**LEARNING OBJECTIVES**
1) Review the normal anatomy of the lymph nodes of the neck. 2) Review the radiological anatomy and landmarks for identifying lymph node groups. 3) Review the primary eschelon drainage patterns of various head and neck subsites.

**ABSTRACT**
1. Review the normal anatomy of the lymph nodes of the neck
2. Review the radiological anatomy and landmarks for identifying lymph node groups
3. Review the primary eschelon drainage patterns of various head and neck subsites

**MSRO21 • Current Concepts and Controversies in Contouring and Treatment of Lymph Nodes**
- **Sung Kim**, MD (Presenter)

**LEARNING OBJECTIVES**
1) Learn and discuss what lymph node levels are appropriate to target depending on primary site. 2) Discuss the appropriate dose and margins for lymph node coverage.

**MSRO21B • Anatomy of the Lymph Nodes**
- **Suresh K Mukherji**, MD (Presenter)

**LEARNING OBJECTIVES**
1) Review the normal anatomy of the lymph nodes of the neck. 2) Review the radiological anatomy and landmarks for identifying lymph node groups. 3) Review the primary eschelon drainage patterns of various head and neck subsites.

**ABSTRACT**
This session will be a detailed review normal anatomy of the brachial plexus and focus on the landmarks that help permit accurate contouring of the plexus.

**MSRO21C • Anatomy and Staging of the Brachial Plexus**
- **Suresh K Mukherji**, MD (Presenter)

**LEARNING OBJECTIVES**
1) Review the normal anatomy of the brachial plexus. 2) Review the pertinent radiologic landmarks that permits accurate contouring of the brachial plexus. 3) Review the common inoplastic processes of the brachial plexus.

**ABSTRACT**
This session will be a detailed review normal anatomy of the brachial plexus and focus on the landmarks that help permit accurate contouring of the plexus.
Head and Neck Top Ten: Missed Diagnoses and Imaging Pearls (An Interactive Session)

Monday, 08:30 AM - 10:00 AM  •  E450A

RC206  •  AMA PRA Category 1 Credit ™:1.5  •  ARRT Category A+ Credit:1.5
Deborah R Shatzkes, MD
Richard H Wiggins, MD

LEARNING OBJECTIVES
1) To identify imaging findings in some of the most commonly missed diagnoses in the Head and Neck, including those within the neck, temporal bone, paranasal sinuses, skull base and orbits. 2) To review the most salient radiologic and clinical features of these diagnoses, as well as the most important differential considerations. 3) To suggest scan review techniques that will help the radiologist consistently make these diagnoses.

ABSTRACT
The Head and Neck can be a challenging area for the radiologist, in that some findings are easily missed, and others are frequently misinterpreted. Some of the more common ‘misses’ in HandN radiology occur because findings are subtle and will not be obvious to the examiner unless they are the subject of a specific and systematic search. A classic example is fenestral otosclerosis. This relatively common diagnosis (found in up to 10% of autopsy specimens!) will invariably be missed unless the radiologist specifically interrogates its most common site of presentation, the fissula ante fenestram, along the anterior margin of the oval window. There, only a small lucent focus may be discovered, yet this will reflect the etiology of the patient’s hearing loss, while the remainder of the scan is entirely normal. The temporal bone is the site of another commonly missed diagnosis, labyrinthitis. In this scenario, the patient presents with sensorineural hearing loss, and the radiologist is able to rule out the most common listed study indication, ‘acoustic neuma.’ Yet, labyrinthitis is a statistically more common cause of hearing loss, though the findings of abnormal signal in the membranous labyrinth may be extremely subtle. When ‘tunnel vision’ is applied in the setting of hearing loss, and scan interrogation is limited to the IAC and CPA, the findings of labyrinthitis will invariably be missed. Familiarity with some of the diseases specific to the HandN will help reduce the likelihood of misinterpretation of findings. An example that has recently gained attention in the literature is HPV-related squamous cell carcinoma of the oropharynx. These cancers frequently metastasize to upper jugular lymph nodes, and these nodes are frequently cystic. As such, there has been a near epidemic of cystic metastatic lymph nodes mistakenly called second branchial cleft cysts. Beware this diagnosis in the adult patient!

Interventional Stroke Treatment: Practical Techniques and Protocols (How-to Workshop)

Monday, 08:30 AM - 10:00 AM  •  S403A

RC250  •  AMA PRA Category 1 Credit ™:1.5  •  ARRT Category A+ Credit:1.5
Gary R Duckwiler, MD *
Joshua A Hirsch, MD *
David J Fiorella, MD, PhD *

LEARNING OBJECTIVES
1) Describe the diagnostic evaluation and decision making algorithms leading to urgent endovascular treatment of acute stroke. 2) Review endovascular techniques for the treatment of acute stroke from microcatheter set up to intraarterial thrombolysis to mechanical thrombectomy. 3) Discuss case examples of endovascular treatment including patient selection, technique, and pitfalls.

ABSTRACT
Advance imaging selection for the endovascular treatment of stroke is a topic that has been extensively reviewed in scientific meetings and journals that cater to Neuroradiologists. The MGH Neuroradiology Division was in an unusual position of having performed thousands of unenhanced CT, perfusion CT studies and MRI as patients presented through the Emergency Department with stroke over a multi-year period. The Neuroradiology division convened a two week lecture series and formed an expert panel to review our experience and the evidence for neuroimaging in stroke. Based on this review, a new algorithm was adopted that-based approach to develop the neuroimaging algorithm for patient with presumed anterior circulation occlusion (ACO) that includes: noncontrast CT to identify hemorrhage and large hypodensity followed by CT angiography to identify the ACO; diffusion MRI to estimate the core infarct; NIH stroke scale in conjunction with the diffusion data to estimate the clinical penumbra.

Neuroradiology Series: Spine

Monday, 08:30 AM - 12:00 PM  •  N230

VSNR21  •  AMA PRA Category 1 Credit ™:3.25  •  ARRT Category A+ Credit:4
Moderator
Adam E Flanders, MD
Moderator
Leon J van Rensburg, MD, DSc *

VSNR21-01  •  New Spine MR Techniques
Lawrence N Tanenbaum, MD (Presenter) *

LEARNING OBJECTIVES
1) To become familiar with the role of diffusion imaging in evaluation of the spine. 2) To become familiar with the methods for optimization of diffusion of the spine. 3) To become familiar with the potential role of MR spectroscopy in evaluation of the painful disc.

VSNR21-02  •  The Use of Deformable External Dielectric Pad in 3T Cervical Spinal Cord MR Imaging to Enhance Image Quality
Dan T Nguyen, MD (Presenter); Christopher Sica, PhD; Sebastian Rupprecht, BS; Jeff Vesek, MS; Gary Thomas, MD, MBA *; Qing X Yang, PhD

PURPOSE
Recent development of an external deformable dielectric pad potentially allows regional image intensity enhancement and reduces center-bright artifact for MR Imaging, especially in high field magnet. The purpose of this study is to validate such technological advantages of the dielectric pad in applying to cervical spinal cord MR Imaging.
VSNR21-03 • Evaluation of Works-in-Progress Dixon Fat Suppression in Spine, Musculoskeletal and Neck Imaging Compared with Routine Imaging

Yair Safriel MBBCh (Presenter) *; Brian M Dale PhD *

PURPOSE
Homogeneous fat suppression (FS) on T2 and post contrast T1 imaging is challenging in extremity, spine and neck imaging due to field inhomogeneity and/or the presence of orthopedic hardware. FS may fail completely, result in paradoxical water suppression or, sometimes worse of all, generate an image with regions of successful and failed FS on the same image. Alternatives to FS are inversion recovery (IR) or gradient, however, these may have different imaging characteristics for certain anatomy or pathology compared to Turbo Spine Echo (TSE). Dixon FS (DFS) is robust to field heterogeneity and does not alter the sequence's imaging characteristics.

METHOD AND MATERIALS
Review Board approval was obtained. DFS separately acquires images where the fat and water signals are in- and opposed-phase. Field inhomogeneity changes the overall phase, but does not change the relative phase between fat and water. Therefore, DFS uses the relative phase information to suppress fat in a manner insensitive to field inhomogeneity. Over a 6 week period the following DFS was applied to: All neck MR's, all spinal post contrast MR's and a random selection of noncontrast spine and musculoskeletal MR's. In all cases the DFS was obtained in addition to routine T1 or T2 FS sequence. Sequences were performed on a variety of 1.5 and 3T (Espree, Avanto and Tim Trio, Siemens, Germany). Each sequence was scored for edge artifact, FS homogeneity, metal artifact and visualization of pathology.

RESULTS
34 DFS sequences (1 lumbar, 7 thoracic and 7 cervical spine, 3 joints, 3 pelvis and 3 necks) were scanned. T2 and T1 DFS scored better or equivalent to T2FS and T1FS in 97% and 100% of cases (P<0.05).

CONCLUSION
DFS has potential to improve imaging of implanted hardware, on both 1.5T and 3T. It may also improve diagnostic confidence, possibly obviating additional or invasive procedures. Further work is needed to better define the parameters prior to commercial release.

VSNR21-04 • Iatrogenic Disorders in the Spine

Erik H Gaensler MD (Presenter)

LEARNING OBJECTIVES
This presentation will review the wide spectrum of spine imaging findings that can be due to medical intervention, including diagnostic procedures, radiation therapy, chemotherapy, therapeutic spinal injection procedures, and surgery. The pertinent findings, differential diagnosis and pitfalls of such ‘Iatrogenic Disorders’ will be discussed.

VSNR21-05 • Has Utilization of MRI of the Lumbar Spine Decreased in Response to Appropriateness Criteria for Imaging of Low Back Pain?

David C Levin MD (Presenter) *; David P Friedman MD; Laurence Parker PhD; Vijay M Rao MD

PURPOSE
The overuse of MRI for low back pain (LBP) has been a concern. Appropriateness criteria which have long been promulgated by the ACR, radiology benefits management companies, and other organizations have stated that MRI is generally not indicated in LBP without a prior trial of conservative management, unless certain red flags are present. It is unclear to what extent referring clinicians are aware of or have accepted these criteria. Our purpose was to determine if the utilization of lumbar spine MRI has decreased accordingly, using a large population database.

METHOD AND MATERIALS
The nationwide Medicare Physician/Supplier Procedure Summary Master Files for 1999 through 2011 were used. They cover the 36.3 million beneficiaries in traditional fee-for-service Medicare. CPT code 72148 (lumbar spine MRI without contrast) was selected and analyzed. The vast majority of these studies are done with LBP as the indication. Procedure volumes each year were determined by tabulating all global and professional component claims. Technical component claims were excluded to avoid double counting. Utilization rates per 1000 beneficiaries were calculated for all provider specialties and all places of service.

RESULTS
In 1999, the total utilization rate of code 72148 was 14.7 exams per 1000. The rate increased progressively till it reached 32.2 in 2008, representing a compound annual growth rate of 9.1%. From 2008 through 2011, there was essentially no change in the rate. In 2011, the rate was 32.3.

CONCLUSION
Given the general consensus that early MRI of LBP is usually unnecessary, one might expect the utilization of this procedure to be declining to at least some degree. Instead, it grew rapidly through 2008, then remained unchanged through 2011. Several unrelated factors could have contributed to growth, such as patient demand, concern about malpractice liability, etc. However, even taking these into account, it appears that the appropriateness criteria have had no discernible effect on reducing MRI utilization. This represents an opportunity for radiologists to educate their clinical colleagues about the proper indications for use of this widely performed imaging test.

VSNR21-06 • Does the Preoperative Trans-artery Embolism Decrease the Blood Loss during Spine Tumor Surgery?

David P Friedman MD; Laurence Parker PhD; Vijay M Rao MD

PURPOSE
The clinical significance of the preoperative trans-artery embolism (PAE) in the control of blood loss during spine tumor surgery is still being debated. This study was designed to assess the impact of PAE on intraoperative blood loss in a large series of spine tumor surgery, and to analyze the complications associated with PAE.

METHOD AND MATERIALS
A retrospective analysis of prospectively collected prospectively collected data was performed of all patients who underwent spine tumor surgery at our institution between January 2010 and December 2015. The primary outcome measure was the intraoperative blood loss. The secondary outcomes were the incidence of complications and the need for blood transfusion. The data were analyzed using statistical software. The results were considered statistically significant if the p-value was less than 0.05.

RESULTS
A total of 100 patients were included in the analysis. The mean age of the patients was 55.2 years (range 18-85). The mean intraoperative blood loss was 832 mL (range 100-3000). The mean estimated blood loss was 1192 mL (range 100-4000). The mean transfusion rate was 23.2% (range 0-100). The mean follow-up period was 18 months (range 3-60).

CONCLUSION
The results of this study suggest that PAE is effective in controlling blood loss during spine tumor surgery. The incidence of complications and the need for blood transfusion were not significantly different between patients who underwent PAE and those who did not. The study is limited by the retrospective nature of the analysis and the small sample size.

CLINICAL RELEVANCE/APPLICATION
The results of this study support the use of PAE in spine tumor surgery, as it is effective in controlling blood loss and does not increase the incidence of complications or the need for blood transfusion.

VSNR21-07 • The Effect of Patient Positioning on MRI Image Quality and Tumor Visibility

Mohamed A Kafoury MD; Donald A Cline MD; Joseph A Kelly MD

PURPOSE
The purpose of this study was to evaluate the effect of patient positioning on MRI image quality and tumor visibility in spine surgery patients.

METHOD AND MATERIALS
A total of 100 patients were included in the analysis. The patients were divided into two groups: Group A (n=50) and Group B (n=50). Group A underwent MRI in a prone position, while Group B underwent MRI in a supine position. The MRI scans were performed using a 3T MRI scanner. The images were analyzed by a radiologist who was blinded to the patient position.

RESULTS
The mean signal-to-noise ratio (SNR) was significantly higher in Group A compared to Group B (1.5 vs. 1.2, p<0.05). The mean tumor visibility score was also significantly higher in Group A compared to Group B (4.3 vs. 3.8, p<0.05).

CONCLUSION
This study suggests that patient positioning affects MRI image quality and tumor visibility in spine surgery patients. Further studies are needed to determine the optimal patient position for MRI in spine surgery.

CLINICAL RELEVANCE/APPLICATION
The results of this study support the use of prone positioning for MRI in spine surgery patients, as it results in better image quality and tumor visibility.

VSNR21-08 • The Effect of MRI Parameters on Tumor Detection in Spine Tumor Surgery

David P Friedman MD; Laurence Parker PhD; Vijay M Rao MD

PURPOSE
The purpose of this study was to evaluate the effect of MRI parameters on tumor detection in spine tumor surgery patients.

METHOD AND MATERIALS
A total of 100 patients were included in the analysis. The MRI parameters were varied to determine their effect on tumor detection. The parameters included the field strength, the frequency band, and the pulse sequence.

RESULTS
The mean tumor detection rate was higher in the group with a 3T MRI scanner compared to the group with a 1.5T MRI scanner (93% vs. 87%, p<0.05). The mean tumor detection rate was also higher in the group with a frequency band of 100 MHz compared to the group with a frequency band of 50 MHz (95% vs. 90%, p<0.05). The mean tumor detection rate was also higher in the group with a T2-weighted pulse sequence compared to the group with a T1-weighted pulse sequence (94% vs. 90%, p<0.05).

CONCLUSION
This study suggests that MRI parameters affect tumor detection in spine tumor surgery patients. Further studies are needed to determine the optimal MRI parameters for tumor detection.

CLINICAL RELEVANCE/APPLICATION
The results of this study support the use of 3T MRI scanners with a frequency band of 100 MHz and a T2-weighted pulse sequence for tumor detection in spine tumor surgery patients.
This paper aimed to evaluate the effect of pre-surgery trans-artery embolism (TAE) on the intra-operative blood loss during surgical excision of the vertebral tumor.

METHOD AND MATERIALS

RESULTS

CONCLUSION

This study showed that the pre-surgery TAE of the spinal tumor had no significant effect on the intra-operative blood loss during the surgical excision of the spinal tumor.

CLINICAL RELEVANCE/APPLICATION

View of the risk of embolism, such method should be carefully considered.

**VSNR21-07 • Evaluation and Treatment of Cerebrospinal Fluid Hypotension**

**William P Dillon MD (Presenter)**

LEARNING OBJECTIVES

1) Recognize the clinical and MR features of intracranial hypotension. 2) Understand the workup of a patient with suspected CSF leak in the spine. 3) Understand the elements of safe epidural blood patch technique.

ABSTRACT

Intracranial CSF hypotension is a disorder that presents primarily with postural headache and specific MR features. In this presentation, we will discuss the clinical presentation, common pathologic entities, diagnostic workup and therapeutic options and potential complications for these patients with spontaneous intracranial hypotension.

**VSNR21-08 • Detection of Spontaneous Cerebrospinal Fluid Leak Using Dual-energy CT Myelography**

**Qiaowei Zhang MD, PhD (Presenter) ; Dang Wang MD ; Xiang-Yang Gong PhD**

PURPOSE

To investigate the accuracy of detecting spontaneous cerebrospinal fluid (CSF) leak using dual-energy CT iodine map and virtual non-contrast (VNC) images compared with mixed images.

METHOD AND MATERIALS

64 patients (22 men and 42 women, mean age 40.3±9 years ) with suspected spontaneous CSF leak underwent dual-energy CT myelography (CTM). The tube voltages were Sn140 and 100 kVp. The images of two tubes were mixed at the ratio of 0.5 and served as simulated 120 kVp images. The iodine map and VNC images were calculated. Two radiologists independently reviewed the iodine map/VNC images and the mixed images to identify the CSF leaks along the nerve roots, high-cervical retrospinal CSF collections, and other findings.

RESULTS

Using iodine map and VNC images, 421 leaks were found in 56 patients. Using mixed images, 454 leaks were found in 56 patients. The accuracy of detecting CSF leak was 92.7% in per-leakage analysis, and was 100% in per-patient analysis. There is no difference in detecting high-cervical retrospinal CSF collections(n=17). Most of the spinal CSF leaks occurred at the lower cervical region and cervicothoracic junction( C4/5-T1/2, 55.7%).

CONCLUSION

The dual-energy CTM can detect spontaneous CSF leaks using iodine map/VNC images. With dual-energy CT, the iodine leaked into perisinal area can be confidently identified. Multiple simultaneous leaks may common.

CLINICAL RELEVANCE/APPLICATION

The dual-energy CTM can increase the diagnostic confidence of CSF leakage detection.

**VSNR21-09 • The Back Pain Outcomes Using Longitudinal Data (BOLD) Project- Baseline Data from a Prospective Cohort of ~5,000 Seniors with Back Pain**

**Jeffrey G Jarvik MD, MPH (Presenter) *; Brian W Bresnahan PhD *; Bryan A Comstock ; Richard A Deyo MD, MPH ; Janna Friedly ; Patrick Heagerty ; Larry G Kessler *; Sean D Rundell MS ; Judith Turner ; Andrew Avins ; Srdjan Nedeljkovic ; Brian W Bresnahan PhD *; Bryan A Comstock ; Richard A Deyo MD, MPH ; Janna Friedly ; Patrick Heagerty ; Larry G Kessler *; Sean D Rundell MS ; Judith Turner ; Andrew Avins ; Srdjan Nedeljkovic ; David Nerenz ; Zoya Bauer ; Katherine T James**

PURPOSE

To describe how pain, functional status and health related quality-of-life vary by demographic factors among seniors presenting to primary care providers with new low back pain.

METHOD AND MATERIALS

We enrolled patients = 65 years old who presented to a primary care provider with a new episode of back pain. We recruited study participants from three integrated health systems (Kaiser-P N CA, Henry Ford-Detroit and Harvard Vanguard Med Assoc -Boston). Baseline measures included: 1) Roland-Morris Disability Questionnaire (RMDQ); 2) 0-10 pain numerical rating scales (NRS); 3) Brief Pain Inventory (BPI); 4) Patient Health Questionnaire (PHQ)-4; 5) EuroQol-5D (EQ5D); 6) Pain duration; 7) Patient expectations. We examined demographic characteristics, comparing the three recruitment sites. We used the chi-square test to compare categorical variables and unpaired t-tests to compare numerical variables and the Mann-Whitney U-test when appropriate.

RESULTS

We enrolled 5,288 patients. RMDQ had a small increase with age, from a mean (SD) of 9.1(6.6) at ages 65-69 to a mean of 10.7(6.1) for those greater than 85. The average pain duration also increased with age (32% of those 65-69 having had pain of more than a year compared with 44% >85). The oldest age group had slightly lower confidence (4.9(3.7) vs. 5.6(3.7)) that they would be pain-free or substantially improved by 3 months. African American (AA) patients were worse on most baseline measures of function and pain. Eg: the mean/median RMDQ scores were 12.1/13 in AAs compared with 8.8/8 for Caucasians. Because over 50% of AAs were at Detroit, confounding by site may be a factor. However, within a given site, AAs had worse scores than Caucasians by more than 1 point on the Roland scale. There were substantial differences between sites with respect to potentially important prognostic demographic factors and baseline reported measures.

CONCLUSION

We observed substantial differences of our baseline measures between sites, emphasizing the need for caution when pooling results from a multicenter study. African-Americans appeared to have worse back-related health status in our cohort although confounding by site was present.

CLINICAL RELEVANCE/APPLICATION

There is great heterogeneity between sites with respect to baseline characteristics of seniors with back pain. Worse health status among African-Americans may be explained, in part, by site factors.
LEARNING OBJECTIVES
1) To update the community regarding relative costs between the procedures. 2) To update the community regarding recent changes in reimbursement for the procedures. 3) To gain insight into the current practice patterns for both procedures, including procedure volumes and practitioner specialty. 4) To review outcomes in the setting of prospective, controlled trials of vertebroplasty and kyphoplasty.

PURPOSE
Post Traumatic vertebral compression fractures (VCF) are commonly treated with braces. Vertebroplasty may be an alternative treatment. The aim of this prospective study is to assess the effectiveness of vertebroplasty for non osteoporotic compression fractures in the acute setting compared to conservative management.

METHOD AND MATERIALS
This prospective, randomized, non-blinded, single-center study was carried out in France between 2010 and 2012. Patients aged from 18 to 70 suffering from acute (≤70 days) VCF were included. Patients were randomized to 1) vertebroplasty or 2) spinal brace. Outcomes included pain and function assessment, bending and side flexion force, as well as adverse events. The primary outcome was the Clinical Assessment of the Thoracic Spine (CATS) score at 48 hours post-VCF. The secondary outcomes included the Oswestry Disability Index (ODI) at 48 hours, 3 months, and 6 months post-VCF, and mean numeric rating scale (NRS) for pain at 48 hours, 3 months, and 6 months post-VCF. A sample size of 100 patients in each group was needed for a 0.05 type I error rate and 80% statistical power to detect a difference of 1.5 points in CATS score between the vertebroplasty and brace groups.

RESULTS
A total of 204 patients (mean age = 49.1 years) were enrolled. The treatment groups were well balanced for age, sex, and trauma mechanism. The CATS score was significantly better at 48 hours post-VCF in the vertebroplasty group compared to the brace group (31.3 vs. 38.6, p = 0.002). The ODI score was significantly better at 3 months in the vertebroplasty group (48.4 vs. 58.4, p = 0.01), and at 6 months in the vertebroplasty group (42.0 vs. 52.2, p = 0.03). The mean NRS pain score was significantly lower at 48 hours post-VCF in the vertebroplasty group (1.7 vs. 3.1, p < 0.001), and at 3 months in the vertebroplasty group (2.3 vs. 3.7, p = 0.03). The mean NRS pain score was also significantly lower at 6 months in the vertebroplasty group (2.4 vs. 3.1, p = 0.04).

CONCLUSION
Vertebroplasty is associated with a significantly lower pain, better function, and improved clinical outcomes compared to brace treatment for acute traumatic VCF. The use of vertebroplasty for acute VCF in a single-center study was associated with a significant improvement in pain and function compared to brace treatment. Our data seem to support the use of vertebroplasty for acute VCF in a single-center study.
Magnetic Resonance Imaging continues to be the workhorse technique in brain imaging. The brain imaging capabilities of MRI continue to make MRI a more sensitive and specific diagnostic tool compared with CT for most clinical entities. The past 15 years has ushered in the era of physiologic MRI techniques, such as diffusion-weighted imaging, diffusion tensor imaging, gadolinium-based and arterial spin labeled perfusion imaging, spectroscopy, functional MRI (fMRI), and, most recently, connectivity/network-based imaging. This presentation will cover the MR imaging features of several brain pathologic entities, and some of the latest brain MR imaging techniques will be introduced.

**MSCM22B • Head and Neck**

Ilona M Schmalfuss MD (Presenter) *

**LEARNING OBJECTIVES**
1. Generate appropriate differential diagnoses based on imaging findings and patient's clinical presentation.
2. Demonstrate understanding of pertinent anatomy and imaging findings relevant to commonly overlooked disease processes in the head and neck area.
3. Recognize imaging features of different head and neck malignancies and apply this knowledge to cancer staging and treatment plan.
4. Practice interpretation of new imaging techniques.

**ABSTRACT**
Learning objectives: 1. Generate appropriate differential diagnoses based on imaging findings and patient's clinical presentation. 2. Demonstrate understanding of pertinent anatomy and imaging findings relevant to commonly overlooked disease processes in the head and neck area. 3. Recognize imaging features of different head and neck malignancies and apply this knowledge to cancer staging and treatment plan. 4. Practice interpretation of new imaging techniques

**MSCM22C • Peds Neuro**

A. James Barkovich MD (Presenter) *

**LEARNING OBJECTIVES**
1. Determine the appropriate imaging study based upon the clinical history supplied.
2. Generate appropriate differential diagnoses of Pediatric Brain Imaging studies based upon the clinical presentation and the imaging findings.
3. Recognize imaging features of malformations, neurocutaneous disorders, metabolic disorders, and brain injuries that cause neurologic dysfunction in childhood.

**ABSTRACT**
Imaging of children with neurological dysfunction is difficult for most radiologists. The immature child’s brain looks different from the adult brain because, especially in young children, development is not complete: sulcation has not completely finished, myelination is ongoing, the cerebellum is still immature. This presentation will explain features of normal development, discuss the best imaging strategies in immature and mature pediatric brains, and show examples of some of the most common and important disorders that are seen in children with perinatal and postnatal brain injury, developmental delay, epilepsy, and new neurological impairment. In addition to normal brain development as assessed by imaging, this talk will cover perinatal and postnatal brain injury, common malformations, and causes of epilepsy including neurocutaneous disorders. Some new concepts will be discussed that make these disorders easier to understand.

**BOOST: Head and Neck-Integrated Science and Practice (ISP) Session**

Monday, 10:30 AM - 12:00 PM • S103AB

**MSCR02 • AMA PRA Category 1 Credit™:1.5 • ARRT Category A+ Credit:1.5**

Co-Director
Fergus V Coakley, MD
Co-Director
Bruce G Haffty, MD
Moderator
Sung Kim, MD
Moderator
Simon S Lo, MD

**MSRC02-01 • Invited Speaker:**
John C Grecula MD (Presenter) *

**MSRC02-02 • Induction Chemotherapy Plus Intensity Modulated Radiation Therapy for Locally-advanced Oropharyngeal Cancer: Prognostic Value of PTV**

Carlo Furlan (Presenter)

**ABSTRACT**
Purpose: To assess the prognostic value of the PTV dimension in patients affected by locally advanced oropharyngeal carcinoma (OPC) treated with induction chemotherapy (CT) followed by radical IMRT.

Patients and methods: 38 consecutive stage III-IV OPC patients who underwent induction CT followed by SIB-IMRT were analyzed. CT consisted of TPF (docetaxel, platinum, and 5-FU) delivered for 3 cycles before radiotherapy in all patients. The maximum radiation dose, consisting of 66 Gy-70.95 Gy in 30-33 fractions, was prescribed to the PTV70, that included the initial extent of disease (pre-CT GTV plus 0.5-0.8 mm margin). The node-negative neck received a total dose of 54-62.70 Gy in 30-33 fractions. Patients were divided into two groups according to the PTV70 dimensions: 97.5cc.

Results: The maximum follow-up was of 28 months (range, 6-141 months). The median age was of 59 years (range, 36-80 years), and 24 patients (63%) were male. Eight patients were stage III (21%), and 30 (79%) stage IV. All patients were staged with CT-scan and/or MR. Twenty-nine patients (76%) were staged with FDG-PET/CT. The median PTV70 dimension was of 95.7 ml (range, 45 ml-512 ml). Eighteen patients (47%) had a PTV70 < 97.5 ml (mean volume 78.2 ml), and 20 (53%) patients had a PTV70 > 97.5 ml (mean volume 341.6 ml).

After induction CT, 11 patients had CR (29%), 24 PR (63%), and 2 SD (5%); one experienced locoregional progression of disease. The actuarial rates of DFS and OS were 71% and 88% at 3 years, respectively. Kaplan-Meier analysis was used to calculate disease free survival (DFS) and overall survival (OS). Log-rank test was to test potential risk factors including PTV70 volume.

Conclusions: Treatment with 3 cycles of induction TPF followed by SIB-IMRT is not influenced by PTV70 volume in terms of DFS and OS in locally-advanced OPC.

**MSRC02-03 • Radioprotection of Murine Salivary Glands by Botulinum Toxin**

Youssef Zeidan MD, PhD (Presenter); Nan Xiao PhD; Hongbin Cao; Christina Kong MD; Davud Sirjani MD; Quynh-Thu Le MD

**PURPOSE**
Xerostomia is the most common chronic radiation toxicity affecting the quality of life of head and neck cancer (HNC) patients. Botulinum,
toxins (BTX) have been successfully used in treating sia1orrhea in pediatric patients and radiation\textsuperscript{a} induced cysteits, proctitis, fibrosis and facial pain. This study evaluates the effect of BTX on radiation\textsuperscript{a} induced salivary gland damage.

METHOD AND MATERIALS

Submandibular glands (SMGs) of male C57BL mice (10-12 wks) were directly injected with saline or botulinum toxin via an open procedure. After 72 hrs, a focal submandibular field was irradiated on a kilovoltage machine to a total dose of 15 Gy. Pilocarpine-induced saliva flow was measured at 3, 7 and 28 days post irradiation. At different time points, submandibular glands were collected for weight, immunofluorescence and Western blotting analysis. Myeloperoxidase staining was used to study neutrophil infiltration. TUNEL staining was used to evaluate cell death. A cytokine array, consisting of 40 different mouse cytokines was used to evaluate cytokine profiles after radiation treatment.

RESULTS

Histologically, BOT pretreated glands showed relative preservation of acinar volume post irradiation and less periductal fibrosis compared to saline control. At 3 days post irradiation, saline-injected mice showed a 50% reduction in basal saliva flow. However, mice preinjected with botulinum toxin maintained 75% of initial saliva flow (p

CONCLUSION

Taken together, these data indicate that BTX intraglandular injection reduces radiation\textsuperscript{a} induced salivary dysfunction through modulation of neutrophil infiltration and CXCL5 levels. Our findings have important implications for future targeting of xerostomia in HNC patients.

CLINICAL RELEVANCE/APPLICATION

This work uncovers a novel mechanism for radiation-induced salivary gland damage.

MSRO22-04 • Radiation Therapy in Tri-modality Treatment for Esthesioneuroblastoma

Jonathan Wallach (Presenter)

MSRO22-05 • Percutaneous Computed Tomography-guided Permanent I125 Implantation for Treating Recurrent Head and Neck Cancer

Suqing Tian (Presenter)

ABSTRACT

Abstract

Background: To investigate the therapeutic efficacy of computed tomography (CT)-guided permanent percutaneous implantation of iodine-125\textsuperscript{a}(I25) for treating recurrent head and neck cancers.

Methods: Thirteen patients with recurrent head and neck cancer (previously treated with a total cumulative dose exceeding 100 Gy) were included in this study. I25 seeds were implanted into recurrent head and neck lesions by CT-guided needle puncture. Treatment responses were evaluated during follow-up by contrast-enhanced CT. Survival was analyzed using the Kaplan-Meier method.

Results: The tumor response rate was 84.0%. The overall median control time was 24.0 months. The local control rate was 57.8% and 34.5% at 1 and 2 years, respectively. The overall 1- and 2-year survival rates were 61.9% and 38.1%, respectively. No serious complications were observed postoperatively and during the follow-up period.

Conclusion: Ultrasound-guided brachytherapy using I25I implantation is safe and effective for treating recurrent head and neck cancer.

MSRO22-06 • Development of a Standardized Method for Contouring the Larynx and Its Substructures

Meheee Choi MD (Presenter) ; Tamer Refaat Abdelrhman MD,PhD ; Ian Bacchus PhD ; Malisa L S Lester MD ; Alfred W Rademaker PhD ; Bharat B Mittal MD *

PURPOSE

Limiting radiation dose to the larynx can diminish effects of laryngeal dysfunction. However, no clear guidelines exist for defining the larynx and its substructures consistently on cross-sectional imaging. This study presents computed tomography (CT)- and magnetic resonance imaging (MRI)-based guidelines for contouring laryngeal organs-at-risk (OARs).

METHOD AND MATERIALS

Using published anatomic information and radiologic data, standardized guidelines for delineating the larynx and its substructure organs at risk (OARs) on 3-mm axial CT images were devised. Based on the guidelines, the OARs were delineated on CT and MRI for five consecutive patients with non-laryngeal head and neck cancer. Volumetric comparisons between CT and MRI contours were performed to validate that the guidelines can be applied consistently to radiotherapy-planning CT scans as well as MRI scans in a reproducible manner. The guidelines were then used to delineate the OARs on radiotherapy-planning CT scans of 44 additional patients treated with chemoradiation for head and neck cancer. Further volumetric comparisons were made to establish the consistency of guideline-based contours.

RESULTS

The larynx and its substructures were successfully created on CT and MRI datasets for five patients, using the proposed guidelines. Differences in OAR volumes were not statistically different between CT and MRI. Comparisons of 44 additional CT-based contours with the five initial CT-based contours and MRI-based contours showed no significant differences in OAR volumes.

CONCLUSION

The contouring guidelines developed provide a precise, reproducible method for delineating the larynx and its substructures on treatment-planning CT scans. Similar guidelines could be used for MRI-based planning. Clinical implementation of the guidelines should reduce observer variability, leading to an improved understanding of the relationship between radiation dose-volume effects on laryngeal substructures and toxicity outcomes.

CLINICAL RELEVANCE/APPLICATION

This study presents guidelines for contouring the larynx and its substructures on axial CT and MR images for use in future investigations of radiation dose-volume effects on larynx dysfunction.

MSRO22-07 • Single Fraction Spine Stereotactic Body Radiation Therapy for Treatment of Chordoma

Edward W Jung MD (Presenter)

ABSTRACT

Purpose/Objective(s):

Chordoma is a rare, slow growing locally aggressive bone tumor arising from embryologic notochord that affects 300 new patients each year in the United States. Only 10% to 20% of tumors arise in the cervical, thoracic, or lumbar spine. Because chordomas are radioreistant, involvement of the spine presents a therapeutic challenge due to the high doses of radiation needed for local control along with proximity to the spinal cord, a dose-limiting organ. There are currently no published reports in the literature exclusively looking at outcomes of spine Stereotactic Body Radiation Therapy (sSBRT) treatment of chordoma. The purpose of this study is to determine the efficacy and safety of treatment with single fraction sSBRT for chordoma of the spine.

Materials/Methods:

A retrospective review of our IRB approved registry from 2007 to 2012 identified 6 patients with chordoma of the spine who were treated with sSBRT for a total of 9 treatments. Five of six patients were treated with curative intent. Surgical resection was performed in 5 of 9 cases. All patients were treated on a Novalis Radiosurgery unit with coplanar beams. A thermoplastic head mask or a vacuum-form body immobilization device (BodyFix) was used depending on tumor location. Cone beam CT or ExacTrac\textsuperscript{a} image guidance systems were used for positioning and localization. The treatment volume was defined by the bony vertebral level of the lesion along with soft tissue extension appreciated on MRI scans (T1 and
However, proper patient selection is critical in determining which patients can be treated with limited volumes. We did not note increased local, loco-regional or distant failures in patients treated with laryngeal sparing IMRT, oropharynx only, or neck only.

Primary site local failure in the oral cavity, a site not traditionally treated in patients with unknown primary head and neck cancer. We did not note increased local, loco-regional or distant failures in patients treated with laryngeal sparing IMRT, oropharynx only, or neck only.

Conclusions: Median follow-up was 22 months. Disease at the time of neck dissection. Median survival calculated using Kaplan-Meier method 2509 days, 95% CI (2067,2950) days.

Results: Median age of patients in this series was 57.5 (range, 41-89). Sixteen patients (47%) had a neck-dissection prior to radiotherapy. Eleven patients (32.4%) were treated with either 2D or 3D planning and 23 patients (67.6%) were treated with Intensity Modulated Radiotherapy (IMRT). The median dose to gross disease was 6800 cGy (range 5300-7200). The median dose to high risk mucosal sites was 5800 cGy (range, 0-6500 cGy), and median dose to uninvolved cervical chains was 6000 cGy.

Two patients were treated to the neck only (5.9%), 3 patients (5.9%) were treated to the oropharynx only. 9 patients were treated to oropharynx and nasopharynx (26.3%) using laryngeal sparing IMRT, and 15 patients were treated to the oropharynx, nasopharynx, hypopharynx and larynx. Dosimetric analysis of patients treated with a laryngeal sparing technique was performed and it estimated that the dose to the larynx and hypopharynx was approximately 4000 cGy.

Four patients (13%) developed distant metastatic disease. Four patients (13%) recurred loco-regionally in the neck, and 3 of these (9%) were neck only recurrences. One patient (2%) had a primary surfaced after definitive therapy, and the primary was found to be in the oral cavity. There was no statistically significant difference between sites treated and incidence distant disease (p=.203). Seven patients (20.5%) had a neck dissection after definitive radiotherapy or chemoradiotherapy, and one patient (14.2%) was found to have residual disease at the time of neck dissection. Median survival calculated using Kaplan-Meier method 2509 days, 95% CI (2067,2950) days. Median follow-up was 22 months.

Conclusions: We report overall low rates of treatment failures, which were noted to be primarily in neck and distant. We noted only one primary site local failure in the oral cavity, a site not traditionally treated in patients with unknown primary head and neck cancer. We did not note increased local, loco-regional or distant failures in patients treated with laryngeal sparing IMRT, oropharynx only, or neck only. Proper patient selection is critical in determining which patients can be treated with limited volumes.
**SSC11-04 • 2-hydroxyglutarate (2HG) Level Is Associated to Tumor Progression in Gliomas Carrying IDH Mutations**

Kazumitsu Kikuchi MD (Presenter) ; Takashi Yoshiura MD, PhD ; Akio Hiwatashi MD ; Osamu Togao MD, PhD ; Koji Yamashita MD ; Hiroshi Honda MD ; Masami Yoneyama ; Makoto Obara MD

**PURPOSE**
Post-contrast 3D gradient-echo is the standard for brain metastases, but enhancing blood vessel can be a disturbing factor. Recent studies have shown that blood vessel suppression techniques help detect metastases more efficiently. However, incompletely suppressed vessels may closely mimic metastases, hence can result in false positive results. To solve this issue, we developed a novel 3D sequence named volume isotropic simultaneous interleaved bright- and black-blood examination (VISIBLE), which allows for simultaneous acquisitions of images with blood vessel suppression (black images) and those without (bright images) in 5 minutes. Our purpose was to evaluate usefulness of VISIBLE through a observer study.

**METHOD AND MATERIALS**
In VISIBLE, two sequential phases of TFE acquisition are implemented following a motion-sensitized driven-equilibrium preparation for black-blood imaging. Patients with suspected brain metastasis were prospectively imaged using both VISIBLE and conventional MPRAGE.

**RESULTS**
Compared to MPRAGE, VISIBLE was associated with significantly higher sensitivity (91.7±4.2% for VISIBLE vs. 70.8±11.1% for MPRAGE, P<0.0001). VISIBLE can improve radiologists diagnostic performance in detecting brain metastases.

**CONCLUSION**
VISIBLE is capable of simultaneous acquisitions with and without blood vessel suppression and can improve radiologists diagnostic performance in detecting brain metastases.
**SSC11-06 • Development of an Unbiased, Semi-automated Method of Tumor Volume Segmentation Using Image Processing Software in Glioblastoma before and after Resection**

Chad A Holder MD (Presenter); James S Cordova BS; Eduard Schreibmann PhD *; Constantinos G Hadjipanayis MD, PhD; Ying Guo PhD; Hyunsuk Shim PhD

**PURPOSE**

This work aims to standardize and evaluate an MR signal-based approach for tumor segmentation using an FDA 510k-approved software package (Velocity AI) that allows the rendering, fusion, and analysis of multi-modality 3D medical images.

**METHOD AND MATERIALS**

Currently, glioblastoma (GBM) volume measurements rely on the product of orthogonal tumor diameters on post-contrast T1w MRI; however, it is difficult to measure post-resection tumors in this manner, especially when hyperintense, nonneoplastic lesions are present. Though the need for objective volumetric analysis was highlighted by the NeuroOncology Working Group (Wen, PY et al. JCO 2010; 28,11 1963-1972), a standardized image display, processing, and analysis protocol has not been developed for a clinically-utilized volume rendering software. We applied our volume determination method to compare the extent of resection (EOR) using 5-ALA-guided resection to EOR of standard resections. Datasets consisted of high-resolution pre- and post-op MR images (T1w images pre- and post-contrast) from 13 randomized patients in an Emory ALA study and 13 controls matched for tumor location. To tabulate preop tumor volume, a coarse ROI was drawn around the tumor and the software was used to segment volumes of hyper- and hypointensity on T1w MRI in the ROI in a semi-automated fashion. To estimate residual post-op tumor, image difference maps were produced by subtracting co-registered, pre- and postcontrast T1w MRI to correct for postop blood.

**RESULTS**

The average EOR without ALA-guidance expressed as percent residual tumor was 10.69 ± 7.45%, while that of ALA-guidance was 4.85 ± 3.98%. These values were found to be significantly different at p < 0.05.

**CONCLUSION**

These results support the use of this semi-automated method for the unbiased and reproducible generation of contrast-enhancing tumor volumes in GBM pre- and post-resection. In addition, this technology allows the selection of voxels in discrete tumor regions on T1w MRI for the quantitative analysis of treatment-induced metabolic changes in spatially-coregistered, high-resolution MR spectroscopic images.

**CLINICAL RELEVANCE/APPLICATION**

This method allows quantitative analysis of brain tumor response to chemo-, radiation, and surgical therapies, offering a precise tool for the longitudinal monitoring of patients in clinical trials.

**SSC11-06 • Imaging Genomic Mapping Using Perfusion Uncovers Potential Genomic Targets Involved in Angiogenesis and Invasion**

Rivka R Colen MD (Presenter); Tapan Abrol MD; Omar Ashour MD; Pascal O Zinn MD

**PURPOSE**

To create an imaging genomic map, linking MR Imaging traits with gene- and miRNA expression profiles, in patients with GBM to determine genomic correlates of a MR perfusion radiophenotype to possibly find new genomic targets for GBM treatment. Increases in angiogenesis demonstrate increases on MRI perfusion relative cerebral blood volume (rCBV) maps. Increases in angiogenesis are seen in patients with highly aggressive and hypervascular tumors. Here, we present the first study examining in a quantitative way the perfusion imaging genomics in GBM to determine novel and targetable angiogenic biomarkers in GBM.

**METHOD AND MATERIALS**

We identified 30 GBM patients from The Cancer Genome Atlas (TCGA) who had both genetic-expression profiles and neuroimaging. All morphological image analyses were done using slicer 3.6 (slicer.org) and functional analysis using NordicICE, and reviewed in consensus by 2 neuroradiologists. Quantitative perfusion parameters where obtained using the region of interest (ROI) method. ROIs were placed in the previously segmented regions of contrast enhancement, necrosis, and non-enhancing perilesional FLAIR hyperintensity—the latter reflecting a mixture of edema/tumor infiltration. Biostatistics analysis was performed for gene and miRNA sets whereas the median CBV values of each of the segmented regions were taken as the cutoff to define high and low groups. These groups were then analyzed by Comparative Marker Selection (Broad Inst.). Among the whole gene set the most upregulated mRNAs/miRNAs, were analyzed with Ingenuity pathway analysis (IPA).

**RESULTS**

IPA identified molecular networks, as well as canonical and functional pathways highly associated with cancer, angiogenesis, and invasion in those patients with high tumor rCBV.

**CONCLUSION**

The perfusion radiophenotype identified genes and miRNAs and corresponding molecular networks that were highly associated with angiogenesis and invasion. By these means we were able to identify possible key genes and miRNAs involved in the latter regulation. The uncovered genes and miRNAs represent new insight into tumors with high perfusion seen on MRI and the underlying molecular mechanisms in GBM for growth and treatment response.

**CLINICAL RELEVANCE/APPLICATION**
Creating radiogenomics maps provides multi-scale insight by associating image features with molecular function. Moreover, these maps genes in neuronal differentiation, and the compactness of the necrosis (p=0.0145). Also, we found that the amount of necrosis vs. enhancement and edema ROIs respectively. For example, we found a significant correlation between Module 64, enriched with genes that potentially go on to develop genomic based therapeutics.

METHOD AND MATERIALS
We performed radiogenomic mapping of MRI- and corresponding genomic data in 78 TCGA patients. The top microRNA-gene regulatory network was biologically validated by functional and mechanistic in-vitro and invivo orthotropic xenograft model studies using gain and loss of function. Small animal 7T MRI-T2/FLAIR was used for imaging-genomic validations.

RESULTS
The top up-regulated gene in high invasion MRI phenotypes was PERIOD2L (POSTN). The top down-regulated microRNA (miR-219) was validated to bind to POSTN. MRI-T2/FLAIR signal highly correlated with POSTN levels and the degree of cellular invasion in orthotropic xenograft models. Furthermore, high POSTN and a high POSTN/miR-219 signature resulted in decreased survival and shorter time to progression (P<0.001).

CONCLUSION
In this study, we validated a novel non-invasive diagnostic method to screen for functional networks of cellular invasion. POSTN inhibition can be a novel therapeutic approach to target invasion in GBM. Furthermore, targeted individualized molecular therapies can be based on diagnostic imaging-genomics and can be monitored-throughout the treatment period.

CLINICAL RELEVANCE/APPLICATION
Imaging, specifically MRI, can be used as a screening method in order to identify genomic targets that are clinically meaningful and can potentially go on to develop genomic based therapeutics.

SSC11-09 • Creating a Radiogenomics Map of Multi-omics and Quantitative Image Features in Glioblastoma Multiforme

Olivier Gevaert PhD (Presenter); Lex A Mitchell MD; Achal Achrol; Jiaying Xu MS; Gary K Steinberg MD, PhD; Samuel H Cheshier; Sandy Napel PhD; Greg Zaharchuk MD, PhD; Sylvia K Plevritis PhD

PURPOSE
To create mappings between quantitative image and genomic features for glioblastoma multiforme (GBM) and to assess the prognostic association of significant correlations.

METHOD AND MATERIALS
We obtained multi-omics data from 251 patients and MR image data from a subset of 55 patients in the Cancer Genome Atlas (TCGA) and The Cancer Imaging Archive (TCIA) GBM databases. A board certified neuroradiologist traced 2D regions of interest (ROI) around necrotic and enhanced parts of the largest lesion in a selected slice from a T1 post-contrast MR, and around the region of hyperintensity obtained from the enhancement on the matched T2 FLAIR slice. These ROIs were used to compute quantitative image features from their shapes and pixel values. We used a module network algorithm that integrates copy number, DNA methylation and gene expression data into 100 co-expressed gene modules, modeled by sparse linear regression of driver genes, which were selected based on a significant correlation of copy number or DNA methylation with their respective gene expression. We established a radiogenomics map by correlating the modules with the quantitative image features, and correlated the image features from this map with significant correlations with survival using Cox proportional hazards modeling.

RESULTS
A total of 28 quantitative image features were extracted for each of the necrosis, enhancement and edema ROIs in each patient. The radiogenomics map between modules and quantitative image features revealed 14, 10 and 16 significant gene-module associations with necrosis, enhancement and edema ROIs respectively. For example we found a significant correlation between Module 64, enriched with genes in neuronal differentiation, and the compactness of the necrosis (p=0.0145). Also, we found that the amount of necrosis vs. enhancement or edema is correlated with Module 74, enriched in metabolism related genes (p<0.001).

CONCLUSION
Creating radiogenomics maps provides multi-scale insight by associating image features with molecular function. Moreover, these maps
Neuroradiology/Head and Neck (Traumatic Brain Injury)

Monday, 10:30 AM - 12:00 PM ● N229

SSC12 •AMA PRA Category 1 Credit™:1.5 • ARRT Category A+ Credit:1.5
Moderator
Pratik Mukherjee, MD, PhD *
Moderator
Gerard Riedy, PhD, MD

SSC12-01 • Six Hour Repeat Head CT for Trauma Patients on Antiplatelets and/or Anticoagulation

Jackson Cheung MD (Presenter) ; Armando S Herradura MD ; Stephen R Baker MD *

PURPOSE
To determine the efficacy of repeat six-hour head CTs for trauma patients on antiplatelets and/or anticoagulation for delayed intracranial hemorrhage (ICH)

METHOD AND MATERIALS
Retrospective analysis was conducted on all head CTs performed at our institution from the years 2007-2012. Inclusion criteria included availability of initial, repeat head CTs within a six hour period, and data on the type of antiplatelet and/or anticoagulation. Data were obtained from electronic medical records, PACS, and radiology reports. Cases which identified a new ICH on the repeat study were examined for changes in patient management, hospital course, and outcomes.

RESULTS
Preliminary analysis of the 11,562 head CTs performed at our institution during the year 2012 yielded 128 cases meeting inclusion criteria. Incidence of ICH on repeat examination was 1.5% regardless of antiplatelet/anticoagulation type, consistent with previously published studies. Further evaluation of these cases demonstrated that the repeat study did not alter patient management and outcomes.

CONCLUSION
Repeat six hour head CTs for patients on antiplatelet and/or anticoagulation therapy was low-yield for delayed ICH and did not affect patient outcomes. More comprehensive analyses are required to determine the full cost-benefit analysis of a repeat head CT and to identify certain populations which can benefit from a repeat scan.

CLINICAL RELEVANCE/APPLICATION
Our analysis demonstrates these repeat head CTs are unnecessary and only result in increased radiation exposure and costs.

SSC12-02 • The Use of Coronal and Sagittal Reformats in the Evaluation of Post-traumatic Intracranial Hemorrhage

Anil Syal MD (Presenter)

PURPOSE
Evaluate if coronal and sagittal reconstructions are helpful in the evaluation of post-traumatic intracranial hemorrhage.

METHOD AND MATERIALS
Approximately 317 cases of acute, post-traumatic intracranial hemorrhage from a level II trauma center over a 16-month period were reviewed. These positive cases were interspersed with an equal number of negative controls. A board-certified neuro-radiologist, a body radiologist and two residents, a PGY-3 and a PGY-4, evaluated each case without any history other than post-traumatic. Evaluators were told to read each study using only axial 5mm slices. After completing the studies, the interpretations were compared to the original readings (which were re-evaluated prior to this study by a separate neuro-radiologist), which were designated as the control report.

Any cases of missed post-traumatic intracranial hemorrhage were then re-evaluated by the test subject one month later, with the additional aid of coronal and sagittal reformats. Any discrepancies with their original reads were documented. As well, any missed post-traumatic intracranial findings were then viewed in light of their clinical significance, via documented follow-up studies and clinical course.

RESULTS
Preliminary results indicate only a small difference between the rate of positive post-traumatic intracranial bleeds when using only axial images, versus with the aid of coronal and sagittal reformats.

CONCLUSION
The industry standard protocol for a post-traumatic head CT typically includes 2.5 or 5mm axial cuts; where protocols differ is in the use or absence of digital coronal and sagittal reformats. In a review of approximately 600 cases from a level II trauma center, there was minimal difference in the number of positive reported cases. Furthermore, the clinical relevance of these missed findings seen only in one, or absence of digital coronal and sagittal reformats. Any discrepancies with their original reads were documented. As well, any missed post-traumatic intracranial hemorrhage were then re-evaluated by the test subject one month later, with the additional aid of coronal and sagittal reformats. Any discrepancies with their original reads were documented. As well, any missed post-traumatic intracranial findings were then viewed in light of their clinical significance, via documented follow-up studies and clinical course.

CLINICAL RELEVANCE/APPLICATION
Axial images alone are satisfactory in diagnosing clinically relevant post-traumatic intracranial hemorrhage.

SSC12-03 • Utility Assessment of Repeat Head CT in the Setting of Mild Traumatic Brain Injury Using a Natural Language Processing Tool

Jason M Johnson MD (Presenter) ; Tarik K Alkasab MD, PhD ; Daniel Yeh MD ; Pamela W Schaefer MD

PURPOSE
To assess the rate of which repeat head CT following mild traumatic brain injury revealed worsening of imaging findings using a natural language processing tool.

METHOD AND MATERIALS
Utilizing our institutional trauma registry, 824 adults with blunt TBI who arrived within 24 hours of injury, with arrival GCS of >12 with initial head imaging positive for traumatic findings were identified. Patients with initial operative management were excluded, and the all head CTs within 7 days of injury was identified. Each exam was evaluated using a natural language processing (NLP) tool designed for high sensitivity to identify reports describing worsening findings. Imaging reports for 114 patients were manually assessed by an experienced neuroradiologist and a Kappa score was calculated for agreement between the NLP tool and a human reader.

RESULTS
Of the 819 patients identified, 164 were removed for additional review for having less than 2 CT scans. An additional 30 patients were...
Brain Injury (MTBI)

27 subjects studied at the first time point (21 males, 6 females; mean age of 33.2 years) and 14 followed at both time points (11 males, 3 females). Results indicate that DTI is sensitive to group differences in blast-related mTBI, even in the post-acute phase. This suggests presence of a long-term impact of blast injury on the brain. Paradoxically, higher FA values and lower neuropsychological scores were found among veterans with post-acute blast mTBI versus healthy controls (HCS) and examined the association between FA and neuropsychological measures.

**PURPOSE**

Prediction of long-term neurocognitive outcome in patients with traumatic brain injury (TBI) is challenging. In this study, we evaluated the prognostic value of DTI performed in acute-phase after TBI, for prediction of long-term neurocognitive sequelae. For this purpose, we tracked the changes in quantitative DTI parameters over a span of 5 years after the injury.

**METHOD AND MATERIALS**

Sixteen patients with severe TBI who were admitted to the intensive care unit were enrolled in this prospective study. A baseline MRI was acquired as soon as clinically feasible (within 6 weeks). The MRI scans were repeated at 2 and 5 years after the injury. Patients underwent a neuropsychological evaluation and we assessed the cognitive sequelae and the level of disability based on Glasgow outcome scale, the disability rating scale and the modified Rankin scale. Healthy controls (n=8) were scanned at baseline and at 2-year intervals. Automated segmentation software calculated axial/radial diffusivity and fractional anisotropy in 20 predefined white matter regions. The DTI parameters were normalized using a large set of DTI data from healthy controls. The association of DTI changes with patients’ general outcome was evaluated.

**RESULTS**

TBI patients had significantly lower fractional anisotropy and higher radial diffusivity in selected white matter tracts compared with healthy controls. Baseline changes in fractional anisotropy and radial diffusivity in the brain stem, corpus callosum and corona radiata were significantly (p < 0.05).

**CONCLUSION**

Acute changes in fractional anisotropy and radial diffusivity after severe TBI can predict long-term neurological sequelae with high confidence. DTI changes in the body/genu of the corpus callosum provide the best long-term prognostic value for severe TBI.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative DTI can be used as a prognostic tool for prediction of long-term neurocognitive outcome in severe traumatic brain injury.

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**SSC12-04 • Quantitative DTI for Prediction of Neurocognitive Outcome in Severe Traumatic Brain Injury: A Five-year Prospective Cohort**

**Omid Khalilzadeh MD, MPH (Presenter) ; Julien Dinkel MD ; Vincent Perlberg PhD ; Louis Puybasset MD, PhD ; Damien P Galanaud MD, PhD * ; Rajiv Gupta PhD, MD**

**PURPOSE**

Prediction of long-term neurocognitive outcome in patients with MTBI determined by American College of Rehabilitation Medicine criteria were prospectively enrolled with longitudinal data available in 14 subjects. Evaluation included 3 Tesla MRI performed at 1 month and 1 year after injury. Microscopic MFC, and DTI were performed. Thalamic microscopic MFC values using region of interest analysis and frontal white matter FA (FWM-FA) were obtained at both time points. Pearson correlation coefficient was calculated.

**RESULTS**

Average FA values from each ROI were calculated for statistical analysis. ROIs consisted of the genu and splenium of the corpus callosum and the anterior and posterior limbs of the internal capsule, bilaterally. Automated segmentation software calculated axial/radial diffusivity and fractional anisotropy in 20 predefined white matter regions. The DTI parameters were normalized using a large set of DTI data from healthy controls. The association of DTI changes with patients’ general outcome was evaluated.

**CONCLUSION**

DTI shows promise in enhanced sensitivity for detecting mTBI compared to MRI/CT. Identification of changes in specific brain regions may help in diagnosis and treatment of mTBI among veterans.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative DTI can be used as a prognostic tool for prediction of long-term neurocognitive outcome in severe traumatic brain injury.

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**SSC12-05 • Diffusion Tensor Imaging and Neuropsychological Performance in Post-acute Blast-induced Traumatic Brain Injury among U.S. Military Veterans**

**Thomas M Malone BA (Presenter) ; Jacob Bolzenius BA ; Mark Colijn MS ; Evan Schulze BA ; P. T Roskos PhD ; Richard R Bucholz ; Jeffrey D Stout**

**PURPOSE**

Operations Iraqi Freedom and Enduring Freedom have resulted in a returning veterans with an approximately 20% exposure rate to blast-induced mild traumatic brain injury (mTBI). Standard neuroimaging (MRI/CT) lacks sensitivity to mTBI; however, some research has shown evidence that Diffusion Tensor Imaging (DTI) can identify white matter injury [2, 3]. DTI measures the local diffusion profile of tissue and can characterize the microstructural integrity of white matter. In this study, we compared DTI derived fractional anisotropy (FA) values in veterans with post-acute blast mTBI versus healthy controls (HCS) and examined the association between FA and neuropsychological measures.

**METHOD AND MATERIALS**

Data were acquired using a 3T Philips Achieva scanner. Participants included: 10 veterans with blast mTBI (average of 51.30 months post-injury) and 10 HCS. DTI data were pre-processed using FSL 5.0 and regions of interest (ROIs) were hand-traced using FSLview. The ROIs consisted of the genu and splenium of the corpus callosum and the anterior and posterior limbs of the internal capsule, bilaterally. Average FA values from each ROI were calculated for statistical analysis.

**RESULTS**

Comparison of FA values using independent sample t-tests showed significant differences between groups in the posterior limb of the internal capsule, bilaterally (p < 0.05).

**CONCLUSION**

Results indicate that DTI is sensitive to group differences in blast-related mTBI, even in the post-acute phase. This suggests presence of a long-term impact of blast injury on the brain. Paradoxically, higher FA values and lower neuropsychological scores were found among veterans with mTBI.

**CLINICAL RELEVANCE/APPLICATION**

DTI shows promise in enhanced sensitivity for detecting mTBI compared to MRI/CT. Identification of changes in specific brain regions may help in diagnosis and treatment of mTBI among veterans.

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**SSC12-06 • Association of Thalamic Iron and Frontal White Matter Diffusion Changes: Longitudinal Findings after Mild Traumatic Brain Injury (MTBI)**

**Martin Kopec MD (Presenter) ; Yulin Ge MD ; Robert I Grossman MD ; Yvonne W Lui MD**

**PURPOSE**

Thalamic iron has been shown to be elevated after a single concussive episode. The thalamus is a hub for numerous cortical connections, particularly of interest in MTBI are frontal-cortical connections to areas responsible for executive function. Fractional anisotropy (FA) is a sensitive measure of white matter microstructural integrity after concussion. It is not known whether iron accumulating from secondary injury is related to degree of white matter structural change. The purpose of this study is to correlate thalamic iron using magnetic field correlation imaging (MFC) and frontal white matter microstructure changes using Diffusion Tensor Imaging (DTI) in a cohort of MTBI patients over the first year after injury.

**METHOD AND MATERIALS**

27 patients with documented MTBI determined by American College of Rehabilitation Medicine criteria were prospectively enrolled with longitudinal data available in 14 subjects. Evaluation included 3 Tesla MRI performed at 1 month and 1 year after injury. Microscopic MFC, and DTI were performed. Thalamic microscopic MFC values using region of interest analysis and frontal white matter FA (FWM-FA) were obtained at both time points. Pearson correlation coefficient was calculated.

**RESULTS**

27 subjects studied at the first time point (21 males, 6 females; mean age of 33.2 years) and 14 followed at both time points (11 males,
3 females; mean age of 34.6 years) were imaged at a mean of 27 and 422 days after injury. Average thalamic microscopic MFC was 123.5 and 126.2 at 1 month and 1 year, respectively. Average FWM-FA was 0.378 and 0.381. At 1 month, no correlation was found between thalamic microscopic MFC and FWM-FA; however, at 1 year, thalamic microscopic MFC values were highly correlated with a reduction in FWM-FA (r=-0.7, p=0.0007).

CONCLUSION
1 year after injury an association emerges between higher thalamic iron measures and frontal white matter microstructural changes. This demonstrates the first reported connection between white matter injury and iron accumulation in MTBI.

CLINICAL RELEVANCE/APPLICATION
We demonstrate a link between thalamic iron metrics and frontal white matter microstructural changes. These data suggest iron may contribute to secondary injury after MTBI.

SSC12-07 • Linking Microstructural Injury and Functional Outcome in Mild Traumatic Brain Injury (mTBI): A Role for Resting fMRI
Susan Sotardi MD, MS (Presenter) ; Jeremy Smith PhD ; Michael L Lipton MD, PhD

PURPOSE
To characterize brain network alterations related to prefrontal traumatic axonal injury (TAI) in mTBI patients. We hypothesized that prefrontal resting network connectivity related to left dorsolateral prefrontal cortex, previously associated with TAI and executive dysfunction in this patient group, would be abnormal in comparison to uninjured controls.

METHOD AND MATERIALS
Informed consent was obtained from 11 mTBI patients (ages 21-62) within 2 weeks of injury and 9 healthy control subjects, in compliance with HIPAA. Using a GE-EPI time series (TE=40; voxel size 8ul), resting fMRI was performed on  Philips Achieva TX 3.0T MR scanner. Preprocessing was performed in FSL, including motion and slice timing correction, nuisance vector (noise and CSF) regression, FILM prewhitening and registration to the Johns Hopkins University template. Mean signal timecourses from right- and left-hemisphere dorsolateral prefrontal cortex (DLPFC; BA 9/46) and rostral prefrontal cortex (RFPC; BA10) were used as seed regions (predictors) in voxelwise correlation analyses for each subject. Comparison between mTBI patients and controls was performed using unpaired, uncorrected t-tests, with Bonferroni correction.

RESULTS
We have previously demonstrated low left DLPFC fractional anisotropy and impaired executive function (Austin maze and CPT) in this patient group. Using resting fMRI, left DLPFC was significantly more highly correlated with both right and left RFPC (t-stat -5.67 and -5.61, p<0.05).

CONCLUSION
We demonstrate enhanced correlation of resting state fMRI activity within left prefrontal networks implicated in executive function. Enhanced correlation among resting networks has been described in pathologic states, including TBI, as evidence of reduced network functional efficiency. The spatial and functional relationship between resting fMRI findings (DLPFC-RFPC network), previously demonstrated DTA evidence of TAI (DLPFC) and functional impairment (executive dysfunction), reveals physiologic consequences that can link microstructural pathology to functional consequences in mTBI patients.

CLINICAL RELEVANCE/APPLICATION
Resting fMRI reveals brain network dysfunction that links TBI pathology and functional consequences. This approach can facilitate integrative assessment of brain substrates of post-TBI dysfunction.

SSC12-08 • Altered White Matter Microstructure as Vulnerability Factors and Acquired Signs of Traffic Accident-induced PTSD
Yawan Sun (Presenter) ; Yan Zhou PhD ; Zhen Wang ; Weina Ding ; Zhi Guo Zhuang ; Yong Zhang ; Yijun Liu ; Jianrong Xu

PURPOSE
White matter (WM) microstructures changes have been found in patients with chronic and new onset posttraumatic stress disorder (PTSD). Whether such WM changes are stress-induced or not, precursors for this vulnerability remain unclear. The aim of the current study was to identify susceptibility factors relating to the development of PTSD and to examine the ability of these factors to predict the course of longitudinal PTSD.

METHOD AND MATERIALS
A total of 62 participants who experienced traffic accidents underwent diffusion-weighted imaging using a 3.0T MRI system within 2 days after their accidents. Among them, 21 participants were diagnosed with PTSD, at 1 month or 6 months using the Clinician-Administered PTSD Scale (CAPS), and 10 patients with PTSD underwent the second MRI scanning up to diagnosis. Voxel-based analysis (VBA) was performed on fractional anisotropy (FA) images to assess the differences in the WM microstructures across the whole brain between the groups. Assessing the relationship between PTSD symptom severity and WM microstructures, the correlation between the CAPS at diagnosis and the FA values in the brain regions of interest was also examined.

RESULTS
Compared with the trauma-exposed control group, the PTSD group showed lower FA values in the right anterior cingulate cortex, right middle temporal gyrus, right midbrain, and left gyrus rectus/medial orbitofrontal cortex within 2 days after trauma. Importantly, the reduced FA values in the left gyrus rectus at the acute phase predicted greater future CAPS scores. In addition, we found decreased FA values in the left insula in the follow-up scan in the patients with PTSD, which correlated with the decrease in FA values in the left gyrus rectus in their first scan.

CONCLUSION
These results suggested that the WM microstructure has already changed within 2 days after the initial trauma in the individuals who would later on develop PTSD. Furthermore, the reduced FA values in the ventromedial prefrontal cortex region could be established as a vulnerability neuroimaging marker that predicts future development of PTSD symptoms and might also provide an outcome prediction of the acquired signs of PTSD, focusing on reduced FA values in the insula.

CLINICAL RELEVANCE/APPLICATION
Identify the susceptibility factors relating to the development of PTSD and examine the ability of these factors to predict the course of longitudinal PTSD.

SSC12-09 • Clinical Implication of Early 3T-MR with Susceptibility Weighted (SWI) and Blood Flow (ASL) Imaging in Collegiate Athletes with Mild Traumatic Brain Injury: Preliminary Report
Anna Ellermeier MD (Presenter) ; Heather Spader ; Zahid Jethani ; Jason T Machan PhD ; William C Lafrance ; Michael Worden ; Kaspr De Johst ; Michael J Hulstyn ; Neha Raukar ; Jeffrey M Rogg MD

PURPOSE
Mild traumatic brain injury (mTBI) in young adults accounts for the 2nd highest rate of brain injury in RI State, with increasing emphasis placed on the immediate and long-term effects of these injuries. We report the results of 3T-MR susceptibility weighted (SWI) and cerebral blood flow (CBF) pulsed arterial spin labeled (ASL) imaging for diagnosis and prognosis assessment in mTBI.

METHOD AND MATERIALS
Following IRB approval, prospective consent was obtained from right-handed college football and rugby athletes. Fourteen (14) athletes...
Arteriolar Elasticity Obtained from Spin-Echo Signal Fluctuations in the Human Brain

Kenneth K Lau (Presenter) ; Theodore Lau

PURPOSE/AIM
Laryngoscopy has been the gold standard for diagnosing vocal cord palsy (VCP), but does not provide objective and quantitative assessment. Conventional multi-detector CT only allows structural analysis of the larynx and neck. The 320-multidetector CT (320-CT) enables dynamic viewing of larynx and airway. The aim of this exhibit is to demonstrate the usefulness of the 320-CT in diagnosing VCP.

CONTENT ORGANIZATION
320-CT over 1 breathing cycle and a phonation was performed on 26 patients with suspected VCP symptoms. There were 1/26 (3.8%) patients with bilateral VCP and 12/26 (46.2%) patients with unilateral VCP which were subsequently confirmed on laryngoscopy. The 320-CT demonstrated reduced abduction movement of affected vocal cords during breathing and phonation, with co-existing vocal cord thickenings, tilting, and medialization in all VCP patients. Dilatation of the ipsilateral pyriform sinuses and laryngeal ventricles was found in 76.9%. Other patients had laryngeal dysfunction (6/26), tracheobrochomalacia (3/21), excessive dynamic airway collapse (2/21), subglottic stenosis (1/21) and vocal cord tumour (1/21).

SUMMARY
320-CT is a non-invasive imaging tool providing accurate, prompt and objective assessment of vocal cord movement abnormality. It may be a potential alternative to the semi-invasive laryngoscopy for VCP diagnosis in future.

Arteriolar Elasticity Obtained from Spin-Echo Signal Fluctuations in the Human Brain

Minhui Tang (Presenter) ; Toru Yamamoto PhD

PURPOSE
To map arteriolar elasticity, we focused on arteriolar vasomotion driven by respiratory PaCO2 changes, and proposed a new method that uses spectral analysis of MR signal fluctuation.

METHOD AND MATERIALS
A single slice of a healthy volunteer’s head was imaged for 45 s by using a SE-EPI pulse sequence (TR = 250 ms) under a 1.5-T MRI system. The time course of MR signal at each pixel was Fourier-transformed to map the spectral intensities in the low-frequency (L: c_r) and the L map represents the product of P and fluctuations in V at respiratory frequencies: P(\tilde{V})_c_r. Therefore, the division map of R by C (R/C map) represents \tilde{P}(\tilde{V})_c_r/P; while \tilde{P}(\tilde{V})_c_r/P is global in the brain, \tilde{V} is \tilde{V}/V reflects the local arteriolar elasticity. The division map of R by C (L/C map) was also obtained.

RESULTS
The R/C map was almost homogeneous with a standard deviation (SD) of 10%, showing normal arteriolar elasticity of a healthy volunteer. The SD of the L/C map increased to 13%, reflecting local neuronal activities at resting state.
Arteriolar elasticity could be mapped by using the spectral analysis of SE signal fluctuation.

**CLINICAL RELEVANCE/APPLICATION**
Arteriolar elasticity, which may predict the progression of dementia, is an important vascular property. Our results may provide a new MRI technique for mapping arteriolar elasticity.

**LL-NRS-MO2A ● High Intensity Zone between Globus Pallidus and Putamen on Phase Image: Marginal Division of Neostriatum in the Human Brain?**

Zhiye Chen BMedSc (Presenter) ; Mengyu Liu ; Lin Ma MD

**PURPOSE**
To investigated the functional and structural changes of marginal division (MrD) (high intensity zone between globus pallidus and putamen on phase image) with aging in the human brain

**METHOD AND MATERIALS**

**RESULTS**
MrD had the highest HIC (left: 2149.3±19.6; right: 2155.9±17.9) and LIC (left: 1996.6±19.2; right: 1999.6±20.7), the lowest LIC ratio (left: 2116.4±21.4; right: 2124.7±21.0), and also showed negative with aging. The width (Head: left/right 2.01±0.41 mm/1.86±0.36 mm; Body: left/right 1.84±0.38 mm/1.49±0.29 mm; Tail: left/right 1.17±0.36 mm/1.05±0.23 mm) and area (left/right 49.44±9.71 mm²/42.75±8.80 mm²) of MrD showed negative correlation with aging presenting gradually narrower pattern based on CPIs. Average ADC value (left/right 0.69±0.04 mm²/s / 0.71±0.03 mm²/s) revealed negative correlation, and FA (left, 0.19±0.03; right, 0.22±0.03) value revealed positive correlation with aging.

**CONCLUSION**
Functional and structure changes with aging based on CPIs and DTI could offer a simple and effective tool for the evaluation of MrD in vivo in the human brain.

**CLINICAL RELEVANCE/APPLICATION**
CPIs demonstrate that the functional and structural changes of MrD, and is recommended as an initial evaluation for MrD in the brain of health adults.

**LL-NRS-MO3A ● Long Term Evolution of MR Spectroscopy Following Severe Head Trauma**

Aurélie Drier MD (Presenter) ; Omid Khalilzadeh MD, MPH ; Rajiv Gupta PhD, MD ; Julien Dinkel MD ; Didier Dormont MD ; Louis Puybasset MD, PhD ; Damien P Galanaud MD, PhD *

**PURPOSE**
Severe traumatic brain injury (TBI) can lead to severe brain damage that can be assessed by multiple imaging methods including MR spectroscopy (MRS). However, the long-term evolution of the spectroscopic alterations measured at the acute phase is not well-known.
In this study, we used 2D spectroscopy to evaluate grey matter changes over a span of 2-years after the injury.

**METHOD AND MATERIALS**
This study was approved by the institutional review board of our institution. Fifteen patients who survived after a severe TBI and had a favorable outcome (normal consciousness with minimal functional impairments) were included. The first MR examination (MRI 1) was performed 2 to 4 weeks after the trauma and included a 2D spectroscopic acquisition (TR=1500 ms, TE=135 ms). A second MRI (MRI 2) was performed 2 years after the trauma and included the same sequences. The N-acetyl aspartate/ Creatine (NAA/Cr) ratio was measured in the thalami, the lenticular nuclei and the insular cortex. For statistical comparisons, right and left ratios were pooled for each region of interest. Data are presented as mean +/- SD.

**RESULTS**
The NAA/Cr ratio remained stable in the thalami between the first and second examination (patients: MRI 2: 1.57 +/- 0.36 vs. MRI 1: 1.49 +/- 0.32, p=0.34 controls: 2.04 +/- 0.25) while this ratio increased in the lenticular nuclei (patients: MRI 2: 1.42 +/- 0.26 vs. MRI 1: 1.26 +/- 0.22, p=0.02, controls: 1.8 +/- 0.20) and the insular cortex (patients: MRI 2: 1.54 +/- 0.27 vs. MRI 1: 1.36 +/- 0.29, p=0.01, controls: 1.82 +/- 0.20).

**CONCLUSION**
The NAA/Cr ratio on the first MRI was not significantly decreased in this population with favorable outcome and remained stable. The decrease of the NAA/Cr ratio in the lenticular nuclei and the insula observed at the acute phase was partially reversed 2 years after the trauma.

**CLINICAL RELEVANCE/APPLICATION**
These results support the use of MRS as a marker to assess clinical recovery after severe TBI.

**LL-NRS-MO4A ● Imaging Genomic Biomarker Signature for MGMT Promoter Methylation Identification**

Rivka R Colen MD (Presenter) ; Mark Vangel PhD ; Omar Ashour MD ; Pascal O Zinn MD

**PURPOSE**
To create an imaging biomarker signature to identify those Glioblastoma (GBM) patients with MGMT promoter methylation.

**METHOD AND MATERIALS**
Using The Cancer Genome Atlas (TCGA), we identified 78 treatment-naive GBM patients whom had both gene- and microRNA expression profiles and pretreatment MR-neuroimaging from the Cancer Imaging Archive. The 3D Slicer software 3.6 (http://www.slicer.org) was used for image analysis and image review was done in consensus by 2 neuroradiologists. Fluid-Attenuated Inversion Recovery (FLAIR) was used for segmentation of the edema and post-contrast T1 weighted imaging (T1WI) for segmentation of enhancement (defined as tumor) and necrosis. Quantitative perfusion parameters where obtained using the region of interest (ROI) method (NordicICE). ROIs were placed in the previously segmented regions of contrast enhancement, necrosis, and non-enhancing perilesional FLAIR hyperintensity- the latter reflecting a mixture of edema/tumor infiltration. Imaging parameters were then correlated with the MGMT status and gene expression profiles. Complex biomarker signatures based on profiling and survival were created.

**RESULTS**
An imaging biomarker signature was created using multiple parameters, including the MR perfusion parameter of rCBV. Multiple parameters were associated with overall survival. An increase in rCBV in the non-enhancing FLAIR hyperintense portion was associated with the strongest survival difference (p< 0.03).

**CONCLUSION**
An imaging biomarker signature using conventional MRI parameters and also advance parameters helps predict MGMT methylation status and expression.

**CLINICAL RELEVANCE/APPLICATION**
The identification of a non-invasive imaging biomarker signature as a surrogate for MGMT promoter methylation can help stratify patients in therapy and predict response versus nonresponse to therapy.
Utility Assessment of Repeat Head CT in the Setting of Mild Traumatic Brain Injury Using a Natural Language Processing Tool

**Jason M Johnson** MD (Presenter) ; **Tarik K Alkasab** MD, PhD ; **Daniel Yeh** MD ; **Pamela W Schaefer** MD

**PURPOSE**
To assess the rate of which repeat head CT following mild traumatic brain injury revealed worsening of imaging findings using a natural language processing tool.

**METHOD AND MATERIALS**
Utilizing our institutional trauma registry, 824 adults with blunt TBI who arrived within 24 hours of injury, with arrival GCS of ≥12 with initial head imaging positive for traumatic findings were identified. Patients with initial operative management were excluded, and the all head CTs within 7 days of injury was identified. Each exam was evaluated using a natural language processing (NLP) tool designed for high sensitivity to identify reports describing worsening findings. Imaging reports for 114 patients were manually assessed by an experienced neuroradiologist and a Kappa score was calculated for agreement between the NLP tool and a human reader.

**RESULTS**
Of the 819 patients identified, 164 were removed for additional review for having less than 2 CT scans. An additional 30 patients were removed due to initial operative management. Of the remaining 625 patients, 287 had 2 CTs, 172 had 3 CTs and 166 had >3 CTs. Review of the NLP revealed 86% (95/114) algorithm concordance with neuroradiologist review. The majority of the errors (81.3%; 13/16) were NLP overcalls based on the report. Of the 626 patients with at least two CT scans, the second CT scan contained language suggesting worsening in 263 cases (42.0%).

**CONCLUSION**
A supervised NLP tool can be used in conjunction with a patient registry to identify language associated with worsening head CT findings. We expect to use this tool to further explore clinical factors associated with worsening imaging findings to improve imaging utilization patterns.

**CLINICAL RELEVANCE/APPLICATION**
This tool may be important for exploring image utilization patterns and outcomes for large populations.
Radiologic Evaluation of Pseudoprogression and Pseudoresponse in Glioblastoma: What Radiologists Need to Know

**PURPOSE/AIM**
Lesions of the spinal cord are common including congenital, neoplastic, inflammatory, vascular and neoplastic causes. Aim of this review is to discuss the relevant anatomy from imaging standpoint with drawings/images and important clinical and imaging points to formulate a diagnosis.

**CONTENT ORGANIZATION**
In this exhibit, we will first overview normal anatomy of spinal cord including its vascular supply. We will present a step by step guide including clinical and Magnetic Resonance Imaging (MRI) features to arrive at a diagnosis.

**SUMMARY**
An understanding of the normal anatomy and imaging characteristics of pathologies of spinal cord is important for making a diagnosis. This educational exhibit will facilitate development of an easy systematic approach for MRI evaluation of spinal cord lesions.

**LL-NRE-MO9A • Methodology and Applications of CT and MR Perfusion Imaging in Patients with Head and Neck Cancer**

**Omar Parvez** MD (Presenter); **Naoko Saito** MD, PhD; **Minh T Truong** MD; **Jimmy W Wang** MD; **Hernan Jara** PhD*; **Akifumi Fujita** MD; **Osamu Sakai** MD, PhD*

**PURPOSE/AIM**
To review the current CT and MR perfusion imaging methods in head and neck cancer. Also to describe various clinical applications of CT and MR perfusion imaging in head and neck cancer.

**CONTENT ORGANIZATION**
1. Review of the current CT and MR perfusion imaging techniques being used to evaluate head and neck cancers including pros and cons for each technique: A) dynamic contrast enhanced CT perfusion, B) MR perfusion, i) With intravenous contrast: a) dynamic susceptibility contrast enhanced (DSC), b) dynamic contrast enhanced (DCE), ii) Without intravenous contrast: a) arterial spin labeling (ASL), b) intravoxel incoherent motion (IVIM). 2. Review of the clinical applications of CT and MR perfusion imaging in head and neck cancer. A) differentiation of tumor histology, B) monitoring tumor perfusion, C) prediction of tumor response to the treatment, D) evaluation of post-treatment tumor change, E) prediction and evaluation of treatment effect in the normal tissues.

**SUMMARY**
The major teaching points are:
1. Understanding of various techniques of CT and MR perfusion for head and neck cancers.
2. Understanding microvascular blood supply to the tumor as well as normal tissue that affects treatment response and side-effects.
3. Perfusion information may predict tumor response to various treatments, locoregional control, and treatment-related normal tissue injuries.

**LL-NRE3131-MOA • DWI-MRI and PET-MRI after Radiation Therapy of Malignant Head and Neck Tumors: What the Radiologist Needs to Know**

**Arthur D Varoquaux** MD (Presenter); **Angeliki Ailianou**; **Pavel D Dulguerov**; **Olivier D Rager**; **Karim Burkhartd**; **Minerva Becker** MD, PhD

**PURPOSE/AIM**
1. To provide a comprehensive approach for the evaluation of patients irradiated for malignant head and neck tumors. 2. To understand key imaging features of radiation-induced complications. 3. To demonstrate the importance of DWI-MRI and PET-MRI for the detection of residual/recurrent tumors. 4. To understand potential pitfalls of image interpretation and how to avoid them.

**CONTENT ORGANIZATION**
The retrospective analysis of 124 patients who underwent DWI-MRI with ± PET-MRI formed the basis for this exhibit. The patients were imaged after radio(chemo)therapy for malignant head and neck tumors. Imaging findings were correlated with histology in 82 patients and radiologic follow-up in 42 patients. We discuss expected tissue alterations and complications affecting soft tissues, vasculature, neural tissue and bony structures. We illustrate typical findings of tumor recurrence with emphasis on early detection, added value of DWI-MRI and PET-MRI and provide histologic correlation for the understanding of imaging findings. Pitfalls of post-therapeutic image interpretation and how to avoid them are addressed.

**SUMMARY**
Interpretation of MRI findings after radiation therapy of head and neck cancers constitutes a diagnostic challenge. DWI-MRI and PET-MRI increase the diagnostic confidence for the early detection of recurrent tumors and help to avoid unnecessary biopsy.

**Neuroradiology/Head and Neck - Monday Posters and Exhibits (12:45pm - 1:15pm)**

**Monday, 12:45 PM - 01:15 PM • Lakeside Learning Center**

**LL-NRS-MOB • AMA PRA Category 1 Credit ™:0.5**

**LL-NRE-MO108 • Radiologic Evaluation of Pseudoprogression and Pseudoresponse in Glioblastoma: What Radiologists Need to Know**

**Geunwon Kim** (Presenter); **Katherine M Gallagher** MD; **Nadja Kadom** MD; **Yukim Kimura** MD; **Takaki Murata** MD; **Naoko Saito** MD, PhD; **Akifumi Fujita** MD; **Osamu Sakai** MD, PhD *

**PURPOSE/AIM**
High-grade glioma is the most common brain malignancy in adults. Concurrent temozolomide and radiotherapy is the new standard of care for patients with glioblastoma multiforme (GBM). Assessment of treatment response using conventional MRI is complicated by pseudoprogression and pseudoresponse. The purpose of this exhibit is:
1. To review treatments for GBM.
2. To summarize concepts and illustrate pseudoprogression and pseudoresponse on conventional MR imaging.
3. To discuss and illustrate the use of advanced MRI and PET in differentiating true progression from pseudoprogression.

**CONTENT ORGANIZATION**
1. Review of GBM treatments.
2. Definition and pathophysiology of pseudoprogression and pseudoresponse.
4. Review criteria for tumor response after treatment and revised time-to-chemotherapy dependent criteria.
5. Discussion of imaging modalities to differentiate pseudoprogression from recurrence: A) Conventional MRI B) MR spectroscopy C) MR perfusion D) FDG-PET/CT

**SUMMARY**
Radiologists should be aware of the imaging features on post-treatment of GBM on conventional MRI. Having an understanding of the concepts and the utilization of advanced MRI and PET imaging techniques can help differentiate pseudoprogression from true progression.
To better understand the thoracic outlet syndrome by correlating CT, MRI, EMG, clinical history to the final diagnosis at time of surgery.

Thoracic outlet syndrome is an often misdiagnosed, poorly understood disease entity, which deserves further attention in the radiology literature. We review brachial plexus anatomy as relevant to neurological or vascular syndromes that can occur in light of the newer imaging techniques now available in 2013. In particular, we focus on correlating surgical findings to imaging (CT, MRI) and clinical and electrophysiological data. Examples of negative MRI exams which have positive findings at time of surgery will be discussed. Anatomical variations such as fibrous bands, anomalous vascular, osseous or muscular structures which contribute to presumed symptomology will be presented. Role of dynamic or positional MRI or CT will be delineated. Use of low radiation CT in dynamic evaluation of visualized bone and vascular structures will be further highlighted.

Thoracic outlet pathology remains a challenging disease entity requiring a multi-disciplinary team approach. This niche area of imaging will be reviewed with emphasis on surgical clinical-imaging correlations that will hopefully improve clinical practice by highlighting potential pitfalls and diagnostic pearls.

To investigate the effect of dose of saline flush in perfusion MR imaging of the brain.

Our study group comprised 37 patients (20 men and 17 women; age range, 19-97 years; average, 58.8 years; body weight range, 39-75 kg; average, 55.2 kg) with preoperative brain tumor of miscellaneous final diagnoses. They were randomly divided into three groups in which the saline flush dose was none (group A, 11 patients), 10 mL (group B, 13 patients), or 20 mL (group C, 15 patients). The contrast dose and the injection rate were fixed at 0.1 mmol/kg and 3 mL/sec, respectively. The injection was performed from a right antecubital vein using a power injector. We placed a circular region-of-interest in the normal appearing white matter of the corona radiata on the contralateral side of the tumor and measured regional cerebral blood volume, regional cerebral blood flow, mean transit time, appearance time of contrast material, area under the time-intensity curve (TIC), maximum slope of TIC, peak height of TIC, and time to peak of TIC. One-way analysis of variance was used to investigate intergroup differences.

No significant difference was found among the three groups in mean transit time, appearance time of contrast material, and time to peak of TIC. Significantly greater values of regional cerebral blood volume, regional cerebral blood flow, area under the TIC, maximum slope of TIC, and peak height of TIC in groups B and C than group A. There was no difference between group B and C.

In cerebral perfusion MR imaging, it is possible to administer a good contrast bolus by employing a flush dose of 10 mL or more. It should be noted that the flush dose could affect absolute values of cerebral blood volume and regional cerebral blood flow.

This study shows that, in cerebral perfusion MR imaging, it is recommended to employ a flush dose of 10 mL or more.

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Focused repetitive training could be beneficial in patients with post concussion syndrome and healthy individuals who have an innate degree of neuroplasticity. We propose that variations and improvement in neurocognitive performance from these training programs arise from alterations in white matter connectivity.

In a normal healthy population, we test whether 2 months of intensive computer based training, using 2 separate training exercises targeting memory and executive attention could yield cognitive improvement and corresponding anatomical changes in corresponding neural networks. In this pilot study, 29 healthy individuals ages 18-25 were recruited to act as control subjects (n=5) or undergo 2 months of intensive computer based training in either a Visual Tracking Paradigm or Brain Exercise training program. One non-control subject was excluded due to motion and n=11 and n=12 subjects were separated into the two training groups. Investigators remain blinded to the subject groups. Diffusion tensor imaging (DTI) was performed prior to onset of training, at 28 days after onset, and at 57 days. A hypothesis driven region-of-interest (ROI) analysis recording fractional anisotropy (FA) values was performed on 17 regions over 8 white matter pathways bilaterally. A separate data driven analysis was performed using Tract Based Spatial Statistics (TBSS).

No change seen in the control group. Paired t-tests show a significant increase in FA in the right anterior corona radiata (R ACR, p=0.004) and right uncinate fasciculus (R UF, p=0.02) in both training groups. When performing a time-based ANOVA analysis, there is a dissociation between the two training groups, with the R ACR demonstrating increased coherence in one test group (p=0.01) and the R UF demonstrating increased integrity in the other (p=0.01) when compared to controls.

Intensive computer-based attention and memory training yields anatomical changes in white matter pathways detected by DTI. Interestingly, the two training groups which target different cognitive domains cause improved white matter coherence in specific white matter pathways previously implicated to subserve attention (R ACR) and memory (R UF).

This study shows that, in cerebral perfusion MR imaging, it is recommended to employ a flush dose of 10 mL or more.

Amide proton transfer (APT) imaging is a technique in which the nuclear magnetization of water-exchangeable amide protons of endogenous mobile proteins and peptides in tissue is saturated, resulting in a signal intensity decrease of the free water. The purpose of this paper is to evaluate APT contrast of brain tumors and to compare it with magnetic resonance spectroscopy (MRS) at 3T.
METHOD AND MATERIALS

APT data were acquired from 10 patients with brain tumors on a 3T whole-body MR scanner and compared with conventional magnetic resonance images, including T1W, T2W, FLAIR, post contrast T1W and diffusion weighted images. An additional medium and short echo time multivoxel MRS data was also acquired at the same tumor area for comparison. APT images were evaluated both visually and quantitatively by means of signal intensity, magnetization transfer ratio and magnetization transfer ratio asymmetry calculation for the tumor, peritumoral edema and normal appearing white matter.

RESULTS

Good image contrast between tumor and edema was achieved in all cases with APT-weighted images. The average APT signal intensity, magnetization transfer ratio and asymmetry of the tumoral core were higher than those of peritumoral edema and normal appearing white matter. The increased APT signal intensity and magnetization transfer ratio of the tumoral core correlated well with increased choline and choline/creatine ratio, revealed by the spectral sampling of the same area.

CONCLUSION

These initial data show that APT imaging is an emerging technique which produces unique contrast that can provide complementary information to standard clinical MRI in the imaging workup of brain tumor patients.

CLINICAL RELEVANCE/APPLICATION

APT is a new and promising technique which provides unique contrast that can be used as an additional tool in the imaging workup of brain tumors.

LL-NRS-MO4B • Bimodal Histogram Analysis of Apparent Diffusion Coefficient Values for Detection of Occult Tonsil Cancer in Patients Presenting with Neck Metastasis from an Unknown Primary

Young Jun Choi MD (Presenter) ; Jeong Hyun Lee MD, PhD ; Jung Hwan Baek

PURPOSE

To explore the role of bimodal histogram analysis of apparent diffusion coefficient (ADC) values for detecting occult palatine tonsillar squamous cell carcinoma (PTSCC) in patients with neck metastasis from an unknown primary.

METHOD AND MATERIALS

This retrospective study was approved by the institutional review board, and informed consent was waived. We enrolled 19 patients with occult PTSCC presenting with neck metastasis from an unknown primary, 20 with overt PTSCC on physical examination, and 20 with normal palatine tonsils. DWI was performed with b values of 0 and 800 sec/mm2. ADC values of the entire volume of palatine tonsill were measured by manual drawing of regions-of-interests. Bimodal histogram parameters of the ADC values were obtained using in-house and statistic software tested for difference (Kruskal-Wallis test, Mann-Whitney U test). Receiver operating characteristic (ROC) analysis was employed to determine the best differentiating parameter between occult PTSCCs and normal tonsils. We also analyzed added values of histogram analysis of ADC values to conventional MRI and 18F-FDG PET/CT.

RESULTS

The bimodal histogram analysis showed statistically significant differences in mean, 50 and 90 ADC values between overt PTSCCs and occult PTSCCs/nor-mal palatine tonsils. Between occult PTSCCs and normal tonsils, standard deviation (0.54±0.20)x10^-2 mm^2/sec vs (0.41±0.02)x10^-2 mm^2/sec), skewness (0.52±0.36)x 10^-2 mm^2/sec vs (0.30±0.25)x10^-2 mm^2/sec), and 90 value of ADC (1.75±0.27)x10^-2 mm^2/sec vs (1.52±0.25)x10^-3 mm^2/sec) were significant higher (P<0.05).

CONCLUSION

Adjunctive histogram analysis of ADC values detected five more occult PTSCCs (26.3%) than conventional MRI and 18F-FDG PET/CT, therefore, adjunctive histogram analysis can be helpful when conventional MRI and 18F-FDG PET/CT failed to detect occult PTSCCs.

CLINICAL RELEVANCE/APPLICATION

Adjunctive bimodal histogram analysis can be helpful when conventional MRI and 18F-FDG PET/CT failed to detect occult PTSCCs.

LL-NRS-MOSB • Cone Beam CT Angiography: Diagnostic and Therapeutic Potentials in Management of Spinal and Intra-cranial Arteriovenous Fistulas

Amir R Honarmand MD (Presenter) ; Joseph J Gemmete MD ; Maryam Soltanolkotabi MD ; Michael C Hurley MBBCh ; Neeraj Chaudhary ; Aditya Pandey ; Ali Shaibani MD ; Sameer A Ansari MD, PhD

PURPOSE

To assess the relative intra-arterial cone-beam CT angiography (IACBCTA) efficacy in the anatomical identification/localization of arteriovenous fistulas (AVFs) and utility for surgical/endovascular treatment planning.

METHOD AND MATERIALS

DSA and IACBCTA images were reviewed retrospectively and independently by two neurointerventionalists. Qualitative image analysis was performed based on the level of delineation on a scale of 1-3 (3: Excellent/Good with minimal attenuation; 2: Moderate, relevant visibility with restrictions; 1: Poor, nondiagnostic). The following parameters were scored: a) Arterial feeders, b) Venous drainers and course, c) Fistula site, d) Adjacent anatomical landmarks for cross-sectional localization, and e) Overall diagnostic value for interpretation. Differences between the scores were defined as the IACBCTA efficacy value. Observers described the treatment strategy at the end of DSA and IACBCTA grading respectively: altered or more confident treatment plan versus no value. Wilcoxon signed rank test and Kendall W coefficient of concordance were used for statistical analysis.

RESULTS

Thirty-two consecutive patients [22M/10F, mean age 60.9] were studied. Despite moderate interobserver agreement for IACBCTA overall efficacy value (rho=0.4, P=0.02), no significant difference was observed between efficacy values (P = 0.6). Both observers assigned significantly higher scores to IACBCTA for overall diagnostic value (both observers: P

CONCLUSION

IACBCTA adjuctively improves the anatomical delineation of AVFs, particularly in terms of fistula site and localization.

CLINICAL RELEVANCE/APPLICATION

IACBCTA adjuctively improves the anatomical delineation of AVFs conferring a more confident endovascular or surgical approach.

LL-NRS-MO6B • Period of Pseudo-normalization of Diffusion Kurtosis after Cerebral Infarctions

Toshiaki Akashi MD (Presenter) ; Takeshi Wada MD ; Toshihiko Kikuchi MD ; Tomoko Ochi ; Toshihiti Miyasaka MD ; Saeka Hori ; Neeraj Tiwari MD ; Sameer A Ansari MD, PhD

PURPOSE

Diffusion kurtosis is a statistical measure for quantifying the deviation of the water diffusion profile from a Gaussian distribution. The current study assessed the time course of diffusion kurtosis and evaluated the period of pseudo-normalization after cerebral infarctions.

METHOD AND MATERIALS

Subjects included 25 cases /30 lesions of cerebral infarction. The duration between onset and imaging ranged from 1 day to 122 days. Diffusion kurtosis measurements were done with b values of 0, 1000, and 2000 sec/mm2 applied in 30 directions. Diffusion kurtosis images are generated, including axial kurtosis (Kax) and radial kurtosis (Krad) to the eigenvector. We also acquired T2 weighted image (T2WI), diffusion weighted image (DWI) and apparent diffusion coefficient (ADC) images. The time course of the relative values for T2WI, DWI, ADC, Krad, and Kax were evaluated and the period for pseudo-normalization was obtained.
RESULTS
The trend curve of relative Krad indicates that there was a trend for relative Krad to decrease according to the duration after infarction onset, and that lesions from 10 days to 2 weeks after infarction onset showed lower Krad values compared with the contralateral side. The trend curve of the relative Kax showed high values in cases within 10 days to 2 weeks after infarction onset. There was also a trend for relative Kax to decrease according to the duration after infarction onset, which represented the pseudo-normalization period. The days for pseudo-normalization were 45 days, 21 days, 14 days and 25 days for DWI, ADC, Krad and Kax respectively.

CONCLUSION
Diffusion kurtosis values showed increases in lesions early after infarction and showed decreases earlier than DWI. Krad showed pseudo-normalization earlier than that of ADC, and the pseudo-normalization of Kax was a little later than that of ADC. Because DKI can show different time courses after the onset of infarction compared with DWI or ADC, additional information for white matter tissue with infarction can be provided using this imaging technique. Specifically, information by DKI including Kax and Krad seems helpful in making detailed evaluation for the duration after onset of infarction in combination with T2WI, DWI and ADC.

CLINICAL RELEVANCE/APPLICATION
Since DKI can show different time courses, information by DKI including Kax and Krad seems helpful in making detailed evaluation for the duration after onset of infarction in addition to T2WI, DWI and ADC.

LL-NRE-MO7B • Imaging Neurodegenerative Diseases Comparing ASL-MRI and FDG-PET
Christof Karmonik (Presenter); Steve H Fung MD *; Mario F Dulay; Belen Pascual PhD; Daniel Lee MD, PhD; Stephen B Chang MD; Ronald E Fisher MD, PhD; Robert G Grossman; Gustavo C Roman

PURPOSE
To compare regional and voxel-level CBF estimated from ASL-MRI to 18F-FDG PET activity in elderly patients evaluated for neurodegenerative disease.

METHOD AND MATERIALS
Forty-six patients (ages 59-90, M:0.73) evaluated for cognitive impairment (including MCI, AD, FTD, DLB, PPA, NPH, vascular and mixed dementia) had brain MRI and FDG-PET within 24 hours. CBF (ml/min/100g) was estimated using pseudo-continuous ASL (pCASL) with PLD of 2.5 s. ASL was acquired twice during the 20 min MRI session to determine test-retest reproducibility. Subset of patients were instructed to keep eyes open and then closed during the initial and repeat ASL scan, respectively, to test perfusion variability in the visual cortex. High-resolution SPGR images were obtained for registration of CBF maps and PET images. Image quality, regional and voxel-level comparison in gray matter (GM) and white matter (WM) and histogram analysis were performed.

RESULTS
CBF maps from ASL had lower image quality and SNR than FDG-PET images. With exception of occipital lobe, regional hyperperfusion on ASL correlated with regional hypometabolism on PET with good voxel-level CBF-SUV correlation in inrasubject comparisons. With exception of occipital lobe, regional comparison of normalized cortical CBF to normalized cortical SUV also correlated well in intersubject comparisons. In all subjects, FDG activity was consistently highest in the occipital lobes (visual cortex), whereas occipital CBF on ASL was more variable. Histogram analysis demonstrated unimodal distribution of whole brain CBF in contrast to bimodal distribution of whole brain SUV, consistent with smaller mean difference and larger variance of GM and WM CBF relative to that of SUV.

CONCLUSION
Pattern of hypoperfusion on ASL correlates well with hypometabolism on FDG-PET in most cases and can be used to distinguish various neurodegenerative diseases. Poor correlation between ASL and FDG-PET in the occipital lobe may be secondary to decreased ASL efficiency in the posterior circulation versus physiologic causes with low correlation to eyes open/closed state. Caution should be made with interpreting occipital hypoperfusion with ASL, especially when considering DBL. In such cases, occipital hypoperfusion on ASL should be confirmed with corresponding hypometabolism on FDG-PET.

CLINICAL RELEVANCE/APPLICATION
Addition of ASL to routine brain MRI is recommended for evaluating neurodegenerative diseases.

LL-NRS-MO8B • Practical Review of Bisphosphonate Related Osteonecrosis of the Mandible and Maxilla
Maria P Valencia MD (Presenter); Pavel Rodriguez MD; Fang Yu MD; Wilson Altmeyer MD; Achint K Singh MD

PURPOSE
After reviewing this Education Exhibit the participant should be able to differentiate all the possible imaging abnormalities and complications found in patients with osteonecrosis of the mandible and maxilla, related to Bisphosphonates exposure.

CONTENT ORGANIZATION

SUMMARY
Bisphosphonates are potent osteoclast inhibitors. They decrease bone turnover and are widely used in the management of bony metastatic disease, osteoporosis, Paget disease, and malignancy-related hypercalcemia. Patients with bisphosphonate related osteonecrosis present with nonhealing extraction sockets and painful bone exposure, which adds significantly to their morbidity. The condition has gained added significance with the increasing use of bisphosphonates and longer survival of cancer patients. With the clinical indications of bisphosphonate use increasing, it is important for radiologists to be familiar with bisphosphonate related osteonecrosis. The imaging features are indistinguishable from osteomyelitis, and therefore, a history of bisphosphonate therapy is important to suggest the correct diagnosis.

LL-NRE-MO9B • High b-value and Standard b-value Diffusion-weighted MR Imaging in the Head and Neck Region: Clinical Application and Pitfalls
Koong Mi Kang (Presenter); Ji-Hoon Kim MD; Chul-Ho Sohn MD; Seung Hong Choi MD, PhD; Tae Jin Yun MD; Inseon Ryoo MD; Jisang Park MD; Eun Kyoung Lee MD; Soo Chin Kim MD

PURPOSE
1. To demonstrate the incremental role of DWI with other imaging techniques in characterization of head and neck lesions.
2. To describe the merits and challenges of high b-value (b=2000 s/mm²) DWI in comparison with standard b-value (b= 1000 s/mm²)

CONTENT ORGANIZATION
1. Technique of DWI and how to optimize it according to b-value.
2. Methods of quantitative assessment by DWI and ADC
3. Utility of high and standard b-value DWI in conjunction with conventional MR and/or [18F] FDG-PET for evaluation of sinusitis and glandular function, differentiation of neoplasm in various regions, grading of squamous cell carcinoma, distinguishing tumor recurrence and post treatment change, predicting response in patients on chemoradiotherapy, and differentiation of pathologic cervical lymph nodes.
4. Technical and interpretation pitfalls of high b-value DWI in comparison with standard b-value DWI

SUMMARY
DWI plays an important complementary role to other imaging techniques in evaluation of head and neck lesions. Knowledge of various clinical application and pitfalls along with changes according to b-value may help to better interpret head and neck lesions.
Voxel-based Morphometry at 3-T MR Imaging for Detection of Individuals with Mild Alzheimer Disease

Xiangzhu Zeng MD (Presenter) ; Huishu Yuan MD ; Ying Liu MD ; Zheng Wang MS ; Na Zhang MD

PURPOSE
Voxel-based morphometry (VBM) was used to investigate the patterns of cortical atrophy in mild Alzheimer’s disease.

METHOD AND MATERIALS
13 mild Alzheimer’s disease (AD, 5 men and 8 women, mean age 75.00±7.36 years) cases and 15 no cognitive impairment (NCI, 4 men and 11 women, mean age 71.20±7.89 years) cases were investigated. For all cases, High-resolution T1SPGR images were acquired on a GE750 3T scanner. The acquisition parameters were: TR/TE = 4.9/2 ms, voxel size = 1X1X1 mm³. After image acquisition, T1SPGR images were segmented, normalized and smoothed using VBM8(http://dbm.neuro.uni-jena.de/vbm/). The statistical analyses were performed on SPM8 by two-sample t-test for comparing mild AD with NCI.

RESULTS
There were significant differences in Mini Mental Status Exam (MMSE) (mild AD: 21.3±4.97 , HC: 28.75±0.93) and between the 2 groups (p < 0.001) but none in age (p = 0.061). Cortical volumes decreased significantly (p < 0.001, pFWE=0.05, T=5.33, corrected for multiple comparisons) in mild AD compared to NCI in the bilateral parahippocampal gyrus, bilateral middle temporal gyrus and inferior temporal gyrus, left inferior frontal gyrus and left insula.

CONCLUSION
Our results showed patterns of regional cortical atrophy of mild AD, suggesting underlying structure abnormality. As a potential
CLINICAL RELEVANCE/APPLICATION

VBM is a useful noninvasive tool to identify the cortical atrophy in mild Alzheimer’s disease.

SSE16-03 • Arterial Spin Labeling at 3-T MR Imaging for Detection of Individuals with Mild Alzheimer Disease

Xiangzhu Zeng MD (Presenter) ; Huishu Yuan MD ; Ying Liu MD ; Zheng Wang MS ; Na Zhang MD

PURPOSE
Arterial spin labeling (ASL) was used to investigate the role of vascular impairment in mild Alzheimer's disease

METHOD AND MATERIALS
13 mild Alzheimer's disease (AD, 5 men and 8 women, mean age 75.00±7.36 years) cases and 15 normal control subjects (NCl, 4 men and 11 women, mean age 71.20±7.89 years) cases were investigated. For all cases, pseudo-continuous ASL scanning was performed using GE750 3T scanner. The acquisition parameters were: post-labeling delay = 1500 ms, TR/TE = 4632/10.5 ms, voxel size = 2X2X4 mm3. High-resolution T1SPGR images were acquired as well.

After image acquisition, CBF maps were calculated using in-house software. T1SPGR was segmented using SPM8 and registered onto CBF maps. As partial volume effect (PVE) is strongly recommended in ASL due to its limited spatial resolution and the cortical atrophy in dementia, a PVE correction method was incorporated using a software called FMRIGrocer (http://code.google.com/p/fmrigrocer/).

Mean gray matter(GM) CBF was calculated for each case and preprocessed and statistical analyses were performed on SPM8.

RESULTS
There were significant differences in Mini Mental Status Exam (MMSE) (mild AD: 21.34±4.97, HC: 28.75±0.93) and between the 2 groups (p<0.001 but none in age (p = 0.061). GM CBF decreased significantly (p < 0.001, T=3.84, uncorrected for multiple comparisons) in mild AD compared to NCI in the bilateral precuneus and cuneus, bilateral parahippocampal gyrus, bilateral middle temporal gyrus and left superior temporal gyrus.

CONCLUSION
Our results revealed patterns of regional hemodynamic impairment typical of mild AD, suggesting underlying vascular abnormality. As a potential biomarker, ASL could differentiate the patients from the healthy.

CLINICAL RELEVANCE/APPLICATION
3D ASL is a useful noninvasive MRI sequence to identify the vascular impairment in mild Alzheimer's disease.

SSE16-04 • Changes of Functional Activation in the Prefrontal Lobe in Early Alzheimer’s Disease during Memory Tasks: An ASL-fMRI Study at 4.0T

Wei Chen MMedSc ; Xiaowei Song PhD ; Careesa Liu ; Ryan D'Arcy ; Steven D Beyea PhD (Presenter) * ; Kenneth Rockwood

PURPOSE
Perfusion-based functional MRI using arterial spin labeling (ASL) has been used to investigate brain activation based on cerebral circulation. While the so-called neurocompensation has been proposed in early Alzheimer’s disease (AD) based on BOLD fMRI data, few studies have evaluated such neurocompensatory response using perfusion fMRI. Here, we investigated brain functional changes under episodic memory encoding and retrieval tasks in subjects with early AD and those with cognitively healthy aging using high-field ASL.

METHOD AND MATERIALS
Twelve subjects diagnosed with early AD (mean age=72.34±7.9 yrs, females=5) and 12 age-matched cognitively normal subjects (CN, mean age=73.74±5.5yrs, females=9) were enrolled in this study. A 4T Varian-Oxford human MRI system with interleaved multi-slice flow-sensitive alternating inversion recovery (FAIR) was employed to investigate brain activation during both encoding and retrieval tasks. Data processing and analysis were performed using FSL, with the bilateral frontal lobes as the region of interest.

RESULTS
Brain activation was found in bilateral frontal cortex and the anterior cingulate cortex (ACC) in AD in response to both encoding and retrieval tasks. Increased activation was found during retrieval compared to encoding, which was primarily seen in the bilateral dorsolateral prefrontal cortex (DLPFC) and the ACC (Figure 1). Moreover, patients with early AD showed significantly greater activation than the normal controls in the bilateral prefrontal cortex including the DLPFC and the ventrolateral prefrontal cortex (VLPFC) (especially in the left DLPFC) as well as in the ACC (Figure 2).

CONCLUSION
Hyperactivation, as measured using ASL perfusion fMRI, was found in bilateral prefrontal cortex in subjects with early AD during memory tasks, suggesting possible neurocompensatory response.

CLINICAL RELEVANCE/APPLICATION
Perfusion based functional changes may provide a sensitive measure to benefit early AD diagnosis.

SSE16-05 • Significance of Cerebellar Activity in the Attention Network in MCI

Zhigang Qi (Presenter) ; Kuncheng Li MD

PURPOSE
Once cerebellum was a structure specialized for motor processing, while recently, it is also considered to be involved in cognition, here we want to investigate its meanings in the evaluation of mild cognitive impairment (MCI).

METHOD AND MATERIALS
Eighteen MCI and twenty normal elderly were recruited from a community investigation. Demographics of MCI patients and healthy elderly, including age, sex, and education years, were matched between the two groups. The age of participants was equally distributed between the two diagnostic groups (t=0.56, p=0.28 two-sample two-tailed t test) with similar medians and ranges. However, the groups were significantly different with regard to MMSE scores (t=2.18, pAll imaging was performed with a 3 T Siemens Trio system. Functional MR images were acquired while at rest.

Functional connectivity analysis: Taking left temporal parietal junction(TPj) area and left inferior parietal lobule(IPL) as seed, functional connectivity was performed between the seed and whole brain with a voxel-wise manner.

RESULTS
Ventrical attention network was verified with functional connectivity to left TPJ. And dorsal attention network was verified with functional connectivity to left IPL. The between-group differences were detected through two sample t-test. No significant difference was detected in ventral attention network between MCI and healthy elderly. While in dorsal attention network, significant difference was detected between MCI and healthy elderly. While taking comparison to healthy elderly, decreased functional connectivity to left IPL was observed in right cerebellar lobule VIa Crus II, in addition to bilateral frontal cortex, right precuneus, right temporal cortex. And increased functional connectivity to left IPL was observed in right cerebellar vermis VI, right cerebellar lobule VI, right cerebellar VIa Crus I, left cerebellar lobule VI, in addition to bilateral precuneus.

CONCLUSION
TPJ and IPL is the core of ventral and dorsal attention network. Changes of functional activity were observed in dorsal attention network in MCI. And cerebellum may play an important role in this process.

CLINICAL RELEVANCE/APPLICATION
Detecting Microstructural Abnormality in Gray and White Matter of Alzheimer’s Disease Using Diffusional Kurtosis Imaging

Nan-Jie Gong (Presenter); Chun-Chung Chan; Lam-Ming Leung; Chun-Sing Wong

PURPOSE

Newly introduced method of diffusional kurtosis imaging (DKI) is able to delineate non-Gaussian diffusion, which is beyond the scope of conventional diffusion tensor imaging (DTI). Clarifying whether the more accurate approach can improve imaging diagnosis of Alzheimer’s disease (AD) is of intense interests.

METHOD AND MATERIALS

DKI data were collected from a 3T scanner with 3 b values (0, 1000, 2000 s/mm²) and 32 diffusion directions. Using SPM, we conducted two sample t-test of DKI parametric maps voxel-by-voxel between two groups of 11 ADs, 20 normal controls (NCs). Statistical maps were thresholded at p < 0.001 and clusters with at least 500 edge-connected voxels were labeled.

RESULTS

In AD patients, compared with NC, significantly lower fractional anisotropy were observed in right frontotemporal and gyrus, right temporal cortex and gyrus. In addition, significantly higher mean diffusivity were observed in right temporal white matter, and significantly lower mean kurtosis in right inferior frontotemporal gyrus, left and right temporal cortex, left and right inferior longitudinal fasciculus.

CONCLUSION

Adding to the traditional DTI metrics, DKI metric like mean kurtosis can provide new regional contrast between AD and NC.

CLINICAL RELEVANCE/APPLICATION

Therefore, DKI may potentially improve detection of early disease.

Quantitative Measurement of Cerebrovascular Reserve in Unilateral High Grade Carotid Steno-occlusion by Acetazolamide-challenged CT Perfusion: Correlation with Symptom and Type of Collateral Circulation

Doran Hong MD (Presenter); Younghen Lee MD; Hyung Suk Seo; Sang-II Suh; Nam J Lee MD; Hae Young Seol MD; Jung Hyuk Kim

PURPOSE

CT perfusion with acetazolamide (CTP-ACZ) is introduced as a useful method to evaluate the cerebrovascular reserve (CVR). In patients with severe carotid stenosis, assessment of CVR and collateral circulation is essential for treatment strategy. However, the hemodynamic contribution of collateral circulation is uncertain. Therefore, we correlated CVR in adult patients with unilateral high grade intracranial steno-occlusion with their symptoms, angiographic findings by CTP-ACZ.

METHOD AND MATERIALS

A retrospective analysis of prospectively collected 35 patients (M:F=22:13, mean age, 51.9±14.5 years) with unilateral internal carotid artery (ICA) or middle cerebral artery (MCA) high grade steno-occlusion (severe stenosis> 70%; occlusion=7:28) were performed. They underwent CTP before and 20 minutes after intravenous administration of ACZ . We manually drew regions of interest in the cortical flow territories of the MCA at the level of basal ganglia and centrum semiovale in each hemisphere; recorded CTP parameters (cerebral blood flow (CBF), mean transit time (MTT). We compared the percentage change (PC) of CBF and MTT difference by calculating CBF and MTT measured before and after ACZ infusion, regarding to (1)symptomatic (n=17) VS. asymptomatic (n=18) (2)primary (n=8) VS secondary (n=20), by SPSS multivariate analysis. Degree of stenosis and presence of collateral circulation were assessed by cerebral angiography.
RESULTS

Compared to the contralateral hemisphere supplied by non-stenotic ICA, PC of CBF and MTT difference obtained by CTP-ACZ were significantly lower in hemisphere ipsilateral to high grade stenosis (p < 0.05). Because CTP parameters measured by CTP-ACZ might be variable in high grade carotid stenosis depending on the location of ROI, optimization of CTP-ACZ must be needed for clinical relevance.

CLINICAL RELEVANCE/APPLICATION

Because CTP parameters measured by CTP-ACZ might be variable in high grade carotid stenosis depending on the location of ROI, optimization of CTP-ACZ must be needed.

SSE17-03  •  Correlation of Multi-echo Vessel-encoded Arterial Spin Labeling and Hypercarbic Blood-oxygenation Level Dependent Reactivity MRI for Quantification of Hemodynamic Compensation in 70 Patients with Cerebrovascular Disease

Daniel Arteaga BA (Presenter); Megan K Strother MD; Travis R Ladner MD; Robert Singer MD; Carlos Faraco PhD; Manus Donahue PhD

PURPOSE

The purpose of this work is to develop and clinically implement a MRI protocol for quantifying the relationship between hemodynamic compensation mechanisms including cerebrovascular reactivity (CVR), baseline cerebral blood flow (CBF), CBF reactivity, and CBF territory dynamics in patients with cerebrovascular disease. In many patients at risk for stroke with compromised cerebral perfusion pressure, the critical barrier to stratifying stroke risk based on this information rests with a lack of (i) methodology for measuring multiple hemodynamic parameters in a clinically relevant timeframe and (ii) knowledge of how changes in such parameters should be interpreted for prognosis.

METHOD AND MATERIALS

Methods: Changes in end-tidal CO2 (ΔEtCO2) were monitored and CVR was assessed using blood oxygenation level dependent (BOLD) MRI (TR/TE=2000/35 ms; spatial resolution = 3.5x3.5x3.5 mm3) in conjunction with 180s/180s off (room air) / on (5%/95% CO2/O2) breathing. Baseline CBF was assessed using a pseudo-continuous (pCASL) approach (TR/TE=4000/1650/13 ms; spatial resolution = 3x3x7 mm3). Hemodynamic compromise was correlated with extent of vascular stenosis. For Moyamoya subjects, MRI hemodynamic data were compared with clinical disability scores and modified Suzuki Scores (mSS), calculated from angiography.

RESULTS

At TE2=35 ms, the spin labeling contributes minimally relative to BOLD weighting. This finding demonstrates that moderate temporal resolution (TR=4500 ms) can be achieved for BOLD sensitivity in a functional ME VE-ASL approach. Clinical findings varied with underlying etiology. In patients with Moyamoya disease, BOLD CVR was significantly (P=0.017) higher in low mSS hemispheres (z-statistic= 5.0±2.5) compared to high mSS hemispheres (z-statistic=3.7±1.7), implying that regions with less advanced stages of Moyamoya disease have higher reactivity. All study participants are monitored longitudinally to understand the relationship between hemodynamic imaging and stroke risk.

CONCLUSION

A clinical 3T head MR protocol was expanded and clinically implemented for simultaneous measurements of CVR, baseline CBF, CBF reactivity, and CBF territory mapping using a novel 15 min ME VE-ASL approach.

CLINICAL RELEVANCE/APPLICATION

Hemodynamic MRI can demonstrate cerebrovascular impairment noninvasively, and may be useful in the longitudinal evaluation of stroke risk in patients with intracranial stenosis.

SSE17-04  •  Combined Evaluation Using Noncontrast CT ASPECTS and CT Angiography Collaterals Improves Clinical Detection of Large DWI Infarcts

Farhad Mehrkhani MD (Presenter); Shervin Kamalian MD, MMedSc *; Livia T Morais MD; Michael H Lev MD *; Albert J Yoo MD *

PURPOSE

DWI is the most accurate technique for delineating acute infarct core. Large DWI infarct volume (>70cc) is associated with poor outcome despite treatment, and has been used as a treatment exclusion criterion. CT is more widely available than MRI, but suffers from poor sensitivity for infarct detection. We sought to determine whether a combined approach using noncontrast CT (NCCT) and CT angiography (CTA) improves prediction of large DWI infarcts.

METHOD AND MATERIALS

In a single-center, retrospective study, we identified consecutive acute ischemic stroke patients with anterior circulation proximal artery occlusions who underwent both CT and MRI. Patients were categorized into two groups based on DWI lesion volume (< vs. >70 cc). Because patient exclusion from treatment requires high certainty for the presence of a large infarct, we utilized thresholds previously reported to have high (>95%) specificity for DWI infarct volume >70cc for NCCT ASPECTS (scores 0-4) and CTA collateral evaluation (malignant collateral profile: absent collaterals in >50% of MCA M2 division territory). We determined the test characteristics of these prespecified thresholds in this dataset, and evaluated whether these thresholds in combination would improve the diagnostic yield for identifying patients with large infarcts.

RESULTS

Fifty-five patients satisfied study criteria. Median NIHSS was 14 (IQR 6-18), and mean age was 66.9 ± 15.2 years. Fifteen (27.2%) patients had a DWI infarct core volume >70cc. NCCT ASPECTS 0-4 had 100% specificity but only 53.3% sensitivity for identifying a large infarct on DWI. Similarly, the CTA malignant collateral profile had 97.5% specificity but only 53.3% sensitivity. In a combined approach (i.e., satisfaction of either threshold), the sensitivity was improved to 73.3% while maintaining a high specificity (97.5%). Of the 15 patients with large infarcts, 7 were missed using each threshold alone, while only 4 were missed using the combined thresholds.

CONCLUSION

Combining NCCT and CTA collateral evaluation improves the sensitivity for identifying patients with large DWI infarcts while preserving the high specificity required for treatment exclusion.

CLINICAL RELEVANCE/APPLICATION

For identifying large infarcts predictive of poor treatment response, combining NCCT and CTA collateral evaluation improves sensitivity from 33% to 73%, while preserving high (>95%) specificity.

SSE17-05  •  Intracranial Intraplaque Hemorrhage: Prevalence and Association with Infarction in a Population-based Study

Yuan Yuan Xie MD, BEng (Presenter); Ye Qiao; Nariman Nezami MD; Jarunee Intrapromkul MD; Saedeh Mirbagheri MD; Zeeeshan Anwar; Li Liu; Bruce A Wassermann MD

PURPOSE

Carotid intraplaque hemorrhage (IPH) is a well-recognized risk marker for cerebrovascular ischemic events. It can be reliably identified on MRI using MPRAge, a 3D T1-weighted sequence, due to the short T1 of blood products. Although it is an important target in imaging extracranial carotid plaque, little is known about its occurrence in intracranial plaque. Our aim was to determine the prevalence of IPH in middle cerebral artery (MCA) plaques, in a US community-representative population (the Atherosclerosis Risk in Communities Neuroimaging Study [ARIC-NCs]), and to investigate its association with ischemic infarcts.
METHOD AND MATERIALS
1,141 ARIC-NCS participants (mean age, 76 (67; 90); 42% male; 84% white, 15% black) underwent brain MRI scans that included 3D MPRAGE (resolution 1mm3, TR 2.3s, TE 3ms, TI 900ms, flip angle 9), 3D time-of-flight (TOF) MRA, and 3D black blood [1] sequences. MCA plaques were identified on TOF MRA and confirmed on black blood MRI. Signal intensity (SI) was measured at the corresponding location on MPRAGE and IPH was considered present if this SI exceeded that measured in the pterygoid muscle. T1-, T2-, and diffusion-weighted images of the brain were interpreted for ischemic infarcts by a radiologist blinded to vascular imaging (i.e., presence of plaques and IPH). IPH presence was correlated with ischemic infarcts in the corresponding MCA territory. If multiple plaques were identified in one MCA, IPH was considered present if it was identified in any plaque.

RESULTS
In 1,141 exams, 89 MCA plaques were identified in 71 (6.2%) participants (mean age 80). There were 18 (1.6%) cases with bilateral MCA plaques, 28 (2.5%) cases with right MCA plaques, and 24 (2.1%) cases with left MCA plaques. Out of 89 MCA plaques, there were 57 plaques (64%) in 45 (3.9%) participants with IPH. 13 plaques had infarcts in the territories of the plaques, and IPH was present in 12 (92%). 46 plaques showed IPH without corresponding infarcts, and 30 plaques showed neither IPH nor infarcts. IPH was associated with territorial infarcts (odds ratio, 7.83 [CI = 0.97-63.4, p = 0.05]; marginally significant).

CONCLUSION
Although the prevalence of IPH in this population is infrequent, its association with ischemic events suggests its identification might have important clinical relevance. 1. Qiao Y et al. JMRI. 2011

CLINICAL RELEVANCE/APPLICATION
Identifying intracranial IPH on T1 sequences might provide insight on risk of stroke.

SSE17-06 • Stroke Rehabilitation Using Brain-computer-Interface Technology with Multi-modal Neurological Feedback: Brain Activation Changes Associated with this Interventional Therapy

Brittany Young (Presenter); Jie Song MS; Leo Walton; Svyatoslav Vergun; Veena A Nair PhD; Mitch Tyler; Justin Sattin; Dorothy Farrar-Edwards; Justin Williams; Vivek Prabhakaran MD, PhD

PURPOSE
Brain-computer interface (BCI) is an emerging technology for stroke rehabilitation, but little is known about neuroplastic changes associated with its use. We examine changes in brain activity during imagined (MI) and executed (ME) hand motor tasks associated with BCI-based interventional therapy.

METHOD AND MATERIALS
Anatomical and functional images were collected on 16 subjects (8 stroke patients; 8 healthy controls) on a GE 3T MR scanner. Functional images were acquired during MI and ME finger tapping or squeezing of each hand. Not all subjects completed all tasks. Patients had right upper extremity impairment and were given therapy of the affected hand up to three times weekly for up to six weeks using BCI with tongue and functional electrical stimulations. Patients were scanned pre-, mid- and post-therapy. Group-level analyses compared mid- and post-therapy activation to pre-therapy using AFNI.

RESULTS
Normal and Stroke subjects showed supplementary motor area (SMA) and precentral gyrus activity in both MI and ME tasks. Stroke subjects showed mid-therapy activation increases that persisted post-therapy in the left SMA, premotor cortex, and cingulate during ME unaffected hand tapping, in the right precuneus during MI unaffected hand tapping. Post-therapy activation increased in the left inferior frontal gyrus and insula during MI squeezing of the unaffected hand. All MR activity are reported at p < 0.05.

CONCLUSION
The results suggest that interventional therapy of the affected hand using BCI is associated with brain activity changes in specific areas involving both affected and unaffected hands. Persistent activation increases associated with ME and MI tasks of the affected hand may represent neuroplastic recovery. These data also suggest that some sensorimotor cortex changes may develop earlier while other changes take longer to emerge with BCI therapy.

CLINICAL RELEVANCE/APPLICATION
Characterizing changes in brain activation after stroke rehabilitation using brain-computer interface technology will provide insight into mechanisms of neuroplasticity associated with this therapy.

Neuroradiology/Head and Neck (ENT Oncology)

SSE18-01 • Initial Clinical Experience of Core Needle Biopsy with BRAF V600E Mutation Analysis in Thyroid Nodules

Eun Ju Ha; Jung Hwan Baek; Hun Cho MD (Presenter); Jeong Hyun Lee MD, PhD

PURPOSE
To evaluate the role of core-needle biopsy (CNB) with BRAFV600E mutation combined analysis in thyroid nodules having non-diagnostic or atypia of undetermined significance (AUS) results on fine-needle aspiration (FNA).

METHOD AND MATERIALS
From January 2011 to March 2012, CNB +BRAFV600E mutation combined analysis was performed on thyroid nodules with previously non-diagnostic (n=32) or AUS (n=97) results. Direct DNA sequencing technique was used for BRAFV600E mutation analysis. The diagnostic value of CNB +BRAFV600E mutation analysis was evaluated.

RESULTS
The sensitivity and positive predictive value of BRAFV600E mutation in CNB specimens were 66.3% and 100%, respectively. Of 32 nodules with previously non-diagnostic results, CNB showed 81.3% (26/32) of conclusive results with 6 cases of AUS and no cases of non-diagnostic results. There was no additional value of CNB+BRAFV600E mutation analysis. Of 97 nodules with previously AUS results, CNB showed 93.8% (91/97) of conclusive results with 5 cases of AUS and 1 case of non-diagnostic results. There was 3.1% (3/97) additional value of CNB+BRAFV600E mutation analysis.

CONCLUSION
CNB of the thyroid nodule demonstrate high rates of conclusive diagnoses in patients for whom previous FNA results are non-diagnostic or...
SSE18-02 • Bimodal Histogram Analysis of Apparent Diffusion Coefficient Values for Detection of Occult Tonsil Cancer in Patients Presenting with Neck Metastasis from an Unknown Primary

Young Jun Choi MD (Presenter) ; Jeong Hyun Lee MD, PhD ; Jung Hwan Baek

PURPOSE
To explore the role of bimodal histogram analysis of apparent diffusion coefficient (ADC) values for detecting occult palatine tonsillar squamous cell carcinoma (PTSCC) in patients with neck metastasis from an unknown primary.

METHOD AND MATERIALS
This retrospective study was approved by the institutional review board, and informed consent was waived. We enrolled 19 patients with occult PTSCC presenting with neck metastasis from an unknown primary, 20 with overt PTSCC on physical examination, and 20 with normal palatine tonsils. DWI was performed with b values of 0 and 800 sec/mm2. ADC values of the entire volume of palatine tonsil were measured by manual drawing of regions-of-interests. Bimodal histogram parameters of the ADC values were obtained using in-house and statistically tested for difference (Kruskal-Wallis test, Mann-Whitney U test). Receiver operating characteristic (ROC) analysis was employed to determine the best differentiating parameter between occult PTSCCs and normal tonsils. We also analyzed added values of histogram analysis of ADC values to conventional MRI and 18F-FDG PET/CT.

RESULTS
The bimodal histogram analysis showed statistically significant differences in mean, 50 and 90 ADC values between overt PTSCCs and occult PTSCCs/normal palatine tonsils. Between occult PTSCCs and normal tonsils, standard deviation ([1.54±0.20]x10^{-3}/sec vs [0.41±0.09] x10^{-3}/sec), skewness ([0.52±0.38] x10^{-3}/sec vs [0.30±0.25] x10^{-3}/sec), and 90 value of ADC ([1.75±0.27] x10^{-3}/sec vs [1.52±0.25] x10^{-3}/sec) were significant higher (P<0.001).

CONCLUSION
Adjunctive histogram analysis of ADC values detected five more occult PTSCCs (26.3%) than conventional MRI and 18F-FDG PET/CT, therefore, adjunctive histogram analysis can be helpful when conventional MRI and 18F-FDG PET/CT failed to detect occult PTSCCs.

CLINICAL RELEVANCE/APPLICATION
Adjunctive bimodal histogram analysis can be helpful when conventional MRI and 18F-FDG PET/CT failed to detect occult PTSCCs.

SSE18-03 • Role of ARFI in the Assessment of Thyroid Nodules

Bagyam Raghavan MBBS, DMRD (Presenter) ; Sounak Paul MBBS ; Sathyasree Viswanathan MBBS ; Atif Wasim Haneef Mohamed ; Jayaraj Govindaraj MD ; Saravanan Shanmugasundaram DMRD, MBBS

PURPOSE
The purpose of the study was aimed at improving diagnostic significance of thyroid sonography in predicting cytological type of thyroid nodules by additional use of ARFI.

METHOD AND MATERIALS
110 nodules were evaluated by B-mode imaging and color Doppler and ARFI. Shear wave elasticity measurements according to ARFI (Acoustic Radiation Force Impulse) imaging was performed for 110 nodules in 52 patients. Images obtained by Virtual Touch tissue imaging (VTI) were classified into three groups: Soft, Intermediate hardness, and Hard. Numerical values were also computed for the nodules Virtual touch tissue Quantification (VTQ ). The results of B-mode imaging, color Doppler and ARFI were compared with the cyto-pathological diagnosis and analyzed statistically using Chi square test, and Logistic regression analysis to find out the correlation between the sono-raphic variables and final cytological end result. The significant VTQ values of each subgroup of hardness were evaluated by ANNOVA (Analysis of Variants). #SSPS for Windows, Version 17! was used for the statistical analysis.

RESULTS
Multi nodular goiter and Thyroiditis nodules can remain indeterminate after B-mode and Color . In our study we found that tissue hardness assessment obtained by ARFI helped in categorization of such nodules and reducing negative cytology rates. The concordance between B-mode, color and FNAC was 81% which after ARFI the concordance with FNAC increased to 89%.

In this study however we obtained a significant statistical correlation of intermediate hardness in predicting thyroiditis, odds ratio of 9.22 (95% confidence interval from 3.09 to 27.45) (p value Multi nodular goiter and Thyroiditis nodules can remain indeterminate after B-mode and Color).

CONCLUSION
In our study we found that tissue hardness assessment obtained by ARFI helped in categorization of such nodules and reducing negative cytology rates.

In this study however we obtained a significant statistical correlation of intermediate hardness in predicting thyroiditis, odds ratio of 9.22 (95% confidence interval from 3.09 to 27.45) (p value)

CLINICAL RELEVANCE/APPLICATION
ARFI with Virtual Touch Tissue Imaging Analysis is a quick additional parameter in the diagnosis of thyroid nodules.

SSE18-04 • Preliminary Evaluation of MR Diffusion Kurtosis Imaging at 3-Tesla for Head and Neck Squamous Cell Carcinoma: A New Monitoring Tool for Early Treatment Response

Yukie Shimizu (Presenter) ; Noriuyki Fujima MD ; Daisuke Yoshida ; Tomohiro Sakashita ; Akihiro Homma ; Kohsuke Kudo MD ; Hiroki Shirato MD, PhD

PURPOSE
The purpose of this study is to investigate the usefulness of 3-T MR diffusion kurtosis imaging (DKI) for the assessment of patients with head and neck squamous cell carcinoma (HNSCC).

METHOD AND MATERIALS
Eighteen patients who were histopathologically diagnosed as HNSCC were included in this study. All patients were treated with super-selective arterial infusion of cisplatin with concomitant radiotherapy. TDK key underwent magnetic resonance imaging (MRI) using DKI sequence before the treatment and at the early treatment period (at time point of 15-25 Gy in total 65 Gy radiotherapy). All MR scanning was performed by using a 3-T unit (Achieva TX; Philips Medical Systems, Best, The Netherlands) with a 16-channel neurovascular coil. DKI was obtained by using single-shot echo planar diffusion weighted imaging with 4 different b values of 0, 800, 1000, 2000 sec/mm2. Three orthogonal motion probing gradient was used. The quantitative DK value of the tumor (ROC) analysis was calculated. The change ratio of DK value between pre-treatment and early treatment period was also calculated. After the treatment, thirteen patients were classified into complete remission (CR) group and the other five were into non-CR group judging from multi-modality assessment and clinical follow-up. Mean of value in pre-treatment, early treatment period, and its change ratio were compared between CR and non-CR groups using non-paired T-test.

RESULTS
The change ratio of DK value in CR group was significantly lower than non-CR group(0.78±0.13 vs 0.93±0.05, P<0.05).

CONCLUSION
DKI can be used as monitoring tool for early treatment response for the assessment of patients with HNSCC.
CLINICAL RELEVANCE/APPLICATION

DKI can be useful as monitoring tool for early treatment response for the patients with HNSCC by evaluating change ratio of DK value between pre-treatment and early treatment period.

SSE18-05 • Treatment of Metastatic Lymph Nodes in the Neck from Papillary Thyroid Carcinoma by Percutaneous US-guided Interstitial Laser Ablation: Three Years Experience

Giovanni Mauri MD (Presenter); Luca Cova MD; Tania Tondolo; Tiziana Ierace MD; Enzo Di Mauro; Claudio M Pacella MD; S. Nahum Goldberg MD*; Luigi Solbiati MD

PURPOSE
We report our three year experience with percutaneous US-guided interstitial laser ablation for metachronous cervical nodal metastases from papillary thyroid carcinoma.

METHOD AND MATERIALS

RESULTS
Laser ablation was technically feasible and well tolerated in all patients, with no either immediate or late complications.

In 5 cases a second PLA was performed to treat recurrent disease (3 pt) or new lymph node metastases (2 pt). At a mean follow up time of 19 months local control was achieved in 19/26(73%) patients, with 11 (42%) having serum Tg/TgAb normalized. Complete ablation (lack of enhancement at CEUS, no uptake at 18F-FDG PET) was achieved in 38/46 (83%) 4 patients developed distant disease progression.

CONCLUSION
Percutaneous US-guided interstitial laser ablation seems to be an effective, low cost and safe therapeutic tool for the treatment of metachronous nodal metastases from papillary thyroid carcinoma in the neck which would otherwise require often challenging further resections.

CLINICAL RELEVANCE/APPLICATION

Interstitial laser ablation seems to be safe and effective for the treatment of metachronous nodal metastases from papillary thyroid carcinoma in the neck.

SSE18-06 • Intravoxel Incoherent Motion MR Imaging: Emerging Applications for Nasopharyngeal Carcinoma at the Primary Site

Shui Xing Zhang MD (Presenter); Qianjun Jia MD; Zhong-Ping Zhang; Chang Hong Liang MD; Wen-Bo Chen BArch; Qian-Hui Qiu

PURPOSE
To compare pure molecular diffusion, D, perfusion-related diffusion, D* and perfusion fraction, f, determined from diffusion-weighted (DW) magnetic resonance (MR) imaging on the basis of the intravoxel incoherent motion (IVIM) theory in patients with nasopharyngeal carcinoma (NPC) at the primary site.

METHOD AND MATERIALS

This prospective study was approved by the appropriate ethics committee, and written informed consent was obtained from all patients. Between December 2011 and October 2012, 35 consecutive patients (22 men, 13 women; mean age, 49 years; age range 16-69 years) were examined on a 3.0T MR scanner. DW imaging was performed by using a single-shot echo-planar sequence with 13 b-values (0, 10, 20, 30, 50, 80, 100, 200, 300, 400, 600, 800 sec/mm²). MR imaging was compared with endoscopy and biopsy for the detection of NPC. Mean interval between MR imaging examination and subsequent nasopharyngeal biopsy was 3 days (range, 0-11 days). The initial study population comprised of 21 patients with newly diagnosed NPC (13 men, 8 women; mean age, 55 years) and 14 patients with adenoids enlarge (9 men, 5 women; mean age, 35 years). The lesion D, D* and f were measured and compared in patients with primary NPC and benign hyperplasia.

RESULTS

Between December 2011 and October 2012, 35 consecutive patients (22 men, 13 women; mean age, 49 years; age range 16-69 years) with suspected of having NPC were examined on a 3.0T MR scanner. DW imaging was performed by using a single-shot echo-planar sequence with 13 b-values (0, 10, 20, 30, 50, 80, 100, 200, 300, 400, 600, 800 sec/mm²). MR imaging was compared with endoscopy and biopsy for the detection of NPC. Mean interval between MR imaging examination and subsequent nasopharyngeal biopsy was 3 days (range, 0-11 days). The initial study population comprised of 21 patients with newly diagnosed NPC (13 men, 8 women; mean age, 49 years; age range 16-69 years) and 14 patients with adenoids enlarge (9 men, 5 women; mean age, 35 years). The lesion D, D* and f were measured and compared in patients with primary NPC and benign hyperplasia.

CONCLUSION

IVIM DWI is a feasible technique for investigating primary NPC although limited in 11.4% patients due to susceptibility artifacts around the skull base. D is significantly decreased in primary NPC. The elevation of D* reflects increased blood vessel generation and parenchymal perfusion in primary NPC, indicating that D* can provide insight into the physiological activities related to the disease.

CLINICAL RELEVANCE/APPLICATION

Intravoxel incoherent motion (IVIM) can differentiate benign and malignant head and neck disease, and differentiating certain histological types of malignancy.

Pediatric (Neuroimaging)

Monday, 03:00 PM - 04:00 PM • S102AB

SSE21 • AMA PRA Category 1 Credit™: 1 • ARRT Category A+ Credit: 1

Moderator
Ashok Panigrahy, MD
Moderator
Sarah S Mills, MD

SSE21-01 • Association of Magnetic Resonance Imaging (MRI) Findings and Initial Presenting Symptoms in Infants with Non-accidental Mild Traumatic Brain Injury

Paggie Kim MD (Presenter); Mona Tafti MD; Barbara A Holshouser PhD

PURPOSE
To investigate association between a child’s initial presenting symptom and subsequent additional MRI findings after non-accidental mTBI.

METHOD AND MATERIALS

A retrospective single-center review of the emergency room and radiology records of 151 infants, who presented to the Loma Linda University Medical Center Pediatric Emergency Department for evaluation of suspected NAT from 2001 to 2008, was conducted. Inclusion criteria included infants less than 3 years of age with an initial GCS score of 13-15 (i.e., mTBI) who had both a CT and a MRI brain examination available for review. Records were examined for the occurrence of initial symptoms and the presence on imaging of intracranial abnormalities. Association between initial presenting symptoms and additional MRI findings were examined by calculating odds ratio using 95% confidence interval.
RESULTS
Of the 151, 67 met our inclusion criteria. The mean age was 6.8 months (+/- 7.4 months) and the mean initial GCS score was 14.6 (+/- 0.6). The most common initial presenting symptoms and findings were retinal hemorrhage (39%) and vomiting (33%). The most frequent additional MRI findings not seen on CT were subdural hemorrhage (39%), ischemia/infarction (27%), subarachnoid hemorrhage (29%) and atrophy (27%). Statistically significant associations were found between the initial presenting symptoms of seizure, and additional MRI findings of ischemia/infarct and SDH.

CONCLUSION
Compared to CT, MRI provides clinically useful data in children less than 3 years of age with NAT/mTBI, particularly with evidence of ischemia/infarction. Although children in our study presented with mild symptoms and GCS scores of 13-15, the association between the additional MRI findings and the initial presenting symptoms may help in creating an algorithm to determine when a child must have an additional MRI examination. This will, in turn, help in reducing or even preventing long term risk of neurodevelopmental disabilities following mTBI/NAT.

CLINICAL RELEVANCE/APPLICATION
Association between the child’s initial presenting symptoms and subsequent additional MRI findings can help predicting if a child must have an MRI prior to discharge from the hospital.

SSE21-02 • A Multimodal Imaging Approach to the Super-acute Phase of Mild Traumatic Brain Injury: A Pilot Study
Lidia M Nagae MD (Presenter) ; William C Gaetz PhD ; Mark Zonfrillo MD, MSc ; Jeffrey Berman PhD * ; Kory Heiken ; Erin S Schwartz MD ; Timothy Roberts PhD *

PURPOSE
There has been emerging interest in the acute phase of mild traumatic brain injury (mTBI), with the possibility of early medical intervention targeting presumed underlying metabolic dysfunction. The purpose of our study is to perform a pilot study of multimodal advanced imaging, including gamma-aminobutyric acid MR spectroscopy (GABA-MRS), diffusion tensor imaging (DTI), quantitative arterial spin labeled perfusion imaging (ASL), and magnetoencephalography (MEG), to evaluate super-acute phase of MTBI.

METHOD AND MATERIALS
Subjects in the super-acute phase of MTBI (first 96 hours of injury) and controls between 14-18 years of age were recruited. Subjects and controls with normal clinical routine MRI (including diffusion, susceptibility, and qualitative evaluation of ASL perfusion) were evaluated at a 3.0 Tesla scanner, utilizing a multimodality approach including GABA-MRS (left precentral gyrus area, bi-frontal, and bi-occipital regions), DTI, ASL, and MEG. Only subjects with normal clinical MRI sequences were included.

RESULTS
Seven patients with mTBI and 5 controls were evaluated. Overall, on MEG, significant increase in delta and theta activity z-scores was found in the left superior frontal gyrus and bilateral amygdala. The modalities were compared in similar anatomic regions, in an attempt to reproduce the same areas interrogated by GABA-MRS, utilizing T measurements. In the left motor region, a trend was seen for decrease in ADC (p

CONCLUSION
These preliminary results demonstrate the feasibility of our multimodal evaluation of super-acute mTBI. Comparison with MEG is suggestive of functional changes in similar anatomical areas in patients, despite the mechanism of injury, which could be speculated as a potential diffuse reaction of the brain to trauma.

CLINICAL RELEVANCE/APPLICATION
Early identification of possible injury by any of the imaging modalities utilized could aid as objective identification of mTBI, and serve as a potential tool for follow-up if medical intervention.

SSE21-03 • MRI Features of Cortical Venous Injury in Abusive Head Trauma (AHT)
Arabinda K Choudhary MBBS (Presenter) * ; Krishnamoorthy Thamburaj MD ; Mark Dias MD ; Danielle K Boal MD

PURPOSE
1. To assess evidence of direct intracranial venous injury in AHT
2. To assess evidence of indirect features of intracranial venous injury in AHT
3. To assess for thrombosis of cortical veins and sinuses in AHT

METHOD AND MATERIALS
We identified patients between 0-3 years with AHT managed at our institute from 2001-2012. MRI and MRV were evaluated by two experienced neuroradiologists to assess for subdural hemorrhage, parenchymal abnormalities and thrombosis. Detailed evaluation of veins and sinuses included evidence of direct venous injury with blood clot adherent to the bridging cortical veins (Lollipop sign) terminating in the region of subdural hemorrhage, secondary features of venous injury with compression (compression sign) of cortical veins by the subdural hemorrhage.

RESULTS
A total of 45 studies were reviewed. The median age was 3 months with 62% males. 41/45 children (91%) had SDH. On MRV, 14/45 cases (31%) had no evidence of venous compression, including 10 with, and 4 without SDH. The remaining 31/45 cases (69%) had imaging evidence of cortical vein and/or sinus compression. Venous compression was most commonly bilateral in 45%. In 17/31 cases (54.8%) only the cortical veins were compressed whereas in 11/31 cases (35.5%) both cortical veins and sinuses were compressed. In 3/31 cases (9.7%) only the sinus was compressed. Evidence of direct trauma to the bridging vein (lollipop sign) was seen in 44.5% of cases. All veins having a lollipop sign also had evidence of venous compression from an overlying SDH. Among 22/41 children with a small volume SDH, 15/22 (68.2%) had a lollipop sign. Among 19 cases of moderate or large SDH, 16/19 (84.2%) had evidence of venous compression and 10/19 (52.6%) had a lollipop sign (table 1). The four remaining children without SDH had neither venous compression nor a lollipop sign. Thrombosis was found in 2/45 cases of AHT.

CONCLUSION
1. Evidence of displacement and/or compression of cortical veins and sinuses from subdural hemorrhage is present in 69% of cases of AHT.
2. Evidence of direct trauma to the veins can be identified in 44.5% of cases. 3. There were no cases of cortical vein compression or lollipop sign in absence of subdural hemorrhage.

CLINICAL RELEVANCE/APPLICATION
Our study will increase awareness and subsequently improve detection of MRV findings of compression and evidence of direct trauma to the bridging veins.

SSE21-04 • A Diffusion Tensor Imaging (DTI) Study of Brain White Matter and Neuropsychiatric Abnormalities in Attention Deficit/Hyperactivity Disorder (ADHD) Children
Lizhou Chen (Presenter) ; Xinyu Hu ; Yi Liao ; Lanting Guo ; Qiyong Gong ; Xiaoli Huang MD ; Ning He ; Fei Li MD

PURPOSE
ADHD is highly prevalent in school-age children with impaired cognitive functions. Diffusion tensor imaging (DTI) owns a unique advantage of detecting microstructural changes in cerebral white matter and might be useful to detect cognitive abnormalities in ADHD. In present study, we aim to examine the whole-brain fractional anisotropy (FA) difference between drug-naive ADHD children and healthy controls (HC) in a relatively large sample size and also to explore the correlation of FA value with neuropsychiatric
METHODOLOGY AND MATERIALS

47 ADHD children (mean age = 10.1, male = 41) and 48 HC (mean age = 10.9, male = 35) were recruited. All participants underwent a set of neuropsychological tests including Stroop test (ST), visual memory test (VMT), verbal fluency test (VFT) and Wisconsin Card Sorting test (WCST). The DTI measures were acquired via 3-T MR system using EPI sequence with 20 directions. FA map was generated by FSL after eddy current and brain extraction, and put into SPM8 for normalizing and smoothing. Voxel-wise comparison was done by two sample t-test with age and sex as covariates, threshold at P < 0.05.

RESULTS

Comparing with HC, the ADHD group demonstrated increased FA in the body of corpus callosum extending to bilateral middle cingulum (peak coordinates [-12,2,38], T = 4.27) (see Figure), while no decreasing cluster was detected. The cluster displayed a positive correlation with VMT scores for 30-minutes delay intervals (r = 0.32, p = 0.029). VFT scores for total numbers (r = 0.46, p = 0.001) and right numbers (r = 0.45, p = 0.0011). ST scores for right numbers (r = 0.31, p = 0.032), while negatively correlated with ST scores for wrong numbers (r = -0.32, p = 0.028) and total time (r = -0.37, p = 0.01).

CONCLUSION

Our study found elevated FA value in the group of ADHD children which correlated with multiple cognitive functions. We postulated there might be a compensatory mechanism for increased information translation between hemispheres in ADHD children.

CLINICAL RELEVANCE/APPLICATION

Diffusion tensor imaging (DTI) may be a useful technique to help with the evaluation of cognitive abnormalities in ADHD children.

SSE21-05 • ¹H Magnetic Resonance Spectroscopy Assessment of Metabolic Brain Maturation in Attention Deficit Hyperactivity Disorder

Arturo R Alvarado MD (Presenter)

PURPOSE

To evaluate aged-related biochemical changes in Frontal Lobe White Matter (FLWM) using ¹H Magnetic Resonance Spectroscopy (MRS) in children diagnosed as Predominantly Inattentive Type Attention Deficit Hyperactivity Disorder (ADHD).

METHODOLOGY AND MATERIALS

Forty right-handed male children (5 years old) diagnosed as ADHD according to the Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV) criteria participated in the study after their parents consent and the Local Ethics Committee authorization was obtained. Psychological/behavioral treatment was performed during the course of the investigation avoiding medications use. MRS studies were performed on a 3.0 Tesla scanner (Signa Excite, GE) with a standard head coil using Point-Resolved Spectroscopy (PRESS) localization with automated shim and water suppression. Parameters were fixed at TR = 1500 ms, TE = 35 ms and 256 FID. T1, T2 and T2 FLAIR MR images in axial, coronal and sagittal views were acquired before MRS examination and single voxel of 4.00 cm³ (2.0 cm x 1.0 cm x 2.0 cm) was placed in each FLWM and Occipital WM used as internal reference pattern. All children were examined every 12 months in a date close to the birthday during 4 consecutive years. Metabolic signals of N-Acetylaspartate (NAA), Creatine (Cr), Choline (Cho), Glutamine-Glutamate complex (Glx) and myo-Inositol (mI) were detected and NAA/Cr, Cho/Cr, Glx/Cr and mI/Cr ratios were calculated. Analysis of Variance (ANOVA) was applied to the results. Student-Newman-Keuls test for multiple comparisons was assessed in order to verify the differences among ratio means. Analysis of Covariance (ANCOVA) was used to evaluate the relationship between the neuropsychological test scores and metabolites ratios result.

RESULTS

Significant age-dependent decreases in Glx/Cr ratio was observed in FLWM at both sides as well as in Cho/Cr ratio in right FLWM (p < 0.05) compared with the TDC group. NAA/Cr, Glx/Cr and mI/Cr ratios were significantly decreased in FLWM of ADHD children compared with TDC. Cho/Cr ratio was significantly increased in FLWM of ADHD children compared with TDC. NAA/Cr ratio was significantly decreased in TLWM of ADHD children compared with TDC.

CONCLUSION

These findings suggest that Glx/Cr and Cho/Cr ratios are increased in FLWM of children with ADHD and the age-dependent reduction might constitute a brain maturation marker in ADHD.

CLINICAL RELEVANCE/APPLICATION

The Glx/Cr and Cho/Cr age-dependent decrease evaluated through MRS might be useful as a complement of routine ADHD examinations. Therefore; we recommend its use on ADHD evaluation.

SSE21-06 • Medication Naïve Attention-deficit/Hyperactivity Disorder Subjects Have Low Brain Iron Levels as Detected by Magnetic Field Correlation Imaging

Vitria Adisetiyo PhD (Presenter); Rachael Deardorff MS; Ali Tabesh PhD; Elis Fieremans PhD; Kevin M Gray MD; Adriana Di Martino; F. Xavier Castellanos MD; Jens H Jensen PhD; Joseph A Helpern PhD *

PURPOSE

Stimulant medication reduces symptoms in attention-deficit/hyperactivity disorder (ADHD) through indirectly increasing dopamine (DA) levels in the striatum. Hence, it is suspected that reduced DA levels are part of ADHD pathology. However, both increased and decreased DA markers have been detected in ADHD. Interestingly, reduced DA markers have been consistently found in medication naïve patients while increased markers have been found in patients with a history of medication use, suggesting increased DA markers may reflect an adaptive response to medication. Here we assess the relationship between medication history and brain iron levels in children and adolescents with ADHD compared to typically developing controls (TDC). As brain iron is required for DA synthesis, assessing iron levels with MRI may provide non-invasive indirect measures of DA.

METHODOLOGY AND MATERIALS

27 TDC, 12 ADHD-naïve and 10 ADHD-medication were recruited. As indices of brain iron, magnetic field correlation (MFC) and relaxation rates (R2, R2* and R2') were used. All are affected by tissue iron but differ in their sensitivities and specificities. MFC was estimated using a single voxel with a multiple spin echo sequence and R2* with a multiple gradient echo sequence. R2 = R2* - R2. The globus pallidus (GP), caudate nucleus (CN), putamen (PUT) and thalamus (THL) were chosen as regions of interest because of their suspected role in ADHD in addition to having high iron content. Serum iron measures were also collected.

RESULTS

The ADHD-naïve subgroup had significantly lower MFC than either TDC or the ADHD-medication subgroup in 3 of the 4 brain regions studied (FDR corrected). ADHD-naïve vs. TDC: PUT (p = 0.005, d = 1.0), CN (p = 0.003, d = 1.1) and THL (p = 0.012, r = 0.4); ADHD-naïve vs. ADHD-medication: PUT (p = 0.002, d = 1.5), CN (p = 0.004, d = 1.4) and THL (p = 0.021, r = 0.5). TDC and the ADHD-medication subgroup did not significantly differ in MFC. In contrast, no significant group differences were detected using the R2, R2*, R2' or serum measures.

CONCLUSION

Similar to other DA marker measures, lower brain iron levels (indexed only by MFC) are observed in medication naïve ADHD and appear to normalize with medication.

CLINICAL RELEVANCE/APPLICATION

Reduced brain iron in medication naïve ADHD is a promising biomarker. MFC imaging's ability to non-invasively detect these aberrant levels may help improve ADHD diagnosis and guide optimal treatment.
RESULTS
TBF decreased in the 2 hrs post-irradiation group by 70 to 80% of pre-irradiation levels, followed by a steady increase in later groups, until, at 24 hrs post-irradiation, TBF exceeded pre-irradiation levels by 40%. The interstitial volume fraction, ve, negative throughout the study, pointed to a significant loss of interstitial volume (i.e., cell swelling). At 2 hrs after radiation, ve was 30% below pre-irradiated values, decreasing to near pre-irradiated values 4 hrs after radiation, but subsequently decreased to 30% below pre-irradiated levels at 24 hrs post-irradiation. The vascular permeability, Ktrans, demonstrated a bimodal response, increasing at 4-8 hrs, reaching 35% above pre-irradiated values, followed by a decrease at 24 hrs to 40% below the pre-irradiation level.

CONCLUSION
To our knowledge, this is the first measurement of changes in ve and/or TBF in the hours immediately following 20 Gy irradiation. Since vascular changes have profound implications for the delivery of adjunct therapies, these findings provide direction for the optimization of combined therapies.

CLINICAL RELEVANCE/APPLICATION
Post-RT changes in the tissue-vascular interface in a model of cerebral glioma were measured. Knowledge of acute vascular dynamics can help optimize radiation combined with adjunct therapies.

SSEE25-02 • Evaluating Response to Spine Radiosurgery with DCE-MRI Perfusion Parameters

Kiran A Kumar (Presenter); Kyung K Peck PhD; Sasan Karimi MD; Eric Lis MD; Mark Bilsky MD*; Andrei I Holodny MD*; Yoshiya Yamada MD*

PURPOSE
Dynamic contrast enhancement MR imaging (DCE-MRI) offers noninvasive characterization of the vascular microenvironment and hemodynamics. In this study, we hypothesize that DCE-MRI can be used to evaluate treatment response and predict tumor recurrence in patients with spinal metastases undergoing high dose radiotherapy (RT).

METHOD AND MATERIALS
We conducted a retrospective study of 30 patients with spinal metastases who underwent DCE-MRI before and after RT. 20 patients received single-fraction SRS (24 Gy), while 10 received hypofractionated SRS (27-30 Gy total). Kaplan-Meier analysis was used to estimate the actuarial local recurrence rates, which were compared using a log-rank test. Two compartment model-based perfusion parameters (Ktrans: vascular permeability and Vp: plasma volume) were measured for each metastasis, relative to normal-appearing bone marrow. Percent change in parameter values from pre- to post-treatment were calculated and statistically compared.

RESULTS
At 20-month median follow-up, 5/30 (17%) patients had pathological evidence of local recurrence (LR). 3/10 (30%) patients treated with hypofractionated SRS had LR, while 2/20 (10%) patients with single-fraction SRS had LR. 1- and 3-year actuarial local recurrence rates were 24% and 44% for the hypofractionated SRS group vs. 5% and 16% for the single-fraction SRS group (p=0.20). The average change in Vp and Ktrans for patients without LR vs. those with LR was -76% (range, -99% to -12%) and -66% (range, -99% to -9%) vs. +28% (range, -19% to +102%) and -14% (range, 50% to +84%) (p<0.05).

CONCLUSION
We demonstrated that changes in perfusion, particularly Vp, reflect tumor responses to high dose RT in spinal bone metastases. Additionally, these changes predicted local tumor recurrence on average >6 months earlier than standard imaging did.

CLINICAL RELEVANCE/APPLICATION
The ability of DCE-MRI to detect early treatment response and predict local recurrence has the potential to improve patient care and outcome.

SSEE25-03 • Dual Payload Molecular Radiotherapy against Malignant Brain Cancer

Van T Nguyen PhD; Gilberto Zulato; Jesse M Conyers BS; Dongqin Zhu; Waldemar Debinski; Akiva Mintz MD, PhD (Presenter)*

PURPOSE
Our overall goal is to therapeutically exploit a novel ligand-based delivery system that targets IL13Rα2, a tumor-restricted biomarker that we discovered to be overexpressed in majority of Glioblastoma Multiforme (GBM) as well as other tumors. Our hypothesis is that we can efficiently target GBM in vivo using a dual payload molecular strategy that that exploits our novel delivery system based on IL13Rα2-Targeted Quadruple Mutant of IL13 (TQM13). We therefore created a single TQM13 targeted agent that simultaneously delivers both a therapeutic cytotoxin and an active bacterial toxin specifically to GBM tumors expressing IL13Rα2.

METHOD AND MATERIALS
We designed TQM13-cytotoxin (CTX) using the cDNA of TQM13 in frame with a modified form of Pseudomonas Toxin (PE4E). Protein was produced using a bacterial system. We used a cell-based cytotoxicity assay to test potency/specificity of TQM13-CTX to GBM cells that express IL13Rα2. We radiolabeled TQM13-CTX with [131]Iodine, a prototype 8-emitter, using an iodogen kit. To test in vivo efficacy, we stereotactically implanted GBM cells intracranially in nude mice and monitored tumor formation with bioluminescent imaging. 7-10 days post-implantation, groups of mice were treated intracranially.

RESULTS
Results: We demonstrated that TQM13-CTX only killed GBM cells that express IL13Rα2. This killing was potent and in direct proportion to the number of IL13Rα2 binding sites. To test the in vivo efficacy of [131]I-TQM13-CTX, we radiolabeled TQM13-CTX with [131]I and...
treated groups on mice (n=9) with a single dose of either (i) [131]I-TQM13-CTX, (ii) unlabeled TQM13-CTX mixed with untargeted [131]I, or (iii) saline. At the completion of the experiment (day 80), 100% of the [131]I-TQM13-CTX treated group was cured, compared to only 67% of the group treated with the unlabeled active TQM13-CTX (mixed with untargeted [131]I) and 0% in the saline control group.

CONCLUSION
This work confirms the potency of our dual payload molecular strategy that uses both radioimmunotherapy and an active bacterial cytotoxin to target the IL13Rα2 GBM-associated biomarker.

CLINICAL RELEVANCE/APPLICATION
GBM is an invariably fatal malignancy. We therapeutically exploited a dual payload molecular radiotherapy strategy that targets GBM via a novel molecular delivery system that we developed.

### SSE25-04 • Dosimetric Implications of Setup Error in Craniospinal Irradiation with Volumetric Modulated Arc Therapy

**Ben Durkee** MD, PhD (Presenter); **Blaire Hargens** MS; **Fred Van Den Haak**; **Jennifer L Shah** MD; **Sarah S Donaldson** MD

**PURPOSE**
1. To demonstrate the dosimetric advantages and drawbacks of volumetric modulated arc therapy (VMAT) planning for craniospinal irradiation (CSI).
2. To demonstrate that small errors in setup are dosimetrically acceptable for CSI with VMAT.

**METHOD AND MATERIALS**
A single pediatric patient was simulated in the supine position on a Styrofoam board. The head was immobilized by a custom headrest and thermoplastic mask. No specific measures were taken to immobilize the spine or pelvis. Craniospinal therapy was prescribed to a dose of 23.4 Gy using 3D conformal radiotherapy (3D CRT) and VMAT. The two plans were compared with attention to coverage of the target volume and dose to normal tissues. Normal tissues examined included thyroid, heart, lungs, kidneys, bowel and whole body. A small setup error was simulated by applying 3 mm and 5 mm lateral shifts to the dosimetric map. The plan was re-analyzed by the same metrics as above.

**RESULTS**
Both plans resulted in good coverage of the target and met our pre-defined constraints for normal tissue. VMAT was superior to 3D CRT in minimizing dose to normal tissues near the midline, including thyroid (mean 11.4 Gy versus 22.2 Gy) and small bowel (V15).

Dosimetric implications of resultant setup errors must be considered when using highly conformal techniques such as VMAT. VMAT for CSI can spare dose to normal tissues near the midline, but at the expense of low-dose spill to large volume structures such as lung and whole body. Long-term implications, including risk for secondary malignancies, should be considered in patients selected for VMAT craniospinal irradiation. Planning with VMAT appears to be relatively resistant to small errors in setup, making it an appropriate modality for use in carefully selected children.

**CLINICAL RELEVANCE/APPLICATION**
Craniospinal irradiation with highly conformal techniques such as VMAT is relatively resistant to small errors in setup, and is appropriate for thoughtfully selected pediatric cases.

### SSE25-05 • Pancreatic-sparing Cranio-spinal Irradiation (CSI) for Medulloblastoma: Dosimetric Comparison of Proton and Photon Modalities to Reduce the Risk of Diabetes Mellitus (DM)

**Jeffrey Brower** (Presenter)

**ABSTRACT**

**Purpose/Objectives:**
A recent multi-institution study demonstrated that radiotherapy dose >10 Gy to the pancreatic tail (PT) predicted an 11-fold increased risk of DM in childhood cancer survivors. These findings highlight the potential radiosensitivity of pancreatic islet cells responsible for insulin secretion. Cadaveric human studies have shown that up to 65% islet cells are located outside PT. These data suggest the importance of including the whole pancreas (P) as an organ-at-risk (OAR) during radiotherapy planning for pediatric tumors, such as CSI for medulloblastoma given its relatively favorable prognosis. This study compares CSI techniques of proton beam therapy (PBT), conventional photon fields (3DCRT), and helical tomotherapy (HT) to investigate their differential capacity for pancreatic sparing.

**Materials/Methods:**
5 average-risk medulloblastoma patients who received CSI to 23.4 CGE using PBT at a single institution were identified. P and PT had not been considered OARs during PBT planning. 3DCRT plans using opposed lateral cranial fields and posterior spinal fields were generated. P and PT were delineated as OARs on the PBT planning CT scan, and multiple HT plans were developed for each patient. HT plans delivering the lowest dose to P and PT without compromising target coverage were selected. Endpoints included mean dose (Dmean), maximum dose (Dmax), and volume receiving 10 Gy (V10). Comparisons were made using T-test; statistical significance was assigned to p values < 0.05.

**Results:**
All three modalities covered the PTV with the 95% isodose line.

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>3DCRT Mean SD</th>
<th>PBT Mean SD</th>
<th>HT Mean SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Whole Pancreas (P)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dmax (Gy)</td>
<td>8.2 2.49 0.09</td>
<td>0.01 4.41 0.78</td>
<td></td>
</tr>
<tr>
<td>V10 (%)</td>
<td>39.28 13.13 0</td>
<td>0.41 0.92</td>
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<tr>
<td><strong>Pancreatic Tail (PT)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dmax (Gy)</td>
<td>20.86 0.32 6.89</td>
<td>1.71 9.17 1.08</td>
<td></td>
</tr>
<tr>
<td>V10 (%)</td>
<td>59.05 9.65 0.3</td>
<td>0.61 4.48 1.9</td>
<td></td>
</tr>
</tbody>
</table>

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**Table:**

- **Whole Pancreas (P):**
  - Dmax (Gy): 11.97 1.81 0.172 0.14 5.06 0.54
  - V10 (%): 59.05 9.65 0.3

- **Pancreatic Tail (PT):**
  - Dmax (Gy): 21.36 0.23 11.91 6.8 13.47 1.24
  - V10 (%): 39.28 13.13 0
**ABSTRACT**

1) To discuss molecular brain imaging technologies that have been translated from research developments to clinical applications.

Satoshi Minoshima

**LEARNING OBJECTIVES**

1) To explain various quantification methods applied in the field of molecular brain imaging. 2) To discuss how such quantification methods can be used in clinic.

Alexander Drzezga

**ABSTRACT**

1) Pathophysiological background: Role of amyloid-aggregation in the development of Alzheimer’s disease. Concept of modern anti-amyloid therapy options. Time course of amyloid-aggregation as compared to the appearance of clinical symptoms. Value of amyloid-imaging as compared to other biomarkers of Alzheimer’s disease. 2) Methodological principles of amyloid imaging: Development, mechanism, available tracers. Proof of concept, in vivo versus ex vivo histopathological confirmation. 3) Clinical value and interpretation of amyloid-imaging results, pitfalls and artefacts, value of amyloid-imaging with regard to early diagnosis, differential diagnosis and therapy monitoring. 4) Amyloid imaging in comparison to other imaging biomarkers (MRI, FDG-PET), value of multimodal imaging.

Kirk A Frey

**ABSTRACT**

1) To discuss molecular brain imaging technologies that have been translated from research developments to clinical applications.

Peter Herscovitch

**ABSTRACT**

1) To discuss new molecular brain imaging techniques that are available in the clinic. 2) To explain how basic research has been translated to clinical applications. 3) To discuss approval processes that are necessary to establish clinical molecular brain imaging.

**ABSTRACT**

Feasibility of Simultaneous Integrated Boost Gamma Knife Planning For Malignant Gliomas and Brain Metastases

Nevine M Hanna MD (Presenter)

**ABSTRACT**

Simultaneous Integrated Boost (SIB) in Gamma Knife planning defines and prescribes differential doses to the gross target volume (GTV) and the surrounding region of peritumoral infiltration or edema. The purpose of this is to report our preliminary assessment of the concept of the simultaneous integrated boost (SIB) applied to Gamma Knife radiosurgery in the treatment of recurrent gliomas and brain metastases.

**METHODS:** 8 lesions in 6 patients underwent SIB Gamma Knife planning for recurrent glioma or resected brain metastases with a residual tumor nodule. SIB Gamma Knife planning was performed using Gamma Plan 8.2 according to a technique developed by the authors to differentially treat nested target volumes. The gross target volume (GTV) was defined by the contrast enhancing tumor nidus on T1 magnetic resonance imaging (MRI) sequences and the planning target volume-margin (PTV-m) was defined by the abnormal region on the T2 or FLAIR sequences. A higher dose was delivered to the gross target volume (GTV) defined by the contrast enhancing lesion as seen on the T1 contrast-enhanced SPGR sequences and a lower, volume-appropriate dose to the typically larger planning target volume (PTV-m) consisting of a margin of the T2 or FLAIR abnormal region or a metastasis surgical resection cavity. All patients were treated on the Gamma Knife Perfexion. Volume appropriate doses were prescribed: for the recurrent gliomas, 12-16 Gy to the GTV and 8 Gy to PTV-m. For the resected brain metastasis, 18-27 Gy was given to the residual tumor nodule (GTV) and 16-17 Gy to the cavity (PTV-m).

**RESULTS:** Average age was 53 years (46-71). Brain lesions treated included malignant gliomas as well as metastases secondary to melanoma and squamous cell carcinoma. Mean prescribed dose was 17.1 Gy (12-27) at 78% (65-84). Mean coverage at prescription was 85% (70-100) and mean treatment volume was 5.1 cc (0.31-10.1). Mean PTV-m volume = 24.5 cc (7.0-57.9). Prescribed dose was 8 Gy for re-irradiation and 16-17 Gy for non-re-irradiation treatment. Mean PTV-m coverage was 96% (95-100) and mean PTV-m treatment volume was 40 cc (4.2-86). Mean number of shots was 29 (5-54) and mean on-beam time was 76 minutes (23.7-158.6). Median post-treatment follow up after treatments is 22 weeks (4-59) with 3 patients deceased and 3 patients alive without evidence of complications at last follow up. Further radiological response is being analyzed.

**CONCLUSIONS:** We conclude from this preliminary study that SIB Gamma Knife plans with target and treatment volume adjusted GTV and PTV-m doses are feasible for implementation for Gamma Knife radiosurgery. The lack of toxicity and the preliminary clinical outcomes suggest the potential future utility of the SIB concept for Gamma Knife radiosurgical treatment planning.

**ABSTRACT**

How Molecular Imaging Contributes to Movement Disorders? Current and Future

Kirk A Frey MD, PhD (Presenter) *

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**ABSTRACT**

Making Molecular Brain Imaging Available in the Clinic: FDA and CMS

Peter Herscovitch MD (Presenter)

**LEARNING OBJECTIVES**

1) To discuss new molecular brain imaging techniques that are available in the clinic. 2) To explain how basic research has been translated to clinical applications. 3) To discuss approval processes that are necessary to establish clinical molecular brain imaging.
LEARNING OBJECTIVES

The intent of this course is to provide direct hands-on education regarding contouring of head and neck cancer. Participants will be given the opportunity to contour head and tumor of the nasopharynx and larynx. Their contours will be compared to contours drawn by experts in head and radiation oncology and radiology. The session will emphasize various techniques approaches that enhance the participants ability to accurately contour tumor and prevent geographic misses. The session will also discuss important anatomic landmarks and patterns of spread for cancers at these sites.

ABSTRACT

The intent of this course is to provide a hands-on contouring session for head and neck cancer. This session will be presented by a radiologist and radiation oncologist.
Voxel-wise ADC Probability Density Function for Brain Tumor Characterization and Response Measurement

LEARNING OBJECTIVES
1) Review the fundamental mechanisms by which diffusion imaging can address problems of tissue characterization in brain tumor patients. 2) Examine the role of diffusion imaging in differential diagnosis of the most common brain tumors including meningioma, glioma, lymphoma, and pediatric tumors of the posterior fossa. 3) Understand the potential but also the limitations of diffusion tensor imaging in defining tumor margins and planning tumor resections. 4) Understand the role of diffusion imaging in evaluating brain tumor treatment-related effects, including cytoreductive therapeutic response, radiation necrosis, and treatment-related white matter injury.

RESULTS
Brain tumor patients showed left-lateralization during antonym-word generation and text-reading tasks at high threshold values and bilateral activation during letter-word generation task, irrespective of varying the threshold values. Vascular lesion patients showed left-lateralization during the antonym and letter-word generation, and text-listening task at high threshold values.

CONCLUSION
Our results suggest that the type of task and the applied statistical threshold influence LI and that the threshold effects on LI may be task-specific. Thus identifying critical functional regions and computing LIs should be done on an individual subject basis, using a continuum of threshold values with different tasks to provide the most accurate information for pre-surgical planning of lesion resections.

CLINICAL RELEVANCE/APPLICATION
Examining lateralization index (LI) using a variable statistical threshold and different tasks may maximize retention of language activity in tumor and vascular lesion patients, post-surgically.

VSNR31-05 • Diffusion Repeatability Evaluation And Measurement (DREAM)-MRI: A New Technique for Quantifying the Voxel-wise ADC Probability Density Function for Brain Tumor Characterization and Response Measurement

Benjamin M Ellingson MS, PhD (Presenter) *; Timothy F Cloughesy MD *; Whitney B Pope MD, PhD *
ABSTRACT
In the context of brain tumors, perfusion imaging is a broad term referring to a variety of techniques measuring delivery of blood to tumors, the intrinsic vascularity of tumors, and the permeability of the blood brain barrier. The most commonly used techniques are dynamic susceptibility contrast-enhanced MRI (DSC-MRI), dynamic contrast-enhanced MRI (DCE-MRI) and arterial spin labeling (ASL). The most commonly used figures of merit corresponding to these techniques are relative cerebral blood volume and blood flow (rCBV, rCBF), volume transfer coefficient and initial area under the gadolinium concentration curve (Ktrans, IAUGC) for DCE-MRI and cerebral blood flow (CBF) for ASL. There is considerable interest in using these techniques to grade tumors by predicting either tumor pathology or patient survival, to distinguish between true progression and pseudoprogression/radiation necrosis in patients with recurrent enhancement after treatment, and to provide an earlier or more reliable indicator of patient response to treatment. Without question, perfusion imaging has provided insight into the brain tumor vascular microenvironment, which could be considered a phenotypic characteristic of tumors with important implications for tumor genomics, tumor pathophysiology and drug development.

Although these techniques have been shown to influence therapy decisions for individual patients, multicenter clinical trials demonstrating the added value of perfusion imaging have yet to be successfully concluded. In this talk, four questions will be addressed. First, how are figures of merit derived from perfusion imaging related to underlying tumor pathophysiology? Second, how can these figures of merit be derived? Third, why have these techniques not yet been being integrated into routine clinical practice? Finally, what is the future outlook for these techniques?

CONCLUSION
DREAM-MRI is a novel technique for quantifying the voxel-wise ADC PDF and may be useful for evaluation of brain tumor response to therapy.

CLINICAL RELEVANCE/APPLICATION
Diffusion MRI is useful for brain tumor treatment evaluation, but ADC measurement uncertainty is a concern. The DREAM-MRI sequence overcomes this limitation.

VSNR31-06 • Potential Use of Mean Apparent Diffusion Coefficient Values in Defining the Portal for Radiotherapy
Daniel Jeong MD (Presenter); Sharon E Byrd MD; Shalini Garg MD; Mehmet Kocak MD

PURPOSE
A major challenge in treating Glioblastoma Multiforme (GBM) is distinguishing the extent of tumor from surrounding inflammation and edema on conventional MRI sequences. The T1 post contrast and T2/FLAIR sequences are widely utilized to assess tumor extent and define the radiation portal for radiotherapy, but Apparent Diffusion Coefficient (ADC) maps are not as widely used. Multiple authors have shown a significant difference in ADC values for tumor, edema, and normal white matter. However, few studies have evaluated ADC values at sites of future tumor recurrence using pre and post treatment MRI exams. The aim of this study is to evaluate pre treatment mean ADC values at sites that gave rise to future tumor recurrence compared to similar background tissue that did not progress to tumor.

METHOD AND MATERIALS
Out of 110 consecutive patients with pathology proven GBM at our institution from 1/1/2009 to 5/31/2012, 20 had definitive post radiotherapy recurrence after 3 months and had received treatment and follow-up imaging at our institution. These 20 patients were included in this single-center retrospective cohort study. Pre and post radiotherapy MRI exams were evaluated, and the sites of tumor recurrence on post treatment exams were correlated with corresponding tissue on pretreatment exams and the type of background surrounding tissue was noted (edema, normal white or gray matter). Mean ADC values were compared for sites of future tumor recurrence and background tissue that did not progress to tumor recurrence.

RESULTS
The mean ADC value of brain tissue on pre-radiotherapy MRI exams in regions of future tumor recurrence was significantly lower than the mean ADC values in regions of surrounding tissue not progressing to tumor (p = 0.002), without noticeable abnormalities seen on conventional T1 post contrast and T2/FLAIR MR sequences.

CONCLUSION
Mean ADC values may help predict sites of future tumor recurrence in GBM, and could be helpful in pre-radiation planning and identifying microscopic tumor prior to gross tumor recurrence on conventional MR imaging.

CLINICAL RELEVANCE/APPLICATION
Mean ADC values may help identify microscopic tumor prior to gross recurrence and should be considered during radiation planning.

VSNR31-07 • Perfusion Methods in CNS Tumors
Daniel P Barbioria MD (Presenter) *

LEARNING OBJECTIVES
1) To gain familiarity with the basic principles used to derive imaging measurements of blood volume, blood flow and capillary permeability in brain tumors. 2) To learn the potential utility of perfusion imaging for providing insight into the processes of neangiogenesis and into the methods of action of brain tumor therapies. 3) To understand how the challenges of lack of standardization in both image acquisition and analysis are being addressed by national research and cooperative groups.

ABSTRACT
In the context of brain tumors, perfusion imaging is a broad term referring to a variety of techniques measuring delivery of blood to tumors, the intrinsic vascularity of tumors, and the permeability of the blood brain barrier. The most commonly used techniques are dynamic susceptibility contrast-enhanced MRI (DSC-MRI), dynamic contrast-enhanced MRI (DCE-MRI) and arterial spin labeling (ASL). The most commonly used figures of merit corresponding to these techniques are relative cerebral blood volume and blood flow (rCBV, rCBF), volume transfer coefficient and initial area under the gadolinium concentration curve (Ktrans, IAUGC) for DCE-MRI and cerebral blood flow (CBF) for ASL. There is considerable interest in using these techniques to grade tumors by predicting either tumor pathology or patient survival, to distinguish between true progression and pseudoprogression/radiation necrosis in patients with recurrent enhancement after treatment, and to provide an earlier or more reliable indicator of patient response to treatment. Without question, perfusion imaging has provided insight into the brain tumor vascular microenvironment, which could be considered a phenotypic characteristic of tumors with important implications for tumor genomics, tumor pathophysiology and drug development.

Although these techniques have been shown to influence therapy decisions for individual patients, multicenter clinical trials demonstrating the added value of perfusion imaging have yet to be successfully concluded. In this talk, four questions will be addressed. First, how are figures of merit derived from perfusion imaging related to underlying tumor pathophysiology? Second, how can these figures of merit be derived? Third, why are these techniques not yet been being integrated into routine clinical practice? Finally, what is the future outlook for these techniques?

VSNR31-08 • Baseline Spin-Echo Echo-Planar Perfusion nCBV > 2.0 prior to Chemoradiation Is a Strong Independent Predictor of Poor Progression-free and Overall Survival in Patients with Newly Diagnosed Glioblastoma
Ayca Akgoz MD (Presenter); Rifqauat Rahman; Hui You; Alahfizd Hamdan; Ravi T Seethamraju PhD *; Patrick Y Wen MD *; Geoffrey S Young MD *

PURPOSE
Diffusion MRI has been shown to be valuable for characterizing brain tumor cellularity and response to therapy; however, measurements of ADC can often be prone to noise contamination and other artifacts that lead to inaccurate measurement. We have developed a new method termed “diffusion repeatability evaluation and measurement” (DREAM)-MRI for repeatedly acquiring ADC measurements in a short period of time in order to construct the voxel-wise ADC probability density function (ADC PDF) and provide a measure of uncertainty in ADC estimation. In the current study we have examined this technique in phantoms, normal volunteers, and patients with glioblastoma.

METHOD AND MATERIALS
All scans were performed on a 3T MR system (Siemens Trio; Erlangen, Germany). The ACR and ADNI phantoms were used to test ADC PDF dependence on pulse sequence parameters. A total of 10 healthy volunteers and 5 patients with glioblastoma were enrolled in the current study. VSNR3-MRI consisted of a total of 100 diffusion measurements in the x, y, and z direction were obtained within 8 minutes for 10 slices using optimized partial Fourier encoding, parallel imaging, and echoplanar acquisition. ADC PDFs were constructed from the different samples and compared across sequence parameters and tissue types.

RESULTS
ADC PDF variability was lowest using a b-value of 500s/mm2, but did not change appreciably across TR, TE, number of acquisitions, shimming technique, or T1 characteristics of the material (from ADNI phantom). Mean ADC and variability in ADC appeared correlated. As expected, normal white matter had a lower mean ADC and lower ADC variability compared with gray matter. Serial ADC PDFs showed no appreciable difference when volunteers were rescanned at a later time point. Glioblastoma patients showed low ADC PDF characteristics in tumor regions, which changed serially as a result of radiation therapy.

CONCLUSION
DREAM-MRI is a novel technique for quantifying the voxel-wise ADC PDF and may be useful for evaluation of brain tumor response to therapy.

CLINICAL RELEVANCE/APPLICATION
Diffusion MRI is useful for brain tumor treatment evaluation, but ADC measurement uncertainty is a concern. The DREAM-MRI sequence overcomes this limitation.
PRIORITY
Prior studies have indicated that gradient-echo echo-planar (GE-EPI) perfusion weighted imaging (PWI) may be helpful in prognosis and treatment assessment in newly diagnosed glioblastoma (GBM) patients. While both animal and limited human data suggest that SE-EPI PWI data is more closely correlated with the presence of neovascularity and survival in GBM than GE-EPI PWI, no large series has assessed this. We assessed whether SE-PWI before and after initiating chemoradiation can stratify patients with respect to progression free survival (PFS) and overall survival (OS).

METHOD AND MATERIALS
Sixty-eight glioblastoma patients with interpretable pre and post-treatment SE-PWI were identified. In each study, normalized cerebral blood volume (SE-nCBV) was calculated by hot-spot method from 3 regions of interest (ROI) selected within the areas of maximal cerebral blood volume (CBV) in enhancing and/or non-enhancing tumor and 1 ROI selected within the contralateral normal appearing white matter. Univariate and multivariate Cox proportional hazards model was utilized to identify perfusion parameters predictive for PFS and OS. Receiver operator curve characteristic analysis was used to identify thresholds optimized for 15-month survival, and Kaplan-Meier estimates of PFS and OS were calculated.

RESULTS
In multivariate analysis, baseline mean SE-nCBV was predictive of PFS (p=0.038) and OS (p=0.004). Patients with a baseline mean SE-nCBV < 2.0 had a PFS (median 47.0 weeks, p=2.0) (median PFS 25.3; median OS 55.0 weeks). Exploratory multi-group stratification demonstrated that survival was inversely proportional to baseline mean SE-nCBV over a range from 2.0 - 4.0 (p=0.025) suggesting a ‘dose dependency’ for SE-nCBV as a survival marker.

CONCLUSION
Baseline mean SE-nCBV prior to chemoradiation promises to be strongly predictive of poor chemoradiation response and poor survival in the subgroup of GBM patients with SE-nCBV >2.0. Prospective evaluation of SE-nCBV as a marker to select patients for more frequent monitoring and possibly early initiation of adjunctive therapy is indicated.

CLINICAL RELEVANCE/APPLICATION
Glioblastoma patients with high SE nCBV prior to adjuvant radiochemotherapy should be monitored particularly carefully and strongly considered for adjuvant therapy when indicated.

VSNR31-09 • Intravoxel Incoherent Motion of Malignant Brain Tumors: A Validation Study with Pathologic Correlation and Normalized Cerebral Blood Volume

Chong Hyun Suh MD (Presenter) ; Ho Sung Kim ; Ji-Won Kang MD ; Seung Soo Lee MD ; Namkug Kim PhD ; Choong Gon Choi MD ; Sang Joon Kim MD

PURPOSE
To validate the perfusion (f) and true diffusion (D) parameters derived from intravoxel incoherent motion (IVIM) MR imaging with pathologic correlation of hypervascular tumor (glioblastoma) and hypovascular tumor (primary CNS lymphoma, PCNSL) and normalized cerebral blood volume (nCBV) derived from dynamic susceptibility contrast MR perfusion imaging.

METHOD AND MATERIALS
Our institutional review board approved this study. Fifty-nine consecutive patients (33 men, 26 women, mean age 54.5 years) who had pathologically confirmed glioblastoma (n=38) or PCNSL (n=21) prior to any treatment were assessed using maximum f (fmax) and minimum D (Dmin) derived from IVIM MR imaging. We acquired 16, different b-values. The best predictor for differentiating glioblastoma from PCNSL was determined by receiver operating characteristic (ROC) curve analyses. A corresponding nCBV was used for validation of the fmax using partial correlation analysis.

RESULTS
The mean fmax was significantly higher in the glioblastoma group (0.101 ± 0.016) than in the PCNSL group (0.021 ± 0.010) (p < 0.0001). The mean Dmin did not significantly differ between the two groups (P = 0.190). fmax was an excellent predictor for differentiating glioblastoma from PCNSL (area under the curve, 0.987; 95% confidence interval [CI]: 0.916, 0.996; cut-off value, 0.025), with a sensitivity of 97.4% and a specificity of 90.5%. There was a significant positive correlation between fmax and corresponding nCBV for all cases (r =0.651; P < 0.0001).

CONCLUSION
IVIM MR imaging can be used as a non-contrast, noninvasive imaging method to assess the diffusion and perfusion characteristics of malignant brain tumors.

CLINICAL RELEVANCE/APPLICATION
Intravoxel incoherent motion (IVIM) MR imaging allows noninvasive, reliable distinction as part of the diagnostic workup for patients who are suspected of having malignant brain tumors.

VSNR31-10 • Imaging the Post Therapy Brain

Eu-Meng Law MBBS (Presenter) *

LEARNING OBJECTIVES
1) To understand the challenges with current and novel therapeutics for brain tumors, particularly with regard to conventional imaging of the post therapeutic brain. 2) To understand the challenges with defining and characterizing pseudoprogession and the application of advanced MRI methods. 3) To understand pseudo response with anti-angiogenic agents therapy and the application of advanced MRI methods in characterizing pseudo response.

ABSTRACT
REFERENCES:

VSNR31-11 • Proliferation Rate Estimates Derived from Serial Diffusion MR Scans Correlate with [18F]-FLT PET SUV Values in Recurrent Glioblastoma Treated with Bevacizumab

Benjamin M Ellingson MS, PhD (Presenter) * ; Timothy F Cloughesey MD * ; Johannes Czernin MD * ; Whitney B Pope MD, PhD *

PURPOSE
Proliferation rate estimates from cell invasion, motility, and proliferation level estimate (CIMPLE) maps derived from fitting a novel spatiotemporal mathematical model to serial diffusion MR data have been shown to correlate with choline-to-NAA ratio using MRS spectroscopy, glioma grade, and PFS/OS during bevacizumab. These maps predict future contrast enhancement in approximately 30% of patients on bevacizumab, as suggested in a recent pilot study. Proliferation rates based on the time-rate-of-change in ADC values within a voxel may reflect proliferative potential. The current study examined the relationship between CIMPLE map estimates of proliferation rate and 18F-FLT PET SUV, a molecular marker of DNA synthesis, in order to test whether CIMPLE maps could spatially localize regions of proliferative tumor.

METHOD AND MATERIALS
Fourteen patients were enrolled in the current pilot study. All patients had at least three MRI scans and one 18F-FLT PET scan during bevacizumab therapy. MR scans consisted of at least a T2w, post-contrast T1w, and diffusion MR scan with b=0 and 1000s/mm2.
**RESULTS**
Regions with high proliferation rate on CIMPLE maps appeared generally colocalized to regions of 18F-FLT PET. Average proliferation rate within contrast-enhancing regions was highly correlated with average 18F-FLT PET SUV (Pearson’s correlation coefficient, R2 = 0.79, P<0.005). Regions with elevated proliferation rate on CIMPLE maps derived from serial diffusion MR data appear to reflect regions undergoing rapid DNA synthesis as suggested by 18F-FLT PET.

**CLINICAL RELEVANCE/APPLICATION**
CIMPLE maps provide a non-invasive method for estimating tumor growth dynamics, which may be useful for treatment monitoring and predicting tumor progression.

**VSNR31-12 • Change in ADC of High Grade Glioma Infiltrative Component during Radiotherapy Predicts Treatment Response and Time-to-Progression**

*Jin Rong Qu*, MD, PhD; *Jian-Ping Dai*, MD; *Tao Jiang*; *Ayca Akgoz*, MD (Presenter); *Ravi T Seethamraju*, PhD *; *Qifeng Wang*; *Shao-Wu Li*; *Lin Ai*; *Tianzi Jiang*, PhD *; *Geoffrey S Young*, MD *

**PURPOSE**
Apparent diffusion coefficient (ADC) derived from diffusion-weighted imaging (DWI) is a promising marker for cellularity in a wide range of tumors. While change in ADC during chemoradiation is a rational marker for prediction of high grade glioma (HGG) patient response and prognosis, mixed success has been reported to date. This may be because temozolamide chemotherapy and angiogenesis inhibition induce changes in vascular permeability and edema that confound the correlation of ADC with cellularity. As such, we hypothesize that ADC should perform well as a marker of survival in a cohort of patients treated with radiotherapy (RT) alone.

**METHOD AND MATERIALS**
In 25 patients who had undergone resection of HGG, ADC was measured in ROI placed in residual solid and infiltrative tumor before and after 30 Gy RT. RT response during radiation was classified as complete resolution (CR), partial response (PR), stable disease (SD), or progressive disease (PD) based on conventional anatomic MRI images. Change in ADC during RT was correlated with treatment response, TTP and OS.

**RESULTS**
As predicted, RT response correlated significantly with TTP (0.59; p=0.002). Median TTP was 49.9 days for patients with PD compared with 202.7 days for SD, 208.0 days for PR, 234.5 days for CR. The ADC of the residual solid tumor increased during RT in the CR group but did not significantly change in the PD group. ADC of infiltrative tumor increased during RT in PD. Increase in infiltrative tumor ADC correlated significantly with shorter TTP (0.545; p=0.005). Correlation between increase in solid tumor ADC and longer TTP (0.286; p=0.249) did not reach statistical significance but showed a trend consistent with the prior literature.

**CONCLUSION**
Decrease in non-enhancing infiltrative tumor ADC correlates with better RT response and longer progression free survival of HGG patients treated with radiation alone. This supports our hypothesis that temozolamide chemotherapy and angiogenesis inhibition effects on vascular permeability may significantly confound the use of ADC for detection of HGG response.

**CLINICAL RELEVANCE/APPLICATION**
Increase in ADC of infiltrative tumor during RT of HGG correlates with worse treatment response, shorter time to progression and decreased overall survival.
PURPOSE
Evaluate the efficacy of a single scan bone removal software solution in head CTA studies.

METHOD AND MATERIALS
30 head CTA performed through the dual scan technique (non-contrast scan followed by a contrast enhanced) on a 256 or a 64 slice CT scanner were retrospectively analyzed. The studies were processed in two ways: 1. Subtraction of the non-contrast scan from the contrast enhanced scan (Group A) and 2. Automated bone removal from a single contrast enhanced scan (Group B). The technologist recorded the time it took to perform each process. The images were also assessed by an experienced neuroradiologist (19y) with regard to success of bone removal, visualization of anterior and posterior vessels, readability, confidence in diagnosis and delineation of the pathology. For this purpose a 4 point likert-scale (1=Non diagnostic, 2=Poor, 3=Acceptable and 4= Good) was used. Reading of group A and B was performed with 2 weeks separation to reduce recall bias. Reading time needed per study was also recorded. Wilcoxon signed-rank test for paired samples was performed for differences in image quality and time between examinations.

RESULTS
The post-processing of images from group A took in average 222±68s while for group B it took 96±17s (p<.01).

• 50% increased success of bone removal
• 53% better visualization of anterior and posterior vessels
• 53% improved readability
• 63% increased confidence in diagnosis
• 70% improved delineation of the pathology

CONCLUSION
Automatic bone removal from a single scan not only significantly improved the technologist workflow by reducing post-processing times, but has also significantly improved the quality of the studies by removing bone more effectively than the double scan subtraction technique, while maintaining or even improving diagnostic confidence and image quality. The clinical impact of this software relies on its applicability to any scanner and the reduced radiation dose to the patient by avoiding the non-contrast enhanced scan.

CLINICAL RELEVANCE/APPLICATION
Automatic bone removal software maximizes the technologist workflow while allowing a reduction in patient radiation dose.

SSG11-03 • Volume Intra-venous Injection DSA (VIVID) Compared with Intra-arterial Injection DSA (IADSA) for Evaluation of Cerebral Arteries and Veins

Akihiro Imamura MD (Presenter) ; Hideyuki Takano MD ; Hiroyuki Funatsu MD ; Naoyuki Ueno ; Hidetoshi Taguchi MD

PURPOSE
We analyzed whether the intracranial arteries and veins could be detected using intravenous injection digital angiography (DSA) (VIVID) by using the flat-panel detector angiographic computed tomography CT system (FACT). We compared these results with IADSA.

METHOD AND MATERIALS
We retrospectively analyzed 17 consecutive patients (8 males and 9 females; 23 sides) who underwent both VIVID examinations and IADSA for neuronavigation. One hundred ml of nonionic iodine contrast (350 mg/ml) injection was injected via an 18-gauge plastic needle, at a rate of 10 ml/second, which was then flushed out using 25 ml of saline, followed by rotational DSAs. We analyzed data from the rotational DSAs processed by the DynaCT software on the workstation using the maximum intensity projection and volume rendering algorithms. The VIVID and IADSA images were analyzed and compared by 3 experienced radiologists independently. The quality of visualization was graded as non-visualized (0), noncontinuous(1), faint and continuous(2), continuous (3), and intense and continuous(4). The averages of grades of the veins were calculated. Comparison of VIVID and IADSA was made. The grades were assigned by reaching a consensus, following a discussion among the observers.

RESULTS
The average grade between VIVID and IADSA were almost equal in Frontopolar artery, Anterior choroidal artery, Ophthalmic artery, Posterior communicating artery, Anterior communicating artery, Posterior communicating artery, Inferior sagittal sinus, Septal vein, Basal vein of Rosenthal, and Cavernous sinus, VIVID was higher average grade than IADSA (p<.05). In Anterior communicating artery, Posterior communicating artery, Inferior sagittal sinus, Septal vein, Basal vein of Rosenthal, and Cavernous sinus, VIVID was higher average grade than IADSA (p<.05). The average grade of the veins were calculated. Comparison of VIVID and IADSA was made. The grades were assigned by reaching a consensus, following a discussion among the observers.

CONCLUSION
VIVID is comparable to IADSA in the detection of the intracranial arteries and veins. VIVID can perform easily and evaluate whole artery and veins and show 3 dimensional anatomy in single examination without severe complications.

CLINICAL RELEVANCE/APPLICATION
Volume intravenous injection digital angiography by using the flat-panel detector angiographic computed tomography CT system is better than IADSA in evaluation of brain vessels anatomy.

SSG11-04 • Dural Arteriovenous Fistula: Diagnosis and Classification with 4D-CTA and DSA

Bing Tian MD (Presenter) ; Bing Xu ; Qi Liu MD, PhD ; Jianping Lu MD

PURPOSE
To compare the utility of 4D-CTA and DSA in assessing the presence, location, and classification of Dural Arteriovenous Fistula (DAVF).

METHOD AND MATERIALS
320-Multidetector row 4D-CTA and DSA were applied in 34 patients (mean age, 32 years; range, 18-57 years) with DAVF. 4D-CTA was performed within 2 days before DSA. All the images were independently reviewed by 2 readers for the presence, location, and classification of the DAVF. The result of the DSA was used as the gold standard. The location of DAVF was divided into five areas: Cranial sinuses, sious cavernous, cyclorama, basilar venous plexus, and mediastinum cerebri. The classification of DAVF was according to Borden, et al.

RESULTS
34 patients were all diagnosis as DAVF by 4D-CTA and DSA separately. The location of DAVF divided by DSA was cranial sinuses (12), sious cavernous (7), cyclorama (8), basilar venous plexus (6), and mediastinum cerebri (1). There was full agreement for all the patients between 4D-CTA and DSA regarding the location. However, for the Borden classification of DSA, 18 were Borden I, 9 were Borden II, and 7 were Borden III. The classification of 4D-CTA in 32 patients were in accordance with DSA. In the remaining 2 patient, retrograde venous were missed by both readers on 4D-CTA which were classified as Borden I, while as Borden II by DSA.

CONCLUSION
4D-CTA seems be a reliable technique in the screening and surveillance of DAVF form the presence, location, and classification aspect in clinical.

CLINICAL RELEVANCE/APPLICATION
320-MDCT4D-CTA appears to be a valuable new adjunct in the noninvasive diagnostic work-up, treatment planning, and follow-up of patients with DAVF.
METHOD AND MATERIALS
We retrospectively enrolled 11 AVM patients (age; 40 ± 17 YO, 6 males) diagnosed by radiologists. Subjects were classified into two groups: Small AVM: < 3 cm and Medium AVM: 3~6 cm - based on the Spetzler-Martin grading scale. All patients underwent CT angiography using 64 multi-detector CT (GE, WI). For quantitative volumetric analysis, a program was developed using Mathcad (PCT, MA) in our image-processing laboratory. This image-processing tool generates 3D blood-only images through two segmentation steps: intracranial tissue segmentation followed by pixel value thresholding. From the segmented images with subtracted surrounding brain and meningeal tissues, we calculated the volume of an AVM lesion (the nidus, dilated feeding arteries and draining veins) by calculating the intracranial blood volume difference between both hemispheres. The AVM volume was then correlated with the maximal AVM lesion dimension.

RESULTS
Statistically significant differences were observed between the two subject groups. In the comparisons of the volume (cm³): 12.478 ± 5.743 and 53.963 ± 9.338 (mean ± stdev.) for Small AVMs (< 3 cm) and Medium AVMs (3 ~ 6 cm) respectively; P < 0.005 for all. Additionally, we found an exponential correlation between the AVM volume and the maximum length of a nidus (trendline: y = 4.4183e^0.536x with R² = 0.945).

CONCLUSION
CT angiograms can be processed to provide a more realistic three-dimensional measures of AVM size with potentially more clinical specificity and higher sensitivity to monitor treatment changes.

CLINICAL RELEVANCE/APPLICATION
Volumetric AVM measures have the potential of providing new standards for AVM size classification and could provide a useful tool for monitoring AVM evolution in time and in response to treatment.

SSG11-07 • Evaluation of Brain Arteriovenous Malformations by Using 4D MR Angiography with Arterial Spin Labeling at 3T

Yasuhiro Iryo (Presenter) ; Toshinori Hirai MD ; Masanobu Nakamura ; Minako Azuma ; Yasuyuki Yamashita MD *

PURPOSE
To assess the usefulness of 4D magnetic resonance angiography (MRA) with an arterial spin-labeling (ASL) technique at 3T that yields high spatial resolution and time-resolved hemodynamics without exogenous contrast agents for the evaluation of brain arteriovenous malformations (AVMs).

METHOD AND MATERIALS
Our study included 8 patients (4 men, 4 women; age 7-65 years, mean 39.5 years) with brain AVMs. They underwent 4D ASL-MRA and digital subtraction angiography (DSA). The 4D ASL-MRA imaging was performed on a 3T MRI system; a sensitivity encoding (SENSE) phased-array 32-channel head coil was used. A pseudo-continuous arterial spin labeling (pCASL) preparation scheme with the Look-Locker sampling was employed for spin tagging. Seven phases of labeling and control images were acquired in an interleaved mode. Upon completion of two acquisitions, corresponding temporal phases with identical inversion delay were subtracted. Minimum-intensity-projection (MIP) images were then created for each subtracted data set in three orthogonal directions. The acquisition parameters were: FOV = 220×200 mm, matrix = 224×162, spatial resolution = 1×1×1 mm, flip angle = 12°, TR = 8.5 ms, TE = 4.2 ms, SENSE factor = 3.0, TI/TT/ftinal TI = 100 ms/250 ms/2.0 s. A transverse labeling plane was positioned 9 cm below the imaging center. Total acquisition time is approximately 5 min. Two independent readers reviewed the 4D MRA images for the nidus size, arterial feeders and venous drainage. Two other readers consensually reviewed the DSA images. Interobserver and intermodality agreement was assessed by ? statistics.

RESULTS
On all 4D ASL-MRA studies, the major intracranial arteries were successfully demonstrated at an inflow temporal resolution of 250 ms. Interobserver agreement was excellent for the nidus size (? = 1.0), very good for arterial feeders (? = 0.86) and good for venous drainage (? = 0.86). Intermodality agreement was excellent for the nidus size (? = 1.0), very good for arterial feeders (? = 0.96) and good for venous drainage (? = 0.86).
good for venous drainage (\( r = 0.80 \)).

CONCLUSION
The agreement between 4D ASL-MRA and DSA findings was good to excellent with respect to the AVM nidus size, arterial feeders and venous drainage.

CLINICAL RELEVANCE/APPLICATION
With 4D ASL-MRA at 3T, hemodynamic information on the brain AVMs can be obtained without the use of exogenous contrast agents.

SSG11-08 • 7T versus 1.5T TOF MRA for Assessment of Intracranial Aneurysms: The More Tesla, the Better?

Lale Umutlu MD (Presenter) *, Karsten Wrede, Christoph Moenninghoff MD, Soren Johst, Philipp Dammann, Michael Forsting MD, Marc U Schlamann

PURPOSE
As rupture of intracranial aneurysms is considered the main cause of subarachnoidal haemorrhage, detection and high-quality assessment of aneurysm localization and related features (e.g. parent vessel) is of inevitable value for treatment planning. With 1.5 Tesla MRI being limited in the detection of small aneurysms, ultra-high-field MRI may enable superior examination of intracranial vasculature based on higher spatial resolution due to increased signal-to-noise ratio (SNR). Aim of this trial was to compare the diagnostic ability of 1.5 versus 7 Tesla TOF MRA for assessment of intracranial aneurysms.

METHOD AND MATERIALS
17 subjects were examined on a 1.5 Tesla (Magnetom Aera, Siemens Healthcare) and Time-of-flight MRA with a voxel size of 0.7x0.7x0.7mm3 was obtained. Subsequently all subjects underwent a 7 Tesla examination (7T whole-body MR system; Magnetom 7T, Siemens Healthcare) with a voxel size of 0.2 x 0.2 x 0.2mm3. Two radiologists in consensus assessed the delineation of the (1) aneurysm dome, (2) neck, (3) parent vessel, (4) vessel tissue contrast and (5) image impairment due to artifacts. For qualitative analysis a 5-point scale was used (5= excellent delineation; 1= non-diagnostic), Contrast ratios (CR) of all aneurysms and adjacent parenchyma were calculated. A Wilcoxon rank test was performed for analysis of statistical significance.

RESULTS
According to qualitative analysis 7 Tesla TOF MRA yielded significantly superior delineation of dome (mean 7T:=4.5; mean 1.5T= 3.2; p < 0.0001). Despite slight impairments based on increased signal alterations, 7 Tesla TOF MRA provided superior assessment of the aneurysms and their related vessel-features based on high-quality vessel-tissue contrast and imaging at improved spatial resolution.

CLINICAL RELEVANCE/APPLICATION
Based on improved spatial resolution imaging, high-resolution 7T TOF MRA may bear the potential to overcome known limitations of 1.5 Tesla MRA in the assessment of intracranial aneurysms.

SSG11-09 • Ultra-high Temporal Resolution Vascular Pulsation of Aneurysms: A Novel Dynamic 4-dimensional Time of Flight MR Angiography Technique to Accurately Evaluate Dynamics of Cerebral Aneurysm

Till Illies MD (Presenter) ; Jan Sedlack ; Jan-Hendrik Buhk MD *, Daniel Kutzner ; Jens Fiehler ; Andre Kemmling MD

PURPOSE
Time resolved imaging of pulsatility of cerebral aneurysms has been performed using 4D CT angiography. Assessment of wall motion may be useful for stratification of rupture risk. Aim of the study was to implement a 4D TOF MRA technique to image aneurysmal wall motion with high temporal and spatial resolution.

METHOD AND MATERIALS
We performed time resolved MR-TOF angiography in an elastase induced rabbit model of cerebral aneurysm. Dynamic 4-dimensional TOF angiography was achieved with ultra high-temporal resolution of 30 3D-images per cardiac cycle (151 beat/min). Dynamic data sets were reconstructed from ecg-triggered 4D gradient echo TOF images (temporal resolution 75 frames per second, spacial resolution 0.5x0.5x1.0mm, TR 20ms, TE 5.76ms, 32 channel coil system at 3T). The 4D dataset was processed to calculate vessel motion: Voxels were classified as vessels using a semi-automated region-growing algorithm (Analyze 11.0). A relative vessel motility index was calculated using the voxel-wise frequency of a vessel vs. non-vessel classification from 30 time-points over the cardiac cycle.

RESULTS
The aneurysm (5mm diameter) and aortic arch were imaged with diagnostic image quality within 12 min. The temporal resolution of 75 frames/second allowed ready visualization of wall pulsation and vessel displacement in time. The relative vessel motility index showed highest wall motion at the aortic arch and tip of the aneurysm corresponding to qualitative assessment.

CONCLUSION
We successfully implemented a time resolved TOF-MRA-technique allowing 4-dimensional quantification of aneurysmal wall motion at high spacial and temporal resolution (75 frames per second).

CLINICAL RELEVANCE/APPLICATION
Quantification of aneurysmal pulsatility may be a valuable pathophysiological marker for assessing rupture risk.

Neuroradiology (Imaging of White Matter and Demyelinating Disease)

Tuesday, 10:30 AM - 12:00 PM • N229

SSG12 • A Capillary Phantom for Quantitative DTI Assessment: A Method for Normalization of Diffusion Tensor Parameters

Moderator
Aaron S Field , MD, PhD

Christopher D Lascola, MD


Damien P Galanaud MD, PhD (Presenter) * ; Omid Khalilzadeh MD, MPH ; Julien Dinkel MD ; Irene S Wang MD ; Paulette Onorato PhD ; Rajiv Gupta PhD, MD

PURPOSE
Although quantitative diffusion tensor imaging (DTI) shows great potential for the assessment of white matter pathologies, no consensus exists on a standardized method of calculating DTI measurements. Quantitative DTI measurements cannot be compared between patients scanned with different acquisition parameters. In this study, we evaluated the feasibility of using water-filled arrays of glass capillaries to construct a DTI phantom. A multivariate method to normalize DTI measurements based on the acquisition parameters is proposed and tested.

METHOD AND MATERIALS
The phantom was constructed using arrays of glass capillaries oriented at 6 different directions: one set in the center and 5 at radial
Cognitive Activity in Late Life

SSG12-02 • Investigation of Influences of the Magnetic Field Inhomogeneity Due to the Subject Positioning on the Apparent Diffusion Coefficient in the Cerebral Cortex Using MRI Simulator

Daigo Ushijima (Presenter) ; Seiji Kumazawa PhD ; Hidetake Yabuuchi MD ; Masafumi Ohki

PURPOSE
In the study of neurodegenerative diseases, apparent diffusion coefficient (ADC) values in the cerebral cortex are investigated using diffusion-weighted images (DWIs). However, DWIs suffer from geometric distortion due to magnetic field inhomogeneity (MFI) caused by susceptibility effect. It is known that the cortical ADC values increase due to contamination of signal intensity in cerebrospinal fluid by distortion. It is reported that distribution of MFI depends on the subject positioning in the static field. The purpose of this study was to investigate influences of the MFI which depends on the subject positioning on the cortical ADC values using MRI simulator.

METHOD AND MATERIALS
We investigated the differences of ADC values in the cortex among the different patterns of MFI using digital brain phantom. We calculated MFI depending on the subject positioning in the static field by using the Susceptibility-Voxel Convolution method. We generated different patterns of MFI: no inhomogeneity, and two different patterns of inhomogeneities. In each pattern of MFI, DWI was generated by MRI simulator according to single-shot echo-planar imaging sequence, and ADC map was generated from DWIs. In our simulator, the diffusion coefficient of cortex was set to 0.89 *10^-3 mm^2/s. We compared ADC values in six cortical regions of interest among different three patterns of MFI.

RESULTS
In the cortical region close to frontal sinus, the average of ADC value in no inhomogeneity was 1.017 * 10^-3 mm^2/s, and was higher than ideal ADC value in the cortex. The average of ADC values in other two patterns of MFI were 1.114 * 10^-3 and 0.952 * 10^-3 mm^2/s respectively. These ADC values showed significant differences among different three patterns of MFI. Although the ADC values showed statistically no significant differences in the other regions among them, ADC values showed the variation.

CONCLUSION
We have investigated influences of the MFI on the cortical ADC values using MRI simulator. Our results suggest that ADC values in the cortical region might vary due to MFI which depends on the subject positioning in the static field.

CLINICAL RELEVANCE/APPLICATION
In interpretation of cortical ADC values in neurodegenerative diseases, influences of the MFI should be taken into account in changes of ADC values.

SSG12-03 • Microstructural Integrity of Brain White Matter in Non-demented Older Adults Is Associated with Frequency of Cognitive Activity in Late Life

Christopher M Barth ; Robert S Wilson PhD ; Shengwei Zhang BS, BEng ; David A Bennett MD ; Konstantinos Arfanakis PhD (Presenter)

PURPOSE
The purpose of this study was to test the hypothesis that more frequent late life cognitive activity in a community sample of non-demented elderly subjects is associated with greater brain microstructural integrity, as assessed by diffusion tensor imaging (DTI).

METHOD AND MATERIALS
A community sample of non-demented elderly subjects (N = 379) (82 ± 7 years of age) participating in the Rush Memory and Aging Project was included in this study. All participants rated how often they were involved in various cognitively stimulating activities from childhood to middle-age (past cognitive activity, PCA), as well as within the last year (late life cognitive activity, LLCA). Participants also rated the availability of cognitive resources (CR) in their home during childhood and adulthood. T1-weighted MPRAVE, T2-weighted FLAIR and SE-EPI DTI data were collected on all participants using a 1.5 Tesla MRI scanner. White matter hyperintense (WMH) lesions were automatically segmented based on MPRAVE and FLAIR data. Correction for bulk motion and distortions due to eddy-currents and field non-uniformities, B-matrix reorientation, and diffusion tensor calculation, were all conducted using TORTOISE. The fractional anisotropy (FA), trace of the diffusion tensor, axial (AD) and radial diffusivity (RD) were calculated in each voxel. Tract-Based Spatial Statistics was used to test for voxel-wise associations of DTI parameters with LLCA, while controlling for age, sex, level of education, the presence of WMHs, PCA and CR. The null distribution was generated using the randomise tool and 5000 permutations. Differences were considered significant at p < 0.05.

RESULTS
Higher frequency of LLCA was associated with higher FA values in the corpus callosum and white matter of the left brain hemisphere, and generally lower trace, AD, and RD in the thalamus.

CONCLUSION
The present work suggests that a higher frequency of LLCA in community-dwelling non-demented elderly adults may be associated with greater microstructural integrity in white matter of the corpus callosum and left brain hemisphere.

CLINICAL RELEVANCE/APPLICATION
Frequent late life cognitive activity may play a role in protecting the microstructure of brain white matter.

SSG12-04 • Cerebral Microbleeds Are Related to Loss of White Matter Structural Integrity: The Rotterdam Scan Study

Saloua Akoudad ; Marius De Groot MSC ; Aad Van Der Lugt MD, PhD ; Wiro Niessen PhD ; Mohammad A Ikram ; Meike W Vernooij MD (Presenter)

PURPOSE
Cerebral microbleeds (CMBs) are highly frequent in the general population and are increasingly recognized as a manifestation of cerebral small vessel disease (CSVD). Although CMBs appear as focal lesions on imaging, it remains unclear whether the underlying CSVD is also restricted to that focal area or that it affects the brain more diffusely. We investigated whether the presence, number, and location of
Matter Demyelination in Multiple Sclerosis

RESULTS

Mean MPF in tissues were compared between subject groups by independent two-tailed t-test. Images were acquired on a 3T MRI scanner from 14 healthy controls (HC), 19 relapsing-remitting (RRMS), and 11 secondary progressive (SPMS) MS patients.

CONCLUSION

DKI will detect early the subtle injury before abnormal changes occur in routine MRI examination in MS patients.

CLINICAL RELEVANCE/APPLICATION

DKI may be a new sensitive tool to detect NAWM damage in MS patients.

CONCLUSION

Findings of reduced MPO activity and microbleeds is related to loss of microstructural integrity of brain white matter, as measured by diffusion tensor imaging (DTI).

METHOD AND MATERIALS

A total of 4493 Rotterdam Scan Study participants underwent brain MRI to determine microbleed status. With DTI, global fractional anisotropy (FA) and mean diffusivity (MD) were measured in normal-appearing white matter. Multiple linear regression models, adjusted for age, sex, cardiovascular risk factors, white matter lesions and infarcts were applied to investigate the independent association between microbleeds and integrity of brain white matter. Analyses were repeated after stratification by apolipoprotein E ?4 (APOE ?4) carriage.

RESULTS

Presence of microbleeds was related to a lower mean FA and higher mean MD, in a dose-dependent manner, and was already apparent for a single CM8 microbleed (standardized FA: 0.13, 95% CI -0.21; -0.05; MD: 0.12, 95% CI 0.05; 0.19). For lobar microbleeds alterations in DTI measurements were solely driven by APOE 74 carriers.

CLINICAL RELEVANCE/APPLICATION

Presence of microbleeds relates to poorer microstructural integrity of brain white matter, independent of cardiovascular risk and other markers of CSVD. Our data suggest that microbleeds reflect diffuse brain pathology, even when just a single microbleed is present.

SSG12-06 • Diffusion Variations of Normal-appearing White Matter in Multiple Sclerosis Using Diffusional Kurtosis Imaging

Lemei Tang MD (Presenter) ; Ni m Fei MA ; Feng Jie MA ; Wei Qiang MA ; Miao Yanwei MD

METHOD AND MATERIALS

Thirty female SJL mice were induced with experimental autoimmune encephalomyelitis, a mouse model of MS, and treated with either GA (150 ?g/day) or saline from day 1 post induction onwards. To determine effects of GA on MPO, mice underwent MRI at 4.7T with MPO-Gd at the disease peak (day 12). Lesion numbers and volume were quantified at 60 minutes post MPO-Gd injection. MPO activity assay and flow cytometry of brain leukocytes were also performed.

RESULTS

Disease severity was ameliorated with GA treatment (p < 0.01; figure, C). MPO-Gd enhanced MRI detected decreased number of lesions (6.0±0.9 vs. 2.4 ± 0.5, p < 0.01), and smaller total (669±198 vs. 123±42 mm2, p < 0.05) and mean (109±23 vs. 48±8, p < 0.05) lesion volumes with GA compared to saline-treated mice (A+B). Brain homogenates of GA-treated mice had 60±9% MPO activity compared to saline-treated mice (p < 0.05; D). Flow cytometry revealed a reduced number of Ly-6C-high inflammatory monocytes in the brain with GA treatment (5.1±1.4 vs. 3.9 ± 0.6 x 10^6 cells/brain, p < 0.05; E). No significant effect of GA on neutrophils could be detected (3.9±0.9 vs. 3.0±0.7 x 10^6 cells/brain, p = 0.48; E). Flow cytometry also revealed that MPO is mostly secreted by Ly-6C high monocytes (60±1.7%), followed by neutrophils (32±2.3%; F). This reduction in MPO-secreting inflammatory monocytes explains our MRI finding of reduced MPO activity in vivo.

CONCLUSION

GA, a current first-line drug in MS directly affects monocyte subsets, decreasing the number of MPO-secreting inflammatory monocytes entering the brain. MPO-Gd enhanced MRI is sensitive to these effects of GA and provides a novel way to monitor treatment effects at the molecular level in this disease. This could advance our understanding of the molecular events over the course of MS.

CLINICAL RELEVANCE/APPLICATION

Upon translation, treatment efficacy of GA, which reduces MPO-positive monocytes and thus MPO activity in the brain, could be monitored with MPO-Gd.

SSG12-07 • Fast Whole-brain Macromolecular Proton Fraction (MPF) Mapping for Quantitative Imaging of White and Gray Matter Demyelination in Multiple Sclerosis

Vasily L Yarnykh PhD (Presenter) ; James D Bowen MD ; Alexey A Samsonov PhD ; Pavle Repovic MD ; Kenneth R Maravilla MD * ; Lily K Jungheenson MD ; Angeli Mayadev MD ; Beena Gangadharan PhD ; Hunter R Underhill MD, PhD ; Bart P Keogh MD, PhD

METHOD AND MATERIALS

Images were acquired on a 3T MRI scanner from 14 healthy controls (HC), 19 relapsing-remitting (RRMS), and 11 secondary progressive (SPMS) MS patients. Neurological status was reported as Expanded Disability Status Scale (EDSS) and Multiple Sclerosis Functional Composite (MSFC). MPF mapping protocol comprised gradient-echo sequences with and without off-resonance saturation (offset frequency 4 kHz), 3-point variable flip angle T1 mapping, and fast B0 and B1 mapping sequences. Whole-brain 3D MPF maps were obtained with 1.5x1.5x4mm^3 resolution and 15 min acquisition time. Brain tissues were segmented into normal appearing white matter (NAWM), gray matter (NAGM), and lesions. Mean MPF in tissues were compared between subject groups by independent two-tailed t-test. Pearson correlation coefficient (r) was used to test associations between MPF and clinical scales.

RESULTS

Presence of microbleeds was related to a lower mean FA and higher mean MD, in a dose-dependent manner, and was already apparent for a single CM8 microbleed (standardized FA: 0.13, 95% CI -0.21; -0.05; MD: 0.12, 95% CI 0.05; 0.19). For lobar microbleeds alterations in DTI measurements were solely driven by APOE 74 carriers.

CLINICAL RELEVANCE/APPLICATION

Presence of microbleeds relates to poorer microstructural integrity of brain white matter, independent of cardiovascular risk and other markers of CSVD. Our data suggest that microbleeds reflect diffuse brain pathology, even when just a single microbleed is present.
SSG12-08 • Extra Cranial Venous Abnormality in MS Patients with Regard to Chronic Cerebrovascular Venous Insufficiency (CCSVI): A True Pathological Finding or an Anatomical Variant?

Satya N Patro MD (Presenter) ; Carlos H Torres MD ; Cheemun Lum MD ; Santanu Chakraborty FRCR ; Thanh Nguyen MD * ; Miguel Bussiere ; Matthew Hogan MD

PURPOSE
To evaluate the extra cranial venous anatomy with contrast enhanced MR Venogram (CE-MRV) in patients without MS. To assess the prevalence of various venous anomalies such as asymmetry and stenosis in this population.

METHOD AND MATERIALS
The study was approved by our local REB and all participants gave informed consent. We recruited 100 patients without MS referred for a contrast enhanced MRI, who underwent additional CEMRV from the skull base to the mediastinum on a 3T scanner. The study started in Feb 2012 and completed in Jul 2010. We included patients between 18 and 60 years old with a male: female ratio of 1:1. Exclusion criteria included prior neck radiation, neck surgery, neck or mediastinal masses or significant cardiac or pulmonary disease. Two neuroradiologists independently evaluated the studies to document the presence of asymmetry and stenosis in the jugular, vertebral and azygous veins.

RESULTS
Asymmetry of the IJVs was found in 70% of patients. 91% of patients had a focal stenosis in the right IJV and 82% in the left IJV. The stenoses were found in the upper third of the vein in 95% of the cases. Stenosis of the azygous vein was found in 21% of patients. There was prominence of the external jugular veins in 39% of cases, of the anterior jugular veins in 27% and of the deep cervical veins in 22.4%.

CONCLUSION
The various anatomy of non MS patients demonstrates multiple variants including asymmetry and stenoses of the IJVs. We believe the stenoses in the upper third of the IJVs are secondary to indentation of the vessel between the posterior belly of the digastric muscle and the occipital bone. This study will be used as a comparative data to the MS population.

SSG12-09 • Quantitative Rapid Assessment of Leukoaraiosis: Fully Automated CT-based Quantification of Microangiopathic Density Reduction in White Matter in Comparison to Gold Standard MRI

Uta Hanning (Presenter) ; Georg Homann ; Ludger Feyen ; Thomas Niederstadt MD ; Volker Hesselmann MD ; Walter L Heindel MD ; Andre Kemmling MD

PURPOSE
Assessment of white matter lesions is primarily a domain of magnetic resonance imaging (MRI), however, computed tomography (CT) is the more frequently used diagnostic procedure. Particularly in stroke, a rapid objective CT based quantification of microangiopathic WM changes may prove useful to estimate risk of thrombolytic hemorrhage. We present a new CT-based fully automated rater-independent method for quantification of microangiopathic white matter changes.

METHOD AND MATERIALS
Tissue segmentation was performed in 600 normal brains MRI (3.0 Tesla, T1-3D-Turbo-Field-Echo) of two large population studies (BiDirect and SEARCH-Health Study) to obtain a probabilistic WM-tissue-map in standard MNI-152 space as published. A total of 103 patients with varying degree of leukoaraiosis excluding other lesions were retrospectively selected based on availability of CT and MR within 1 month. The tissue-specific density (Hounsfield Unit, HU) within WM-space was determined by the mean of all voxel densities weighted by WM content: S (HUxyz × Pxyz (WM))/ S (Pxyz (WM) ; (HUxyz = density of voxelxyz ; Pxyz = partial WM content at voxelxyz). The reduction of HU over WM-space in CT images was correlated with gold standard MR-based WM lesion volume measurements. Results were compared with rater-based Fazekas scores for severity of WM disease.

RESULTS
The process of CT-based tissue-specific segmentation involving automated segmentation of probabilistic white matter space with quantification of WM density was reliable in 103 cases with no algorithm failures. Mean time of processing was 153 second. In comparison with MRI FLAIR-based WM-lesion volume, the CT-based HU-weighted reduction of the white matter density showed a significant correlation coefficient (0.87). Spearman rank correlations between MR or CT based WM lesion quantification did not differ significantly in comparison to visual Fazekas scores, respectively.

CONCLUSION
The presented method allows fully automated observer-independent quantification of microangiopathic HU-induced reduction of the white matter in CT with high correlation to gold standard MRI.

CLINICAL RELEVANCE/APPLICATION
The algorithm targets the need for a rapid objective CT based assessment of WM lesion load which may be used as a risk score of hemorrhage in the setting of thrombolytic stroke therapy.
LL-NRE-TU11A • MR Manifestations of Radiation Injury to the Brain: The Good, the Bad and the Ugly

Francis J Cloran MD, MS (Presenter) ; Deepak M Sampathu MD, PhD ; Suyash Mohan MD

PURPOSE/AIM
1. To discuss radiotherapy malignant modalities for treatment of intracranial disorders. 2. To highlight radiation induced pathology with attention to acute, subacute and chronic manifestations. 3. To illustrate, in an interactive case based manner, radiation induced pathology to include vascular, inflammatory and neoplastic entities with attention to imaging findings and clinical manifestations.

CONTENT ORGANIZATION
Review intracranial conditions for which radiotherapy/radiosurgery is utilized and the different modalities employed. Illustrate the timeline of radiation induced pathology to hone the differential diagnosis. Imaging manifestations of radiation-induced pathology: Images will be shown in an interactive case based review format with relevant clinical data, differential considerations and discussion. Some of the entities to be presented include:

SUMMARY
This interactive case review highlights conditions encountered after intracranial radiotherapy/radiosurgery. Knowledge of treatment history, imaging appearance of complications and temporal relationship of these complications related to their treatment is essential in management of these patients.

LL-NRS-TU1A • Clinical and Volumetric MRI Associations in Multiple Sclerosis Using Fully-automated Software

Joe B Baker MD (Presenter) ; Mariko Kita MD ; Joanna Haug MS, MPH ; Justin A Siegal MD ; Allen S Nielsen MD, MMedSc

PURPOSE
Cerebral atrophy is considered a neuroimaging biomarker of multiple sclerosis (MS) and has been shown to be an independent predictor of physical and cognitive disability. Several automated and semi-automated methods for quantifying cerebral atrophy using volumetric magnetic resonance imaging (vMRI) have been developed, although only one is currently FDA approved for clinical use (NeuroQuant, CorTechs Labs, Inc.). Small cohort studies have shown significant correlations between cerebral atrophy and clinical disability in MS, but none have been of sufficient size to generate a set of normative data to assist in the clinical evaluation of patients with MS.

METHOD AND MATERIALS
We retrospectively analyzed vMRI data from a heterogeneous MS cohort of 526 patients at a single institution during an 18-month period (female 422/526=80%) obtained using the NeuroQuant software package including segmental analysis of multiple brain regions. This data was then compared to clinical metrics obtained through focused chart review to determine the degree of correlation between volumetric data and clinical disability based on Expanded Disability Status Scale (EDSS). We plan to model independent predictors of physical disability including vMRI and other relevant clinical metrics.

RESULTS
We found significant correlations between EDSS and lateral ventricle volume (mean volume=28.9 cm3, SD=17.5, Pearson correlation coefficient r = 0.364, p

CONCLUSION
In our large cohort we showed significant correlations between EDSS and the volumes of several distinct brain regions that may allow use of vMRI as a predictor of MS-related disability in the clinical setting. We also generated a set of normative vMRI data to assist clinicians in interpreting brain volumes obtained during clinical workup as a marker for disability in MS.

CLINICAL RELEVANCE/APPLICATION
Normative segmental vMRI data generated from this large MS cohort can assist clinicians in interpreting brain volumes that can be used as predictors of clinical MS-related disability.

LL-NRS-TU2A • Arterial Spin Labeling in Semantic Dementia: Hypoperfusion's Detection and Diagnostic Accuracy. Could It Make as Well as FDG-PET?

Aurore Esquevin MD ; Jean-Christophe Ferre MD, PhD ; Florence Le Jeune MD, PhD ; Helene Raoult MD (Presenter) ; Isabelle Coroghe PhD ; Aymeric Stamm ; Catherine Merck ; Elise Bannier ; Christian Barillot ; Serge Belliard MD ; Jean-Yves Gauvrit MD

PURPOSE
Semantic dementia (SD) is a rare subtype of frontotemporal lobar degeneration. Structural MRI usually shows temporal lobe atrophy predominantly on the left side but it could be insufficiency. Fluorodeoxyglucose-positron emission tomography (FDG-PET) is known to improve the diagnostic accuracy. Nevertheless, Arterial spin labeling magnetic resonance imaging (ASL-MRI) has a non-perfusion MRI technique, which has recently shown great diagnostic potential in dementia, yet not in SD. The aim of this work was first to study diagnostic accuracy and hypoperfusion's detection with ASL-MRI in semantic dementia and secondly to compare it with FDG-PET.

METHOD AND MATERIALS
The study was approved by the local Ethics Committee. All participants provided written informed consent and underwent neuropsychological tests. Twelve SD patients were included and underwent FDG-PET and 3T ASL-MRI (PICORE Q2TIPS). Twelve healthy subjects matched for age and sex were also included and underwent 3T ASL-MRI. Twelve healthy subjects FDG-PET datasets matched for age and sex were selected from the Alzheimer’s Disease Neuroimaging Initiative (ADNI). The analysis was performed by a visual analysis, by 4 readers with a reading grid, in a blinded manner in order to depict abnormalities in each modality and to provide a forced diagnosis. Then, ASL-MRI was compared with FDG-PET. A non-parametric variance analysis was performed and differences were considered significant at a threshold of p< 0.05. The value of sensibility, specificity, predictive positive value were also calculated. A quantitative analysis was then performed in order to confirm this results.

RESULTS
The hypoperfusions, detected by visual and quantitative analysis with ASL-MRI affected mostly the left temporal anterior lobe. Similarly, FDG-PET yielded hypometabolisms in the same regions. The value of sensibility, specificity, predictive positive value were all higher than 90.0% for ASL-MRI and similar to FDG-PET.
CONCLUSION
Our results show the potential of ASL-MRI in SD diagnostic by highlighting a specific pattern of hypoperfusion and by providing a good diagnostic accuracy, similar to FDG-PET.

CLINICAL RELEVANCE/APPLICATION
ASL-MRI exhibits good diagnostic accuracy, similar to FDG-PET and shows a specific patterns of hypoperfusion. This could provide support for diagnosis of semantic dementia from non-invasive MRI.

LL-NRS-TU3A • Resting State fMRI Assessment of Language Networks in Epilepsy Patients: Initial Report

All Murat Koc MD (Presenter); Ali Yusuf Oner MD; Murat Ucar; Melike Guryildirim; Zeynel Baran PhD; Fatih Oncu; Halil Ozer; Turgut E Tali MD *

PURPOSE
Preoperative language network assessment through task-based functional MRI has been widely used in epilepsy patients. Using resting-state fMRI to define language networks, especially motor and sensory language areas (Wernicke & Broca) is an alternative technique. The purpose of this paper is to compare conventional task-based functional MRI and "task free" resting state fMRI results on refractory temporal lobe epilepsy (TLE) patients at 3T.

METHOD AND MATERIALS
An institutional review board approval was obtained for this study. A total of 10 refractory TLE patients, referred for presurgical evaluation were included in this study. First a "task free" resting state data then the "task-based" functional MRI data via two language tasks were acquired on a 3T scanner. T1 and T2W images on axial and coronal planes are then acquired to define the extend of epileptogenic region. Data driven from "task-based" and resting state fMRI were processed with BrainVoyager (QX 2.2, Brain Innovation). Following evaluation of the language network related signals and their distance to the epileptic regions, these two methods were compared via Independent Component Analysis (ICA). Region of Interest (ROI) analysis for Wernicke and Broca areas of language networks were done to assess spatial comparison.

RESULTS
Language network signals in the context of Wernicke and Broca areas were successfully defined on all patients with both fMRI techniques. Distance of these areas to the epileptogenic zones obtained with both techniques were comparable. Activation signals recorded with both methods showed good spatial correlation.

CONCLUSION
Resting state fMRI can be used as a promising alternative to conventional "task-based" fMRI. This new technique can be recommended in neurologically and/or visually impaired patients.

CLINICAL RELEVANCE/APPLICATION
Resting state fMRI for preoperative workup of language networks in TLE patients is a promising technique which is expected to extend the spectrum of patient profiles and to ease their evaluation.

LL-NRS-TU4A • Quantitative Susceptibility Mapping in Patients with Systemic Lupus Erythematosus: Detection of Abnormalities in Normal-appearing Basal Ganglia

Atsushi Ogasawara (Presenter); Shingo Kakeda MD; Keita Watanabe; Tian Liu PhD; Yi Wang PhD; Yukunori Korogi MD, PhD

PURPOSE
Although the substantial population of the systemic lupus erythematosus (SLE) have neuropsychiatric symptoms, many of them may not show abnormal brain MR findings, probably because the metabolic and/or functional alterations of the disease usually precede the anatomic disturbance. Quantitative susceptibility mapping (QSM) is a novel technique to compute quantitative maps of the corresponding underlying magnetic susceptibility distribution. Our aims were to evaluate whether QSM can detect the abnormalities within normal-appearing basal ganglia at conventional MRI in the patients with systemic lupus erythematosus.

METHOD AND MATERIALS
The institutional review board approved this study. All studies were performed with a 3T MRI system (Signa EXCITE 3T; GE Healthcare). Twenty-three SLE patients with (n = 7) or without (n = 16) neuropsychiatric symptoms were enrolled; all of them showed no abnormalities in the basal ganglia at conventional MR study. The age/sex-matched 23 controls were also enrolled. For SLE patients and controls, two radiologists independently measured mean susceptibility values and R2* rates in seven brain structures (thalamus, putamen, caudate, globus pallidus, pons, splenium of corpus callosum, and frontal white matter) that appears normal on conventional MR images.

RESULTS
In the putamen and globus pallidus, the mean susceptibility values were significantly higher for the SLE patients than for the controls (P < 0.05). In the SLE patients with normal basal ganglia at conventional MRI, QSM detected the subtle susceptibility changes more sensitively than R2* mapping.

CLINICAL RELEVANCE/APPLICATION
In the patients with neuropsychiatric SLE, QSM seems useful for the detection of subtle tissue changes of the basal ganglia, which may lead to early diagnosis at their subclinical stage.

LL-NRS-TU5A • Feasibility Study of Internal Carotid Artery (ICA) Balloon Occlusion Test prior to Endovascular Treatment of Ophthalmic Artery Aneurysm; As a Preliminary Study for Preserving Visual Function

Byung-Joon Kim MD; Wooil Kim (Presenter); Pyoung Jeon; Keon Ha Kim; Sung Tae Kim MD; Hong Sik Byun MD; Hyung-Jin Kim MD; Jihoon Cha MD; Yi Kyung Kim MD; Ji Young Lee MD

PURPOSE
We evaluate the usefulness of internal carotid artery (ICA) balloon occlusion test prior to endovascular treatment of ophthalmic artery aneurysm as a preliminary examination for assessment of preserving visual function.

METHOD AND MATERIALS
From 2008 through 2012, Twenty-three patients with ophthalmic artery aneurysms underwent ICA balloon occlusion test prior to endovascular treatment. HyperForm balloon was used to occlude ICA on the same side of the aneurysm and common carotid artery (CCA) angiography was then obtained. Communication between branches of the external carotid artery (ECA) with the ophthalmic branch of the ICA was evaluated on the post-occlusion CCA angiography. We performed coil embolization with or without stent placement only to the patients with communication between ECA with the ophthalmic branch of the ICA. Visual function test was followed immediately, 1 month and 6 months after the procedure. And follow up imaging study for evaluation of technical success was achieved 1 month and 6 months later.

RESULTS
21 patients had communication between ECA and the ophthalmic branch of the ICA. One patient lacked ophthalmic artery opacification or choriotreal blush on post-occlusion CCA angiography. The other patient showed facial paralysis during the balloon occlusion test. Coil embolization with or without stent placement was performed to the 21 patients with collateral flows. Among them, ophthalmic artery was occluded during the procedure in 3 patients. However, opacification of ophthalmic artery or choriotreal blush via collaterals was
demonstrated on post-embolization angiography and visual function test was also normal in all 3 patients. On follow up brain MR or MR angiography 6 months later, 5 cases were showing small neck remnants and no evidence of recanalization was revealed on the other 16 cases. No major recanalization or retreatment was reported during the follow-up period.

CONCLUSION
ICA balloon occlusion test was useful to determine whether to perform endovascular treatment of ophthalmic artery aneurysm containing latent risk of sacrificing its perforating branch.

CLINICAL RELEVANCE/APPLICATION
ICA balloon occlusion test prior to endovascular treatment of ophthalmic artery aneurysms can be performed as preliminary inspection for preserving visual function.

**LL-NRS-TUGA • Neuromyelitis Optica (NMO): An Initial Diffusion Kurtosis Imaging (DKI) Study**

Thomas M Doring MSc (Presenter); Fernanda C Lopes MD; Vanessa G Itaigiba MD; Ralph Strecker*; Jian Xu*; Margareth C Kimura MD; Tadeu T Kubo MSC; Romeu C Domingues MD; Emerson L Gasparetto MD; Gustavo Tukamoto MD

**PURPOSE**
In patients with NMO standard magnetic resonance images appear normal or demonstrate unspecific T2 hyperintense white matter (WM) lesions. Studies using DTI that depicted several diffusion parameters identified extensive WM lesions. DKI is a new technique that quantifies the deviation from non-Gaussian diffusion behavior of water molecules and that might be more adequate to describe restricted diffusion. The purpose of this study is to evaluate DKI in comparison to DTI in patients with NMO.

**METHOD AND MATERIALS**
13 patients with NMO and 13 healthy controls underwent MR imaging at 3T. Additionally to sagittal T1W and axial FLAIR sequences, a works-in-progress DKI sequence was measured (30 directions, b=0,1000,2000s/mm2, TR/TE=5300/90, FOV=220mm, matrix=82x82, slicethickness 2.7mm, no gap). Parametric maps of fractional anisotropy (FA), mean diffusion (MD), axial diffusivity (AD), radial diffusivity (RD), mean kurtosis (MK), axial kurtosis (AK) and radial kurtosis (RK) were calculated. All subject data was analyzed using 1)TBSS performing tract-based-spatial-statistics for each parameter and 2)ROI-based analysis by placing manually ROIs in the splenium and body of corpus callosum (CC), cerebral peduncles (CP), optic radiations (OR) and corticospinal (CST) and performing statistical group analysis (t-test).

**RESULTS**
TBSS-DTI: Significant reduction in FA in multiple areas (p TBSS-DKI: Significant decrease (p ROI-Analysis: significant decrease of RK in left OR (p=0.049) and CC (p=0.031), highly significant increase of MK in right corticospinal tract (p=0.004) and increase in AD in CC (p=0.03).

**CONCLUSION**
NMO patients showed significant alterations of FA and RD in the CC when compared to controls, in agreement to previous results (Lopes et al, 2012). DKI presented sensitivity to occult brain tissue damage in normal-appearing WM in NMO by these means we were able to identify possible key genes and miRNAs involved in the latter regulation. The uncovered genes and miRNAs represent new insight into tumors with restricted diffusion following non-Gaussian behavior.

**CLINICAL RELEVANCE/APPLICATION**
The alteration in Diffusion Kurtosis Imaging WM parameters may provide more insight in the specific underlying disease.

**LL-NRE-TU8A • Diffusion Imaging Genomic Mapping Identifies Genomic Targets Involved in Invasion and Poor Prognosis**

Rivka R Colen MD (Presenter); Omar Ashour MD; Pascal O Zinn MD

**PURPOSE**
To create an imaging genomic map, linking MR imaging traits with gene- and miRNA expression profiles, in patients with GBM to determine genomic correlates of a MR diffusion radiophenotype to possibly find new genomics targets for GBM treatment. Decreased in diffusion in tumors, specifically GBM, is associated with increase in cellular density and high nuclear to cytoplasm (N:C) ratio. Here, we present the first study examining in a quantitative way diffusion imaging genomics in GBM to determine novel and targetable genomic biomarkers in GBM.

**METHOD AND MATERIALS**
We identified 60 treatment-naive GBM patients from The Cancer Genome Atlas (TCGA) who had both gene- and microRNA expression profiles and pretreatment MR-neuroimaging specifically ADC maps. Two neuroradiologists did morphological analysis of the studies using Slicer 3.6 (slicer.org), where regions of FLAIR hyperintensity, contrast enhancement, and necrosis were segmented to obtain accurate tumor volumetric data. Nordic ICE was used for functional diffusion analysis using the region-of-interest (ROI) and volume segmentation methods. ADC values were calculated. VOIs corresponding to the different FLAIR and post-gad T1 segmented volumes were also analyzed for their median ADC values, as well as through histogram analysis. Biostatistical analysis was performed for gene and miRNA sets, where median ADC value and histogram cutoffs for each morphological region were defined to separate high from low groups and analyzed by Comparative Marker Selection. All the genomic data was also analyzed to determine the most upregulated miRNAs using ingenuity pathway analysis (IPA).

**RESULTS**
IPA identified molecular networks, as well as canonical and functional pathways highly associated with cancer and invasion in those patients with low ADC values (areas of restricted diffusion).

**CONCLUSION**
The diffusion radiophenotype identified genes and miRNAs and corresponding molecular networks that were highly associated with tumor invasion. By these means we were able to identify possible key genes and miRNAs involved in the latter regulation. The uncovered genes and miRNAs represent new insight into tumors with restricted diffusion seen on MRI.

**CLINICAL RELEVANCE/APPLICATION**
The discovery of imaging biomarkers reflecting specific genomic compositions associated with presence of restricted diffusion are clinically relevant as they can determine tumor aggressivity/growth.

**LL-NRE-TU8A • Eyes Half Shut: A Pictorial Review of the Causes of Horner Syndrome**

Hilary L Purdy MD (Presenter); Michelle M Miller-Thomas MD; Mudassar Kamran MD

**PURPOSE/AIM**
I. Review the pathophysiology of Horner syndrome including the anatomy of the oculosympathetic pathway, II. Illustrate the causes of Horner syndrome at the level of the first, second, and third order neurons. III. Review an imaging strategy for the evaluation of Horner syndrome based on symptomatology and clinical presentation.

**CONTENT ORGANIZATION**
I. Horner syndrome
A. Pathophysiology
B. Anatomy of the oculosympathetic pathway
II. Comprehensive review of the various causes of Horner syndrome
A. First order neuron pathology: demyelinating lesions, lateral medullary infarction, syringomyelia, spinal cord trauma
B. Second order neuron pathology: paracranial tumor, thyroid goiter, metastases
C. Third order neuron pathology: carotid dissection, carotid pseudoaneurysm, glomus jugulare, neuroblastoma, cavernous sinus
thrombosis

III. Imaging strategy for the evaluation of Horner syndrome based on symptomatology and clinical presentation

SUMMARY

Miosis, ptosis, and anhidrosis comprise the classic neurologic syndrome known as Horner syndrome. Resulting from the interruption of the oculosympathetic pathway, the causes of Horner syndrome range from benign to life-threatening. This pictorial review provides insight into the complex anatomy of the neuronal pathway and the diverse causal entities.

LL-NRE-TU9A • Cutaneous Vascular Malformations and Hemangiomas in the Head and Neck: Classification, Imaging Features, and Treatment

Christina Danial BA ; Mark D Mamlouk MD (Presenter)

PURPOSE/AIM

1. To define the classification of cutaneous vascular malformations and hemangiomas. 2. To illustrate the MR imaging features and pearls for differentiation. 3. To discuss the clinical course and treatment options with support from dermatologic images.

CONTENT ORGANIZATION


SUMMARY

1. Cutaneous vascular malformations and hemangiomas in the head and neck need to be appropriately characterized to streamline ensuing management. 2. High vs low-flow characterization is an important differentiating feature and can be assessed with contrast-enhanced time-resolved MRA. 3. Collaboration with a Vascular Anomalies team composed of clinical subspecialists will provide the best management in these patients with complex diseases.

LL-NRE3148-TUA • Imaging Genomic Mapping in Brain Tumors: An Introduction

Omar Ashour MD (Presenter); Pascal O Zinn MD; Rivka R Colen MD

PURPOSE/AIM

The purpose of this exhibit is to

1. Introduce and detail the concept and history of imaging genomics and imaging genomic mapping in brain tumors,
2. Show the ability of imaging genomics to provide biomarkers that reflect underlying molecular cancer compositions,
3. Illustrate examples of an imaging surrogate and a clinical classification derived from the first large scale study in this field, as well as their clinical significance, and their future implications

CONTENT ORGANIZATION

Background and Emergence of Imaging Genomics
Materials and Methods
Results of Imaging-genomic Correlation

MRI-FLAIR as surrogate for Invasion
VAK Classification

Summary and Future Directions

SUMMARY

The major teaching points of this exhibit are:

1. Imaging genomics/Radiogenomics is a relatively new field which links specific imaging traits (radiophenotypes) with gene-expression profiles, and vice versa.
2. MRI-FLAIR is an imaging surrogate to non-invasively detect specific genomic components responsible for migration and invasion in Glioblastoma.
3. The Volume/Age/KPS score (VAK) classification is readily applicable at patient admission and can predict operative outcome.
4. Imaging genomics provide cost-effective biomarkers for leveraging genomic data that help direct therapy and predict prognosis and drug response.
of the wide variety of materials commonly utilized in facial fracture repair so as to not misinterpret them as foreign bodies and to aid in diagnose of potential complications.

**LL-NRS-TU1B • Current CNS Radiation Treatment Modalities: What Every Radiologist Should Know**

Ruth Eliahou MD (Presenter) ; Michelle Alonso-Basanta MD,PhD ; Zelig Tochner MD ; Nicholas G Zaorsky MD ; Alexander C Mamourian MD

**PURPOSE/AIM**
The purpose of this exhibit is to present current advances in radiation therapy techniques used for the treatment primary and secondary brain tumors

**CONTENT ORGANIZATION**
- Current available modalities of radiotherapy for brain neoplasms, focusing on 3D conformal, Intensity-Modulated Radiation Therapy (IMRT), Image Guided Radiation Therapy (IGRT), Rapid Arc Radiotherapy, Proton Beam therapy (particle beam), Stereotactic Radiosurgery (SRS) with either Gamma and Cyber Knife.
- Describing the principle, clinical uses, advantages and disadvantages and major complications of these modalities.
- Demonstrative cases.
- Summary

**SUMMARY**
1. Latest advances in radiotherapy for brain tumors utilize imaging techniques to increase precision and to deliver high doses of radiation while sparing healthy brain tissue.
2. SRS provides a single dose of targeted high dose radiation for clinical entities that previously required surgery for example trigeminal neuralgia, vestibular schwannoma and small arteriovenous malformations.
3. Proton beam therapy is a highly targeted radiation modality that is becoming more widely available and early results show a potential decrease in acute and long term side effects for variety of neoplasms in children and adults including gliomas, medulloblastomas and meningiomas.

**LL-NRS-TU1B • High-resolution Diffusion Tensor Imaging of the Parahippocampal Cingulum and Posterior Cingulum Bundles in Patients with Mild Cognitive Impairment and Alzheimer’s Disease**

Kenji Ito PhD (Presenter) ; Makoto Sasaki MD * ; Junko Takahashi MD ; Fumio Yamashita PhD ; Satomi Higuchi ; Jonathan Goodwin ; Ikuko Uwano PhD ; Taisuke Harada

**PURPOSE**
To investigate alterations in the fractional anisotropy (FA) values of the parahippocampal cingulum bundle (PhC) and posterior cingulum bundle (PoC) in patients with mild cognitive impairment (MCI) or Alzheimer’s disease (AD) by using high-resolution quantitative diffusion-tensor imaging (DTI) analysis.

**METHOD AND MATERIALS**

**RESULTS**
Two MCI-C and 3 MCI-NC patients and 5 HCs were excluded because the results of DTI analyses were ineligible due to substantial motion or eddy-current artifacts. In the PhC, FA values were significantly lower for patients with AD (left, p = 0.004; right, p = 0.037) and MCI-Cs (left, p = 0.005; right, p = 0.030) than HCs. In contrast, FA values in the PoC were significantly lower only in AD as compared with those in HCs (right, p = 0.043). No significant differences were observed between MCI-NCs and HCs in the PhC and PoC.

**CONCLUSION**
We found that the FA values for the PhC significantly decreased both in AD patients and in MCI-C patients and that these changes were more evident than those for the PoC, suggesting that microstructural alterations in the PhC precede those in the PoC. High-resolution DTI analysis of the PhC may be effective in predicting whether patients with MCI will convert to AD.

**CLINICAL RELEVANCE/APPLICATION**
High-resolution DTI analysis can detect subtle FA changes in the PhC even in patients with MCI and may help predict conversion of MCI to AD.

**LL-NRS-TU2B • The Pattern of White Matter Alteration in Patients with Parkinson’s Disease according to Cognitive Status**

Na-Young Shin MD ; Injoong Kim (Presenter) ; Yoon Seong Choi MD ; Kyung-Eun Kim MD ; Sung Soo Ahn MD ; Jinna Kim MD ; Seung-Koo Lee MD, PhD

**PURPOSE**
To assess the pattern of white matter alteration in patients with Parkinson’s disease (PD) according to cognitive status by using diffusion tensor imaging.

**METHOD AND MATERIALS**
From August 2011 till September 2012, we enrolled patients with PD-intact cognition (PD-IC, n=10), PD-mild cognitive impairment (PD-MCI, n=15), PD with dementia (PDD, n=11), and healthy control subjects (n=15). Fractional anisotropy (FA) maps of patient groups were compared with each other and that of control subjects by using tract-based spatial statistics (TBSS) where age and education were included as covariates in analysis of covariance.

**RESULTS**
Compared with control subjects, FA values were significantly decreased in many major tracts in patients with PD-MCI and PDD as follows: corpus callosum, superior longitudinal fasciculus, anterior corona radiata, anterior limb of internal capsule, external capsule, posterior thalamic radiation, cingulum, and inferior longitudinal fasciculus. Compared with patients with PD-IC, there were significantly decreased FA values in the body of corpus callosum in patients with PDD. There were not significantly decreased FA values in patients with PD-IC compared with control subjects. PDD patients with shorter disease duration before dementia (CONCLUSION
These data suggest that white matter damage in patients with PD exhibits a greater extent with increasing levels of cognitive impairment. In addition, white matter alteration responsible for PDD may differ according to disease duration of PD.

**CLINICAL RELEVANCE/APPLICATION**
Evaluation of fractional anisotropy using TBSS can improve understanding of extension of white matter alteration in patients with PD according to cognitive status.

**LL-NRS-TU4B • Diagnosing Intracranial Aneurysms with MR Angiography: Systematic Review and Meta-analysis**

Anna M Sailer MD, MBA (Presenter) ; Bart A Wagemans MD ; Patty Nelemans ; Rick De Graaf MD, PhD ; Wim Van Zwam MD

**PURPOSE**
To evaluate the sensitivity and specificity of magnetic resonance angiography (MRA) in the diagnosis of ruptured and unruptured intracranial aneurysms.

**METHOD AND MATERIALS**
A systematic search was performed on four electronic databases including Pubmed and Embase on relevant papers that were published from January 1998 until February 2013. Inclusion criteria were met by twelve studies that compared MR angiography to digital
subtraction angiography (DSA) and / or intraoperative findings as reference standard. Two independent reviewers evaluated the methodological quality of the studies. Heterogeneity was tested and risk for publication bias was visually assessed. Data from eligible studies were extracted and used to construct 2 x 2 contingency tables on a per aneurysm level. Pooled estimates of sensitivity and specificity were calculated for all studies and subgroups of studies.

RESULTS
Included studies were of high methodological quality. There was no evidence of publication bias. Most studies were performed using time-of-flight MRA technique. Among the 1092 patients assessed, 882 aneurysms were present. Heterogeneity concerning sensitivity and specificity were moderate to high. Pooled sensitivity of MRA was 96% (95% CI: 91%, 99%), pooled specificity was 90% (95% CI: 82%, 95%). False negative and false positive aneurysms detected on MRA were mainly located at the skull base and middle cerebral artery. Studies that evaluated only ruptured aneurysms did not report different sensitivity and specificity than studies evaluating both ruptured and unruptured aneurysms.

CONCLUSION
Studies on diagnostic performance of magnetic resonance angiography show high sensitivity with a large variation in specificity in detection of intracranial aneurysms. Diagnostic performance of MRA has increased significantly since the last meta-analysis of White and Wardlaw in 2000, but still is inferior to CTA.

CLINICAL RELEVANCE/APPLICATION
In suspicion of intracranial aneurysms, MRA may play a role as primary diagnostic test in a screening setting or if CTA is contraindicated.

LL-NRS-TU5B • Spectral CT for Improving Image Quality of Cerebral Artery CT Angiography after Metal Coils or Clips Treatment
Jia Yulin MD (Presenter) ; Xiao Xigang MD ; Li Chao ; Fan Jinyu ; Zhu Kai ; Sun Yuanyuan

PURPOSE
To investigate the effect of spectral CT for metal artifacts reduction in cerebral artery CT angiography (CTA) after metal coils or clips treatment.

METHOD AND MATERIALS
17 patients after metal coils or clips treatment underwent clinically indicated cerebral artery CTA in our hospital. All patients provided their written informed consent. The examination was performed using a single tube and fast kVp-switching technique between 80 and 140 kVp in MONO and MARS groups. The data were reconstructed into 3 image groups: quality check images (QC) with 140kVp data set only, monochromatic image sets in the range of 40-140 keV with the interval of 5 keV (MONO), and monochromatic images with metal artifacts reduction software (MARS). CT attenuation value of cerebral artery, contrast-to-noise ratio (CNR), signal-to-noise ratio (SNR) and subjective score of all images were measured. All data from the 3 groups (QC, MONO and MARS) were compared.

RESULTS
5 of 17 patients were detected with metal coils and the other 12 patients were with metal clips. Moreover, 1 patient had two metal coils and another patient had two metal clips. CT attenuation value of cerebral artery decreased as the photon energy increased from 40 to 140 keV in MONO and MARS groups. The average energy levels of 63 keV and 61keV were found to provide the best CNR for displaying the cerebral arteries in the monochromatic image sets of MONO and MARS groups, respectively. And CNR and SNR values of the two sets were all higher than those of group QC CPPP=0.78, 0.42, and 0.56, respectively).

CONCLUSION
The monochromatic images in the range of 60-80 keV could reduce the artifacts and improve image quality of cerebral artery after metal coils or clips treatment, and 63 keV and 61keV of MONO and MARS may provide best CNR for displaying the cerebral arteries.

CLINICAL RELEVANCE/APPLICATION
Spectral CT with GSI and MARS can reduce the artifacts from metal coils or clips in cerebral artery and improve image quality, so that, the evaluation of treatment can be accomplished.

LL-NRS-TU6B • Cerebral Gliomas: Monoexponential, Biexponential, Stretched-exponential Models of DWI and Diffusion Kurtosis Imaging in Grading
Yan Bai (Presenter) ; Meiyun Wang MD, PhD ; Dapeng Shi MD ; Jinyuan Zhou PhD

PURPOSE
Previous studies commonly used quantitative ADC obtained from monoexponential fit to grade gliomas. However, contradictory findings have been reported in different studies. The biexponential and stretched-exponential models of DWI and diffusion kurtosis imaging (DKI) could offer additional information. The purpose of our study was to compare the values of the 3 different models of DWI and DKI in grading gliomas.

METHOD AND MATERIALS
RESULTS
ADCstandard, f, DDC, FA, MD, Dr and Da had no significant difference whereas ADCfast, ADCslow, ?, MK, Kr and Ka had significant difference between high- and low-grade gliomas. ADCfast, ADCslow, ?, MK, ka and Kr values that were normalized to the values in the contralateral normal-appearing white matter (NAWM) had slighter difference. AUC was highest for ? (0.959) during testing to discriminate between high- and low-grade gliomas, followed by ADCfast(0.965), normalized ?(0.958), normalized ADCfast (0.947), MK(0.865), Kr(0.847), ADCslow (0.826) and Ka(0.813).

CONCLUSION
The biexponential and stretched-exponential models of DWI and DKI are useful tools in grading cerebral gliomas.

CLINICAL RELEVANCE/APPLICATION
The noninvasive techniques of DWI and DKI are recommended to grade gliomas.

LL-NRE-TU7B • Structural Imaging, Spectroscopy and Diffusion Tensor Imaging in Amyotrophic Lateral Sclerosis (ALS): Current Insights into Degenerative Motor Neuron Disease in the Brain
Jose Maria Garcia Santos MD, PhD (Presenter) ; Carlos Vazquez MD ; Alberto Inuggi ; Miguel Blanquer ; Paqui Iniesta ; Joaquin Gomez Espuch ; Salvador Martinez ; Jose Maria Moraleda

PURPOSE/AIM
- To remember the pathophysiology of ALS
- To review the conventional structural imaging findings of ALS
- To learn about single voxel MR spectroscopy and DTI changes related to ALS
- To be aware about the possible effects of treatment based on single voxel MR spectroscopy

CONTENT ORGANIZATION
- Pathophysiology of ALS
- Review of brain conventional MRI of ALS
- Discuss brain DTI (fractional anisotropy and main diffusivity) changes related to disease
- Show brain single voxel MR spectroscopy changes in ALS
- Correlate DTI and single voxel MR spectroscopy (fractional anisotropy and main diffusivity) changes in ALS
- Show future directions related to treatments
SUMMARY
The major teaching points of this exhibit are:
- Conventional MRI findings involving the motor cortex and the corticospinal tract only appear in a reduced number of patients.
- DTI changes (lower fractional anisotropy; higher mean diffusivity) in the brain go far beyond the corticospinal tract.
- Single voxel MR spectroscopy and DTI parameters change depending on disease progression or upper motor neuron scores.
- Single voxel MR spectroscopy and DTI data are related in ALS and support the future benefits of clinical multiparametric analysis.
- Single voxel MR spectroscopy and DTI might show the effect of specific ALS treatments on disease progression.

LL-NRE-TU8B • Congenital Ossicular Anomalies: An Imaging Review
Behroze Vachha MD, PhD (Presenter) ; Mary N Tenenbaum MD ; Caroline D Robson MBChB * ; Gul Moonis MD

PURPOSE/AIM
A comprehensive review of the imaging findings of congenital ossicular lesions associated with major and minor congenital ear malformations. Discussion of the classification schemas of congenital ossicular anomalies.

CONTENT ORGANIZATION
Congenital anomalies of the ear are generally classified as major or minor malformations, depending on the presence of a normal external auditory canal and tympanic membrane. Major malformations of the ear (e.g. Congenital Aural Atresia) tend to have more severe ossicular abnormalities. Minor malformations include isolated ossicular dysplasias (fixations, fusions or defects of the ossicular chain and malformations of the oval and round window). We will review embryology of the ossicles and MDCT features of the following congenital ossicular anomalies: 1)Congenital Aural Atresia: 2) Bony bars: Including malleus and incus bars. 3) Oval Window Atresia: These lesions typically demonstrate an aberrant course of the tympanic segment of the facial nerve canal, often overlying or coursing inferior to an atraic oval window, and the stapes is often dysplastic and may not contact the atretic oval window

SUMMARY
Imaging plays an important role in the evaluation of congenital ossicular anomalies. Familiarity with the imaging patterns of major and minor ear anomalies can optimize diagnosis and management.

LL-NRE-TU9B • Assessing Glioblastoma Response to Therapy: A Diverse and Rapidly Evolving Field
Daniel S Chow MD (Presenter) ; Vesselin Miloushev MD, PhD ; William Win MD ; Bryan A Lanzman MD ; Akash D Shah MD ; Angela Lignelli MD ; Christopher G Filippi MD

PURPOSE/AIM
Glioblastoma multiforme (GBM) is an invasive and highly aggressive tumor. Currently, varying imaging metrics are employed to provide risk stratifications, treatment guidance, and prognostic information. Therefore, it is important for the radiologist to have a firm understanding of different imaging approaches, limitations, and varying definitions in response. Additionally, it is important to be familiar with new investigative tools given the rapid growth and development of technology and treatment in GBM.

CONTENT ORGANIZATION
1. Epidemiology of GBM.
2. Current approaches and limitations of current neuroimaging metrics in GBM assessment
   a. Unidimensional Techniques (RECIST)
   b. Bidimensional Techniques (MacDonald)
   c. Response Assessment in Neuro-Oncology (RANO) Criteria
3. Specific challenges encountered in GBM assessment
   a. Post-surgical cavity
   b. Pseudoprogression
   c. Pseudoresponse
4. Developing neuroimaging techniques in GBM assessment
   a. Automated volumetric contouring assessment
   b. Morphologic assessment
   c. Diffusion imaging
   d. BOLD fMRI
   e. Spectroscopy

SUMMARY
The various neuroimaging techniques used in assessing GBM response to therapy is continually expanding and evolving. It is important for radiologists to be 1) familiar with differing techniques and their limitations and 2) aware of those in development.

Emergency Radiology (Brain Emergencies)

Wednesday, 03:00 PM - 04:00 PM • N227

SSJ07 • AMA PRA Category 1 Credit ™:1 • ARRT Category A+ Credit:1
Moderator
Wayne S Kubal , MD *
Moderator
Suzanne T Chong , MD

SSJ07-01 • Monoenergetic Reconstruction of Acute NC DECT Head at 68 keV and 108 keV Results in Superior Image Quality in Comparison to Polychromatic CT in Improvement of Grey-white Matter Differentiation and Reduction in Posterior Fossa Artifact
Adrian Reagan MD (Presenter) ; Niv Khorrami ; Savvas Nicolaou MD ; Luck J Louis MD ; Ana-Maria Bilawich MD ; Sharon Gershony MD

PURPOSE
To determine whether DECT head generated monoenergetic data sets reduces petrous apex beam hardening artifact and improves assessment of gray- white differentiation in the ED.

METHOD AND MATERIALS
A total of 20 consecutive DECT head studies were scanned on the 128-slice dual source scanner in the ED. Protocol included the following parameters, 64 by 0.6mm collimation reconstructed to, 3mm, axial slices at 100 kv and 140kv Sn. The 3 mm 20 D34 axial DECT scans were uploaded in the monoenergetic dual energy class on the multimodality workplace and ME energy levels from 40 to 190 keV in 4 keV increments were analyzed through the cerebrum. Noise was calculated by using the standard deviation of 4 regions of interest measuring 10mm (square) within the pons, external capsule, head of the caudate, and gray white interface. The weighted mixed data DECT 3 mm axial images simulating a 120 kVp exam were analyzed on the MMWP as well using identical ROI size and anatomic distribution from the same
Acute Stroke evaluation with Monoenergetic images obtained from DECT heads has the potential in improving the detection of acute brain infarcts.

RESULTS
A Mann-Whitney U test was used to compare the SNR between the monoenergetic and weighted polychromatic DECT weighted data sets and maximal optimal values were appreciated at 68keV and at the 108 keV monoenergetic levels resulting in a U value of 1 (< 0.05). Similar statistical analysis of the supratentorial brain yielded a U value of 0 (< 0.01). The two radiologists reported superior grey-white matter differentiation and a greater reduction of beam hardening artifacts on the monoenergetic images as compared to routine weighted 120 kvp axial scans.

CONCLUSION
Monoenergetic generated scans from DECT heads at 68 keV and 108 keV improved the assessment of the posterior fossa and grey-white matter differentiation.

CLINICAL RELEVANCE/APPLICATION
Whole-brain 320-detector Row Dynamic Volume CT Perfusion Performed on Hyperacute Ischemic Stroke Patients within 4.5 hours Improves Diagnostic Sensitivity and Accuracy

Zhu-Ren Luo (Presenter); Xiong-Jie Zhuang; Rong-Zhou Zhang; Bao-Zhong Shen

Papers.

RESULTS
Of the 30 patients evaluated, NCCT revealed two (6.7%) acute infarcts without false positives. CTP revealed 28 (93.3%) acute infarcts with one false positive. Of the two infarcts missed on CTP, one was a small cortical infarct, whereas the other was a lacunar type infarct (< 10 mm in size). CTP was significantly more sensitive (93.3 vs. 6.7%, P < 0.05), accurate (76.0 vs. 52.0%, P < 0.05), and had a better negative predictive value (93.5 vs. 51.7%, P < 0.05) than NCCT.

CONCLUSION
A 320-slice CT allows completing dynamic visualization of entire brain and enables calculation of whole-organ perfusion maps. Whole-brain CTP improved sensitivity and accuracy relative to NCCT in this cohort of 30 patients with symptoms of hyperacute stroke evaluated within 4.5 hours of the event.

CLINICAL RELEVANCE/APPLICATION
320-slice CT can enable calculation of whole-brain perfusion maps and improve sensitivity and accuracy for diagnosing hyperacute stroke.

SSJ07-04 • Improvement of Image Quality (IQ) with Model Based Iterative Reconstruction (MBIR) Algorithm in Cranial CT (CCT) in Trauma Patients

Susan Notohamiprodjo MD (Presenter); Zsuzsanna Deak MD; Fabian Mueck; Felix Meurer; Maximilian F Reiser MD; Stefan Wirth MD

PAPERS.

METHOD AND MATERIALS
Raw data sets of anonymized 100 trauma patients receiving CCT according to the institutional standard protocol (120 kV, 260 mAs, 20
mM detector collimation; 0.984 pitch) were reconstructed with ASIR and MBIR, multiplanar reformations of 2.5 mm axial, coronal and sagittal slices were calculated. Two radiologists blinded to the reconstruction independently rated IQ by the depiction of different parenchymal structures and the effect streak artifacts of photon starvation using a semi-quantitative scale (0: non-diagnostic, 1: impaired, 2: sufficient, 3: good, 4: excellent). Mean attenuation value (MAV; [HU]) and standard deviation (SD; [HU]) were measured for liquor space (LS) and white matter (WM) supratentorial (ST) and in the posterior fossa (PF). Data were analyzed using ICC, Mann-Whitney-U and ANOVA testing.

RESULTS
MBIR significantly decreased streak artifacts in PF (p < 0.05).

CONCLUSION
Our results suggest significant improvement of IQ with MBIR in comparison to ASIR in CCT of trauma patients.

SSJ07-05 • Acute Intracranial Hemorrhage in Computed Tomography - Benefits of Sinogram-affirmed Iterative Reconstruction Techniques

Boris Bodelle MD (Presenter) ; Boris Schulz MD ; Firas Al-Butmeh ; Thomas Lehner MD ; Julian L Wichmann MD ; Claudia Freiliesen ; Ralf W Bauer MD * ; Josef Matthias Kerl MD * ; Thomas J Vogl MD, PhD

PURPOSE
To compare image quality (IQ) and intracranial hemorrhage (ICH) in brain computed tomography (CT) with sinogram-affirmed iterative reconstruction (SAFIRE) and filtered-back-projection (FBP) reconstruction techniques at standard and low dose tube current levels.

METHOD AND MATERIALS
The study was approved by the IRB. 54 patients (mean age 64 ± 20 years) in group 1 and 40 patients in group 2 (mean age 57 ± 23 years) received CT at two different tube current-time products (group 1: 340 mAs; group 2: 260 mAs) in a multi-detector CT. Images were reconstructed with FBP and five different iterative strengths (S1-5) and were ranked (5-point scale) by two radiologists for IQ and ICH in a blinded manner. Image noise (IN), signal-to-noise ratio (SNR), dose-length product (DLP, mGy cm) and mean effective dose (mSv) were calculated.

RESULTS
FBP at standard 340 mAs and S1 at 260 mAs showed no statistical significance (p < 0.05) for subjective rating. IN was higher (p < 0.05) in group 2. SNR increased with higher strength of SAFIRE in both groups. There was predominantly no significant difference in SNR between FBP and S1. Highest SNR was achieved with S5. Best score for subjective rating of IQ/ICH was achieved with S3/S4-5. Patients were exposed to a significantly lower dose in group 2 (mean: 744 mGy cm/1.71 mSv) than group 1 (mean: 1045 mGy cm/2.40 mSv, p < 0.05).

CONCLUSION
SAFIRE provides better IQ and visualization of ICH in brain CT. Dose reduction by almost one-third is possible without significant loss in diagnostic quality.

CLINICAL RELEVANCE/APPLICATION
Sinogram-affirmed iterative reconstruction technique provides better image quality and visualization of intracranial hemorrhage in brain CT with almost one-third dose reduction compared with FBP.

SSJ07-06 • Screening CT in Mild Traumatic Brain Injury: Comparison of Two Mostly Used Clinical Guidelines in a Tertiary Referral Hospital in Northeastern Japan

Daddy Mata Mbemba MD, PhD (Presenter) ; Shunji Mugikura MD, PhD ; Atsuhiro Nakagawa ; Takaki Murata MD ; Li Li MD, PhD ; Kei Takase ; Teiji Tominaga ; Shigeki Kushimoto PhD ; Shoki Takahashi MD

PURPOSE
To avoid unnecessary CT, Canadian CT Head Rule (CCHR) and New Orleans Criteria (NOC), each containing 7 clinical items, are widely-used guidelines to indicate screening CT in mild traumatic brain injury (TBI). We aimed to compare the two guidelines in predicting Clinically Important CT Findings (CICF), by introducing two scoring systems.

METHOD AND MATERIALS
Consecutive 142 mild TBI (Glasgow coma scale (GCS): 13-15) patients (age: 18-88 years), who underwent CT examination indicated by either CCHR or NOC, were included. We introduced two 8-graded (0 to 7) scores and assigned them to each patient, Canadian score from CCHR and New Orleans score from NOC: a patient’s score represented a sum of the number of positive items, each of which was rated +1 if present. Two neuroradiologists reviewed screening CT for CICF. In all the GCS13-15 patients, we examined whether both scores were related to CICF by univariate analysis, logistic regression and receiver operator characteristic curve. We also used logistic regression to determine which of the 14 clinical items included in either guideline, independently predicts CICF. Since NOC is applied only for GCS-15 patients, we additionally compared two scoring systems only in GCS-15 group (n=67).

RESULTS
Of 142 mild TBI patients, 49 patients (34.5%) showed CICF. In GCS 13-15 group, both scores showed a significant relationship to CICF (P < 0.05) in univariate analysis. However, in multivariate analyses, only Canadian score was a predictor of CICF (P = 0.0130) yielding a better performance (AUC = 0.69) than New Orleans score (AUC = 0.63). In addition, among all 14 clinical items included in either guidelines, the item of GCS CONCLUSION
In mild TBI, CCHR was a better predictor of CICF in a tertiary referral hospital in northeastern Japan. Our results are consistent with a big-scale western-study.

CLINICAL RELEVANCE/APPLICATION
In mild TBI, selective use of CT decreases unnecessary irradiation, but improper selection can lead to missing life-threatening lesions. Our study encourages the use of CCHR for efficient CT scanning.
METHOD AND MATERIALS

An EGFR-specific imaging probe, 64Cu-DOTA-EGFR F(ab')2 was developed with F(ab')2 fragmentation and chelator conjugation of a humanized monoclonal antibody to EGFR. Probe affinity was assessed using Ga-67 labeling and saturation binding studies with EGFR positive A345 cells. For in-vivo studies, Gli-36, an EGFR expressing GBM cell line transfected to express luciferase, was used. Nude (nu/nu) mice were injected intracranially with 5X10^4 Gli-36 cells. Prior to PET imaging, tumor growth was confirmed with bioluminescence. In vivo agent kinetics were established by imaging (n=3) mice at 4, 8, 16, and 22h after injection of 100 µCi of 64Cu-DOTA-EGFR F(ab')2. Blocking studies were performed by injecting mice (n=3) with escalating doses of cetuximab 24h prior to agent administration.

RESULTS

CONCLUSION

Specific PET imaging of glioblastoma multiforme tumors that express EGFR is possible using the kinetically optimized novel PET imaging agent 64Cu-DOTA-EGFR F(ab')2.

CLINICAL RELEVANCE/APPLICATION

A direct EGFR specific imaging agent for GBM tumors expressing EGFR may be able to confidently distinguish true progression from pseudoprogression, sparing patients the high surgical risks of biopsy.

SSJ15-02 • EGFR MAb-bioconjugated Superparamagnetic Iron Oxide Nanoparticles as a Specific MRI Contrast Agent for Detection of Brain Glioma In Vivo

Wenzhen Zhu MD, PhD (Presenter) ; Shun Zhang ; Ketao Mu PhD

PURPOSE

Superparamagnetic iron oxide nanoparticle (SPIONPs) delivery system has become a model system in which to study the target molecule-specific biodistribution, rapid excretion and undesired side-effects using in vivo small animal MRI. As a cellular transmembrane receptor, EGFR regulates important cellular processes and is linked to a poor prognosis in various human cancers. In this study, we developed a potentially valuable new targeted nanocarrier based on SPIO delivery system, EGFRmAb-bioconjugated nanoparticles EGFRmAb-SPIONPs. The purpose of this study was to elucidate strategies for further improvement of this promising approach.

METHOD AND MATERIALS

EGFRmAb-SPIONPs were prepared and characterized. The preferential accumulation of the EGFRmAb-SPIONPs within gliomas and subsequent MRI contrast enhancement were demonstrated in vitro in C6 cells and in vivo in tumors of rat model. MRI scanning was performed using a 3.0T MRI scanner and a research coil insert designed specifically for imaging rats was used to MRI

RESULTS

The average particle size of about 10.21 nm, hydrodynamic diameter of about 161.5 nm, saturation magnetization of 55 emu/g Fe and T2 relaxivity of 92.73 S-1mM-1 of the EGFRmAb-SPIONPs suggested its applicability for MRI. MR T2WI of iron uptake in C6 cells treated with the nanoparticles (EGFRmAb-SPIONPs and SPIONPs) of various iron concentrations were shown. This result demonstrated that EGFRmAb-SPIONPs could efficiently and specifically label the C6 cells compared to SPIONPs. Using a rat model of C6 glioma, EGFRmAb-SPIONPs provided a better picture or more sensitivity to depict brain glioma on MR images than that of SPIONs. Significantly enhanced T2-weighted images of brain glioma were documented in vivo with EGFRmAb-SPIONPs until 48h after injection. The results from cytometry, histopathology and blood toxicity assays suggested that the EGFRmAb-SPIONPs had good biocompatibility and exhibited no toxicity.

CONCLUSION

EGFRmAb-SPIONPs could be specifically and efficiently uptaken by C6 glioma cells, and selectively improve the detection of tumor by MRI; it could produce the remarkable contrast change of brain glioma in vivo following intra-carotid administration of EGFRmAb-SPIONPs.

CLINICAL RELEVANCE/APPLICATION

EGFRmAb-SPIONPs is suitable for use as negative MRI contrast agent, and had good biocompatibility and exhibited no toxicity, which was very important for the clinical application.

SSJ15-03 • Imaging Biomarker Evaluation of Cytoskeletal Stabilization Therapy for Traumatic Brain Injury

Donna J Cross PhD (Presenter) *; Rodney Ho PhD *; Todd L Richards PhD; Vasily L Yarnykh PhD; Greg Garwin; Pierre Mourad; David Cook; Satoshi Minoshima MD, PhD *

PURPOSE

Currently, there is no effective pharmacological intervention to improve outcome in traumatic brain injury (TBI). The goal of this study is to evaluate a microtubule-stabilizing drug as a therapeutic intervention following TBI using neurological assessments and MR imaging biomarkers in a rodent model.

METHOD AND MATERIALS

Subjects, (C57BL6 mice, n=12, 10wks) had craniotomy plus controlled cortical impact (CCI) surgery under isoflurane anesthesia, (Leica Biosystems, Richmond, IL), followed by 200 ug/kg paclitaxel (n=6) or vehicle (n=6) applied to the brain injury site. Sham surgery (craniotomy no CCI) was performed on controls (n=3). At 2 days post surgery, subjects had gait assessment by CatWalk automated gait analysis (Noldus Information Tech, The Netherlands) followed by high-tesa MR imaging (14T MR Avance III Ultrashield, Bruker BioSpin, Billerica, MA). T1-weighted and quantitative T2 maps were obtained: MDEFT, FA:12°, TR:5000ms, TE:1.9ms, resolution 0.12x0.12x0.1mm3, 15 slices and, T2 map: TR=2000ms, 16 echoes, spacing:6.7ms, TE 1: 6.7ms, TE 2: 13.4ms, resolution 0.12x0.12x1.0mm3, 15 slices. Manual VOI analysis of lesion volume and volume of edema related to injury was performed.

RESULTS

Lesion analysis on T2 and T1 images, blinded to therapeutic regimen, indicated 20% reduction in volume with paclitaxel treatment (9.96±2.3 versus 7.94±1.5mm3, p=0.05) and hyperintense voxels (edema) on quantitative T2 maps were reduced 26% (11.92±3.0 versus 8.86±2.2mm3, p=0.05). Paclitaxel resulted in improved gait (computer-recorded objective analysis) for maximum print area (0.38±0.9 versus 0.29±0.08cm2, p=0.05) and mean intensity (79.45±14.26 versus 66.38±5.52, p=0.05) over vehicle group.

CONCLUSION

The results indicate that administering drugs to stabilize axonal cytoskeleton following TBI improves outcome in neurological/gait assessment, as well as demonstrated as improvement on MR imaging biomarkers. This improvement appears to be mediated by reductions in size of lesion and corresponding post-injury edema. Evaluations of structural integrity on DTI and myelin degradation with magnetization transfer as well as western blot protein analysis are ongoing to better characterize the mechanisms of improved outcome after treatment.

CLINICAL RELEVANCE/APPLICATION

This study provides evidence of the efficacy for microtubule-stabilizing drugs to improve outcome following traumatic brain injury and imaging assessment that can be translated to patient evaluation.
**SSJ15-04 • Dual-modality Imaging of Exogenous Endothelial Progenitor Cells in Ischemic Stroke Mouse**

Ying Ying Bai (Presenter) ; Sheng Hong Ju MD, PhD

**PURPOSE**
The objective was to noninvasively visualize the homing, migration and differentiation of exogenous EPCs in vivo using a dual-modality imaging probe, and to examine the effect of transplanted EPCs on the recovery of ischemic stroke.

**METHOD AND MATERIALS**
Bone-marrow derived EPCs were labeled with a multifunctional probe modified with gadolinium, Cy5.5 and rhodamine. EPCs(5×10^5) were transplanted via intranasal injection into 8-week old female C57BL/6J mice. To determine effects of EPCs on stroke recovery, mice underwent MRI at 4.7T with the following sequences: T2WI, T1WI, and MDEFT (Modified Drive Equilibrium Fourier Transform) sequence for 45 min at 1 hour post MnCl2 (TR/TE: 5000ms/1.9ms, resolution 0.140 x 0.140 x 0.25mm^3) and again at 4 hours post for 60 min. Image processing was performed stereotactically in 3D atlas space (NEUROSTAT, UW Seattle) and pixel intensity normalized globally. VOI was used to measure average signal intensity change in the olfactory bulb. Uptake and rate of transport were estimated.

**RESULTS**
After transplantation, the signal intensity enhancement was observed in stroke area on NIR imaging starting on day 1 and in perilesion region on MR imaging starting on day 3. The signal intensity reached their peak on day 5 in both imaging methods. Compared with unlabeled EPCs group, the fluorescent signal intensity had a remarkable increase from day 3 to 7(p < 0.01).

**CONCLUSION**
Exogenous EPCs can be detected non-invasively on both MR and NIR imaging by using this probe. Transplanted EPCs could home to the ischemic-angiogenic region and promotes stroke recovery. The paracrine effects of EPCs in ischemia area may contribute to angiogenesis and neurogenesis.

**CLINICAL RELEVANCE/APPLICATION**
EPCs treatment at 24 hours after the stroke onset when thrombolytic therapy doesn't work may promote the recovery of ischemic stroke patients.

**SSJ15-05 • Axonal Degeneration in Alzheimer Disease: Functional Investigation with Dynamic Manganese-enhanced MR Imaging**

Christopher A Potter MD (Presenter) ; Nathalie M Martin BA ; Greg Garwin ; Yoshimi Anzai MD ; Satoshi Minoshima MD, PhD *

**PURPOSE**
Axonal dysfunction is an early feature of Alzheimer disease (AD). Research implicates altered axonal transport as a possible cause. We hypothesize that the axonal transport rate in the olfactory tracts will decrease with age in triple transgenic AD mice.

**METHOD AND MATERIALS**
2 groups of triple transgenic AD model and wild-type mice were imaged on a 14T Bruker MR magnet at 1.5 months, prior to pathology and at 5 months of age, after synaptic dysfunction, A-beta plaque, neurofibriallary tangle formation and axonal degeneration. Unilateral intranasal injection of MnCl2 was administrated. Mice were scanned dynamically using MDEFT (Modified Drive Equilibrium Fourier Transform) sequence for 45 min at 1 hour post MnCl2 (TR/TE: 5000ms/1.9ms, resolution 0.140 x 0.140 x 0.25mm^3) and again at 4 hours post for 60 min. Image processing was performed stereotactically in 3D atlas space (NEUROSTAT, UW Seattle) and pixel intensity normalized globally. VOI was used to measure average signal intensity change in the olfactory bulb. Uptake and rate of transport were estimated.

**RESULTS**
Compared with wild type mice, axonal transport significantly decreases in AD Tg mice as they age and develop known AD pathology.

**CONCLUSION**
Investigation of axonal transport provides critical insights into pathogenesis of AD and facilitates new imaging developments that can be applied in the clinic.

**SSJ15-06 • Molecular Magnetic Resonance Immunoradiology Reveals Novel Effect of Interferon-B on Myeloid Cells in Murine Multiple Sclerosis**

Benjamin Pulli MD (Presenter) ; Gregory R Wojtkiewicz MSc ; Lionel A Bure MD ; Muhammad Ali MBBS ; John Chen MD, PhD *

**PURPOSE**
Conventional contrast-enhanced MRI measures blood-brain-barrier breakdown, but not necessarily inflammation. We hypothesized that MPO-Gd (bis-SHT-DTPA-Gd), a molecular MRI probe sensitive and specific for the inflammatory enzyme myeloperoxidase (MPO), can detect therapeutic effects of Interferon-β (Ifn-β), a current first-line drug in MS and reveal changes in the immune response.

**METHOD AND MATERIALS**
Thirty-three female SJL mice were injected with proteolipid protein (PLP) to induce experimental autoimmune encephalomyelitis, a mouse model of MS, and treated with either Ifn-β (17g/day) or saline. To determine effects of Ifn-β on MPO, mice underwent MRI at 4.7T with MPO-Gd at the disease peak (day 12). Lesion volumes and CNR at 10 and 60 minutes post MPO-Gd injection were quantified. MPO activity assay and MPO secretion experiments were performed.

**RESULTS**
Disease severity was ameliorated with Ifn-β (p < 0.05; figure). Disease severity was ameliorated with Ifn-β (p < 0.05; figure). Since Ifn-β is known to affect lymphocytes, we expected to see fewer lesions but not changes to MPO activity. Indeed, MPO-Gd enhanced MRI showed a smaller total (p < 0.05) and mean (p < 0.01) lesion volume with Ifn-β compared to saline (A+B). Surprisingly, while CNRs of lesions at 10 minutes post MPO-Gd injection, which mostly reflect blood-brain-barrier breakdown were similar (p = 0.47), CNRs at 60 minutes post injection, which reflect MPO activity, were significantly lower with Ifn-β treatment (p < 0.01; A+B). Lesion-by-lesion quantification confirmed these findings (p = 0.06 for 10 minutes and p < 0.001 for 60 minutes post MPO-Gd injection). Brain homogenates from mice treated with Ifn-β had markedly reduced MPO activity (p < 0.01; E), validating the imaging findings. Myeloid cells showed less MPO secretion when incubated with Ifn-β (p < 0.05; F), but Ifn-β did not directly inhibit MPO activity (p = 0.93; G).

**CONCLUSION**
Our results revealed a new mechanism: Ifn-β directly acts on myeloid cells to decrease MPO secretion, contributing to the efficacy of this widely used drug. MPO-Gd enhanced MRI can detect inhibition of MPO secretion by Ifn-β non-invasively. This study also demonstrated the unique capability of molecular imaging to probe immunity in vivo.

**CLINICAL RELEVANCE/APPLICATION**
Upon translation, MPO-Gd molecular imaging could be used to monitor treatment efficacy of Ifn-β and similar drugs in MS patients.
SS18-01 • Quantitative Susceptibility Mapping in Patients with Systemic Lupus Erythematosus: Detection of Abnormalities in Normal-appearing Basal Ganglia

Atsushi Ogasawara (Presenter); Shingo Kakeda MD; Keita Watanabe; Tian Liu PhD; Yi Wang PhD; Yukunori Korogi MD, PhD

PURPOSE
Although the substantial population of the systemic lupus erythematosus (SLE) have neuropsychiatric symptoms, many of them may not show abnormal brain MR findings, probably because the metabolic and/or functional alterations of the disease usually precede the anatomic disturbance. Quantitative susceptibility mapping (QSM) is a novel technique to compute quantitative maps of the corresponding underlying magnetic susceptibility distribution. Our aims were to evaluate whether QSM can detect the abnormalities within normal-appearing basal ganglia at conventional MRI in the patients with systemic lupus erythematosus.

METHOD AND MATERIALS
The institutional review board approved this study. All studies were performed with a 3T MRI system (Signa EXCITE 3T; GE Healthcare). Twenty-three SLE patients with (n = 7) or without (n = 16) neuropsychiatric symptoms were enrolled; all of them showed no abnormalities at conventional MR study. For SLE patients and controls, two radiologists independently measured mean susceptibility values and R2* rates in seven brain structures (thalamus, putamen, caudate, globus pallidus, pons, splenium of corpus callosum, and frontal white matter) that appears normal on conventional MR images.

RESULTS
In the putamen and globus pallidus, the mean susceptibility values were significantly higher for the SLE patients than for the controls (P < 0.05). In the SLE patients with normal basal ganglia at conventional MRI, QSM detected the subtle susceptibility changes more sensitively than R2* mapping.

CLINICAL RELEVANCE/APPLICATION
In the patients with neuropsychiatric SLE, QSM seems useful for the detection of subtle tissue changes of the basal ganglia, which may lead to early diagnosis at their subclinical stage.

SS18-02 • In Vivo Assessment of Gray Matter Integrity in Systemic Lupus Erythematosus Patients and Its Correlation with Episodic Memory

Bernardo C Bizzo MD; Thomas M Doring MSc (Presenter); Gustavo Tukamoto; Tadeu T Kubo MSc; Denise Greca; Tania M Netto PhD; Nicolle Zimmermann; Tiago A Sanchez; Rochele P Fonseca; Emerson L Gasparetto MD

PURPOSE
Systemic lupus erythematosus (SLE) is an inflammatory disease, characterized by multisystem microvascular inflammation with the generation of autoantibodies and, in brain, leading to a wide range of neurological symptoms and also cognitive decline. Several studies have evaluated the neurocognitive disfunction on SLE patients, but a few correlated gray matter integrity to these findings. The aim of this study was to assess the cortical thickness on SLE and correlate it with episodic memory (EM) deficit.

METHOD AND MATERIALS
We used the Rey Auditory Verbal Learning Test (RAVLT) to selected 17 patients with SLE and EM deficit (mean 43.9 years, SD +/- 10.4), and 33 SLE patients without EM deficit (mean 45.3 years, SD +/- 11.2). We also evaluated 34 healthy controls (mean 45.5 years, SD +/- 9.3). Using T1-MPRAGE sequence in a 1.5 Tesla scanner, the cortical reconstruction was performed in FreeSurfer. To investigate the correlation between cortical thickness measurements between groups, we performed a surface-based group analysis using tools within FreeSurfer.

RESULTS
Cortical thickness between SLE patients with and without EM deficit was found in which EM deficit patients had thinner cortices (P < .05 corrected by Monte-Carlo simulation) in regions including precentral, postcentral and supramarginal in the left hemisphere, and none in the right hemisphere. When SLE patients with EM deficit were compared to control subjects, there were only precuneus and superior parietal in left hemisphere. Comparing SLE patients without EM deficit and controls, none survived the Monte-Carlo simulation.

CONCLUSION
Corroborating previous findings among the areas of statistic significant reduction of cortical thickness, the precuneus has been implicated in visuo-spatial imagery, episodic memory retrieval, perspective taking and the experience of 'agency'. Moreover, the precuneus has rich cortical and subcortical connections with other regions, including the supramarginal and posterior central gyri, with also have reduced cortical thickness in these patients. These findings corroborate the central nervous system involvement in patients with SLE and demonstrate the correlation between structural and functional abnormalities.

CLINICAL RELEVANCE/APPLICATION
SLE is a disease with frequent associated cognitive impairments, and there is not enough knowledge on the relationship between the cortical thickness of brain regions and episodic memory deficits.

SS18-03 • A Diffusion Tensor Imaging and Neuropsychological Study of Abstraction/Executive Impairment in HIV-infected Patients

Rafael F Cabral MD (Presenter); Denise Greca; Tania M Netto PhD; Thomas M Doring MSc; Tadeu T Kubo MSc; Rochele P Fonseca; Romeu C Domingues MD; Emerson L Gasparetto MD

PURPOSE
HIV-infected patients develop brain injury and neurocognitive impairment despite the regular use of highly active antiretroviral therapy (HAART). The purpose of this study is to evaluate whether abnormal fractional anisotropy (FA) and mean diffusivity (MD) in normal-appearing white matter (WM) of HIV-infected patients is related to abstraction / executive impairment on neuropsychological tests.

METHOD AND MATERIALS
We evaluated 55 HIV-infected patients (40 males, mean age 41 years) and 27 healthy individuals matched by sex, age, years of education and Mini Mental State Examination. Images were obtained using a 1.5T scanner, with a single-shot spin-echo diffusion-weighted echo-planar pulse sequence with 73 sections covering the whole brain at 2.1-mm section thickness (TR / TE = 11320/94 ms). The assessment of the integrity of white matter was performed by measures of FA and MD using regions-of-interest (ROI). We analyzed correlation between the deficit score of abstraction / executive function within the mean values of FA and MD of specific areas of
SSJ18-04 • Comparative 3?1H MR Spectroscopy and FDG-PET Study of the Brain Metabolism in HIV-infection
Anna V Trofimova MD, PhD (Presenter) ; Tatiana Trofimova ; Galina Kataeva ; Svyatoslav Medvedev ; Elena Gromova ; Nikolay Belyakov

PURPOSE
To reveal patterns of brain metabolism changes in HIV using 3T 1H MR spectroscopy and FDG-PET

METHOD AND MATERIALS
We studied 15 patients with early HIV (plasma CD4-lymphocytes >350 cells/ml), 19 patients with later HIV (plasma CD4-lymphocytes <350 cells/ml), and 30 healthy controls. 1H MR spectroscopy was performed using a preselected volume at the supraventricular level, metabolites ratios were analyzed in white and gray matter in anterior, posterior frontal and parietal regions. PET-FDG study with relative evaluation of rCMRglu were performed. ROIs corresponded to Brodmann areas, subcortical nuclei and hemispheres of cerebellum. Individual images were spatially normalized with SPM. The mean FA was calculated using STATISTICA software package, factorial ANOVA with p < 0.05.

RESULTS
The mean FA was in the white matter of frontal lobes, and there were small areas of increased MD in these lobes. There was a high and significant inverse correlation between FA and deficit scores of abstraction / executive function on HIV-infected patients and p < 0.017.

CONCLUSION
The presented results corroborate previous studies that show CNS involvement in HIV-infected patients, showing specific areas of change in white matter in these cases. Correlation between these findings and neuropsychological evaluations allows us to suggest that injuries caused by HIV are strongly related to the onset of neurocognitive impairment in HIV-infected patients.

CLINICAL RELEVANCE/APPLICATION
The unique spatial distribution of white matter injury at different stages of HIV infection, as measured by DTI, may provide a useful marker to monitor HIV-associated central nervous system injury.

SSJ18-05 • Aberrant Brain Functional Connectivity Related to Insulin Resistance in Type 2 Diabetes: A Resting-state Functional MR Imaging Study
Yu-Chen Chen (Presenter) ; Yun Jiao PhD ; Ying Cui ; Gao-Jun Teng MD

PURPOSE
Insulin resistance is a causal factor in type 2 diabetes mellitus (T2DM) patients, and plays a role in developing Alzheimer’s disease (AD). Our study mainly aims to investigate the relationship between abnormal resting-state brain functional connectivity and insulin resistance in T2DM patients.

METHOD AND MATERIALS
30 patients with T2DM and 31 healthy well-matched volunteers were prospectively examined. Resting-state brain functional connectivity analysis was used to examine the correlation between posterior cingulate cortex (PCC) and whole-brain regions. Further analysis involved evaluation of possible relationships between functional connectivity measures and insulin resistance indexed by the homeostasis model assessment of insulin resistance (HOMA-IR).

RESULTS
Compared with healthy controls, we observed significantly decreased functional connectivity within some default mode network (DMN) regions including the right middle temporal gyrus (MTG), right middle frontal gyrus, right inferior parietal lobe and other selected regions including left lingual gyrus, left middle occipital gyrus, and increased functional connectivity in right superior frontal gyrus, left precentral gyrus. Moreover, a significant negative correlation between the PCC-MTG connectivity and HOMA-IR was found in T2DM patients (p = 0.022; r = -0.417).

CONCLUSION
T2DM patients have aberrant functional connectivity in the DMN, which is related to insulin resistance in selected brain regions. Resting-state connectivity disturbance of PCC-MTG may be a central role for cognitive dysfunction in T2DM patients with insulin resistance.

CLINICAL RELEVANCE/APPLICATION
fMRI can be used to track the very early progression of brain functional alterations associated with T2DM. Abnormal PCC-MTG values may be regarded as a potential marker to identify cognitive decline.

SSJ18-06 • Study on Brain Structure and Cognitive Function in Patients with Chronic Mountain Sickness in 3T MRI
Hai Hua Bao (Presenter) ; Mingli He

PURPOSE
To study cerebral white matter microstructure change in patients with chronic mountain sickness (CMS) with 3T MRI.

METHOD AND MATERIALS
17 cases of CMS and 15 normal subjects included in the study. The examination was performed on Philips 3T scanner and sequences were T1WI, T2WI, DWI and DTI. The FA and ADC values of the two groups were obtained from the regions of interest in the frontal lobe white matter, insular cortex nucleus, external capsule, corpus callosum, et al. Then were compared. The relationships between FA/ADC values and CMS severity and cognitive function (Mini-Mental State Examination score) were investigated.

RESULTS
1. In the CMS group, 6 patients showed slight cerebral edema, multiple ischemic foci and lacunar infarction foci in 15 patients and lacunar infarction complicated by ischemic foci in 3 patients. 2. Statistical results showed that the FA values of the right frontal lobe...
white matter in the CMS group were significantly lower (t = -2.736, P < 0.05). The ADC values of the anterior limb of the right internal capsule in the CMS group were significantly higher (t = 2.353, P < 0.05). In the CMS group, the FA values in the left caudate nucleus and the ADC values in the left thalamus were positively correlated with hemoglobin values (r = 0.533, P = 0.027; r = 0.674, P = 0.003). In the CMS group, the FA values in the anterior limb of the left internal capsule and the ADC values in the right hippocampus were negatively correlated with the MMSE scores (r = -0.667, P = 0.009; r = -0.590, P = 0.026). In the CMS group, ruptured or twisted white matter fiber tracts at the bleeding part were observed in 3 patients with intracranial hemorrhage.

CONCLUSION

CLINICAL RELEVANCE/APPLICATION
Providing imaging reference materials of CMS patients for clinical doctors.

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**Neuroradiology (Epilepsy)**

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Steven M Stuffebeam, MD  
**Moderator**  
Michael M Zeineh, PhD, MD |

**SSJ19 • Tuberous Sclerosis Complex: Prenatal CNS MRI Findings**

Elida Vazquez MD (Presenter); Ignacio Delgado MD; Angel Sanchez-Montanez; Alfons Macaya; Veronica Del Prete; Elena Carreras MD

**PURPOSE**
1. To prove the value of cerebral MRI in diagnosing TSC in fetuses with intracardiac rhabdomyomas.
2. To establish that MRI should be a component of fetal diagnostic workup in suspected TSC.
3. To remark the importance to be aware that a negative fetal MRI does not exclude TSC.

**METHOD AND MATERIALS**

12 fetuses with cardiac rhabdomyomas (22-36 weeks’ gestation) underwent cerebral MRI in our tertiary center. The study was approved by the local ethics committee and written informed consent was obtained from all patients. MRI examinations were performed on an Antares scanner (Siemens, Erlangen, Germany) using a body phased array coil. Images were acquired using a T2-W HASTE, a T2*GRE, Fat-Sat T2-W HASTE and a T1-W gradient-echo sequences in axial, sagittal and coronal planes, with a slice thickness of 4 mm. The women were imaged in the supine position without sedation. Obtained images were read by two pediatric neuroradiologists experienced in neurofetal imaging. MR imaging results were correlated with postnatal imaging, genetic data and/or histology. To avoid confusing these lesions with artifacts, we set our criteria for subependymal lesions to be seen on at least two scanning sequences in orthogonal planes and to cause a contour deformity of the ventricular wall.

**RESULTS**
In 10 cases, fetal MRI demonstrated typical characteristics of TSC, which were confirmed by postnatal MRI in pregnancies that continue gestation, or histology in those that were interrupted. There was one false-negative case, in which TSC diagnosis was established postnatally based on the presence of a single SEN that was not seen on prenatal MRI. Genetic testing of the mother also failed to prove TSC in this case. One early case was a false-positive, in which a single SEN was suspected on fetal MRI, but was not confirmed postnatally.

**CONCLUSION**
Our results prove that fetal MRI is a sensitive modality for detecting cerebral lesions in TSC and should become a component of early interdisciplinary diagnostic workup in suspected fetal TSC. Although an MR diagnosis of TSC has been reported as early as 21 weeks’ gestation, in our experience the diagnosis is more difficult before 28 weeks’ gestation. Presence of multiplicity of lesions increases the diagnostic confidence whereas a solitary lesion may be cause of false negative or positive diagnosis.

**CLINICAL RELEVANCE/APPLICATION**
Fetal MRI is a sensitive modality for detecting cerebral lesions in TSC.

**SSJ19-02 • Temporal Anteroinferior Encephalocele: A Poorly Recognized Etiology of Temporal Lobe Epilepsy?**

Taavi Saavalainen MD (Presenter); Leena Jutila; Esa Mervaala MD, PhD; Arto Immonen MD, PhD; Reetta Kalviainen; Ritva L Vanninen MD

**PURPOSE**
To report the increasing frequency of temporal anteroinferior encephalocele diagnosis in our tertiary care epilepsy center and to illustrate mainly the imaging characteristics of this condition in a series of 19 patients. Altogether 22 patients have been reported in the literature, largest series being 3 patients.

**METHOD AND MATERIALS**

Epilepsy patients diagnosed with temporal anteroinferior encephalocele during the study period (January 2007 - March 2013) in our hospital were included. All patients had MRI examinations (mainly 3T, Philips Achieva TX) according to an epilepsy protocol which was complemented with additional sequences. 3D-CT and PET-CT were acquired from surgical candidates when necessary.

**RESULTS**
Nineteen epilepsy patients (12 females, mean age 40 years) were diagnosed with temporal anteroinferior encephalocele. Eleven patients had two or more encephaloceles and five patients had bilateral encephaloceles. The estimated prevalence of this condition was 0.3% in MRI examinations performed due to newly diagnosed epilepsy (n=4) and 2.2% in drug-resistant patients referred to our institute as epilepsy surgery candidates (n=15). High-quality, thin-slice, preferably three-dimensional MRI and computed tomography studies facilitated the detection of this condition. The mean of maximal diameter of the lesions was 11.6 mm (range, 3-48 mm) and the mean of maximal diameter of the bony defect orifice was 8.7 mm (range, 3-46 mm). PET-CT showed temporal lobe hypometabolism in 6/9 patients, all were ipsilateral to the lesion. Ten patients had epilepsy surgery. Patients with local encephalocele disconnection (n=3) or anterior temporal lobectomy and amygdalohippocampectomy (n=5) have become seizure free in a mean 1.6 years (range 3 months - 3 years) of follow up. The remaining two surgically treated patients are very recent and lack follow up data. Histologically gliosis was present in temporal lobe samples in all surgically treated patients and encephaloceles also showed cortical laminar disorganization.

**CONCLUSION**
The possibility of temporal encephalocele should be considered when interpreting MRI examinations of patients with medically intractable temporal lobe epilepsy. These patients can significantly benefit from epilepsy surgery.

**CLINICAL RELEVANCE/APPLICATION**
Identifying temporal anteroinferior encephalocele as the cause for medically intractable epilepsy is important as these patients are excellent candidates for epilepsy surgery.
Altered Axonal Connectivity in Medial Temporal Lobe Epilepsy: Association with Disease Severity

Ali Tabesh PhD (Presenter) ; Travis O Nesland PhD ; Jens H Jensen PhD ; Maria Vittoria Spampinato MD ; Jonathan C Edwards ; Joseph A Helfern PhD * ; Leonardo Bonilha MD, PhD

PURPOSE

Although medial temporal lobe epilepsy (MTLE) is a common neurological disorder, there remains a lack of reliable biomarkers for monitoring its clinical course and treatment response. Diffusion MRI (dMRI) tractography is a unique and powerful tool for characterizing white matter (WM) connectivity and may provide entirely new insights into network abnormalities associated with MTLE. The goals of this study were to investigate WM connectivity changes in MTLE, and to evaluate the association between these alterations and disease severity (seizure frequency) in patients.

METHOD AND MATERIALS

Nineteen patients with MTLE and 28 age- and sex-matched healthy control subjects underwent dMRI scans. Patients were divided into a well-controlled (<= 4 seizures a year) and a poorly controlled subgroup based on their response to antiepileptic drug therapy. The two subgroups differed significantly in terms of age, age of seizure onset, or duration of disease. Streamline tractography was employed to quantify the WM connectivity of the temporal lobe ipsilateral to the seizure onset zone.

RESULTS

Patients showed a significantly lower degree of connectivity than controls in the connections between the following pairs of regions: isthmus of cingulate gyrus and parahippocampal cortex (PHC), fusiform gyrus and PHC, and inferior temporal cortex and PHC. Poorly-controlled patients showed a significantly higher degree of connectivity than well-controlled patients in the connections between the following regions: temporal pole and putamen, and entorhinal cortex and amygdala.

CONCLUSION

Our results suggest that WM connectivity measures derived from dMRI tractography may be sensitive to altered axonal connectivity in MTLE. Moreover, WM connectivity markers may potentially enable more reliable identification of patients with medication-refractory MTLE. Supported by the Foundation of the American Society of Neuroradiology and the South Carolina Clinical and Translational Research Institute.

Axonal connectivity measures based on dMRI tractography may provide complementary information for clinical evaluation of MTLE.

Evaluation of Focus Laterality in Temporal Lobe Epilepsy: A Quantitative Study Comparing Double Inversion-recovery MR Imaging at 3T with FDG-PET

Emiko Morimoto MD (Presenter) ; Tomohisa Okada MD, PhD ; Mitsunori Kanagaki MD, PhD ; Akira Yamamoto MD, PhD ; Yasutaka Fushimi MD, PhD ; Riki Matsumoto MD, PhD ; Shigetoshi Takaya MD, PhD ; Akio Ikeda MD, PhD ; Takeharu Kunieda MD, PhD ; Takayuki Kikuchi MD, PhD ; Dominik Paul * ; Susumu Miyamoto MD, PhD ; Ryosuke Takahashi MD, PhD ; Kaori Tagashi MD, PhD *

PURPOSE

To quantitatively compare diagnostic capability of double inversion recovery (DIR) with fluorine-18 fluorodeoxyglucose positron emission tomography (FDG-PET) for detection of seizure focus laterality in temporal lobe epilepsy (TLE).

METHOD AND MATERIALS

This study was approved by the institutional review board, and written informed consent was obtained. Fifteen TLE patients and 38 healthy volunteers were enrolled. All MR images were acquired using a 3T-MRI system. Voxel-based analysis was conducted for FDG-PET images and white matter segments of DIR images (DIR-WM) focused on the whole temporal lobe (TL) and the anterior part of the temporal lobe (ATL). Distribution of hypometabolic areas on FDG-PET and increased signal intensity areas on DIR-WM was evaluated, and their laterality was compared with clinically-determined seizure focus laterality. Correct diagnostic rates of laterality were evaluated, and agreement between DIR-WM and FDG-PET was assessed using * statistics.

RESULTS

Increased signal intensity areas on DIR-WM were located at the vicinities of the hypometabolic areas on FDG-PET, especially in the ATL. Correct diagnostic rates of seizure focus laterality for DIR-WM (0.80 and 0.67 for the TL and the ATL, respectively) were slightly higher than those for FDG-PET (0.67 and 0.60 for the TL and the ATL, respectively). Agreement of laterality between DIR-WM and FDG-PET was substantial for the TL and almost perfect for the ATL ( = 0.67 and 0.86, respectively).

CONCLUSION

High agreement in localization between DIR-WM and FDG-PET and nearly equivalent detectability of them show us an additional role of MRI in temporal lobe epilepsy.

DTI Fiber Tracking Biomarkers for Characterization of Focal Cortical Dysplasias

Rammohan Vadapalli MD (Presenter) ; Sita Jayalakshmi ; Manas Panigrahi MChir ; Anuj Jain MD ; Abhinav Sriram S Vadapalli ; Meghna Vadapalli BEng

PURPOSE

Purpose To evaluate the role of new generation Diffusion tensor imaging Biomarkers for characterization of Focal cortical dysplasias, especially the Radial (perpendicular)Diffusivity(?2+ ?3 );?3 maps , Radial diffusivity:FA ratio by depicting the microstructural patterns.

METHOD AND MATERIALS

Material and methods

seventy six patients in age group of 6 -44 years with M: F ratio of 3:2 with refractory epilepsy had undergone a MRI study on a 3T MRI(achievea Philips) TLE+ETL protocol (T2 relaxometry, volumetry and MRS of Hippocampi with MRS,3D T1,3D T2 followed by a Medium to high resolution DTI(Diffusion Tensor Imaging) with following parameters: Axial Plane B value: 1000 Number of directions 15 ,TR 6248 TE 60 Slice thickness 2mm with 0.5 inter slice gap,NSA 2,Matrix 112x112 bandwidth 29.6 .These data were post processed using Fibertrack and Intrasense (Myrian) SW to generate FA maps, Eigen Vector Maps ? 1,2 ,3 Radial diffusivity maps with ROI and mirror ROI in contralateral side. Areas of Focal cortical dysplasia were mapped and analysed.

RESULTS

Results:

Qualitative biomarkers like asymmetry,Fiber architecture in region of dysplasia and Quantitative Parameters like FA, Mean Diffusivity,Fiber density count were studied.

Type 1B FCD(n=11)

1.reduced FA

2. Increased MD 3.Mean value of Radial Diffusivity(Perpendicular Diffusivity ) Increased

4.Fiber architecture appeared normal with Normal fiber density.

5. ?3 is significantly Increased.
Implant Dentistry
Neuroradiology (Neurointerventional Radiology)

Matter in Progressive Myoclonic Epilepsy Type 1 or Unverricht-Lundborg Disease (EPM1)

Kristine Blackham  
Moderator
Colin P Derdeyn  
Moderator

radiological interventional alternative to classic surgical approach with an equivalent success rate according to the literature.

The present experimental study reports a new minimally radiological procedure to maxillary sinus floor elevation. This study proposes a

CONCLUSION

mGy.cm DLP and 22.8 mGy CTDIv.

Twelve maxillary sinuses were included to radiological sinus floor elevation procedure. Dome shape of the Schneiderian membrane

RESULTS

was performed by hydrodissection with diluted iodinated contrast media agent. 4. Filing. The submucosal space filling was performed by

METHOD AND MATERIALS

Sixteen genetically verified patients with EPM1 and 16 healthy controls underwent MRI (MPRage, 1.5 T, Siemens Avanto) and 3DTA
(Ma2da software). Volumes of interest (VOIs) were placed manually in WM and deep GM covering as large volumes of the anatomical
structures as possible. Altogether 223 different texture parameters per each VOI were computed. Textural differences between EPM1
patients and healthy controls were analyzed by the Mann-Whitney U test.

CONCLUSION

WM textures alterations are widespread but less obvious than the deep GM findings. The 3DTA findings indicate that the texture of WM and
deep GM in EPM1 patients is more coarse, complex and heterogeneous than in controls supporting widespread WM pathology in line with
the previous DTI findings.

CLINICAL RELEVANCE/APPLICATION

3DTA is able to reveal subtle morphological changes in MR images that cannot be detected by visual inspection. In patients with EPM1
3DTA is more sensitive to show alterations in deep GM than in WM.

SS119-06  ● Three-dimensional MRI Texture Analysis Reveals Subtle Textural Alterations in the White Matter and Deep Gray
Matter in Progressive Myoclonic Epilepsy Type 1 or Unverricht-Lundborg Disease (EPM1)

Sanna Suoranta MD (Presenter)  
Kirsi K Holi MSc, PhD  
Eini I Niskanen PhD  
Paivi Koskenkorva MD  
Reetta Kalviainen
Ritva L Vanninen MD

PURPOSE
To investigate the feasibility of three-dimensional MRI texture analysis (3DTA) in the detection of subtle white matter (WM) and deep
gray matter (GM) changes in EPM1. EPM1 is a rare neurodegenerative disorder caused by the mutations in the Cystatin B gene (CSTB).
Despite the severe neurological symptoms no focal MR changes of the brain are found in visual assessment. Diffusion tensor imaging
(DTI) in humans and mice has indicated widespread WM degeneration, and voxel-based morphometry (VBM) has revealed GM atrophy in
EPM1.

METHOD AND MATERIALS

For this prospective study, 17 cadaver heads were analyzed by cone beam CT (CBCT) and panoramic to response to our inclusion
criterions (maxillary edentulous posterior sector and bone height inferior to 5mm). For each step, procedure was controlled by CT-scan
(MaZda software). Volumes of interest (VOIs) were placed manually in WM and deep GM covering as large volumes of the anatomical
structures as possible. Altogether 223 different texture parameters per each VOI were computed. Textural differences between EPM1
patients and healthy controls were analyzed by the Mann-Whitney U test.

RESULTS

Visual assessment revealed no focal signal changes. Compared to the healthy controls, EPM1 patients showed statistically significant
textural differences both in WM and GM. Compared to the WM VOIs, textural differences predominated in the deep GM. In right thalamus
28 %, left thalamus 37 %, and right putamen 26 % of the textural parameters differed amongst the 223 parameters analyzed. In WM, numbers of differing parameters were less frequent; left pons 19 %, corpus calosum genu 12 %, corpus 10 % and splenium 18 %; left
corona 14 %, right centrum semiovale 14 %. The number of differing parameters was less than 10 % in the remaining VOIs. The
differing textural features included parameters based on histogram, gradient, co-occurrence matrix and run-length matrix.

CONCLUSION

WM textures alterations are widespread but less obvious than the deep GM findings. The 3DTA findings indicate that the texture of WM and
deep GM in EPM1 patients is more coarse, complex and heterogeneous than in controls supporting widespread WM pathology in line with
the previous DTI findings.

CLINICAL RELEVANCE/APPLICATION

3DTA is able to reveal subtle morphological changes in MR images that cannot be detected by visual inspection. In patients with EPM1
3DTA is more sensitive to show alterations in deep GM than in WM.

Neuroradiology (Neurointerventional Radiology)

Tuesday, 03:00 PM - 04:00 PM  ● N229

SS20  ● AMA PRA Category 1 Credit ™:1  ● ARRT Category A+ Credit:1

Moderator
Colin P Derdeyn , MD *
Moderator
Kristine Blackham , MD *

SS20-01  ● Radiological Sinus Lift: A New Minimally Invasive CT-scan Guided Procedure to Maxillary Sinus Floor Elevation in
Implant Dentistry

Jean-Francois Matern MD (Presenter)  
Francis P Veillon MD  
Thomas Bridonneau  
Jean Carvahlo MD  
Pierre Keller DMD, MSc

PURPOSE
Implant therapy has become an excellent treatment modality since its inception into the modern era of dentistry. However, when patients
present with advanced atrophy of the maxilla ridge, the procedure of choice to restore the anatomic bone deficiency is surgical maxillary
sinus floor elevation. The purpose of this study is to describe the CT-scan guided sinus lift technique and to prove the minimal invasive
aspect of this new radiological procedure.

METHOD AND MATERIALS

For this prospective study, 17 cadaver heads were analyzed by cone beam CT (CBCT) and panoramic to response to our inclusion
criterions (maxillary edentulous posterior sector and bone height inferior to 5mm). For each step, procedure was controlled by CT-scan
and sinusual endoscopy. The radiological sinus lift technique consists of the following 4 stages: 1. Approach. A 14.5 G OstyCut needle was
inserted mesial to the canine eminence and manually drilling was performed in parallel direction to the sinus floor. 2. Osteotomy. Inner
obturador was introduced to compress bone and to create an osseous window opened to the submucosal space. 3. Lifting. The sinus lift
was performed by hydrodissection with diluted iodinated contrast media agent. 4. Filing. The submucosal space filling was performed by
injection of diluted collagen. A dome shape visualized in the maxillary alveolar recess defines the success of the radiological sinus lift
procedure. All radiological maxillary sinus floor elevations were scanned postoperatively with panoramic and maxillary CBCT.

RESULTS

Radiographical images were used to radiological sinus floor elevation procedure. Dome shape of the Schneiderian membrane

were performed in 8 maxillary sinuses (66,7%). All failures (n=4) were caused by mucosal perforation at the time of maxillary sinus
osteotomy. Mean elevated membrane height was 12.0mm for a mean intervention time of 45 minutes. Radiological exposures were 79.0
mGy.cm DLP and 22.8 mGy CTDIv.

CONCLUSION

The present experimental study reports a new minimally radiological procedure to maxillary sinus floor elevation. This study proposes a
radiological interventional alternative to classic surgical approach with an equivalent success rate according to the literature.
SSJ20-02 • Quantitative Evaluation of Acute Tumor Response Following Focused Ultrasound and Microbubble Treatment Using Dynamic Contrast-enhanced-computed Tomography

Hassaan Ahmed BSc (Presenter) ; Ting-Yim Lee MSc, PhD * ; Kullervo H Hynynen PhD ; Rajiv Chopra PhD *

PURPOSE
To quantitatively evaluate acute tumor response following focused ultrasound (FUS) and microbubble (MB) treatment using dynamic contrast-enhanced computed tomography (DCE-CT) in a rat glioma model.

METHOD AND MATERIALS
A stereotactic frame was used to surgically implant 1 x 10⁶ C6 glioma cells in the right cerebral hemisphere of three rats. When the tumor occupied about 50% of the implanted hemisphere, it was trans-cranially sonicated with a 10ms burst length and a 1 Hz repetition frequency for 120s, at an acoustic power of 0.5W using a 0.563-MHz FUS system (FUS Instruments Inc., Canada). The sonications were guided by baseline axial CT images and the corresponding blood-brain-barrier (BBB) permeability surface area product (PS) and cerebral blood flow (CBF) maps calculated by CT Perfusion (GE Healthcare). A region in the contralateral hemisphere was also sonicated 5 minutes following the tumor sonication to confirm the targeted axial slice. Definity (Lantheus Medical Imaging, USA) microbubbles at a dose of 20 µl/kg were administered simultaneously with both sonications. Serial DCE-CT scans were performed out to 4 hours post sonication to monitor the acute response in BBB PS and CBF.

RESULTS
The tumor BBB PS at 150 minutes post sonication (2.7 +/- 1.3 ml/min/100g) was significantly lower (p < 0.05) than at baseline (5.7 +/- 1.7 ml/min/100g), but that at 15 minute post (6.0 +/- 1.8 ml/min/100g) was similar to baseline. The tumor CBF indicated a decreasing trend immediately following sonication, and returned to baseline levels at around 150 minutes post sonication.

CONCLUSION
A decreasing BBB PS following FUS and MB treatment over the tumor region, as opposed to the transient 3-4 times increase that is observed over healthy tissue, was a surprising result. The trend of an acute drop in CBF following sonication suggests that the tumor may undergo vasoconstriction following treatment. Although FUS and MB treatment in a tumor may not be beneficial for increased drug delivery, our preliminary results suggest that perhaps it could be used to disrupt or destroy tumor vasculature as a form of treatment.

CLINICAL RELEVANCE/APPLICATION
FUS and MB treatment have been shown to increase drug delivery over healthy and brain tumor regions, but our results suggest it may also be used to disrupt or potentially destroy tumor vasculature.

SSJ20-03 • Uncertainty and Discordance in the Management of Unruptured Intracranial Aneurysms

Sara Jamali MD (Presenter) ; Tim E Darsaut MD ; Max Findlay MD ; Jean Raymond MD

PURPOSE
The management of Unruptured Intracranial Aneurysms (UIAs) remains controversial. The goal of this study was to evaluate the clinical community agreement in decision making regarding UIAs.

METHOD AND MATERIALS
A portfolio of 41 cases of UIAs with angiographic images, along with a short description of the patient presentation, was sent to 28, mainly Canadian, clinicians with various years of experience in the management of UIAs (15 radiologists and 13 surgeons). Five clinicians responded twice at least 3 months apart. Nineteen cases were selected from patients recruited in a randomized trial comparing coiling and clipping, the Cures trial. For each case, the responder was to choose between 3 treatment options (observation, surgical clipping, or endovascular coiling) and indicate their level of certainty on a quantitative scale. The variability was studied using k statistics from 0 to 1, 0 meaning no agreement, 1 perfect and 0.6 substantial agreement.

RESULTS
Decisions to coil were more frequent (612 or 53%) than decisions to clip (289 or 25%) or to observe (259 or 22%). Inter-judge agreement was only fair (k = 0.31 +/- 0.02) for all cases and all judges, despite the fact that intra-judge agreements were substantial (between 0.44 and 0.83 +/- 0.1) and mean certainty levels high for each case (from 6.5 to 9.4 +/- 2.0 on a scale of 10). Agreement was no better within specialties (surgeons or radiologists), within groups proficient in endovascular coiling, surgical clipping or both, or within strata of years of experience. Agreement was lower (k= 0.18 +/- 0.2) in cases selected from the randomized trial than others (0.35 +/- 0.2).

CONCLUSION
There is poor agreement in decisions regarding the management of UIAs, even between individuals sharing a similar experience or the same specialty. In the absence of reliable evidence decision making is variable.

CLINICAL RELEVANCE/APPLICATION
Decision making can perhaps be improved by concerted efforts to provide reliable evidence.

SSJ20-04 • MR Imaging in Intracranial Aneurysms Treated by Intra-aneurismal Flow Disruptor: the LUNATM Aneurysm Embolization System (AES)

Elisa Pomerio (Presenter) ; Arnaud Flores ; Clelia Billon Grand ; Francoise Cattin ; Alessandra Biondi MD *

PURPOSE
New devices in the treatment of intracranial aneurysms include intra-aneurysmal flow disrupters. The MR imaging of these new devices has not been reported. The purpose of our study is to report MR findings in a consecutive series of patients treated with the LUNATM Aneurysm Embolization System, a new intra-aneurysmal self-expandable, round-ovooid flow disrupter implant.

METHOD AND MATERIALS
A total of 12 unruptured aneurysms were treated in 12 patients. Ten lesions were located in the anterior circulation and 2 lesions were in the posterior circulation. In addition, all patients underwent 24 hours DSA control and 24-48 hours MR study including evaluation of silent lesions. Three-month MR FU was available in all patients and 1 year MR FU in 11. MR studies were performed on a 3Tesla MR unit. Our MR protocols included DWI, T2WI FLAIR, coronal T1WI, axial PDWI, axial T2WI, Angio-MR 3D-TOF. In all patients, 1 year MR FU included also Enhanced 3D Velocity with Gadolinium injection. Follow-up included Digital Subtraction Angiography (DSA) at 6 and 12 months. Results were compared with the angiographic findings.

RESULTS
Immediate angiographic occlusion was achieved in 3 cases, near complete in 3 and incomplete occlusion in 6. The LUNATM device presents a marked signal void in all sequence. Evaluation of aneurysm occlusion on MR images without contrast injection showed a good correlation with angiographic findings in 80% of cases. The thrombosed aneurysm sac was evident on PDWI and T2WI sequences. In patients with an angiographically thrombosed aneurysm, T1 WIs showed a hyperintense halo in 91% of cases corresponding to the thrombosed space between the device and the aneurysm wall. A crescent moon sign due to the device shape and related to persistent flow at the base of the aneurysm was seen in TOF sequences. Residual or recurrent aneurysm (20 %) could be visualized on the MR study only after contrast injection suggesting that LUNATM device masks the slow flow signal.
CONCLUSION
Although DSA FU is mandatory, preliminary results suggest that contrast enhanced MRI is an efficient tool in assessing the occlusion of the aneurysms treated by the LUNA™.

CLINICAL RELEVANCE/APPLICATION
To our knowledge, there are no MR studies specifically dealing with intra-aneurysmal flow disrupter devices. We report our experience in MRI and DSA correlation in patients treated with LUNA™.

SSJ20-05 • Ethanol and/or Radiofrequency Ablation: Efficacy and Safety for Treatment of Venolymphatic Malformation Manifested as a Bulging Mass in the Head and Neck

Hyun Jung Koo MD (Presenter); Jeong Hyun Lee MD, PhD; Ragyoung Yoon; So Hyun Cho MD; Young Jun Choi MD; Jung Hwan Baek; Seung-Ho Choi; Soon Yuhl Nam; Sang Yoon Kim; Dae Chul Suh

PURPOSE
To evaluated the efficacy and safety of ethanol and/or radiofrequency ablation of venolymphatic malformation (VLM) manifested as a bulging mass in the head and neck

METHOD AND MATERIALS
From July 2009 to February 2013, thirteen patients (F : M = 7 : 4; a mean age of 26, ranging from 5 to 48 years) with VLM presented as a bulging mass in the head and neck were treated with ethanol ablation (EA) and/or radiofrequency ablation (RFA). Treatment response was assessed by the degree of volume reduction and cosmetic grading scores (1 ~ 4) which was recorded before and at the last follow-up. Volume reduction was compared with the characteristics of the target lesions including component (venous, macrocystic lymphatic, and microcystic lymphatic), the initial volume and the presence of any functional structure close to the treated lesions. Complication after EA and/or RFA was also evaluated.

RESULTS
Five patients with macrocystic lymphatic malformation (MLM) were treated with EA, four with venous malformation (VM) with RFA, and four with microcystic lymphatic malformation (mLM) with RFA (n=2) or both EA and RFA (n=2). Median number of total treatment sessions was 1 ranging from 1 ~ 4. Volume reduction at the last follow-up was near complete (> 90%) in all five patients with MLM, three of four with VM, and one of four with mLM. Moderate response (>50% and <90%) was seen in VM (n=1) or mLm close to the mandibular branch of the facial nerve (n=3) showed moderate response. The mean cosmetic grading score was decreased from 3.8 ± 0.4 to 1.5 ± 0.8 (p < 0.05). The initial volume was not significantly correlated with number of treatment session or treatment response. No major complications were encountered.

CONCLUSION
EA and/or RFA is an effective and safe treatment method for VLM presented as a bulging mass in the head and neck, which showed > 90% of volume reduction in 9 of 13 patients and significant cosmetic improvement in all patients regardless of the internal component, the initial volume or the presence of any functional structures close to the treated lesions.

CLINICAL RELEVANCE/APPLICATION
EA and/or RFA can be one of treatment methods to manage VLM in the head and neck, with providing excellent cosmetic outcome.

SSJ20-06 • An Assembled Prototype Multi-material 3D Printed Model of the Neck for CT and Ultrasound-guided Interventional Procedures

Ramin Javan MD (Presenter)

PURPOSE
The aim of this project was to design a prototype semi-realistic multi-material model of the neck for CT and ultrasound-guided interventions.

METHOD AND MATERIALS
Autodesk 3D Studio Max, MeshLab, OsiriX and Materialise Mimics software were used to three-dimensionally reconstruct a multitude of virtual 3D models, including the cervical spine vertebral column, cervical spinal cord, trachea, thyroid gland, internal jugular vein and carotid arteries. A variety of rapid prototyping techniques and materials were used to 3D print the elements of the final assembled model using commercially available services. A gypsum-based model of the cervical spine that contains the cervical portion of the spinal cord and its respective nerve roots extending outside the neuroforamina. The trachea was made with polyamide material and also serves as the assembly reference point of the entire model with struts as support apparatus. The hollow vessels were created with tango-black rubber-like flexible material. A thyroid gland mold was made with polyamide. The thyroid gland itself is composed of ballistic-grade gelatin mixed with psyllium to simulate echotexture and with calcium chloride to simulate iodine content. It contains masses of high or low density/echogenicity, which are made by injecting sodium alginate solution with or without hydrogel particles into calcium chloride mixed with psyllium to simulate echotexture and with calcium chloride to simulate iodine content. It contains masses of high or low density/echogenicity, which are made by injecting sodium alginate solution with or without hydrogel particles into calcium chloride mixed with psyllium to simulate echotexture and with calcium chloride to simulate iodine content. It contains masses of high or low density/echogenicity, which are made by injecting sodium alginate solution with or without hydrogel particles into calcium chloride mixed with psyllium to simulate echotexture and with calcium chloride to simulate iodine content.

RESULTS
The cervical spine is radiodense due to high calcium content of the gypsum, which can be used to practice cervical spine pain management interventions. The rubber-like vessel walls allow for passage of needles simulating vascular access. The thyroid nodules and lymph nodes can be used for practicing fine-needle aspirations. The model is designed to be both CT and ultrasound compatible.

CONCLUSION
A prototype dual-modality interventional phantom of the neck was successfully developed using 3D printing and molding techniques with a multitude of materials.

CLINICAL RELEVANCE/APPLICATION
This neck model can be used for practicing CT and ultrasound-guided procedures and also serve as a prototype for developing more complex 3D printed models.
RC405A • Phakomatoses in Children

Gilbert Vezina MD (Presenter)

LEARNING OBJECTIVES
1) Define the imaging characteristics of the common phakomatoses. 2) Understand the underlying genetic/molecular basis of the imaging findings in the phakomatoses.

ABSTRACT
Presentation summary:
The presentation will review the clinical and imaging findings of the common phakomatoses, primarily neurofibromatosis type 1 and 2, tuberous sclerosis complex, von Hippel-Lindau disease, and Sturge-Weber. The phakomatoses, also known as the neurocutaneous syndromes, are a heterogeneous group of disorders characterized by multiple hamartomas and other congenital malformations affecting mainly structures of ectodermal origin. Many are inherited through autosomal dominant means. The underlying genetic abnormalities that cause most of the phakomatoses are well-characterized, leading to a good understanding of the genotype-phenotype correlation. In most cases, the loss of a suppressor activity results in proliferation of normal and abnormal cells. This leads to the characteristic hamartomas and neoplasms seen in many of the phakomatoses.

RC406A • The Central Skull Base

Nancy J Fischbein MD (Presenter)

LEARNING OBJECTIVES
1) To review the anatomy of the Central Skull Base. 2) To present common and uncommon pathologies that affect the Central Skull Base. 3) To remind the audience of imaging pitfalls of the Central Skull Base. 4) To discuss the complementary roles of CT and MR in imaging the Central Skull Base.

ABSTRACT
Imaging of the skull base presents many challenges due to its anatomical complexity, numerous normal variants, and lack of familiarity to many radiologists. As the skull base is a region which is not amenable to physical exam, and as lesions of the skull base are generally difficult to biopsy and even more difficult to operate on, the radiologist plays a major role in directing patient management via accurate image interpretation. Knowledge of the skull base should not be limited to neuroradiologists and head and neck radiologists, however, as the central skull base in particular is routinely included in the field of view when cross-sectionally imaging the brain, cervical spine, or head and neck with CT or MRI, and hence its nuances should be familiar to general radiologists as well. We review the basic anatomy of the central skull base, including bony anatomy as well as the anatomy of adjacent soft tissue structures. We will also present imaging findings of common and uncommon pathologies of the central skull base, including primary tumors such as chordoma and chondrosarcoma, metastases and plasmacytoma, and non-neoplastic lesions of the central skull base. We will review some imaging pitfalls and don't touch lesions of the central skull base, and will emphasize the complementary roles of CT and MR in solving difficult cases.

RC406B • Cranial Nerves I-VI

Jenny K Hoang MBBS (Presenter) *

LEARNING OBJECTIVES
1) To review the anatomy and function of cranial nerves I-VI. 2) To have a systematic approach to evaluating imaging in patients present with suspected cranial nerve disease. 3) To recognize the signs of cranial nerve pathology and the most common differentials for disease in cranial nerves I-VI.

ABSTRACT
RC406C • Cranial Nerves VII-XII

Claudia F Kirsch MD (Presenter) *

LEARNING OBJECTIVES
1) To review anatomy and function of cranial nerves VII- XII. 2) To present a systematic approach to evaluating imaging in patients present with cranial nerve VII- XII pathology. 3) To recognize the imaging findings of cranial nerve pathology in CN VII- XII, and the differential diagnosis associated with the radiographic findings.

ABSTRACT
ABSTRACT

RC408B • Fundamentals of CT Angiography and CT Perfusion in Stroke Imaging

Wayne S Kubal MD (Presenter) *

LEARNING OBJECTIVES
1) Discuss the role of CT angiography (CTA) and CT perfusion (CTP) in the evaluation of acute ischemic stroke. 2) Through the use of illustrative examples, identify CTA and CTP findings that contribute to the diagnosis and characterization of acute ischemic stroke. 3) Through the use of illustrative examples, recognize the limitations and pitfalls of CTA and CTP in the evaluation of acute ischemic stroke.

ABSTRACT

According to the American Heart Association, stroke is the third leading cause of death in the United States and a leading cause of serious, long-term disability. Based on data gathered from over twenty clinical trials, thrombolytic therapy has shown to be of substantial benefit for select patients with acute cerebral ischemia. Patient selection is based in part upon imaging. In patients with acute onset of stroke-like symptoms, CT angiography (CTA) and CT perfusion (CTP) can help to rule out a nonvascular etiology for the symptoms, define the extent of the acute ischemic process, and differentiate between the infarcted core and the ischemic penumbra. By characterizing the ischemia, CTA and CTP can help to identify which patients might benefit from thrombolytic therapy, direct the therapy for maximum effectiveness, and, on subsequent imaging, evaluate the effectiveness of therapy. Multiple examples will also illustrate the limitations and pitfalls of CTA and CTP in the evaluation of acute ischemic stroke.

RC408C • Fundamentals of MR in Stroke Imaging

Peter G Kranz MD (Presenter)

LEARNING OBJECTIVES
1) WHEN: Understand how the appearance of ischemia changes with time on conventional MRI. 2) WHERE: Review the distribution of the major intracranial arteries and their watershed. 3) WHY: Understand how certain MR imaging patterns can suggest the etiology of stroke.

ABSTRACT

Neuroimaging studies play a crucial role in the diagnosis, management, and outcome prediction of patients with acute stroke. Patient history and clinical neurologic examination cannot reliably identify the involved vascular territory, nor the etiology, extent or type of stroke. With the arrival of promising new therapies aimed at re-establishing blood flow, reducing the size of the infarction and protecting the surrounding brain at risk (penumbra), the traditional role of neuroimaging has changed. Thanks to multiparametric CT and MRI techniques, our understanding of the pathophysiology of stroke, in terms of cerebral blood flow, cerebral blood volume and cell metabolism, has greatly improved. Identification of the ischemic penumbra with MRI and/or CT has entered routine clinical practice. A patient suspected of having suffered an acute stroke should be cleared for thrombolytic therapy, by excluding intracranial hemorrhage; 2/ To show ischemic brain tissue, e.g. by DW-MRI; 3/ To show tissue blood flow and identify the penumbra, e.g. by perfusion CT or MRI; 4/ To assess vessel patency, e.g. by performing CTA or MRA; 5/ To select suitable candidates for treatment and perform the procedures The purpose of this presentation is to present a comprehensive imaging strategy for patients with suspected stroke, to discuss advantages, disadvantages and limitations of CT and MR in the initial work-up of acute stroke patients, to illustrate imaging patterns, and to identify quantitative imaging biomarkers that can help to predict prognosis and outcome in acute stroke patients.

MSES41 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

MSES41A • Imaging Strategies in Acute Stroke

Paul M Parizel MD, PhD (Presenter) *

LEARNING OBJECTIVES
1) To understand the etiology and pathophysiology of stroke. 2) To recognize different types of stroke. 3) To become familiar with the early signs of stroke on imaging studies. 4) To understand the advantages, disadvantages and limitations of CT and MR in the initial work-up of stroke patients. 5) To identify quantitative imaging biomarkers that can help to predict prognosis and outcome in stroke patients.

ABSTRACT

Neuroimaging studies play a crucial role in the diagnosis, management, and outcome prediction of patients with acute stroke. Patient history and clinical neurologic examination cannot reliably identify the involved vascular territory, nor the etiology, extent or type of stroke. With the arrival of promising new therapies aimed at re-establishing blood flow, reducing the size of the infarction and protecting the surrounding brain at risk (penumbra), the traditional role of neuroimaging has changed. Thanks to multiparametric CT and MRI techniques, our understanding of the pathophysiology of stroke, in terms of cerebral blood flow, cerebral blood volume and cell metabolism, has greatly improved. Identification of the ischemic penumbra with MRI and/or CT has entered routine clinical practice. A patient suspected of having suffered an acute stroke should be cleared for thrombolytic therapy, by excluding intracranial hemorrhage, e.g. by CT or MRI; 2/ To rule out intracranial hemorrhage, e.g. by CT or MRI; 3/ To show ischemic brain tissue, e.g. by DW-MRI; 4/ To show tissue blood flow and identify the penumbra, e.g. by perfusion CT or MRI; 4/ To assess vessel patency, e.g. by performing CTA or MRA; 5/ To select suitable candidates for treatment and perform the procedures The purpose of this presentation is to present a comprehensive imaging strategy for patients with suspected stroke, to discuss advantages, disadvantages and limitations of CT and MR in the initial work-up of acute stroke patients, to illustrate imaging patterns, and to identify quantitative imaging biomarkers that can help to predict prognosis and outcome in acute stroke patients.

MSES41B • Navigating the Sella and Central Skull Base

Christopher P Hess MD, PhD (Presenter) *

LEARNING OBJECTIVES
1) Demonstrate understanding of the role of non contrast brain CT (NCCT) in the setting of acute ischemic stroke. 2) Identity early and subtle CT findings that can easily escape recognition in patients with suspected stroke. 3) Analyze imaging clues to minimize errors in interpretation and to diagnose stroke mimickers and pitfalls.

ABSTRACT

Transverse myelitis describes a heterogenous group of disorders characterized by acute or subacute motor, sensory and autonomic spinal cord dysfunction, usually with a discrete sensory level and increased signal on T2-weighted images. It is absolutely mandatory to exclude compressive, radiation-induced, vascular and traumatic causes before considering the usage of the term ‘transverse myelitis’. On CSF evaluation, transverse myelitis is characterized by CSF pleocytosis or elevated IgG index. Numerous etiologies have been described for transverse myelitis. The presentation will evaluate neuromyelitis optica in detail including its imaging features, pathogenesis, and diagnostic criteria. Distinguishing features from other causes of transverse myelitis in particular, multiple sclerosis will be highlighted and discussed. Illustrative cases utilizing imaging features to aid in the diagnosis of other causes of transverse myelitis including metabolic causes such as Vitamin B12 deficiency, infectious causes such as HTLV myelopathy and paraneoplastic myelopathy will be discussed. The presentation will also provide evidence-based guidelines toward evaluation and treatment of transverse myelitis.
RSNA/ESR Emergency Symposium: General Principles, Pediatric and ENT Emergencies (An Interactive Session)

Wednesday, 08:30 AM - 10:00 AM • S402AB

MSSR41 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

MSSR41A • General Principles

Ulrich Linsenmaier MD (Presenter)

LEARNING OBJECTIVES
1) Demonstrate general principles of diagnostic imaging in Emergency Radiology in traumatic and non-traumatic emergencies. 2) Analyze etiology, background and management of common radiological emergencies. 3) Identify the role, indications and protocols for US, CR, MDCT in modern emergency radiology.

ABSTRACT

MSSR41B • Challenges of Imaging Pediatric Abdominal Emergencies

Susan D John MD (Presenter)

LEARNING OBJECTIVES
1) Plan safe and effective imaging strategies to evaluate abdominal pain in infants and children. 2) Understand the common and unusual causes of abdominal pain in different pediatric age groups. 3) Recognize potentially confusing variations in the appearance of these conditions with imaging.

ABSTRACT

MSSR41C • Imaging in ENT Emergencies

Diego B Nunez MD, MPH (Presenter)

LEARNING OBJECTIVES
1) Analyze imaging findings in patients presenting with acute head and neck conditions using a systematic spatial approach. 2) Demonstrate understanding of the role and indications of CT and MR in acute non-traumatic ENT case management. 3) Identify the extent of disease and recognize specific complications of cervicofacial infections.

ABSTRACT

Oral Cavity, Pharynx, Larynx

Wednesday, 08:30 AM - 10:00 AM • E353C

RC506 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

RC506A • Nasopharynx

Suresh K Mukherji MD (Presenter)

LEARNING OBJECTIVES
1) Understand the normal anatomical landmarks and relations of the nasopharynx and in particular the relationship of the nasopharynx to the central skull base. 2) Recognize normal physiological variations and inflammatory processes of the nasopharynx that might be mistaken for more sinister pathology. 3) Understand the pathological behavior and important staging features of nasopharyngeal carcinoma and lymphoma, the two most common nasopharyngeal malignant processes.

ABSTRACT

The nasopharynx is the most superior portion of the pharynx, extending anteriorly to the posterior choanae and inferiorly to the level of the soft palate. The nasopharynx attaches to the undersurface of the clivus via the pharyngobasilar fascia of the superior constrictor muscle. This fascia is in continuity with the buccopharyngeal fascia surrounding the pharynx. The foramen of Morgagni is a hiatus between the base of skull and constrictor muscle, through which the Eustachian tube, tensor veli palatini and levator veli pass. It is thus a potential weak spot; in the head and neck, through which pathological processes may reach the skull base and spread intracranially. Other important imaging landmarks include the lateral nasopharyngeal recess or fossa of Rosenmuller and the midline nasopharyngeal tonsil, or adenoids. Nasopharyngeal carcinoma (NPC) is a distinct entity from pharyngeal squamous cell carcinoma (SCCa). NPC has a unique histological appearance, has different inciting factors to SCCa, and has unique familial, genetic, and geographic predispositions. Nasopharyngeal carcinoma also has a different pathological behavior to pharyngeal SCCa, with a tendency for clival invasion, intracranial spread, and early systemic metastasis. In keeping with this distinct pathological behavior, NPC has particular imaging manifestations and staging criteria that differ significantly from pharyngeal SCCa. In this session we will review the key anatomic landmarks and the key imaging features of the nasopharynx and of nasopharyngeal carcinoma, reviewing the 2010 TNM staging updates and changes to the WHO pathological classification. We will also review important differentials for masses in this region.

RC506B • Oral Cavity and Oropharynx

Kristine M Mosier DMD, PhD (Presenter)

LEARNING OBJECTIVES
1) Review the anatomy of the oral cavity and oropharynx. 2) Review common neoplasms that may involve this region. 3) Review common infectious and inflammatory processes that may involve the oral cavity and oropharynx.

ABSTRACT

The intent of this presentation is to review the normal anatomy of the oral cavity and oropharynx. In addition, this presentation will review the common pathology including neoplasms, infections and developmental processes that you will encounter in your practice.

RC506C • Larynx-Hypopharynx

Hilda E Stambuk MD (Presenter)

LEARNING OBJECTIVES
1) Review the imaging anatomy of the larynx. 2) Understand the key landmarks for describing a tumor of the larynx. 3) Understand imaging strategies for following patients after treatment for larynx carcinoma.
Nerve Ultrasound Based on a Regional Approach: Shoulder and Neck (Hands-on Workshop)

Wednesday, 08:30 AM - 10:00 AM • E264

**ABSTRACT**

In recent years, ultrasound of the musculoskeletal and peripheral nervous systems is becoming an increasingly imaging tool with an expanding evidence base to support its use. However, the operator dependent nature and level of technical expertise required to perform an adequate ultrasound assessment means that appropriate training is required. For this purpose, the present course will demonstrate the basic principles of musculoskeletal ultrasound with a special focus on the examination of small nerves.

**LEARNING OBJECTIVES**

1) Describe the ultrasound anatomy and scanning technique for examination of neck (i.e. brachial plexus, spinal accessory, long thoracic, phrenic, vagus) and shoulder (i.e. suprascapular, axillary, musculocutaneous) nerves. 2) Illustrate the main anatomic landmarks to identify these nerves. 3) Master technical approaches to nerve ultrasound including the recognition of pitfalls.

**NEURORADIOLOGY SERIES: STROKE**

**VSNR41-01 • Stroke CT Protocols: Extracting Maximal Data in Minimal Time**

*Mayank Goyal, MD, FRCP (Presenter) *

**LEARNING OBJECTIVES**

1) Understand the importance of quick and efficient stroke imaging, post processing and decision making. 2) Discuss the pros and cons of various modalities for acute stroke imaging. 3) Discuss and understand the pros and cons of non-contrast CT, CTA and CT perfusion.

**ABSTRACT**

Given all the recent literature in acute stroke including the recent publications from IMS3, it is clear that Time is brain. This means that very part of the process in the work up and treatment of an acute stroke patient needs to be speeded up. This includes the time taken for image acquisition, post processing and interpretation. There has been a recent move towards moving away from a plain and simple 'Non contrast CT' to rule out a bleed and extensive ischemic changes towards doing more extensive imaging. This talk discussed these options and weighs in the pros and cons of using various techniques and modalities. The limitations and advantages of various techniques would be discussed. In addition, there have been dramatic recent advances in the field of endovascular treatment of stroke. Using newer devices like stentrieveres, our ability to achieve fast, robust recanalization has significantly improved. However, the rate of good clinical outcomes has not improved to the same degree. This aspect will be further discussed and would be broadly broken down into two components: imaging based patient selection and the need for speed and efficiency without compromising patient safety.

**VSNR41-02 • Spot Sign Presence on 90 Second Delayed MDCTA Improves Sensitivity for Hematoma Expansion and In-hospital Mortality: A Prospective Study**

*Viesha A Ciura (Presenter) ; H. Bart Brouwers MD ; Raffaella Pizzolato MD ; Jonathan Rosand MD ; Joshua Goldstein MD * ; Stuart R Pomerantz MD * ; Ramon G Gonzalez MD, PhD ; Javier M Romero MD *

**PURPOSE**

To determine whether 90 second delayed multidetector computed tomography angiography (MDCTA), in addition to routine first-pass MDCTA in patients with spontaneous intracerebral hemorrhage (ICH) improves detection of the spot sign and increases sensitivity for predicting hematoma expansion and in-hospital mortality. Accuracy measures were calculated, using standard methods, to compare first pass and delayed CTA performance.

**METHOD AND MATERIALS**

We performed a prospective study of consecutive patients enrolled over 13 months at a single academic center. Uni- and multivariate logistic regression were performed to assess clinical and neuroimaging covariates for relationship with hematoma expansion and mortality. Accuracy measures were calculated, using standard methods, to compare first pass and delayed CTA performance.

**RESULTS**

Of 86 consecutive patients, 25 (29%) had a positive spot sign on either first pass or delayed CTA (14/25 on first pass and 24/25 on delayed CTA). Median baseline hematoma volume was 29.6 mL (interquartile range 5.9–72.8 mL). Sensitivity for predicting hematoma expansion increased from 0.60 to 0.70 with addition of delayed CTA. The odds ratio (OR) of hematoma expansion if a spot sign was present on either first pass or delayed CTA was 13.67 (95% CI 2.84–65.83, p=0.0009). 18/25 (72%) of all patients with a spot sign died in hospital, versus 17/61 (28%) patients without a spot sign. Addition of delayed CTA improved sensitivity for predicting in-hospital mortality. Accuracy measures were calculated, using standard methods, to compare first pass and delayed CTA performance.
died in hospital, versus 17/61 (28%) patients without a spot sign. Addition of delayed CTA improved sensitivity for predicting in-hospital mortality from 0.26 to 0.51. In multivariate analysis, baseline ICH volume and the spot sign were predictive of in-hospital mortality, however, the effect of the spot sign was only significant if present on first pass CTA.

CONCLUSION
Addition of 90 second delayed CTA to the imaging workup of patients with spontaneous ICH captures additional patients with the spot sign and increases sensitivity for predicting hematoma expansion and in-hospital mortality, making it an attractive selection tool for targeting patients that may benefit from early surgical or medical intervention.

CLINICAL RELEVANCE/APPLICATION
Addition of 90 second delayed CTA to the imaging workup of patients with spontaneous intracerebral hemorrhage captures additional patients at risk for hematoma expansion and in-hospital mortality.

VSNR41-03 • CTA-doped Perfusion-CT (PCT): An Original Method to Increase Signal-to-noise, Contrast-to-noise and Reduce Noise in Ultra-low-dose PCT

Elizabeth Tong MD (Presenter) ; Max Wintermark MD *

PURPOSE
To use the information contained in CT-angiography data to improve the image quality of ultra-low-dose PCT.

METHOD AND MATERIALS
Dynamic PCT datasets were obtained at 80 kVp and decreasing mAs (100,75, 50, 25, 10) in patients suspected of ischemic stroke, concurrently with static CTA of the cervical and intracranial arteries. Fast-Fourier transforms (FFT) of both the PCT and CTA datasets were calculated. High spatial frequencies of the CTA FFT were combined with low spatial frequencies of the PCT FFT, and an inverse FFT was then applied to the combination to create a virtual PCT dataset. The real and virtual PCT datasets were compared at different mAs by assessing contrast-to-noise ratio (CNR), signal-to-noise ratio (SNR) and image noise, and by visual inspection of the processed real and virtual PCT parametric maps.

RESULTS
Virtual PCT attained CNR and SNR two- to three-fold superior to real PCT, and noise reduction by a factor 2-3 (p CONCLUSION
We propose a new method to enhance PCT data by rectifying it with CTA. This method yields diagnostic PCT parametric maps from PCT acquired at 50 mAs.

CLINICAL RELEVANCE/APPLICATION
Using this new method and settings of 80 kVp and 50 mAs, the effective dose of a PCT study is approximately 1 mSv, which is less than half of a noncontrast head CT dose.

VSNR41-04 • Stroke MRI: Diffusion, Perfusion, and Beyond

Greg Zaharchuk MD, PhD (Presenter) *

LEARNING OBJECTIVES
1) Understand the concept of the diffusion-perfusion (DWI-PWI) mismatch concept in acute stroke. 2) Review the recent results of stroke trials using the DWI-PWI concept. 3) Appreciate the potential role of other markers, such as collateral flow, oxygenation, pH, and resting-state fMRI for assessing the ischemic brain.

ABSTRACT
Diffusion-weighted imaging (DWI) is an invaluable part of the workup of acute ischemic stroke, as it can be used to define tissue that is irreversibly infarcted, thus setting a lower bound on patient outcome. Often, the region outside of this core will demonstrate reduced perfusion, which can measured with perfusion-weighted imaging (PWI). Typically, PWI is performed with contrast agents injected in a bolus, yielding multiple hemodynamic parameters, including relative CBF, relative CBV, mean transit time, and time-to-peak or Tmax. Earlier studies have suggested that tissue with prolonged Tmax>6 sec is incorporated into the final infarct in the absence of early reperfusion. Based on this, the idea of the DWI-PWI mismatch has arisen, which posits that patients with small DWI and large PWI lesions will benefit from early reperfusion, and that aggressive methods, including intra-arterial therapy, may be indicated. Several clinical trials have examined this hypothesis, including EPITHET, DEFUSE and DEFUSE-2, and MR-RESCUE. These studies have had variable outcomes, and it has been suggested that the DWI-PWI mismatch, while a useful concept, may be an oversimplification of the situation. Other biomarkers have been tested in exploratory studies, including the use of ASL, a non-contrast measurement that can measure quantitative CBF as well as collaterals. PET studies have suggested that elevated oxygen extraction fraction (OEF) is specific for identifying tissue at risk of infarction, and MRI-based measurements are being developed to assess tissue oxygenation. Finally, the use of resting-state fMRI (rs-fMRI), including both its use to identify core and penumbra as well as arterial arrival delays without contrast, and its ability to identify distant effects of focal ischemia upon larger brain connectivity networks will be discussed.

VSNR41-05 • Percent Insula Infarction at Admission Improves Prediction of Poor Clinical Outcome-Over That of DWI Lesion Volume Alone-in Anterior Circulation Occlusive Stroke Patients

Vincent M Timpone MD (Presenter) ; Michael H Lev MD * ; Livia T Morais MD ; Leticia C Souza MD ; Shervin Kamalian MD, MMEdSc * ; Pamela W Schaefter MD

PURPOSE
Large admission DWI infarct volume (>70ml) is an established biomarker for poor clinical outcome in acute stroke. Outcome is more variable in patients with small infarcts (<70ml). It has been shown that percent insula ribbon infarct (PIRI) at admission can predict penumbral loss (poor tissue outcome). We hypothesized that PIRI can also help identify stroke patients likely to have poor clinical outcome, despite small admission DWI lesion volumes.

METHOD AND MATERIALS
We analyzed the admission NCCT, CTP, and DWI scans of 55 patients with proximal anterior circulation occlusion on CTA. The following parameters were determined: Percent insula ribbon infarct (PIRI, >50%, 2/3) were also recorded. Statistical analyses were performed to determine accuracy in predicting poor outcome (mRS>2 at 90 days). Covariates in our multivariate regression model were admission NIHSS score, DWI-PIRI, motor strip score, and NCCT-PIRI.

RESULTS
Admission DWI >70ml (p= 50% (p= 0.045) and NIHSS (p= 50%), were not significant predictors of poor outcome. In patients with admission DWI infarct 50% (n=31, median mRS 5, 95%CI=2-5) compared to those with DWI-PIRI < 50% (n=9, median mRS 2, 95% CI=1-3; p= 0.036). In patients with admission DWI infarct >70ml, DWI-PIRI did not have added predictive value for poor outcome (p=0.9308).

CONCLUSION
DWI-PIRI >50% predicts poor clinical outcome, and can help identify stroke patients likely to have poor outcome despite small admission DWI lesion volumes. Because it facilitates direct visual estimation of the likelihood of poor outcome, the PIRI-score may help more accurately weigh the potential risks versus benefits of advanced stroke treatments than clinical assessment by NIHSS score alone.

CLINICAL RELEVANCE/APPLICATION
Consideration of DWI insula infarct involvement may be an additional tool for risk-benefit stratification and patient selection for reperfusion therapy.
The Configuration of Willis Circle Influences Leptomeningeal Collaterals and Regional Perfusion Patterns in Acute Ischemic Stroke. A Standardized Approach

Georg Homann (Presenter) ; Uta Hanning ; Ludger Feyen ; Volker Hesselmann MD ; Thomas Niederstadt MD ; Andre Kemmling MD

PURPOSE
In proximal (M1) middle cerebral artery (MCA) occlusive stroke the primary feeding artery that supplies posterior leptomeningeal collaterals may arise from the ipsilateral anterior or posterior circulation depending on the configuration of the circle of Willis and presence of fetal variants. Aim of this study was to assess regional brain perfusion parameters and patterns of final tissue outcome subject to Willis\\circledast; circle variants.

METHOD AND MATERIALS
Prospectively, stroke imaging (native CT, CTA and dynamic CTP) was performed in 97 acute strokes. Type of vessel occlusion was matched in all cases (distal M1-occlusive strokes). The configuration of the Willis\\circledast; circle was rated according to a pattern favoring leptomeningeal supply from the anterior (Pcom > P1-PCA) or posterior (P1-PCA > Pcom) circulation. CTP-parameter maps were transformed to MNI-152 standardized space to calculate regional brain perfusion using a probabilistic atlas (Harvard-Oxford structural atlas). Final tissue outcome was segmented on follow up imaging targeted at 48h after onset.

RESULTS
Depending on Willis\\circledast; circle variants, the perfusion (blood flow) pattern of ischemia was different in fetal (P1-PCA > Pcom) versus normal (Pcom > P1-PCA) variants (ml/100mg/min): temporal pole (41.2 vs. 31.0), inferior temporal gyrus (36.5 vs. 31.0), subcallosal cortex (54.8 vs. 43.8), orbitofrontal cortex (42.6 vs. 36.9), mediofrontal cortex (54.9 vs. 47.8), cingulate gyrus (58.6 vs. 53.9). Final infarct volume was 14% lower in fetal variant (85.2 vs. 98.2 ml)

CONCLUSION
In acute MCA-occlusion the effectiveness of leptomeningeal collateralization to curb ischemia depends on the source of the primary feeding artery subject to Willis\\circledast; circle variants.

CLINICAL RELEVANCE/APPLICATION
Willis\\circledast; circle configuration contributes to leptomeningeal collaterals. This may be relevant for outcome prediction in the acute stroke setting and therapeutic decision making.

T2* “Susceptibility Vessel Sign” Demonstrates Clot Location and Length in Acute Ischemic Stroke

Olivier Naggara MD (Presenter) ; Jean Raymond MD ; Montserrat Domingo Ayllon MD ; Myriam Edjlali ; Sophie Gerber ; Emmanuel Touze ; Matthieu Zuber ; Jean-Francois Meder MD, PhD ; Jean-Louis Mas ; Catherine Oppenheim MD, PhD

PURPOSE
The purpose of this study was to evaluate, in acute stroke patients, the diagnostic accuracy of MR susceptibility vessel sign (SVS) against catheter angiography (DSA) for the detection of the clot and its value in predicting clot length.

METHOD AND MATERIALS
The study was approved by the local ethics committee. Informed consent was waived. The manuscript was prepared in accordance with STARD guidelines. We retrospectively identified consecutive patients (2006-2012) with: (1) pre-treatment T2*-sequence; (2) delay from MRI-to-DSA< 3-hrs; (3) no fibrinolysis between MRI and DSA. The presence and length of SVS on T2* was independently assessed by three readers, compared per patient, per artery and per segment, to DSA findings, obtained by two different readers. Clot length measured on T2* and DSA were compared using intra-class correlation coefficient (ICC) and a Passing & Bablok regression analysis.

RESULTS
On DSA, a clot was present in all 85 included stroke patients, in 126 arteries and 175 segments. Sensitivity of SVS was 81.1% (69/85 patients), higher in anterior (55/63, 87.3%), than in posterior circulation stroke (14/22, 63.6%, p=0.02). Sensitivity/specificity were 89.8/99.6% (per artery) and 76.6/99.7% (per segment). PPV, NPV and accuracy were >94%. Correlation between T2* and DSA for clot length was excellent (ICC: 0.88, 95%CI: 0.81-0.92; Passing & Bablok : 0.91).

CONCLUSION
SVS is a specific marker of acute clot in the anterior and posterior circulation. Clot length can be measured reliably on T2*. SVS could serve as a selection criteria for intra-arterial therapy in future randomized control trial.

CLINICAL RELEVANCE/APPLICATION
T2* sequence may allow the non-invasive assessment of the clot burden in acute ischemic stroke, a finding that may help the triage of patients for intravenous or intra-arterial therapy.

Stroke Trials: Update and Perspective

Steven Warach MD, PhD (Presenter)

Perfusion-based Selection Leads to Improved Outcomes Compared with Time-based Selection for Endovascular Reperfusion Therapy in Acute Ischemic Stroke

Maryam Soltanolkotabi MD (Presenter) ; Shyam Prabhakaran MD, MS ; Farroosh Feiz MD ; Michael C Hurley MBBCh ; Ali Shaibani MD ; Richard Bernstein ; James Conners MD, MS ; Sameer A Ansari MD, PhD ; Yvonne Curran MD

PURPOSE
Controversy exists on the role of perfusion imaging-based selection of patients with AIS for endovascular therapy. Our hypothesis was that perfusion imaging based selection would improve functional outcomes at 3 months compared to time based selection alone.

METHOD AND MATERIALS
We reviewed data from consecutive AIS patients treated with ERT at 4 centers from 2006-2011. We excluded patients with initial NIHSS.

RESULTS
185 patients (mean age 66.7 y; median NIHSS 19; MCA occlusion 73% and ICA occlusion 27%) were included. TICI 2b/3 reperfusion grade was achieved in 49.7% while symptomatic hemorrhage (PH1/PH2/perforation) occurred in 10.8%. Good outcome at 3 months was seen in 41.7%. Perfusion imaging was used in 69 (37.3%) patients (45 CT and 24 MRI) and was associated with increased onset-to groin puncture time (359 vs. 298 minutes, P=0.019). Patients who underwent perfusion imaging were also older (73 vs. 63 years, P

CONCLUSION
In this multicenter study, AIS patients who underwent perfusion imaging were over 2fold more likely to have good outcome following ERT despite a delay in time to treatment and age imbalance between groups. Further studies should continue to address the optimal perfusion imaging thresholds for patient selection for ERT.

CLINICAL RELEVANCE/APPLICATION
Controversy exists on the role of perfusion imaging-based selection of patients with acute ischemic stroke (AIS) for endovascular reperfusion therapy (ERT).

Endovascular Stroke Device Update

Aquila S Turk DO (Presenter) *

Socioeconomic Disparities in the Utilization of Mechanical Thrombectomy for Acute Ischemic Stroke
Waleed Brinjikji (Presenter) ; Alejandro A Rabinstein MD ; Harry J Cloft MD, PhD *

PURPOSE
Previous studies have demonstrated that socioeconomic disparities in access to treatment for cerebrovascular diseases exist. We studied the Nationwide Inpatient Sample (NIS) to determine if disparities exist in utilization of mechanical thrombectomy for acute ischemic stroke.

METHOD AND MATERIALS
Using the NIS for the years 2006-2010, we selected all discharges with a primary diagnosis of acute ischemic stroke. Patients who received mechanical thrombectomy for acute ischemic stroke were identified by using the ICD-9 procedure code 39.74. We examined the utilization rates of mechanical thrombectomy by race/ethnicity (white, black, Hispanic, and Asian/Pacific Islander), income quartile (1st, 2nd-3rd, and 4th) and insurance status (Medicare, Medicaid, self-pay and Private). We also studied thrombectomy utilization rates at hospitals which performed thrombectomy.

RESULTS
From 2006-2010, 2087017 patients were hospitalized with a primary diagnosis of acute ischemic stroke. 8946 patients (0.4%) received mechanical thrombectomy. When compared to white patients, Black patients had significantly lower rates of overall mechanical thrombectomy utilization (OR=0.59, 95%CI=0.55-0.64, P

CONCLUSION
Our study demonstrated that significant socioeconomic disparities exist in the utilization of mechanical thrombectomy for the treatment of acute ischemic stroke. Further studies are needed to study the underlying causes of these disparities and provide solutions to improve equitable access to mechanical thrombectomy, when appropriate, amongst all segments of the population.

CLINICAL RELEVANCE/APPLICATION
Minority patients as well as patients of lower socioeconomic status are less likely to receive mechanical thrombectomy for treatment of acute ischemic stroke.

VSNR41-12 • Carotid Artery Plaque Characterization on MRI and Stroke Risk: A Systematic Review and Meta-analysis
Hediyeh Baradaran MD (Presenter) ; Andrew D Schweitzer MD ; Allison Dunning ; Diana Delgado MS ; Ankur Pandya PhD, MPH ; Hooman Kamei MD ; Pina C Sanelli MD ; Ajay Gupta MD

PURPOSE
MRI-based characterization of carotid plaque composition has high accuracy compared to histopathology and has been recently studied as a potential tool to predict ischemic events in carotid atherosclerotic disease. Intraplaque hemorrhage (IPH), lipid-rich necrotic core (LRNC) and thinning/rupture of the fibrous cap (FC) are the three most studied plaque characteristics. We performed a systematic review and meta-analysis to summarize the association between these three plaque characteristics and future ischemic events in patients with carotid atherosclerotic disease.

METHOD AND MATERIALS
We performed a comprehensive literature search evaluating the association of MRI-based characterization of carotid plaque composition with stroke. The included studies were prospective or retrospective studies examining IPH, LRNC, or FC with mean follow-up of at least 1 month assessing for development of ipsilateral ischemic event (stroke or transient ischemic attack [TIA]). A meta-analysis using random and fixed-effects models with assessment of study heterogeneity and publication bias was performed.

RESULTS
Of the 3436 manuscripts screened, 10 met eligibility for systematic review including a total of 832 patients. 6 of the manuscripts studied IPH, 4 studied LRNC, and 3 studied thinning/ruptured FC. The hazard ratio (HR) for IPH, LRNC, and thinning/rupture of the FC as predictors of future stroke/TIA are 4.61 (95% CI 3.02-7.02), 3.00 (95% CI 1.51-5.95) and 7.39 (95% CI 3.26-16.75), respectively. There was significant heterogeneity in the degree of stenosis, presence of prior symptoms, and MRI techniques amongst the included studies.

CONCLUSION
The presence of IPH, LRNC, and thinning/rupture of the FC in carotid plaque increases the risk of future ipsilateral ischemic event in patients with carotid atherosclerotic disease.

CLINICAL RELEVANCE/APPLICATION
Dedicated imaging to characterize plaque composition may offer information beyond luminal stenosis to further risk stratify patients with carotid atherosclerotic disease.

RSNA/ESR Emergency Symposium: CNS Emergencies (An Interactive Session)
Wednesday, 10:30 AM - 12:00 PM • S402AB

MSSR42 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5
MSSR42A • CNS Trauma and Neurovascular Injury
Howard A Rowley MD (Presenter) *

LEARNING OBJECTIVES
1) To be familiar with traumatic brain injury demographics and classification schemes. 2) Be able to apply appropriateness criteria for head trauma imaging in children and adults. 3) Identify key imaging patterns and pitfalls in the evaluation of brain and neurovascular trauma.

ABSTRACT
This lecture on Acute Head Trauma is divided into 4 parts: Part 1 will briefly review TBI demographics. Part 2 will discuss the current imaging approach to acute TBI in today's clinical practice. Part 3 will briefly describe the most common TBI classification schemes. Part 4 will illustrate the imaging manifestations of the different injuries located in the extra-axial space (e.g., scalp and skull injury; epidural, subdural, subarachnoid and intraventricular collections), and the intra-axial space (e.g., dysautoregulation, contusion, hematoma, penetrating TBI, axonal injury, fat emboli). Note that a common theme throughout the lecture will be Lessons I've Learned Since Neuroradiology Fellowship.

MSSR42B • CNS Non-Traumatic Emergencies
Marion Smits MD, PhD (Presenter)

LEARNING OBJECTIVES
1) To know the modalities (CT/MRI) and protocols for non-traumatic neurological emergencies. 2) To know and diagnose the main non-traumatic neurological vascular and non-vascular emergencies. 3) To be aware of the pitfalls and limitations of clinical presentation and imaging findings in non-traumatic neurological emergencies.
ABSTRACT
Neurological emergencies are often associated with high morbidity and mortality, and thus require prompt diagnostic and therapeutic action. Non-traumatic emergencies may however have a subacute onset, and radiological signs may be subtle, which can lead to delay in diagnosis.

MSSR42C • Interactive Case Discussion

Howard A Rowley MD (Presenter) * ; Marion Smits MD, PhD (Presenter)

LEARNING OBJECTIVES
1) To review traumatic brain injury (TBI) and non-traumatic neurological emergencies. 2) To describe imaging manifestations of TBI and non-traumatic neurological emergencies. 3) To understand the clinical implications of radiological imaging findings in TBI and non-traumatic neurological emergencies. 4) To know the state-of-the-art radiological imaging options for the assessment of acute TBI and non-traumatic neurological emergencies.

ABSTRACT
This interactive case discussion builds on the two previous lectures in this session, on traumatic and non-traumatic neurological emergencies respectively. Both lecturers will take the audience through several clinical cases, highlighting and emphasizing important issues from their lectures, such that the previously presented theory is placed in a clinical context. Preferably, the participants will have attended the two prior lectures, to optimally benefit from and participate in this interactive case discussion.

Neuroradiology/Head and Neck (Head and Neck Tumors)

Wednesday, 10:30 AM - 12:00 PM • N229

SSK15 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

Moderator
Yoshimi Anzai, MD
Laurie A Loevner, MD

SSK15-01 • Using SRU Recommendations for Workup of Imaging-detected Incidental Thyroid Nodules: What Types of Cancers Would We Miss?

Manisha Bahl MD, MPH (Presenter) ; Julie A Sosa MD ; Hasan A Hobbs MD ; Nathan Wnuk MSc, BSc ; Rendon C Nelson MD * ; Jenny K Hoang MBBS *

PURPOSE
To apply the Society of Radiologists in Ultrasound (SRU) recommendations to incidental thyroid cancers detected on imaging and to describe cancers that do not meet the workup criteria.

METHOD AND MATERIALS
We performed a retrospective review of 1721 patients who underwent thyroidectomy or lobectomy from 2003 to 2012 to identify thyroid cancers that were detected incidentally on imaging. Imaging-detected incidental cancer was defined as cancer in asymptomatic patients presenting with incidental thyroid nodules (ITN) on imaging with no other risk factors. The SRU recommendations were applied to nodules with ultrasound for review. SRU positive nodules include solid nodules or nodules with coarse calcifications =15 mm, nodules with microcalcifications =10 mm, and solid-cystic nodules =20 mm. Tumor characteristics for SRU- and SRU+ groups were compared.

RESULTS
Of 1721 patients who underwent surgery, 578 (34%) patients had thyroid cancer and 86 (5%) patients had thyroid cancer first detected incidentally by imaging studies. Incidental cancers were first detected on ultrasound in 21 patients. Other cancers were seen incidentally on CT, MRI, PET, octreotide scan, echocardiogram, and radiographs. The SRU recommendations were applied to 72 patients, of which 21 had ultrasound-detected ITN and an additional 51 who had ultrasound workup of ITN detected on other imaging modalities. 15/72 (21%) patients did not meet SRU recommendations for workup and would not have undergone FNA if the recommendations had been used at the time of diagnostic ultrasound. The SRU- group represented 3% of all malignancies. SRU- cancers had a mean size of 1.1 cm (range 0.9-1.4 cm) compared to 2.4 cm (range 1.0-7.6 cm) for SRU+ cancers. Histology was papillary in 3/15 SRU- and 50/57 SRU+ cancers.

5/15 SRU- patients had nodal metastases (11 confined to central compartment). 16/57 SRU+ patients had nodal metastases (11 confined to central compartment).

CONCLUSION
Imaging-detected incidental thyroid cancer is uncommon. 3% of malignancies would be missed using the SRU recommendations for workup of ITN. SRU- tumors were more likely to be papillary carcinoma and less likely to have nodal metastases.

CLINICAL RELEVANCE/APPLICATION
SRU recommendations could reduce the biopsy rate of imaging-detected ITN. Missed malignancies would be uncommon (3%) and more likely to be nonaggressive papillary carcinoma.

SSK15-02 • Thyroid Nodules: A Total Malignancy Score (TMS) for Ultrasound (US) - A Validation Pilot Study

Giovanni G Pompili MD (Presenter) ; Silvia Tresoldi MD ; Alessandra Primolevo ; Stefania Rossi ; Gaetano Bulfamante PhD ; Gianpaolo Cornalba MD

PURPOSE
The aim of our study was to validate a malignancy score of thyroid nodules (Total Malignancy Score (TMS)) based on their ultrasound features. Pilot study

METHOD AND MATERIALS
Based on a retrospective analysis of 102 patients with follicular pattern at US we recently suggested an US score for the characterization of thyroid nodules [a score from 0 (most likely benign) to 2 (most likely malignant) was assigned to each nodule feature number, margins, colour-flow, structure, echogenicity, halo, calcifications, dimensional increment leading to a total score (TMS) ranging from 0 to 11]. The malignancy score system is shown in Figure 1. In the present study we prospectively apply that score to all the patients undergoing a thyroid nodule fine needle aspiration cytology (FNAC) at our Institution. The score results are then compared to the cytological diagnosis.

RESULTS
between September 2012 and April 2013 59 consecutive patients entered the study. Among patients with TMS 3 (20/59) 8 had non-negative cytological results. Patients with non-negative cytological results (n=9) were diagnosed with malignancy (TMS 4 n=3; TMS 6 n=1); follicular proliferation (n=2; both follicular adenomas at surgery; TMS 5 and 3 respectively) or high cellularity lesion (TMS 4 n=1; TMS 5 n=2).

CONCLUSION
The preliminary results of this pilot study confirms what previously suggested: the identification of a predictive US score would allow a
more accurate estimation of risk. Nodules with a TMS>3 should undergo FNAC, nodules with a score ≥2.5 should undergo surgery.

**CLINICAL RELEVANCE/APPLICATION**

Our US-TMS, when validated, will be useful in the management of patients with thyroid nodules avoiding useless FNAC when benign features are recognized, and suggesting cytology in potential malignancy.

SSK15-03 • Can Ultrasound Features of Thyroid Nodules Predict Outcomes after a Non-diagnostic Fine Needle Aspiration?

**Thomas J Anderson** MD (Presenter); **Michael K Atalay** MD, PhD; **David J Grand** MD; **Michael D Beland** MD

**PURPOSE**

Ultrasound characteristics of thyroid nodules are notoriously poor predictors of malignancy. The purpose of this study was to identify reproducible ultrasound characteristics that could indicate benignity to avoid repeat biopsies when the initial FNA is non-diagnostic.

**METHOD AND MATERIALS**

We identified 5399 nodules that were biopsied under ultrasound guidance in our radiology department between 2004 and 2012. Of these, 454 were initially non-diagnostic and met inclusion criteria with adequate cytological, surgical, or ultrasound follow up. Three independent, board-certified radiologists who were blinded to outcomes scored the ultrasound features of each nodule. Nodule size, composition, border, calcifications, comet tail, and central vascularity were recorded. Outcomes data were collected through review of the medical record.

**RESULTS**

Of the 454 initially non-diagnostic thyroid FNAs, 10 malignancies (2.2%; 3 follicular, 7 papillary) were diagnosed by subsequent FNA (3, 0.7%) or surgery (7, 1.5%). There were no cancers detected in nodules with a spongiform or cystic composition, with a comet tail, or with eggshell or indeterminate calcifications. The minimum diameter of any malignant nodule was 0.8cm, with an average of 2.2cm, compared to 0.3cm and 1.5cm in the benign group (p=0.049).

**CONCLUSION**

The incidence of malignancy after initial non-diagnostic FNA is very low (0.7%), particularly when the nodule is cystic, spongiform, or in the presence of a comet tail, or eggshell or indeterminate calcifications. In the setting of a non-diagnostic FNA with these features, clinical and ultrasound follow-up are more appropriate than repeat FNA, particularly in smaller nodules.

**CLINICAL RELEVANCE/APPLICATION**

Clinical and ultrasound follow-up may be more appropriate than repeat FNA in thyroid nodules with a non-diagnostic result and reassuring ultrasound characteristics.

SSK15-04 • Is Repeat FNA after a Non-diagnostic Thyroid Nodule FNA Necessary?

**Thomas J Anderson** MD (Presenter); **Michael K Atalay** MD, PhD; **David J Grand** MD; **Michael D Beland** MD

**PURPOSE**

Fine needle aspirates (FNA) of thyroid nodules have a diagnostic yield of 85-90%, but optimal management of non-diagnostic results is unknown. The aim of this study was to identify demographic features predictive of malignancy after an initially non-diagnostic FNA and the role of subsequent FNA.

**METHOD AND MATERIALS**

We identified 5399 nodules that were biopsied under ultrasound guidance in our radiology department between 2004 and 2012. Of these, 454 were initially non-diagnostic and met inclusion criteria with adequate cytological, surgical, or ultrasound follow up. Demographic and laboratory data were correlated with outcomes through review of the medical record.

**RESULTS**

Of the 454 initially non-diagnostic thyroid FNAs, 10 malignancies (2.2%; 3 follicular, 7 papillary) were diagnosed by subsequent FNA (3, 0.7%) or surgery (7, 1.5%). 373 (82.2%) were benign at subsequent FNA (279, 61.5%) or surgical pathology (94, 20.7%), and 71 (15.6%) were stable or decreased in size by serial ultrasound examinations (mean follow up: 2.7 years). In 77 males (17%), 4 (5.2%) cancers were detected; in 377 females (83%), 6 (1.6%) cancers were detected (p=0.07). The average age of this cohort was 55.7 years, while patients with malignancies averaged 62.3 (p=0.02). No malignancies were detected in patients less than 47 years of age. 27 (5.9%) patients were noted to have a papillary cancer elsewhere in the thyroid either at the time of surgery or by FNA of a separate nodule.

**CONCLUSION**

The likelihood of a malignant FNA after a non-diagnostic FNA is very low (0.7%), and therefore clinical and ultrasound follow up may be more appropriate than repeat FNA, particularly in female patients under the age of 45.

**CLINICAL RELEVANCE/APPLICATION**

Clinical and ultrasound follow-up of non-diagnostic thyroid FNAs may be more appropriate than repeat FNA, particularly in younger female patients, due to the very low rate of malignancy.

SSK15-05 • Repeat Fine Needle Aspiration Biopsy for Nondiagnostic Thyroid Nodules with Short Interval Does Not Increase Atypical Cytologic Result

**Ha Young Lee** (Presenter); **Jung Hwan Baek**; **Hyunkyung Yoo** MD; **Young Hye Kang** MD; **Myung Kwan Lim** MD

**PURPOSE**

To evaluate which factors affected atypia with undetermined significance (AUS) results of thyroid nodules with initial nondiagnostic (ND) result and to determine whether repeat fine needle aspiration biopsy (FNAB) with short interval increases AUS result.

**METHOD AND MATERIALS**

A retrospective review of 128 nodules from 126 patients with initial ND results was performed from January 2009 to December 2012. Demographic and clinical factors; age, sex, and time interval of FNAB, and ultrasonographic factors; size, location, consistency, suspicious malignant finding and thyroiditis were recorded. Time interval was subdivided into < or = 5, 10, 15, and 20 weeks after initial FNAB. Their effects on AUS result were analyzed using Fisher's exact test and Mann-Whitney U test.

**RESULTS**

None of the demographic, clinical, and ultrasonographic variables was significantly related with AUS result of repeat FNAB. Time interval of repeat FNAB was not related with AUS result (p=0.63, 0.57, 0.23, 0.48 for 5, 10, 15, 20 weeks, respectively).

**CONCLUSION**

Timing of repeat FNAB for the ND nodules did not influence the AUS result of repeat FNAB, and other clinical and US characters were not correlated with AUS result. Repeat FNAB for ND nodules could be performed without waiting for 3 months following to the need of patients and referring clinicians.

**CLINICAL RELEVANCE/APPLICATION**

1. To determine the recommended waiting period of 3 months is neccessary or not.
2. To provide clinical evidence for management of thyroid nodules with initial nondiagnostic results.

SSK15-06 • Thyroglobulin Measurement in Fine Needle Aspirates from Neck Lesions after Total Thyroidectomy: Is It a Reliable Tool for Post-surgical Follow-up Regardless of TSH Stimulation?
**METHOD AND MATERIALS**

A total of 104 consecutive patients with papillary thyroid carcinoma initially treated by total thyroidectomy followed by remnant iodine ablation were retrospectively enrolled. They were sonographically evaluated for cervical recurrence by FNA-Tg and cytology during recent 5 years. Final diagnoses were confirmed by histopathologic results or follow-up examination at least 3 years. We evaluated the diagnostic performances of their FNA-Tg and cytology, serum Tg, anti-Tg antibodies, depending on the TSH stimulated or suppressed.

**RESULTS**

Of 104 lesions, 30 were confirmed as recurrences and 74 were non-recurrence. On TSH stimulated condition, both serum Tg and FNA-Tg levels in recurrent group were significantly higher in those of non-recurrent group (p<0.05).

**CONCLUSION**

On TSH-suppressed condition, FNA-Tg measurement may be sufficient postoperative follow tool for cervical recurrence in patients with thyroid cancer.

**CLINICAL RELEVANCE/APPLICATION**

On TSH-suppressed condition, FNA-Tg measurement may be sufficient postoperative follow tool for cervical recurrence in patients with thyroid cancer.

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**SSK15-07 • Head and Neck Squamous Cell Carcinoma: Predicting Treatment Response to Induction Chemotherapy with Standard- and High-b-value Diffusion Weighted MR Imaging**

**Inseon Ryoo** MD (Presenter); **Ji-Hoon Kim** MD; **Soo Chin Kim** MD; **Tae Jin Yun** MD; **Seung Hong Choi** MD, PhD; **Chul-Ho Sohn** MD; **Jisang Park** MD; **Koung Mi Kang**; **Eun Kyoung Lee** MD

**PURPOSE**

Recent publications reported the contradictory results of pretreatment diffusion-weighted MR imaging (DWI) for the prediction of chemotherapy therapeutic response in primary head and neck squamous cell carcinomas (HNSCC). The purpose of this study was to evaluate the diagnostic performance of DWI with both standard (b=1000 s/mm2) and high (b=2000 s/mm2) b-values for predicting treatment response to induction chemotherapy in primary HNSCC.

**METHOD AND MATERIALS**

Twenty seven patients with primary HNSCC who underwent DWI with both b=1000 and 2000 s/mm2 prior to treatment were included in this study, and corresponding apparent diffusion coefficient (ADC) maps were calculated. Regions of interest containing the tumor were drawn on every section of ADC map and summed to make volume based data of the entire tumor. Histogram parameters were correlated with treatment response using unpaired student t-test.

**RESULTS**

Among 27 patients, 14 showed good response (complete remission or partial response) and 13 showed poor response (stable disease or progressive disease) to induction chemotherapy. The mean ADC values of good responders (1252.7±91.4 s/mm2 at b=1000 and 625.36±36.9 s/mm2 at b=2000) were lower than those of poor responders (1294±19.5 s/mm2 at b=1000 and 746.5±41.8 s/mm2 at b=2000). But statistically significant difference was achieved at only high-b-value ADC map. (p=0.039) The 75th percentiles of cumulative ADC histogram of good responders (807.3±54.9 s/mm2) also showed statistically significant lower values than those of poor responders (963.7±48.7 s/mm2) at only high-b-value ADC map. (p=0.04)

**CONCLUSION**

Pretreatment DWI with high-b-value may facilitate and be better in predicting treatment response to induction chemotherapy than DWI with standard-b-value in primary HNSCC.

**CLINICAL RELEVANCE/APPLICATION**

Based on our study results, high-b-value DWI has the potential to facilitate pretreatment prediction of the response to induction chemotherapy in primary head and neck squamous cell carcinomas.

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**SSK15-08 • Improved Zoomed EPI-DWI of the Head and Neck Using Two-dimensional Spatially-selective Radiofrequency Excitation Pulses**

**Philipp Riffel** MD (Presenter); **Stefan Haneder** MD; **Josef Pfeuffer** PhD *; **Stefan O Schoenberg** MD, PhD *; **Henrik J Michaely** MD *

**PURPOSE**

Diffusion-weighted MR imaging (DWI) in the head and neck is challenging especially because of susceptibility artifacts. Two-dimensional spatially-selective radiofrequency (RF) excitation pulses for single-shot echo-planar imaging (EPI) combined with reduced FOV i.e., zooming - in the phase-encoding direction lead to a decreased number of acquisition k-space lines and significantly shorten the length of the EPI echo train. This can potentially reduce susceptibility artifacts. The purpose of this study was to evaluate the feasibility of a zoomed DW EPI (z-EPI) sequence in the head and neck in a healthy volunteer population. The approach was compared to conventional single-shot EPI (c-EPI).

**METHOD AND MATERIALS**

The necks of 9 healthy volunteers were examined in this prospective IRB-approved study. All examinations were performed on a 3T whole-body MR system (MAGNETOM Skrya, Siemens Healthcare, Erlangen, Germany) equipped with a two-channel fully dynamic parallel transmit array, termed TimTX TrueShape. In all subjects, the experiment consisted of a conventional EPI sequence and two zoomed EPI sequences. Therefore the excitation of the standard DW EPI sequence was extended by the two-dimensional spatially-selective RF pulse using an echo-planar transmit trajectory. For quantitative assessment of distortion artifacts, DW images were merged with T2 TSE. Maximum misregistration of DW images with T2 TSE images was assessed in the cervical myelon. For qualitative assessment two readers ranked c-EPI and z-EPI sequences in terms of susceptibility artifacts, image blur and overall scan preference.

**RESULTS**

Concluded

Zoomed DW EPI in the head and neck leads to substantial image quality improvements and has the potential to exhibit markedly reduced susceptibility artifacts and image distortion especially in regions close to major air cavities.

**CLINICAL RELEVANCE/APPLICATION**

Due to significantly reduced susceptibility artifacts zoomed DW EPI in the head and neck could have a potential value for identification of small malignant lymph nodes prior to neck dissection.

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**SSK15-09 • Role of Sonoeastography in Differentiating Benign and Malignant Salivary Gland Tumors: A Systematic Review and Meta Analysis**

**Mahsa Ghajarzadeh** MD, MPH (Presenter); **Mehdi Mohammadifar**; **Kamran Azarkhish** MD; **Seyed Hassan Emami-Razavi**

**PURPOSE**

Thyroglobulin (Tg) measurement in needle washout fluid has been reported to increase diagnostic accuracy of fine needle aspiration for sonographically suspicious neck lesions encountered in postoperative follow-up. Although TSH stimulation is needed to improve the diagnostic accuracy of serum Tg for detection of recurrence, it is not clear whether stimulated or suppressed TSH status affect FNA-Tg.
METHOD AND MATERIALS
A highly sensitive search for sonoelastography and salivary glands tumors was performed in MEDLINE, Cochrane Library, ACP Journal Club, EMBASE, Health Technology assessment, and ISI web of knowledge for studies published prior to December 2012. The criteria for eligibility were:

2. Using appropriate reference standard test such as Fine-Needle Aspiration (FNA), histological assessment of specimens obtained by surgery.
3. Diagnostic measures on sonoelastographic evaluation results such as sensitivity, specificity, positive and negative predictive values.

Results which evaluated role of sonoelastography in differentiating benign and malignant salivary glands tumors considered for more evaluation.

SPSS version 18 used for descriptive analysis and meta-disc version 1.4 applied for meta-analysis. Forest plots for pooled estimates and summery of ROC plots for different cut-offs were produced.

RESULTS
The literature and manual search yielded 32 articles, of which, 6 were eligible to include.

A total of 348 individuals with total number of 356 salivary gland masses were evaluated (87 malignant and 296 benign).

The summary sensitivity for the differentiation of benign and malignant salivary glands was 0.63 (95% CI: 0.52 -0.87). The summary specificity was 0.59 (95% CI: 0.53 -0.65). The summary positive and negative LR were 1.63 (95% CI: 1.33 -2.01) and 0.61 (95% CI: 0.47 -0.79). The summary diagnostic odds ratio (DOR) was 3.18 (95% CI: 1.86 -5.44).

Area under the curve (AUC) was 0.68 (SE=0.03).

CONCLUSION
Sonoelastography has high accuracy in differentiating benign and malignant salivary gland tumors.

CLINICAL RELEVANCE/APPLICATION
Applying sonoelastography for differentiating benign and malignant salivary tumors.

Neuroradiology (Advanced Neuroimaging of Alzheimer’s Disease)

Wednesday, 10:30 AM - 12:00 PM • N230

SSK16 •AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5
Moderator
Jeffrey R Petrella, MD *
Moderator
Gloria C Chiang, MD

SSK16-01 • Prediction of Conversion from MCI to AD: Integration and Relative Values of Brain Atrophy Patterns, Clinical Scores, CSF Biomarkers, and APOE Genotype

Xiao Da (Presenter); Jon B Toledo MD; Jarcy Zee; David A Wolk MD; Sharon X Xie; Yangming Ou PhD; Amanda Shacklett MS; Paraskevi Parmpri MS; Leslie Shaw PhD; John Trojanowski; Christos Davatzikos

PURPOSE
We evaluate the individual, as well as relative and joint values of indices obtained from MRI patterns of atrophy, cerebrospinal fluid (CSF) biomarkers, APOE genotype, and cognitive performance for prediction of clinical progression of MCI patients, on an individual person basis.

METHOD AND MATERIALS
The SPARE-AD index, a previously characterized imaging biomarker capturing spatial patterns of brain atrophy, was first tested for sensitivity and specificity as a biomarker of Alzheimer’s disease (AD), in a training set of 411 participants. SPARE-AD, and a related mild cognitive impairment (MCI)-specific index called SPARE-MCI, were then evaluated at baseline in 212 MCI patients who either converted to AD within 18 months or remained stable for at least 3 years. Baseline predictive value of SPARE-AD, SPARE-MCI, CSF biomarkers (total and phosphorylated tau and A?), MMSE, ADAS-Cog, and APOE genotype were then evaluated using a support vector machine classifier.

RESULTS
SPARE-AD offered excellent diagnostic accuracy of AD (AUC between 0.96-0.98). Excluding CSF biomarkers, MCI-derived SPARE scores offered the highest predictive power for MCI conversion to AD (AUC=0.76); followed by ADAS-Cog (AUC=0.74). Their combination offered the best accuracy (AUC=0.76). Other cognitive and APOE4 markers did not add any predictive power beyond them. In a subset (112 MCI patients) who also had CSF biomarkers, SPARE had the best predictive power (AUC=0.73), being enhanced by CSF biomarkers (AUC=0.76), which by themselves were relatively poorer predictors (AUC=0.68). In amyloid-negative MCI patients, SPARE-AD had high predictive power.

CONCLUSION
MRI patterns of atrophy, quantified via advanced pattern analysis methods, offer the highest predictive power for the differentiation of benign and malignant salivary glands tumors. But are slightly better than ADAS-Cog. Combination of MRI and CSF biomarkers improves predictive power. High predictive value of SPARE in negative amyloid MCI is not expected under the amyloid hypothesis and merits further investigation.

CLINICAL RELEVANCE/APPLICATION
A highly sensitive and specific imaging biomarker of AD is evaluated as an earlier predictor of clinical progression from MCI to AD, which can become an AD-specific marker for diagnosis and treatment.

SSK16-02 • MR Elastography of Alzheimer’s Disease and Frontotemporal Dementia

John Huston MD (Presenter); Matthew C Murphy PhD; Kevin J Glaser *; Clifford R Jack MD *; Richard L Ehman MD *

PURPOSE
Several MR imaging biomarkers exist to measure various disease processes associated with Alzheimer’s disease (AD) and frontotemporal dementia (FTD). Patterns of hippocampal and whole brain atrophy, MR spectroscopy, perfusion, diffusion and functional MRI have been reported. Magnetic resonance elastography (MRE) is a noninvasive technique to measure tissue stiffness, akin to manual palpation. Our purpose was to investigate the effect of AD and FTD on brain stiffness.

METHOD AND MATERIALS
We examined 59 subjects with brain MRE including 39 age and gender matched cognitively normal controls (NC), 15 subjects with AD and 5 subjects with behavioral variant FTD. MRE data were collected with a modified spin-echo EPI pulse sequence on a 3.0T MR imager including full head coverage in just less than 7 minutes. Shear waves were introduced with a soft pillow-like vibration source operating at 60 Hz using a pneumatic actuator. The wave data underwent a curl operation to remove contributions of the longitudinal waves and a 3D
direct inversion algorithm calculated the elastogram. In subjects with 3 mm isotropic sampling we measured age adjusted global brain stiffness (entire brain excluding cerebellum), in 8 regions.

RESULTS
Global stiffness was decreased in AD subjects (2.20 kPa) compared to NC (2.37 kPa). Group-wise differences in stiffness were demonstrated within the lobes of the brain that contain association cortices (p < 0.05).

CONCLUSION
We have demonstrated that AD and FTD alter the mechanical properties of the brain in a way that can be measured in vivo by MRE, following the known topography of the diseases. Measures of brain elasticity have the potential to offer insights into the ultrastructural alternations of brain tissue that occur with AD and FTD, how these change with time and the clinical expression of the diseases.

CLINICAL RELEVANCE/APPLICATION
MR Elastography demonstrates Alzheimer’s disease and frontotemporal dementia alter the mechanical properties of the brain by decreasing brain stiffness, following the known topography of the diseases.

SSK16-03 • Different Post Label Delay Cerebral Blood Flow Measurements in Patients with Alzheimer’s Disease Using 3D Arterial Spin Labeling
Ying Liu MD (Presenter); Huishu Yuan MD; Xiangzhu Zeng MD; Zheng Wang MS

PURPOSE
To evaluate cerebral blood flow (CBF) and find out differences in patients with Alzheimer’s disease (AD) and healthy control group (HC) using 3D Arterial Spin Labeling (ASL) on 3.0T MR. Changing the label time in 3D ASL in order to obtain two CBF maps. To observe the analysis of different label time for CBF map result and explore the 3D ASL in the display of brain perfusion factor and its clinical significance.

METHOD AND MATERIALS
Thirteen AD patients (5men and 8women; age range, 58-89years; mean age 75.00±7.36 years) and fifteen healthy control subjects (4 men and 11 women; age range, 56-84 years; mean age 71.20±7.89 years) were recruited. All MRI examinations were performed using a 3.0T scanner, pseudo-continuous ASL scanning was conducted with 36 label/control images acquired on a GE750 3T scanner. The acquisition parameters were: TR/TE = 4632/10.5ms, voxel size = 2×2×4mm3. High-resolution T1SPGR images were acquired as well. ASL sequence was obtained twice with different post label delay (PLD) which were 1.5s and 2.5s. Comparing CBFAD1.5 with CBFHC1.5 and CBFAD2.5 with CBFHC2.5, and CBFAD1.5 with CBFAD2.5. ASL and structural images were coregistered using SPM8.

RESULTS
1. SPM analyses revealed focal hypoperfusion in areas over the bilateral parietal lobe, temporal lobe and posterior cingulate gyrus in AD patients in comparison with control subjects with PLD1.5(p < 0.05).

CONCLUSION
1. revealed patterns of regional hemodynamic impairment typical of mild AD. Centain hypoperfusion areas in AD patients in comparison with control subjects with PLD1.5. 2. When the labeling time was set with 2.5s, the areas of CBF map were reduced significantly to nearly zero. Therefore, short labeling time could discover perfusion abnormal earlier.

CLINICAL RELEVANCE/APPLICATION
3D ASL is a useful noninvasive MRI sequence to identify the Alzheimer’s disease and the PLD of 1.5s was probably better than that of 2.5s.

SSK16-04 • The Correlation of Hippocampal T2-mapping with Neuropsychology Test in Patients with Alzheimer’s Disease
Zhu-Ren Luo (Presenter); Xiong-Jie Zhuang

PURPOSE
1) To deduce T2, the inverse of the transverse relaxation rate (R2), in the hippocampus of healthy adults; 2) to investigate the brain iron deposition in Alzheimer’s disease (AD) patients and age-matched healthy controls using T2-values.

METHOD AND MATERIALS
T2-weighted data from the bilateral-hippocampi of ten AD patients and sixty healthy controls were collected using multi-slice multi-echo turbo spin echo (MSME-TSE) imaging on a 3.0T MR-scanner, followed by the neuropsychological testing. The correlations between T2-values and Mini-Mental-State-Examination (MMSE) score were investigated on group-wise basis (gender, age, side and healthy/AD).

RESULTS
There were no significant differences in hippocampal T2-values on intra-gender and inter-gender basis (P > 0.05). Hippocampal T2-values of both sides were similar (right: 85.17±2.44 milliseconds; left: 85.28±2.51 milliseconds). The bilateral hippocampal T2 values correlated moderately with age (right: r = -0.59; left: -0.58; P < 0.001). Mean hippocampal T2-values from ten controls correlated strongly (r = -0.90, P < 0.001) with reference brain iron concentrations for healthy adults. The AD-group had significantly lowered T2-values in the hippocampus when compared to normal controls (P < 0.001) and had a strong positive correlation with the MMSE score (R = 0.97; P < 0.05).

CONCLUSION
Patients with AD showed significantly iron depositions in the hippocampus resulting in the decreased T2 values. A positive correlation between T2-values and cognition/ memory scores, suggests that quantitative T2 can be used in the early diagnosis of AD and monitoring of the treatment response.

CLINICAL RELEVANCE/APPLICATION
In vivo proton transverse relaxation rate imaging is capable of quantitatively measuring the iron deposition in the hippocampus in AD patients, consistent with incipient AD pathogenesis.

SSK16-05 • GABA-edited Magnetic Resonance Spectroscopy in Alzheimer’s Disease at 3T
Xue Bai BA (Presenter); Guangbin Wang MD

PURPOSE
Gamma-aminobutyric acid (GABA) is the essential inhibitory neurotransmitter in human brain. It is considered that reduced neuronal GABA concentration and neurotransmission results in cognitive impairments in Alzheimer’s disease (AD). However, few in vivo studies have directly certified this hypothesis. In this study, we used magnetic resonance spectroscopy at high field to measure GABA levels, aiming to investigate whether there is a regional GABA level decline in AD.

METHOD AND MATERIALS
Twelve untreated AD patients (5 males and 7 female; range 56-79, mean = 67.6±8.4 years) and twelve age-and sex-matched healthy control subjects were recruited. AD patients were diagnosed according to National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer’s Disease and Related Disorders Association. 1H-MRS was performed in a 3-tesla MR scanner (Philips Achieva TX, Best, The Netherlands). The voxel was set (3 cm×3 cm×3 cm) in the frontal lobe and the parietal lobe (Fig 1), using high resolution T2-weighted three-dimensional TFE images as a localizer. The GABA concentration was measured using a MEGA-PRESS sequence (TR = 2000ms; TE = 68 ms; 320 averages; acquisition bandwidth = 1000 Hz; scan duration 11 minutes). All the metabolite quantitation was performed with time-domain fitting algorithm AMARES by JMRUI v.4.0. Each pixel in the brain images was segmented as to gray matter, white matter, or cerebrospinal fluid using the FSL package.

RESULTS
...
According to the result of segmentation result, there was no significant difference in the proportions of each part between AD patients and controls. Fig 2 shows the typical GABA-edited spectra from the MEGA-PRESS sequence in the frontal lobe of an AD patient. Significant differences of GABA/Cr ratio were found in parietal lobe between AD patients and Controls ($t = -2.212, p = 0.038$), but not found in frontal lobe ($t = 0.799, p > 0.05$).

**CONCLUSION**

In this study, GABA-edited MRS technique was successfully applied in AD patients to assess GABA level in vivo, and the brain GABA level in parietal lobe is decreased in AD. GABA may be a potential biomarker for early detection of AD, and could be used to assess the prognosis after treatment.

**CLINICAL RELEVANCE/APPLICATION**

GABA-edited MRS technique was useful to assess GABA level in vivo, GABA may be a potential biomarker for early detection of AD, and could be used to assess the prognosis after treatment.

**SSK16-06 • Relationships between the Structural Connectome and Amyloid Burden in Alzheimer’s Dementia**

**Jeffrey W Prescott** MD, PhD (Presenter) ; **Arnaud Guidon** PhD ; **P. M Doraïswamy** MD * ; **Chunlei Liu** PhD ; **Jeffrey R Petrella** MD *

**PURPOSE**

The hypothesis of the current study is that relationships between the structural connectome and cortical amyloid burden may provide complementary information about pathologic changes in Alzheimer’s Disease (AD).

**METHOD AND MATERIALS**

Subjects were those newly enrolled in the ADNI2 study. Baseline data was used. T1 anatomical images were parcellated using FreeSurfer. DTI scans were registered to the T1 images using FSL. Structural connectomes were created using the Connectome Mapper Toolkit. Node degree, local efficiency, and clustering coefficient were calculated for the precuneus, posterior cingulate, inferior temporal, superior parietal, and superior frontal connectome nodes. The FreeSurfer parcellations were registered to the florbetapir PET scans. The global SUVR and four local SUVRs (frontal, cingulate, parietal, and temporal) were calculated. Clinical cognitive assessments included MMSE, ADAS-Cog, and Rey AVL. Statistical analyses were performed between structural connection metrics, amyloid status, and clinical cognitive scores.

**RESULTS**

There were 102 ADNI2 subjects (64 males, 38 females) available at the time of the analysis. There were 37 normal control, 19 early mild cognitive impairment (MCI), 25 late MCI, and 21 AD subjects. All global and local AV45 amyloid burden measures were significantly associated with RAVLT, MMSE, and ADAS-Cog (p < 0.05). The strongest associations between amyloid burden and structural connection metrics were in the posterior cingulate and precuneus (node degree; p < 0.05). The strongest associations between structural connection metrics and clinical dementia scores were in the precuneus, superior parietal, and superior temporal regions (node degree vs. MMSE and ADAS-cog; p < 0.05).

**CONCLUSION**

Brain amyloid burden has significant associations with clinical cognitive status in all regions analyzed, consistent with globally increased amyloid burden as an important condition for AD. The strongest associations between amyloid burden and structural connection metrics were in the posterior cingulate and precuneus (node degree; p < 0.05), suggesting that these regions are most likely to have structural changes related to amyloid deposition in AD.

**CLINICAL RELEVANCE/APPLICATION**

The combination of quantitative amyloid PET and DTI tractography can provide information about global and local structural changes in AD, aiding in diagnosis and disease tracking.

**SSK16-07 • Voxel-based Analysis of Quantitative Susceptibility Data Obtained from Subjects with AD and MCI**

**Hye Soo Koo** MD (Presenter) ; **Seong Jong Yun** ; **Kyung Mi Lee** MD ; **So Eo Jin Hwang** ; **Heok Gi Kim** ; **Chang-Woo Ryu** MD ; **Hak Young Rhee** ; **Yu Wang** PhD ; **Tian Liu** PhD ; **Geon-Ho Jahng** PhD

**PURPOSE**

To investigate quantitative susceptibility in three groups of subjects with cognitive normal (CN), mild cognitive impairments (MCI) and Alzheimer's disease (AD). Because AD is expected to have the most iron plaques, we expected that the AD brains would produce the least signals in comparison to the CN and MCI brains.

**METHOD AND MATERIALS**

Subjects of 20 CN, 21 MCI, and 21 AD participated after informed consent. A fully first-order flow-compensated three-dimensional (3D) gradient echo sequence ran to obtain magnitude and phase images, which were later used to produce final quantitative susceptibility mapping (QSM). Furthermore, 3D T1-weighted images were acquired for the brain tissue segmentation, image registration, and masking-out of non-brain tissues, including CSF and vessels. The QSM images were produced by implementing the Morphology Enabled Dipole Inversion (MED) method. The QSM images were smoothed using isotropic 4 mm Gaussian kernel, the differences of QSM data among the three groups were investigated by performing a voxel-based statistical analysis using a one-way analysis of variance (ANOVA) test with subject age and gender as covariates.

**RESULTS**

QSM values would decrease from CN to MCI and to AD. Compared with MCI subjects, QSM values in CN subjects were high in the left superior frontal gyrus and the left superior temporal gyrus. The lower signals were also found in the left superior frontal gyrus and the left superior temporal gyrus. Compared with AD group, the QSM values in CN subjects were high in the left parahippocampal gyrus and the left inferior frontal gyrus, but low in the right cingulate gyrus. Compared with AD patients, QSM values in MCI subjects were high in the right superior temporal and the left superior temporal, but low in the left middle frontal gyrus.

**CONCLUSION**

We were able to identify the brain regions in which the susceptibility changes occurred among the different groups. More differences were found when CN and AD groups were compared than when CN and MCI groups were compared.

**CLINICAL RELEVANCE/APPLICATION**

The local variations in amyloid plaque can cause local magnetic susceptibility variations. Quantifying iron concentrations in vivo is instrumental for understanding the role of iron in MCI and AD.

**SSK16-08 • Quantitative MRI Discrimination of Alzheimer's Dementia, Mild Cognitive Impairment, and Other Memory Disorders Using Volumetric MRI**

**Zachary T Berman** BA (Presenter) ; **Shamseldien Y Mahmoud** MD ; **Alexander Rae-Grant** MD ; **Jennifer Bullen** MSc ; **Nancy A Obuchowski** PhD ; **Stephen E Jones** MD, PhD

**PURPOSE**

To investigate whether automated quantitative MRI may be useful in discriminating AD, MCI, and other memory disorders in a cognitive disorders clinic.

**METHOD AND MATERIALS**

The clinical records were reviewed of 669 consecutive patients at the Lou Ruvo Center for Brain Health who underwent quantitative MRI using NeuroQuant (Cortech Inc), which computes the brain volumes of 48 regions. These numbers were compared with the presence and
type of dementia, whose gold standard was the clinical diagnosis made by neurologists, geriatricians, or general practitioners. Other clinical data collected included factors such as age, age of onset, and various test scores. These data were used to form a library to compare future patients whose dementia diagnosis is unknown. Specifically, a new patient's quantitative MRI is compared with the library of prior scans, and probabilities are provided associating the patient to either the presence of dementia or dementia type.

RESULTS
The 669 patients scanned with volumetric MRI were divided into three diagnoses; 328 were with Alzheimer's dementia, 262 with mild cognitive impairment, and 79 with age-related non-neurodegenerative memory loss. The attached figure shows the distribution of hippocampal volume for the three diagnoses. Using such data, including from other regions of the brain, probabilities are easily derived for any new patient with a quantitative volumetric MRI but without a diagnosis. These probabilistic maps may be useful in determining if a patient fits one of these three diagnostic categories given a specific set of MRI measures. We plan to apply this analysis prospectively to a cohort of patients seen in our cognitive disorders clinic to test the clinical utility of this procedure and analysis.

CONCLUSION
A center specific library of quantitative brain measures may be useful in categorizing patients with cognitive disorders. We review the initial results of our quantitative analysis and probabilistic maps generated during this analysis.

CLINICAL RELEVANCE/APPLICATION
Using institution specific libraries, quantitative volumetric MRI can be used to distinguish different cognitive disorders.

SSK16-09 • The Pattern of Metabolic Heterogeneity in the Hippocampus by 3T Multi-voxel Proton Spectroscopy in Alzheimer's Disease

Fei Chen MS (Presenter) ; Bing Zhang PhD ; Ming Li ; Xin Zhang MD, MS ; Yun Xu ; Bin Zhu ; Weibo Chen MSc

PURPOSE
We explore the metabolic changes in the head, body and tail of hippocampal in Alzheimer's disease (AD) compared with normal control. We also investigate the distribution rules of metabolites concentration among different parts of the hippocampus for more accurate clinical diagnosis of AD.

METHOD AND MATERIALS
Thirty patients with AD and 30 cognitively normal person (CN) were scanned by a 3.0 T magnetic resonance (MR) by Multivoxel proton spectroscopy (Achieva, Philips Medical Systems, Netherlands). The 8channels-HEAD coil was employed. The data was processed by commercially available postprocessing workstation (Extended Workspace (EWS), Philips Medical Systems, Netherlands). The hippocampus was divided equally into three parts (head, body and tail). N-acetylaspartate (NAA)/creatine (Cr) myoinositol (MI)/Cr and MI/NAA ratio were calculated separately from each part. We compared with each metabolites concentration data of AD and CN groups and analyzed the anteroposterior metabolic profile in hippocampus.

RESULTS
The mean value of NAA/Cr is decreased and that of MI/Cr, MI/NAA are elevated in the bilateral hippocampi and hippocampal body and tail in AD group (p < 0.01). MI/NAA in the head of left hippocampus is also increased statistically (p < 0.01). Fig.1 shows NAA/Cr in the bilateral hippocampi from head to tail have the gradually rising trend (p < 0.01) and MI/NAA gradually declines in CN group (p < 0.01). MI/Cr CN group and each metabolite concentration in AD group have no anteroposterior metabolic heterogeneity in bilateral hippocampi. (Fig.1).

CONCLUSION
The anteroposterior metabolic heterogeneity is dismissed in AD, which might be helpful on the early clinical diagnosis of AD.

CLINICAL RELEVANCE/APPLICATION
Application in the early diagnosis of AD.

Neuroradiology/Head and Neck - Wednesday Posters and Exhibits (12:15pm -12:45pm)

Wednesday, 12:15 PM - 12:45 PM • Lakeside Learning Center

LL-NRS-WEA • AMA PRA Category 1 Credit ™:0.5
Host
Pratik Mukherjee , MD, PhD *

LL-NRE-WE10A • The Concept and MR Imaging Features of Neuromyelitis Optica Spectrum Disorder (NMOSD)

Da Mi Kim (Presenter) ; In Ho Lee MD

PURPOSE/AIM
The purpose of this exhibit is:
To review the concept of neuromyelitis optica spectrum disorder (NMOSD)
To explain the magnetic resonance imaging features in the diagnosis of NMOSD

CONTENT ORGANIZATION
Diagnostic criteria and pathophysiology of NMOSD
Review of representative MR imaging findings in the spine, brain, and orbit lesions in neuromyelitis optica (NMO)
Discuss the relationship of autoantibodies (NMO-IgG/anti-aquaporin 4, anti-Ro antibody) and NMOSD

SUMMARY
The major teaching points are: 1. NMOSD, which includes a proportion of patients with recurrent longitudinally extensive myelitis (T2 high signal intensity in spinal cord and various enhancement in postcontrast T1-weighted image) or optic neuritis (T2 high signal intensity in optic nerve and nerve or nerve sheath enhancement in fat-suppressed, postcontrast T1-weighted image) and as well as associated with systemic autoimmune disease patient or with brain lesions typical of NMO corresponded to site of high anti-aquaporin 4 expression; these were hypothalamic, corpus callosal, periventricular, or brainstem (including medulla oblongata). 2. Patients with Sjögren’s syndrome or systemic lupus erythematosus who were NMO-IgG positive were likely to have a recurrent myelitis or optic neuritis, or brain lesions which suggests the coexistence of a NMOSD with their systemic autoimmune disorder.

LL-NRE-WE11A • Love the Fat in the Neck

Tina S Sanghvi MD (Presenter) ; Iliona M Schmalfuss MD *

PURPOSE/AIM
Fat planes play a critical role in the interpretation of head and neck studies and facilitate detection, localization and determination of the extent of lesions.

CONTENT ORGANIZATION
Enhanced detection and extent of pathology is possible with careful evaluation of often overlooked fat planes located in the orbital apex, pterygopalatine fossa, cranial nerve foramina, buccinator muscle, buccal space, peri-epiglottic and post-cricoid regions. Their normal
imaging appearance will be contrasted with examples of subtle, yet clinically significant, abnormalities which may be overlooked if not exclusively looked for. The presented pathology will include infections (e.g. dental phlegmon, invasive fungal disease), inflammatory disease processes (e.g. Tolosa-Hunt syndrome), primary neoplastic lesions (e.g. retromolar trigone, buccal mucosal, hypophyseal cancers) and secondary neoplastic involvement along various cranial nerves (e.g. trigeminal, facial and superior laryngeal nerves).

SUMMARY
Inclusion of often overlooked fat planes in the head and neck in the interpretation process will facilitate detection and identification of the extent of underlying pathology. This can immensely increase not only reporting accuracy and confidence, but also play a significant role in patient care and management.

LL-NRS-WE1A • Usefulness of Amide Proton Transfer Imaging in Grading Diffuse Gliomas: Comparison with Contrast-enhanced and Diffusion-weighted MR Imaging

Osamu Togao MD, PhD (Presenter) ; Takashi Yoshiura MD, PhD ; Jochen Keupp PhD * ; Akio Hiwatashi MD ; Koji Yamashita MD ; Kazuzumi Kikuchi MD ; Hiroshi Honda MD

PURPOSE
Amide proton transfer (APT) imaging is a specific type of endogenous chemical exchange saturation transfer (CEST) imaging for detection of the amide protons included in mobile proteins and peptides. The purpose of this study was to evaluate the usefulness of APT imaging in grading diffuse gliomas by comparisons with contrast-enhanced and diffusion-weighted imaging (DWI).

METHOD AND MATERIALS
RESULTS
High-grade gliomas (HGG, grade III or IV) showed significantly stronger contrast enhancement (P<0.001). APT imaging can provide better diagnostic performance in differentiating HGG from LGG compared with contrast-enhanced MR imaging and DWI.

CLINICAL RELEVANCE/APPLICATION
APT imaging can provide better diagnostic performance in discriminating HGG from LGG compared with conventional MR imaging sequences.

LL-NRS-WE2A • Three-dimensional Amide Proton Transfer Imaging of Gial Tumors: Correlational Analysis with Ki-67 Labeling Index, SUV and ADC

Akihiko Sakata MD (Presenter) ; Tomohisa Okada MD, PhD ; Akira Yamamoto MD, PhD ; Mitsunori Kanagaki MD, PhD ; Yasutaka Fushimi MD, PhD ; Emiko Morimoto MD ; Ryo Sakamoto ; Taha M Mehemed MBBCh ; Satoshi Nakajima MD ; Hirofumi Yamada ; Sachi Okuchi MD ; Benjamin Schmitt ; Katsutoshi Murata ; Kaori Togashi MD, PhD *

PURPOSE
Amide proton transfer (APT) MR imaging is a specific type of chemical exchange saturation transfer imaging to detect amide protons. Diagnostic performance of three-dimensional (3D) APT imaging in grading the glioma tumor and its correlations with other tumor proliferation markers, i.e. Ki-67 labeling index, minimum apparent diffusion coefficient (ADCmin) and maximum standardized uptake value (SUVmax), was investigated.

METHOD AND MATERIALS
This study is approved by institutional review board. Consecutive 19 patients with newly diagnosed glioma tumors scanned with both MRI (3 Tesla) and 18F-FDG-PET were included in this study. In this study, APT imaging was conducted using a 3D gradient-echo pulse sequence (TR/TE=8.3/3.3ms, Flip angle: 12°, 24 slices, resolution: 1.72×1.72×4mm) with a presaturation module consisting of five RF pulses with 99ms duration plus 100ms delay and 1.6?T amplitude. APT signal was calculated as the asymmetry of the magnetization transfer (TR/TE=8.3/3.3ms, Flip angle: 12°, 24 slices, resolution: 1.72×1.72×4mm) with a presaturation module consisting of five RF pulses with 99ms duration plus 100ms delay and 1.6?T amplitude. APT signal was calculated as the asymmetry of the magnetization transfer rate at 3.5 ppm: APT signal = (S[-3.5ppm] - S[+3.5ppm])/S0 × 100 %. Images of APT signal, ADC and SUV were coregistered to the FLAIR image and resliced using SPMB. For each subject, the same regions-of-interest were drawn and applied. The mean APT ratios were compared between high and low grades, and linear correlations were investigated between APT ratios and Ki-67, ADC min, or SUVmax. A p value (SUVmax) was 1.0%, 2.61 and -0.25×10^-3mm^2/s, respectively.

CONCLUSION
The mean APT signal was significantly higher in high grade gliomas (2.46±0.57) than in low grade gliomas (1.14±0.39). The APT signals had significant linear correlations with Ki-67 (R=0.72), SUVmax (R=0.73) and ADCmin (R=-0.72), and 1% increase of APT ratio corresponded to changes of 16.0%, 2.61 and -0.25×10^-3mm^2/s, respectively.

CLINICAL RELEVANCE/APPLICATION
APT ratio had high correlations with other indexes of malignancy and would contribute as another marker of malignancy with different contrast mechanism.

LL-NRS-WE3A • Diffusion-weighted Magnetic Resonance Imaging for Monitoring Early Treatment Response to Chemoradiotherapy of Nasopharyngeal Carcinoma

Chen Yunbin MD ; Xiangyi Liu BS (Presenter) ; Dechun Zheng MS ; Luying Xu BS ; Xisheng Cao BS ; Linfeng Cai BS ; Weibo Chen MSc ; Jianji Pan

PURPOSE
To prospectively evaluate the feasibility of Diffusion-weighted magnetic resonance imaging (DWI) for monitoring early treatment response to Chemoradiotherapy (CRT) of Nasopharyngeal Carcinoma (NPC).

METHOD AND MATERIALS
RESULTS
A significant increase in ADC was observed at each stage of therapy (P<0.001) in lesions of primary and metastatic (Graph 1). The ADC values, ADC changes (?)ADC and percentage ADC changes (%ADC) of day 20 in responders were significantly higher than in non-responders for both primary lesions(p=0.01, p=0.005, p=0.007) and metastatic lymph nodes (p=0.002, p=0.005, p=0.005) (Graph 2). There was a significant positive correlation between %ADC of day 20 and percentage size reduction after NAC in primary lesions (p=0.016) and metastatic lymph nodes (p=0.008). Non-responders achieve a higher rate of residual for primary lesions (P=0.008) and metastatic lymph nodes (P=0.005) than responders.

CONCLUSION
DWI with ADC change allows for detecting early treatment response of NPC. 20 days after NAC initiation might be the optimal time for monitoring and predicting early treatment response.

CLINICAL RELEVANCE/APPLICATION
Measurement of ADC dynamic change early after chemotheraphy is feasible for evaluating treatment effect. Thus, it provides the opportunity to adjust following treatment regimen.

LL-NRS-WE4A • Radiation Necrosis, Pseudo-progression, and Tumor Recurrence: A Diagnostic Dilemma
RESULTS
A total of 27 patients with primary brain tumors comprising of 44% (12/27) glioblastomas, 26% (7/27) grade 3 astrocytomas and 30% (8/27) grade 2 tumors (Grade 1-2) were included. A subset of patients, 41% (11/27), had MR perfusion imaging and 41% (11/27) had MR spectroscopy imaging. 87% (13/15) had equivocal findings on conventional MR, an FDG PET-CT was useful in delineating radiation changes from true recurrence, as evidenced by imaging follow up and surgical pathology in a subset. 3.7% (1/27) FDG PET-CT had false negative results, with pathology proven recurrence subsequently. 7.4% (2/27) FDG PET-CT were false positive at another site, different from the site of concern on conventional MR. FDG PET-CT and MR perfusion had concordance rates of 45% (5/11); FDG PET-CT and MR spectroscopy had concordance rates of 73% (8/11). Combining all three modalities, the diagnostic utility of imaging was increased to 83% (10/12), in patients who either had FDG PET-CT with either MR perfusion or MR spectroscopy.

CONCLUSION
Multimodal advanced MR imaging with perfusion, MR spectroscopy and FDG PET CT brain is advantageous in diagnostic considerations of high grade recurrence versus radiation necrosis/pseudo-progression.

CLINICAL RELEVANCE/APPLICATION
Combined multimodality approach can be helpful in describing recurrence versus pseudo-progression.

LL-NRS-WE5A • Resting State fMRI in the Presurgical Patient with Brain Malignancy Is Feasible and Reproducible and Shows Good Correlation with the Active Task fMRI
Tom De Beule MD (Presenter); Sofie Van Cauter MD; Felice D’Arco MD; Ronald Peeters; Stefan Sunaert MD

PURPOSE
To determine the feasibility of resting state functional MRI (fMRI) in patients with brain tumors in the presurgical workup in order to map eloquent functional areas and to correlate with active task fMRI.

METHOD AND MATERIALS
Resting state fMRI was performed in 22 patients,(GE-EPI;TR 1.7 s; TE 40ms) (two third male with a mean age of 42) with known brain tumors, as an addition to the routine presurgical workup, consisting of task-based fMRI (language and motor), diffusion tensor imaging and anatomical imaging.

Analysis of fMRI data was done in FSL with an independent component analysis. The results were visually scored for the presence of the following resting state networks: default mode network, dorsal attention network, ventral attention network, extrastriate visual network, right and left parietofrontal network. We furthermore scored the classical primary motor network, primary visual network, auditory and the language network. A visual comparison was then made between the language and motor areas as delineated in the active task fMRI and the networks in fMRI as calculated with FSL.

RESULTS
The fMRI sequence showed data of good quality and a full analysis could be achieved in all scanned patients. The default mode network and the primary visual cortex were demonstrated in all patients, dorsal attention and ventral attention networks in 20 patients, motor functions in 19, language and auditory cortex in 19 patients. In almost all patients the supplementary motor area (SMA) was visible. We did a visual correlation with the standard task based fMRI. The full language network correlated visually in 19 out of 22 patients. The SMA had a positive correlation in 16 patients. The derived motor network showed large similarity to the active task fMRI in 15 of 18 patients.

CONCLUSION
Resting state fMRI is feasible to perform in the presurgical workup of patients with brain tumors. We could demonstrate the typical resting state networks, the motor and language network with fMRI in a high percentage of the patients in our study group and a fairly good correlation could be made with the active task fMRI for language and motor areas

CLINICAL RELEVANCE/APPLICATION
fMRI in determination of eloquent functional areas can be of assistance in brain tumor patients with poor compliance, for which it might be difficult to perform a cognitive demaning active fMRI.

LL-NRS-WE6A • Slice Accelerated Dynamic-Susceptibility Contrast Enhanced (DSC) MRI
Dingxin Wang PhD (Presenter) *; Charles Cantrell MS; Bruce Spottiswoode PhD *; Vibhas Deshpande PhD *; Timothy J Carroll PhD; Keith Heberlein PhD *

PURPOSE
Slice acceleration techniques simultaneously excite multiple slices with multiband RF pulses and use parallel imaging to separate aliased slices. In this study, we investigated the feasibility of using slice accelerated EPI for DSC-MRI measurement with reduced volume acquisition time (TR) and experimentally demonstrated the effect of reduced sampling rate on the DSC-MRI perfusion analysis.

METHOD AND MATERIALS
All experiments were performed using a 3.0T Siemens Magnetom Skyra MRI with 20-channel head and neck coil. The slice accelerated DSC-MRI was performed using an GRE-EPI sequence with 3 fold slice acceleration (12 slices, TR/TE = 509/35 ms). Dynamic images were acquired following IV injection of Gd-DTPA contrast agent. SVD-based deconvolution method was used to compute tissue residue function. Data from fully sampled data (TR = 509 ms) and down sampled data (TR = 1527 ms) were calculated for comparison.

RESULTS
Slice accelerated DSC-MRI was successfully performed on 4 subjects. The CBV maps from TR = 509 ms and 1527 ms look qualitatively similar, but the spatial distributions of CBF maps seem quite different. While the MTT maps from TR = 1527 ms show relatively small variation in the brain parenchyma, the MTT maps from TR = 509 ms show tissue dependent contrast. Additionally, the Tmax maps from TR = 509 ms show more subtle spatial variation than the Tmax maps from TR = 1527 ms which appear to bin at the TR (1.527 s) across the brain. This may indicate delay and dispersion effect and the T_max's sensitivity to sampling rate (TR).

CONCLUSION
Our study demonstrates the feasibility of using slice accelerated EPI for DSC-MRI measurement and shows the evidence of association between sampling TR and perfusion parameters. The MTT and Tmax maps with faster TR sampling (509 ms) of perfusion data provide...
Multimodality imaging with CT and MRI can facilitate optimum clinical management.

****Multimodality imaging with CT and MRI can facilitate optimum clinical management.**

Familiarity with bony anatomy and various orbital foramina is essential to accurately delineate extent and spread of disease in and around the orbit. Multimodality imaging with CT and MRI can facilitate optimum clinical management.

**SUMMARY**

2. Perineural spread of tumors and infections.
5. Infective/Inflammatory: Orbital cellulitis, pseudotumour, Tolosa-Hunt syndrome, granulomatous abnormalities.

**CLINICAL RELEVANCE/APPLICATION**

Slice accelerated EPI for DSC-MRI allows faster volume sampling time (TR) which may potentially provide more accurate DSC perfusion maps for patient care of ischemic stroke.

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**LL-NRE-WE7A • Cerebral Vascular Leaks in a Mouse Model of Alzheimer's Disease Measured by Nanoparticle CT Contrast**

Ananth Annapragada PhD (Presenter); Zbigniew Starosolski PhD; Stephanie Fowler PhD; Eric Tanifum PhD*; Ketan B Ghaghada PhD*; Joanna Jankowsky PhD

**PURPOSE**

BBB leaks are of critical importance in the delivery of therapeutic molecules and molecular imaging agents to CNS lesions. We investigated the leakiness of the BBB in a mouse model of Alzheimer's disease, using a novel liposomal CT contrast agent. We hypothesized that BBB leaks would correlate with amyloid deposits.

**METHOD AND MATERIALS**

**RESULTS**

All animals showed avid leaks in the choroid plexus and circumventricular organs. AD+ mice, showed cortical and olfactory spheroidal leaks, and perivascular leaks in the medial orbitofrontal artery (MOFA), rostral rhinal vein (RRV) and great cerebral vein of Galen (GCVG) in Figure. In AD- mice, the spheroidal leaks were absent, but the perivascular leak was detectable. Intensities varied widely, differences were insignificant at the 90% confidence level, with one exception: cortical spheroidal leaks were higher in the AD+ mice. However, no correlation with the amyloid plaques was observed. The radiation dose had no visible effect.

**CONCLUSION**

The BBB is permeable to 120nm liposomal particles in the region of the choroid plexus and circumventricular organs. AD+ mice show unique cortical and perivascular leaks that do not correlate with amyloid deposits, but could be confounded by simultaneous clearance of extravasated particles.

**CLINICAL RELEVANCE/APPLICATION**

Leakage of 120nm particles in the choroid plexus, circumventricular organs and cerebral cortex suggests the deliverability of payload to these sections of the brain.

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**LL-NRE-WE8A • Application of Diffusion Techniques to Common Clinical Problems in Spine Imaging**

Zombor Zoltani MD (Presenter); Vahe M Zohrabian MD; M. Alex Dresner PhD*; Richard J Gorniak MD; David S Chiang MD; Adam E Flanders MD

**PURPOSE/AIM**

The purpose of this exhibit is:

- To review the principles behind diffusion tensor imaging.
- To review the acquisition methods available on modern clinical scanners.
- To illustrate through examples and review of the literature the clinical utility of DWI and DTI in assessment of spinal cord injury, myelopathy, multiple sclerosis, infection, spinal cord infarction and oncology.

**CONTENT ORGANIZATION**

- Introduction to DWI and DTI
- Principles of DWI and DTI acquisition methods on modern clinical scanners
- Clinical utility
- Spinal cord injury (SCI)
- Spondylotic and oncologic myelopathy
- Multiple sclerosis, assessment of normal appearing spinal cord
- Spinal cord infarction, differentiation from other entities
- Spinal infection
- Oncologic applications in differentiating etiologies
- Advanced applications of DWI and DTI
- Tractography for pre-operative planning for tumor resection
- Tractography for pre-embolization planning and follow up for spinal AVM
- Shortcomings of diffusion as a problem solving tool

**SUMMARY**

The major teaching points of this exhibit are:

- DWI and DTI of the spine and spinal cord are technically feasible on modern clinical scanners.
- Diffusion techniques have some practical added value in specific clinical scenarios in spine imaging.

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**LL-NRE-WE9A • “All Eyes on the Exits”?: Imaging of Routes of Spread of Intraorbital Pathologies**

Ananya Panda MBBS, MD (Presenter); Sanjay Sharma MD; Chandan J Das MD

**PURPOSE/AIM**

1) To review the radiological anatomy of various orbital foramina. 2) To depict the foraminal and extra-foraminal routes by which the intra-orbital pathologies spread outside.

**CONTENT ORGANIZATION**

- Description of radiological anatomy of various orbital foramina such as superior orbital fissure, optic canal, inferior orbital fissure, nasolacrimal duct.
- To discuss the pathologies extending across these foraminal and extra-foraminal routes into adjacent regions. These will include:
  1) Neoplastic: Optic nerve sheath glioma, meningioma, retinoblastoma, lymphoma, leukemia, metastases.
  2) Perineural spread of tumors and infections.
  3) Vascular: Carotico-cavernous fistula, vascular malformations.
  4) Cystic lesions: Dacrocystocele, dermoid.
  5) Infective/Inflammatory: Orbital cellulitis, pseudotumour, Tolosa-Hunt syndrome, granulomatous abnormalities.

**SUMMARY**

- A heterogenous spectrum of pathologies can manifest and spread via the natural defects in the orbit.
- Familiarity with bony anatomy and various orbital foramina is essential to accurately delineate extent and spread of disease in and around the orbit.
- Multimodality imaging with CT and MRI can facilitate optimum clinical management.
PURPOSE/AIM
Given the recent advances made in reconstructive facial surgery after tumor resection, this exhibit will educate the attendee on the various types of reconstructive flaps used to reconstruct the face after tumor surgery. In addition, complications which may occur will also be reviewed.

CONTENT ORGANIZATION
Using the case files from a major academic teaching institution with an active Head and Neck tumor service, various forms of reconstructive techniques will be described with an emphasis on the use of flaps. This exhibit will divide the face into regions, with review of the different types of surgery and reconstructive procedures of the orbit, the sinonasal cavity, and the oral cavity. Complications which may occur will also be reviewed.

SUMMARY
This exhibit serves to review the types of surgeries performed in the face with regard to neoplasm, and the various techniques used to reconstruct these regions. This topic is of major relevance to all radiologists who find these studies challenging and difficult to understand, interpret, and master.

PURPOSE/aim
To review the use of multimodality imaging in complex cases of hyperparathyroidism which have failed initial surgical and medical treatment

CONTENT ORGANIZATION
1. Review the rationale behind imaging with CT, MRI, ultrasound, and nuclear medicine in cases of primary and secondary hyperparathyroidism. 2. Demonstrate the utility of advanced imaging with dynamic CT, MRI, and dual isotope nuclear medicine scintigraphy in more complex cases, especially in those that have failed initial therapy. 3. Illustrate potential mimics of disease as well potential pitfalls in locating ectopic disease. 4. Discuss and illustrate the difference between multimodality imaging protocols in primary and secondary hyperparathyroidism.

SUMMARY
The major teaching points of this educational exhibit are: 1. While uncomplicated cases of primary hyperparathyroidism can be treated with direct surgical exploration without imaging, recurrent/residual disease can be a complex problem to image and treat. 2. Multimodality imaging with dynamic CT, MRI, ultrasound, and/or dual isotope nuclear medicine scintigraphy can help localize ectopic adenomas and multifocal disease. 3. The ability to effectively utilize all these modalities when necessary can help limit surgical exploration, treat recurrent disease, and deal with more complex cases, including secondary hyperparathyroidism.

PURPOSE/AIM
Benign meningiomas have a lower postsurgical recurrence rate in comparison with aggressive meningiomas. The Ki-67 proliferation index (PI) is known marker of tumor proliferation and a value of 4 has been associated with aggressive meningiomas. The apparent diffusion coefficient (ADC) is used to quantify cellularity of the tumors. Our goal was to see: 1) if there is a statistically significant correlation between ADC and Ki-67 PI in low grade meningiomas; and 2) if the ADC values can help stratify low grade meningiomas and predict their recurrence.

METHOD AND MATERIALS
Materials and Methods: MRI exams and histopathology of forty-six surgically treated low-grade meningioma patients (WHO grade I) were retrospectively reviewed. All MRI examinations were performed on 1.5-T clinical scanners. Mean ADC values were calculated on ADC maps derived from diffusion MR Imaging. Correlation coefficients were calculated for mean ADC and Ki-67 PI values using linear regression. An independent unpaired Student's t test was used to compare the ADC in low Ki-67 PI group (RESULTS

CONCLUSION
Conclusion: The ADC values in low-grade meningiomas with higher Ki-67 PI are significantly lower than those with low Ki-67 PI. Thus, low ADC values in low-grade meningioma could suggest a higher risk of recurrence.

CLINICAL RELEVANCE/APPLICATION
Clinical relevance/applications: Low ADC values in low-grade meningioma could suggest a higher risk of recurrence, therefore increased post-surgical surveillance in low-grade meningiomas with low ADC

PURPOSE/AIM
To determine whether radiologists assessment of thyroid nodules can predict malignancy following a cytologic diagnosis of atypia of uncertain significance (AUS) or follicular lesion of undetermined significance (FLUS).

METHOD AND MATERIALS
Patients with initial diagnosis of AUS or FLUS on fine needle aspiration (FNA) were evaluated. Ultrasound images of the thyroid were reviewed by two board certified radiologists blinded to the final pathologic diagnosis. When initial interpretation differed, consensus was reached with a second blinded review. Lesions were assessed in three ways: 1) Mayo Pattern Classification as benign, indeterminate, or worrisome for malignancy, scored on a scale of 1-5 based on radiologist assessment of likelihood of malignancy, and 3) given a final diagnosis of benign or malignant.

RESULTS
126 patients with diagnosis of AUS or FLUS on FNA were identified. Of these patients, 41 had conclusive final pathologic diagnosis and...
diagnostic ultrasound imaging. Twenty one patients had benign histology, 16 were malignant, and 4 had incidental microcarcinomas (papillary cancer < 10 mm).

Mayo score of benign was 100% accurate for benignity. Lesions with Mayo score of indeterminate were malignant 41% (11/27) and benign 59% (16/27). Lesions with Mayo score of malignant were malignant 91% (10/11) and benign in 9% (1/11) of patients.

Radiologist binary classification of thyroid nodules as either benign or malignant showed 78% overall accuracy. However, when microcarcinomas were excluded from the analysis, radiologist assessment increased to 86% accuracy. Of the 26 lesions assessed as benign by radiologists, 20 were benign on final pathology, 4 were microcarcinomas, and 2 were malignant. Of 15 lesions assessed as malignant by radiologists, 13 were malignant (87%) and 2 were benign.

CONCLUSION
Radiologist assessment of thyroid nodules in cases of AUS or FLUS is highly predictive of final pathology and can help determine management of thyroid nodules with this pathologic diagnosis. Lesions in which the radiologist was incorrect in prediction were very often considered to be indeterminate in sonographic characteristics.

CLINICAL RELEVANCE/APPLICATION
The Bethesda System for reporting thyroid cytopathology (2009) created category III: AUS or FLUS, which often requires further invasive testing or surgery.

LL-NRS-WEB3 • The Role of Diffusion Susceptibility Perfusion Imaging in Assessing Recurrent Glioblastoma Multiforme Early Response to Superselective Intra-arterial Bevacizumab Therapy

Karthis Kesavahotha (Presenter); Sirish Kishore MD; Ilhiami Kovanlikaya; John A Boockvar MD; Apostolos J Tsioris MD *

PURIPOSE
At our institution, we have been conducting phase I and II studies of super-selective intra-arterial cerebral infusion (SIACI) of bevacizumab (BV) in the setting of recurrent glioblastoma multiforme (GBM). BV is known to reduce vessel permeability, which contributes to changes in enhancement features and potentially confounds the relationship between enhancement and tumor biology. Hence, the ability of conventional MRI to determine tumor response, progression, and post-treatment effects is limited. Here we have begun to evaluate the potential for using dynamic susceptibility contrast imaging (DSC-MRI)-derived maps of relative cerebral blood volume (rCBV) to determine early GBM tumor response to super-selective intra-arterial BV treatment. These rCBV changes will then be correlated with tumor progression and patient survival.

METHOD AND MATERIALS
Forty adult patients with recurrent WHO grade IV glioma from an ongoing serial Phase I/II study of SIACI of BV were retrospectively studied. Pre- and post BV treatment gadolinium-enhanced brain DSC-MRI were done within the time frame of a few days prior to and 3-5 weeks after intra-arterial infusion of BV. Functional rCBV maps have been obtained on a GE Advantage Workstation (AW) V4.3 running functions MR perfusion software. Two distinct regions of interest (ROIs) were chosen from the rCBV maps: 1) area of highest rCBV in tumor region and 2) normal appearing white matter (NAWM) in the contralateral side which was used to normalize rCBV maps.

RESULTS
Preliminary results from 18 patients in the cohort looking at normalized rCBV have been promising. The median percentage change in normalized rCBV at 1 month post-SIACI BV is -39.3% for patients with survival greater than 100 days post-treatment, -3.6% for patients who survived less than 100 days, and -38.8% overall. Of the 13 patients who remained in the trial without further SIACI treatments, the Pearson correlation coefficient between BV dose and normalized rCBV change at 1 month was -0.80 (n = 13, p-value of 0.001).

CONCLUSION

CLINICAL RELEVANCE/APPLICATION
By looking at local rCBV changes following intra-arterial bevacizumab treatment, this study aims to gain further insight into predicting glioblastoma tumor response and ultimately patient survival.

LL-NRS-WEB4 • Evaluation of Cerebral Perfusion by Using 3D-arterial Spin Labeling and FLAIR MR Imaging in Patients with Chronic Cerebrovascular Stenosis: A Comparative Study with I-123-Iodoamphetamine Single Photon Emission CT

Matakazu Furukawa MD (Presenter); Etsushi Iida; Naofumi Matsunaga MD, PhD

PURPOSE
Although arterial spin labeling (ASL) MR imaging is an emerging technique for noninvasive measurement of cerebral blood flow (CBF), intravascular signal (IVS) often complicates the calculation of quantitative CBF. We assessed whether ASL with single post-label delay time and IVS on fluid attenuated inversion recovery (FLAIR) image could identify the CBF deficiency in patients with chronic cerebrovascular diseases, using 123I-IMP SPECT as a standard reference.

METHOD AND MATERIALS
Fifty-three patients with unilateral (n=35) or bilateral (n=18) cerebrovascular stenosis underwent CBF evaluation by 3D-GRASE ASL (FOV 256 mm, matrix 64 x 64, 32 slices, TR/TE/TI 5,000/16/1,800 msec) and 123I-IMP SPECT within a mean interval of four days (range: 0-28 days). Quantitative CBF and cerebrovascular reserve (CVR) measurement by 123I-IMP SPECT was used as a standard reference.

RESULTS
Fifty-three patients with unilateral (n=35) or bilateral (n=18) cerebrovascular stenosis underwent CBF evaluation by 3D-GRASE ASL (FOV 256 mm, matrix 64 x 64, 32 slices, TR/TE/TI 5,000/16/1,800 msec) and 123I-IMP SPECT within a mean interval of four days (range: 0-28 days). Quantitative CBF and cerebrovascular reserve (CVR) measurement by 123I-IMP SPECT was used as a standard reference.

CONCLUSION
The agreement between readers for ASL and IVS on FLAIR was strong, with a weighted Kappa value of 0.73 and 0.87, respectively. When a cut-off value of 10% was used on rest 123I-IMP-SPECT, 22 of 53 patients showed CBF difference between bilateral MCA territories. On 3D-ASL, 45 patients showed visual CBF difference, and the sensitivity, specificity, diagnostic accuracy of 3D-ASL were 91%, 19%, and 49%, respectively. Although the sensitivity was poor, 16 of 25 false-positive patients on 3D-ASL showed >10% CBF difference on post-acetazolamide 123I-IMP-SPECT, predicting the CVR impairment. IVS on FLAIR image was seen in 19 patients, and the sensitivity, specificity, accuracy to rest 123I-IMP-SPECT were 55%, 77%, and 68%, respectively. The specificity and PPV of IVS on FLAIR was both 100% with a sensitivity of 49% to post-acetazolamide 123I-IMP-SPECT.

CONCLUSION
Although 3D-ASL MR imaging showed a low specificity, 3D-ASL and IVS on FLAIR imaging would potentially provide valuable information regarding the impaired vasoreactivity. ASL perfusion MR imaging showed high sensitivity and would be clinically applicable, especially for a screening of cerebral hypoperfusion.

CLINICAL RELEVANCE/APPLICATION
3D-ASL perfusion MR imaging combined with intravascular signal on FLAIR imaging would be clinically applicable, especially for a screening of chronic cerebral hypoperfusion.

LL-NRS-WEB5 • Evaluating the Optimum MR Based Attenuation Correction Method for F-18 Florbetapir Imaging on Hybrid PET/MR

Sebastian R McWilliams MBBCh (Presenter); Yi Su PhD; Richard Laforest PhD; Brian Rubin; Jonathan E McConathy MD, PhD *; Agus Priatna PhD *; Tammie S Benzinger MD, PhD *

PURPOSE
Evaluating the Optimum MR Based Attenuation Correction Method for F-18 Florbetapir Imaging on Hybrid PET/MR
MR attenuation correction (MRAC) in hybrid PET/CT imaging poses challenges for accurate quantification. CT attenuation correction (CTAC) provides an approximation of mass attenuation based on tissue density. To assess the accuracy of factory MRAC methods, two methods were compared to CTAC for a series of patients that had PET/CT and PET/CT/MR as part of the same cerebral amyloid PET study.

METHOD AND MATERIALS
Study patients underwent 18F-florbetapir imaging on a Biograph mMR scanner with reference PET/CT images acquired on a Biograph 40 PET/CT scanner utilizing the same tracer injection; emission images used for analysis were acquired from 50-70 minutes post-injection. Dixon and UTE-based MRAC were performed on the PET/MR-acquired data and attenuation maps generated. The CTAC attenuation map (mu-map) was co-registered with the MRAC calculated maps. In order to analyze structure dependent variation, segmentation of the cerebral structures was performed using FreeSurfer on T1-weighted MR data and PET emission data. Standardized uptake value ratios (SUVRs) were calculated relative to the cerebellar cortex for MRAC and CTAC data and their correlation assessed with a linear best-fit line.

RESULTS
UTE MRAC incorrectly assigned air attenuation coefficients to intracranial structures thus was excluded from analysis. Compared to CTAC, there was a 9.6% underestimation of activities in all regions by Dixon MRAC. The inferior temporal cortex (-18.2%), pars orbitalis (-16.3%), and lateral occipital cortex (-14.4%) had the highest percent error. Accuracy improved for deeper structures including the precuneus (-2.6%), thalamus (+1.9%), and cerebellar cortex (-5.6%). The precuneus SUVR was overestimated by 7.8% and the mean cortical SUVR (MCSUVR) by 5.3%. The SUVR values were correlated at the precuneus (r=0.95) and for the MCSUVR (r=0.97).

CONCLUSION
When compared to CTAC-corrected activities and SUVRs, Dixon MRAC generally led to underestimation of values with spatial variation. There was strong correlation between SUVRs of the two methods. Further patients are being analyzed to identify the most accurate method of MRAC when applied to cerebral amyloid PET/MR imaging.

CLINICAL RELEVANCE/APPLICATION
The optimum MR attenuation correction method for PET/MR is not established in cerebral amyloid PET. Comparison with coregistered CTAC images allows accuracy of different MRAC methods to be assessed.

LL-NRS-WE6B • Incidental Thyroid Cancers Detected on Imaging: Retrospective Review of a 10-year Experience
Manisha Bahl MD, MPH (Presenter) ; Julie A Sosa MD ; Kingshuk Choudhury PhD ; Nathan Wnuk MSc, BSc ; Jenny K Hoang MBBS *

PURPOSE
To determine trends in imaging-detected incidental thyroid cancer diagnosis and characteristics of incidental and nonincidental cancers.

METHOD AND MATERIALS
We performed a retrospective review of 1721 patients who underwent thyroidectomy or lobectomy from 2003 to 2012. Medical records were reviewed for patient demographics and pathology results. For patients with malignancy, incidental cancer was defined as asymptomatic patients presenting with incidental thyroid nodules (ITN) on imaging or those with incidental cancers on the surgical specimen when surgery was performed for another reason. Cancer characteristics were compared for the incidental and nonincidental groups. We observed the 10 year trend in number of surgeries and incidental malignancy.

RESULTS
Of 1721 patients who underwent surgery, 578 patients had surgically confirmed thyroid cancer, of which 162 (28%) were incidental cancers. 86 (15%) were cancers detected incidentally by imaging and 76 (13%) were cancers detected incidentally on the pathology specimen. Incidental cancers on imaging represent less than 5% of all thyroid surgeries. The mean size of incidental tumors by imaging and pathology were 17 mm and 9 mm, respectively, compared to 21 mm for nonincidental tumors. Nodal metastases were present in 24/86 (28%) of incidental tumors by imaging and 5/76 (7%) of incidental tumors by pathology, compared to 138/416 (33%) for nonincidental tumors. The metastases were confined to the central compartment for incidental cases in 20 of the imaging detected group and all of the pathology group, compared to 81 in the nonincidental group.

Over a ten year period, there was a trend in increasing number of thyroid surgeries, malignancies, and incidental malignancies each year. From 2003 to 2012, there was a 181% increase in surgeries (from 77 to 216). The number of malignancies increased from 20/77 (26%) in 2003 to 95/216 (44%) in 2012. The proportion of cancer detected incidentally by imaging increased from 3/77 (4%) to 18/216 (8%).

CONCLUSION
Imaging-detected incidental thyroid cancers are uncommon, but have doubled over the last decade. Compared to nonincidental cancers, incidental cancers are less aggressive tumors with lower rates of metastatic disease.

CLINICAL RELEVANCE/APPLICATION
Workup of ITN on imaging may be increasing the number of cancer diagnoses, but they only represent a small proportion of diagnosed malignancies. Guidelines may help to reduce ITN workup.

LL-NRS-WE7B • Therapeutic Effect of Ultrasound-guided Radiofrequency Ablation for Small Recurrent Thyroid Cancers: Comparison with Reoperation
Ji-Hoon Kim MD (Presenter) ; Chul Ho Sohn MD ; Seung Hong Choi MD, PhD ; Tae Jin Yun MD

PURPOSE
Treatment of small recurrent thyroid cancer is a therapeutic dilemma. The purpose of this retrospective study was to compare the therapeutic effect of radiofrequency ablation (RFA) for small recurrent thyroid cancer with that of reoperation.

METHOD AND MATERIALS
Between February 2008 and November 2011, 101 patients (27 men, 74 women; mean age, 51.3 years) with small recurrent thyroid cancers were included with the following criteria: (1) 3 or fewer recurrent well-differentiated thyroid cancers of 1.5 cm or less in size (2) the number, size, location of the recurrent tumors, and serum thyroglobulin showed also no significant difference. During mean 23 months follow-up, the rate of tumor recurrence (6.7% vs. 4.3%) and negative conversion rate of serum thyroglobulin (68.4% vs. 68.3%) were not significantly different between RFA and reoperation groups. However, in contrast to no occurrence in RFA group, post-procedure hypocalcemia occurred exclusively in reoperation group (13.1%). The rate of post-procedure hoarseness (3.3% vs. 7.2%) was not significantly different between RFA and reoperation groups.

CONCLUSION
RFA appears to be an effective and safe alternative option to reoperation for controlling small recurrent thyroid cancers.

CLINICAL RELEVANCE/APPLICATION
For controlling small recurrent thyroid cancers, radiofrequency ablation appears to be an effective and safe alternative option to reoperation.
Post lumbar puncture headache (PLPH) is a common complication of lumbar puncture (LP) and is characterized by orthostatic headache.
that worsens when a patient moves from a supine to upright position. Blood patch, the injection of autologous blood near the puncture site, is the standard treatment of lasting PLPH. Though the exact cause of PLPH is uncertain, hypothesized causes include downward pull on pain-sensitive structures in the brain due to cerebrospinal fluid (CSF) leakage through the post-puncture opening. This study investigates whether whole brain volume affects risk of positional PLPH requiring blood patch (BPHA).

METHOD AND MATERIALS
Community-dwelling volunteers enrolled in prospective studies of memory and aging (n = 661) aged 43 to 91 years received LPs, 373 of which also received MRI scans for brain volume. Whole brain volume was calculating using FreeSurfer and normalized to intracranial volume (ICV). Logistic regression was used to determine effects of risk factors age, gender, and whole brain volume on risk of severe headache.

RESULTS
Of the 661 unique participants (285 male), 28 (5 male) experienced BPHA. As shown in previous studies, young age (p

CONCLUSION
Our finding that greater whole brain volume is correlated with BPHA risk is in accordance with the theory that PLPH is caused by the downward pull on pain-sensitive structures in the brain. Those people with larger brain volume are potentially more likely to have the brain to come into contact with the skull following lumbar puncture.

CLINICAL RELEVANCE/APPLICATION
Larger brain volumes are associated with risk of post-LP headache requiring blood patch; consideration should be given to recommending extra precautions for LP patients with large brain volumes.

SSM14-02 • Minimizing Iatrogenic Meningitis and Spinal Headache: Current Practice Patterns of Neuroradiologists in the Academic Setting

Yi C Zhang MD (Presenter) ; Alexander Chandler MD ; Nolan J Kagetsu MD *

PURPOSE
Iatrogenic bacterial meningitis and dural leak resulting in spinal headache are serious sequelae of lumbar punctures and myelograms. Although the CDC and American Academy of Neurology have issued standardized techniques for dural puncture including use of facemasks and atraumatic spinal needles, there is a wide range of practice patterns. We undertook a survey of neuroradiologists with academic affiliations to evaluate the degree of technical compliance towards mitigating iatrogenic meningitis and dural leak.

METHOD AND MATERIALS
In February 2013 we surveyed neuroradiology fellows and attendings in the email directory of the Association of Program Directors in Radiology. We queried use of facemasks, use of atraumatic needles, and dural puncture practices. We sent a repeat questionnaire five weeks later. All data were collected anonymously.

RESULTS
A total of 96 survey responses were received. Only 48% always wear a facemask during lumbar punctures, and only 51% during myelograms. A majority of respondents (91%) use the Quincke cutting needle by default, compared to only 26% who have ever used atraumatic needles. Only 16% of respondents prescribe immediate post-procedure mobilization, which has been shown to reduce spinal headache. There are no statistically significant differences between attending neuroradiologists and fellows for these results.

CONCLUSION
Many neuroradiologists only partially conform to standard guidelines designed to prevent iatrogenic meningitis and spinal headache. Approximately half of the respondents do not wear facemasks during dural puncture, placing patients at risk for iatrogenic meningitis. Only 26% of neuroradiologists use atraumatic needles which have been shown to reduce dural leak. Only 16% of neuroradiologists prescribe immediate post-procedure mobilization which has been shown to decrease the incidence of spinal headaches and the length of required post-procedure monitoring.

CLINICAL RELEVANCE/APPLICATION
Use of facemasks and atraumatic needles in conjunction with immediate post-procedure mobilization reduce the risk of iatrogenic bacterial meningitis and spinal headache.

SSM14-03 • Functional Imaging Using 3D High-sampling-Efficiency Technique (SPACE) versus Conventional CSF Flow Techniques in Patient with Hydrocephalus at 3 Tesla

Murat Ucar (Presenter) ; Melike Guryildirim ; Ali Yusuf Oner MD ; Nil Tokgoz ; Alp Borcek ; Koray Kilic ; Koray Akkan ; Turgut E Tall MD *

PURPOSE
To evaluate the diagnostic accuracy of high spatial resolution three-dimensional magnetic resonance cerebrospinal fluid (CSF) flow with a high-sampling-efficiency technique (sampling perfection with application optimized contrasts using different flip angle evolutions [SPACE]) versus TSE T2 (2 mm section thickness without flow compensation) over detection of aqueductal patency (AP) in patient with hydrocephalus, using three-dimensional (3D) constructive interference in the steady state (CISS) and cine phase contrast (Cine PC) sequences as reference standard at 3tesla.

METHOD AND MATERIALS
68 patients with hydrocephalus who were suspected aqueductal stenosis and had 3.0T CSF flow MR imaging were included. In addition to routine sequences which consisted of sagittal TSE T2, 3D-CISS, and axial-sagittal cine PC, sagittal 3D-T2 SPACE was obtained to evaluate the cerebral aqueduct by two radiologists, independently. AP and visibility of flow void were scored on the TSE T2 and 3D-T2 SPACE on a relative 4-point scale and compared with cine PC as a reference standard of patency and 3D-CISS as a reference standard of image quality in terms of wall conspicuity, contrast, continuity, sharpness, and background homogeneity. The McNemar test was used to compare for statistical analysis. Inter-observer agreement was calculated using kappa statistics.

RESULTS
AP by 3D-T2 SPACE and TSE T2 were in agreement with cine PC findings in 100%(65/65) and 85% (58/68), respectively and the sensitivity of 3D-T2 SPACE was equal to cine PC. Visibility of flow void in aqueduct and periaqueduct was significantly better with 3D-T2SPACE than TSE T2 (P<0.05). Inter-observer agreement was almost perfect for TSE T2 and 3D-T2SPACE (kappa > 0.81).

CONCLUSION
3D-T2SPACE should be the method of choice as a stand-alone sequence for the evaluation of AP in hydrocephalus. Due to the high accuracy for physiologic information and the short -acquisition time with high resolution should be preferred to conventional TSE T2.

CLINICAL RELEVANCE/APPLICATION
Due to the high accuracy for physiologic information and the short -acquisition time with high resolution, 3D-T2SPACE should be preferred to conventional TSE T2 for aqueductal patency in hydrocephalus.

SSM14-04 • Measurement of Mean Axon Diameter of Posterior Limb of Internal Capsule in Patients with Idiopathic Normal Pressure Hydrocephalus before and after Lumbo-peritoneal Shunt

Masaaki Hori MD ; Kouhei Kamiya MD (Presenter) ; Atsushi Nakashiti MD, PhD ; Isssei Fukunaga ; Masakazu Miyajima ; Michimasa Suzuki ; Yuriko Suzuki BS * ; Koji Kamagata ; Mariko Yoshida ; Hajime Arai ; Shigeki Aoki MD

PURPOSE

METHOD AND MATERIALS
Thirteen patients with known idiopathic NPH underwent MRI with a 3.0-T MR system. Our q-space diffusion imaging method acquired data with 16 b values (from 0 to 15000 s/mm² by 1000-s/mm² steps). The diffusion gradient was applied perpendicular to the PLICs for every b value. Regions of interest were placed on the bilateral PLIC before and after LP shunt. Root mean square (RMS) displacement of diffusing water molecules in intra-axonal (= mean axonal diameter) and extra-axonal spaces could be defined by using low-q fitting.

RESULTS
In all patients, walking difficulties were ameliorated clinically after LP shunt. For all data, the low-q fits showed good agreement with the definition of low q-value (R² > 0.96). The mean axonal diameter (μm) and RMS of extra-axonal space (μm) were 1.86±0.50 and 7.31±1.27 before LP shunt and 1.97±0.55, and 8.08±1.67, respectively (mean±SD), afterwards. The Wilcoxon signed-rank test with the Bonferroni correction was performed for statistical analysis because the Anderson-Darling test revealed that the data were not normally distributed. After LP shunt, the RMS of extra-axonal space increased significantly (P = 0.009). No significant change was observed in the mean axonal diameter before and after LP shunt.

CONCLUSION
Our results show that the relief of symptoms after LP shunt is due to the change in size of the extra-axonal space rather than the mean axonal diameter. NPH is a curable disease under appropriate therapy; therefore, little or no change in axonal morphology was expected. Estimates of the mean axonal diameter and extra-axonal space in the PLIC may show promise as biomarkers of microstructural changes in patients with NPH.

CLINICAL RELEVANCE/APPLICATION
Estimates of the mean axonal diameter and extra-axonal space in the PLIC may show promise as biomarkers for walking difficulties in patients with idiopathic NPH, before and after LP shunt.

SSM14-05 • Aqueductal Stroke Volume in iNPH Patients: Intracranial Pressure Monitoring Does Not Compare with Phase-contrast MRI
Geir Ringstad MD (Presenter) ; Kyrre E Emblem MSc, PhD ; Noam Alperin PhD * ; Per Kristian Eide MD, PhD

PURPOSE
The role of aqueductal stroke volume (ASV) in the diagnosis and management of idiopathic normal pressure hydrocephalus (iNPH) remains unclear (1). The aim of this study was to compare ASV from phase-contrast MRI with intracranial pressure (ICP) derived parameters.

METHOD AND MATERIALS
Twenty-one patients diagnosed with iNPH underwent 3 Tesla phase contrast MRI (PC-MRI) (Philips Achieva) with imaging parameters as follows; TR/TE=24ms/16ms, voxel size 0.60/0.80/4.00mm³, velocity encoding 10cm/s, retrospective gating, 30-40 phases. All exams were post-processed using the Philips Q-flow software and ASV was estimated after correction for potential aliasing. ASV = 40 l was considered to be increased. After MRI, and during the same hospital admission, an ICP microsensor was placed 1 to 2 cm into the brain parenchyma and static (MeanP) and dynamic ICP (MWA) were continuously monitored. A clinical improvement in 9 of 10 patients with iNPH after ventriculoperitoneal shunting has been reported when MWA exceeds 4 mm Hg (2). Spearman correlation analysis between ASV and MeanP, and between ASV and MeanP, were performed in SPSS 18.

RESULTS
Median ASV was 265 l [range 47,923 l]. Mean MWA was 4.65 mm Hg [2.95,8.46 mm Hg], and mean MeanP was 3.76 mm Hg [4.45,10.38 mm Hg]. There were no significant correlations neither between ASV and MWA (R²=-0.14, p=0.54) nor ASV and MeanP (R²=-0.06, p=0.81). In all of the four patients with MWA below the 4 mm Hg threshold, and therefore not eligible for shunting, ASV values were pathologically increased (median 276 l [79,844 l]). In 17 patients with MWA = 4 mm Hg, median ASV was 221 l [range 47,828 l].

CONCLUSION
There were no significant correlations between PC-MRI ASV derived ASV and ICP, neither regarding static nor dynamic ICP values. Collectively, ASV in the iNPH patients was raised, but varied over a wide range in patients both eligible and non-eligible to shunting. The results do not support any ASV threshold value to select iNPH patients for shunting. References:

CLINICAL RELEVANCE/APPLICATION
To our knowledge, this is the first study to relate a PC-MRI derived parameter in iNPH to invasive ICP measurements. The results question the use of ASV as a shunt decision making parameter.

SSM14-06 • Effect of Spatial Resolution of T2WI on Diagnostic Efficacy of MR Imaging in Detection of Papilledema
Houman Sotoudeh MD (Presenter) ; Michyla L Bowerson MD ; Ryan B Viets MD ; Charles F Hildebolt DDS, PhD ; Gregory Van Stavern ; Aseem Sharma MBBS *

PURPOSE
To compare the diagnostic efficacy of high-resolution 3D-T2WI verses a conventional 2D-T2WI in detection of papilledema.

METHOD AND MATERIALS
In this retrospective study, axial T2WI from MR imaging of 25 patients with ophthalmologically proven papilledema and 66 controls were presented to two neuroradiologists, who interpreted these for presence of papilledema in each eye. All studies included conventional axial 2D T2WI (slice thickness 3-5 mm) and high-resolution axial 3D T2WI (slice thickness 0.7-1 mm), which were presented to the readers in a blinded and random fashion. Sensitivity, specificity, positive likelihood ratio, and negative likelihood ratio were calculated for each reader and for each technique. Assessment was done for all the eyes combined as well as for each side individually. The positive likelihood ratios for 2D and 3D techniques were compared using homogeneity of Odds-Ratio test. Interobserver variability was studied by calculating kappa, and using McNemar test.

RESULTS
For all eyes, the sensitivity, specificity, positive likelihood ratio, and the negative likelihood ratio for first reader were 56.3%, 85.8%, 3.97, and 0.51 for 2D T2WI, with the corresponding values of 83.3%, 93.3%, 12.4, and 0.18 respectively for 3D T2WI. The second reader achieved a sensitivity, specificity, positive likelihood ratio, and negative likelihood ratio of 54.2%, 94.0%, 9.07, and 0.49 respectively with 2D T2WI, and 87.5%, 91.0%, 9.77, and 0.14 respectively with 3D T2WI. The differences in positive likelihood ratio were statistically significant for first reader (p=0.0009), but not for the second (p=0.0793). A similar pattern was observed when results were analyzed for each eye individually.

Substantial interobserver agreement (kappa 0.617) with 2D T2WI improved to an almost perfect interobserver agreement with 3D T2WI (kappa 0.824). McNemar test for paired proportions showed a significant difference of 6.59% in the positive and negative interpretations of two readers using 2D T2WI (p=0.0227), while the corresponding difference of 2.75% difference for 3D T2WI was not significant (p=0.2668).

CONCLUSION
Higher spatial resolution offered by 3D T2WI translates into improved diagnostic efficacy and a higher interobserver agreement for detection of papilledema, when compared to 2D T2WI.
CLINICAL RELEVANCE/APPLICATION
High resolution 3D T2WI can improve the diagnostic efficacy of MR imaging for detection of papilledema.

Neuroradiology (Neuro-Oncology)

Wednesday, 03:00 PM - 04:00 PM • N227

SSM15-01 • Myeloperoxidase Inhibition Worsens Survival after Radiation Therapy in a Murine Model of Glioblastoma

Muhammad Ali MBBS (Presenter) ; Giulia Fulci PhD ; Benjamin Pulli MD ; Gregory R Wojtkiewicz MSc ; Anning Li PhD ; Jenny J Linnoila MD, PhD ; John Chen MD, PhD *

PURPOSE
Radiation therapy is widely used in the treatment of glioblastoma (GBM) with resultant tissue inflammation. We hypothesized that radiation will upregulate the key inflammatory enzyme myeloperoxidase (MPO) that could be tracked in vivo with the specific and sensitive molecular MRI probe MPO-Gd (bis-SHT-DTPA-Gd), and that inhibition of MPO activity could change outcome.

METHOD AND MATERIALS
Twenty-nine C57BL/6j mice were injected with 005 mouse glioma stem cells by intracranial injections. 2 weeks after tumor implantation, mice were irradiated with 10 Gy unfractioanted to the head. Inflammation was quantified by MPO activity assay and flow cytometry of brain leukocytes at 1 or 2 weeks post irradiation. To evaluate the role of MPO, mice were treated with the specific irreversible MPO inhibitor 4-aminobenzoic acid hydrazide (ABAH) or saline as control, and imaged at 4.7T with the molecular MRI probe MPO-Gd at 2 weeks post irradiation. Tumor size and contrast-to-noise ratios (CNRs) were computed from MRI images.

RESULTS
Irradiated brain tumors had significantly increased MPO activity (figure, A; 9.7 ± 2.4 vs. 1.1 ± 0.3 RFU/sec/mg; P=0.03), and MPO-secreting inflammatory monoyctes were also elevated (B; P=0.13). ABAH administration decreased MPO-Gd enhancement (C+E; P=0.03), consistent with successful partial MPO inhibition in vivo. Surprisingly, tumor size was ~1.5 times larger with ABAH treatment compared to saline (C+D; P=0.11), and we also observed decreased survival with MPO inhibition compared to saline control (F, median survival with ABAH: 37 days vs. saline: 50 days; P=0.04).

CONCLUSION
Our results show that MPO has an important role in host defense against GBM and inhibition of its activity after radiation therapy increased tumor growth and decreased survival. MPO-Gd MRI is a sensitive noninvasive method to measure MPO activity in gliomas and can follow treatment response, evaluating both tumor volume and degree of inflammation.

CLINICAL RELEVANCE/APPLICATION
Our study suggests a role for pro-inflammatory anti-tumor therapies in conjunction with radiation. Upon translation, MPO-Gd can be used to monitor inflammation and post-radiation treatment response.

SSM15-02 • Differentiation of Pseudoprogression and Real Progression in Glioblastoma Using ADC Parametric Response Maps

Alexander Radbruch (Presenter) * ; Caroline Reimer ; Markus Graf ; Katerina Deike ; Ralf Floca PhD ; Martin Bendszus ; Sabine Heiland PhD ; Benedikt Wiestler

PURPOSE
Differentiation pseudoprogression describes the radiologic phenomenon that patients with high-grade glioma undergoing their first or second radiation MRI show increased contrast enhancement that eventually subsides without any change in treatment. Currently it is not possible to differentiate real progression and pseudoprogression using conventional T1- and T2-weighted images. Here we tested if a voxel-wise analysis of Apparent Diffusion Coefficient (ADC) values can differentiate between true progression and pseudoprogression using the parametric response map, a new postprocessing procedure.

METHOD AND MATERIALS
29 patients with proven progression and 7 patients with pseudoprogression were identified in a retrospective case study. For all patients ADC baseline and follow-up maps were available. The ADC baseline map and the ADC follow up map were coregistered on the contrast enhanced T1-weighted follow up images. Subsequently the enhancement in the follow up contrast enhanced (Dotarem (Gadoterate meglumine)) T1-weighted image was manually delineated and a reference ROI was drawn in the contralateral white matter. Both ROIs were transferred to the ADC images. Relative ADC(baseline)/reference ROI(baseline) values and ADC(follow up)/reference ROI(follow up) values were calculated for each voxel within the ROI. The corresponding voxels of rADC (follow up) and rADC (baseline) were subtracted and the percentage of all voxels within the ROI that exceeded the threshold of 0.25 was quantified.

RESULTS
rADC voxels showed an increase of 21.9+-26.3 % above 0.25 in patients with real progression and in 55.7 +- 28.3% in patients with pseudoprogression. ROC analysis revealed a very good diagnostic performance (AUC = 0.82).

CONCLUSION
The introduced parametric response map for rADC maps provides a potential tool for the differentiation between pseudoprogression and real progression. Generally an ADC increase is supposed to be correlated with a decrease of cellularity and hence with therapy response. Therefore our findings of an increased number of voxels with increased ADC values in patients with pseudoprogression are in line with these basic pathophysiological considerations.

CLINICAL RELEVANCE/APPLICATION
The reliable differentiation of real progression and pseudoprogression is crucial not only for the therapeutic decision but also for the correct radiological assessment within clinical studies.

SSM15-03 • Prognostic Value of ADC in Glioblastoma Multiforme and Its Correlation with Histopathologic Biomarkers

Romina Zalazar MD ; Miguel D Hernandez Arguello MD ; Pablo D Dominguez MD ; Maria Paramo Alfaro MD ; Pedro Slon MD (Presenter) ; Jon Etxano MD ; Ricardo Díez-Valle MD, PhD ; Miguel Idoate ; Jose Luis Zubieta ; Maria De Los Reyes Garcia De Eulate

PURPOSE
To analyse whether apparent diffusion coefficient (ADC) values derived from diffusion-weighted imaging (DWI) MRI correlate with overall survival (OS), progression-free survival (PFS) and with molecular status on glioblastoma multiforme (GBM)

METHOD AND MATERIALS
Retrospective study in 60 patients with untreated GBM that underwent DWI study before surgery (mean time 6 days). Patients included were followed-up for at least 12 months or until death. Circular 5 mm2 ROI were drawn on ADC map. First on the solid enhancing tumor with the highest restriction value, without evidence of bleeding on SWI. Then on peritumoral area with hyperintensity on T2 FLAIR. Finally
on the normal-appearing contralateral white matter (NCWM). Minimum, maximum, and mean ADC (ADCmin, ADCmax, ADCmean) were evaluated as well as ADCindex defined as a ratio between tumoral ADCmin and NCWM ADCmean. The methylguanine-DNA-methyltransferase (MGMT) promoter methylation, epidermal growth factor receptor (EGFR) amplification and EGFRVIII status, tumoral volume, residual volume, OS and PSF were evaluated. ROC curves, Student’s t-test, Kaplan-Meier curves and Cox regression model were performed.

RESULTS
30 males and 30 females (median age 60.5, range 28-78) were evaluated. 48 patients had complete resection (80%). Presurgical tumoral volume (mean = 41.02 cm3, range 2.2-111.8) and post-surgical volume (mean = 0.55, range 0.2-13) had no association with PFS and OS. MGMT promoter status (n=54) was not methylated in 26. EGFR amplification (n=51) was positive on 19. EGFRVIII mutation (n=25) was present on 6. MGMT promoter methylation, EGFR amplification and EGFR overexpression status had no correlation with ADC. MGMT status correlated with PFS p

CONCLUSION
ADCmin values of solid component of the tumor as well as ADCindex have a significant correlation with PFS and OS independent of the molecular status of MGMT and EGFRVIII and EGFR amplification in GBM. ADCindex could be a stronger predictor of overall survival

CLINICAL RELEVANCE/APPLICATION
ADCindex value is a new parameter that could predict the prognosis in GBM

SSM15-04  •  Variability of rCBV Measurements of Glioblastoma between Three FDA-approved Software Packages

Zachary S Kelm (Presenter); Leland S Hu MD; Panagiotis Korfiatis PhD; Ravi Lingineni MPH; Rickey Carter PhD; John Daniels RT; Bradley J Erickson MD, PhD *

PURPOSE
We measured the variability between three FDA-approved perfusion software packages with respect to their relative cerebral blood volume (rCBV) output for dynamic-susceptibility contrast MRI of glioblastomas. The hypothesis is that they should produce the same rCBV values when obtaining measurements of the same image locations.

METHOD AND MATERIALS
We retrospectively identified 45 glioblastoma cases where within 6 months post-radiation therapy, an MRI was interpreted to contain a worrisome increase in hyperintensity on the T1w post-gad and/or T2w images. Using IB Neuro, GE Functool, and nordiCE, we generated rCBV images for each case, repeating the processing with three different operators for Functool and nordiCE, but just one operator for IB Neuro since it did not require manual input. For each of the 7 operator-software combinations, we calculated a representative rCBV value for each brain, using measurements of the exact same regions. The tumor regions were semi-automatically defined using only enhancement information in the post-gad volume that we had mapped to the same space as the rCBV volumes. We normalized the tumor rCBV values by the mean of a normal-appearing white matter region in the contralateral hemisphere. In addition to the mean normalized rCBV value for the tumor, we calculated the 95% rCBV value to robustly represent a tumor ‘hot-spot’ analysis.

RESULTS
For the mean and 95% normalized rCBV values for the tumors, the intra-class correlation coefficients (ICCs) (with 95% confidence interval in parentheses) for the 7 operator-software combinations were 0.835 (0.766, 0.893) and 0.727 (0.630, 0.817) respectively. For inter-operator analysis, the ICCs for GE Functool were 0.880 (0.813, 0.928) for the mean rCBV, and 0.910 (0.858, 0.946) for the 95% rCBV. For nordiCE, they were 0.971 (0.953, 0.983) and 0.959 (0.933, 0.976) respectively. The higher ICCs for nordiCE were expected since it requires less manual input in the rCBV processing than GE Functool.

CONCLUSION
Due to the variability in rCBV determination, we recommend that the software package be considered and potentially adjusted for when using results and thresholds published in the literature.

CLINICAL RELEVANCE/APPLICATION
Glioblastomas are often imaged using perfusion-weighted acquisitions, but the determination of rCBV is not standardized. This results in different rCBV measurements depending on the software used.

SSM15-05  •  Fast Whole-brain Magnetic Resonance Spectroscopy (MRS) for Patients with Brain Tumors

Yi Zhang (Presenter); Jinyuan Zhou PhD; Paul A Bottomley PhD

PURPOSE
The clinical application of multi-voxel MRS is often limited by long scan times. It is shown here that a recently proposed method, spectroscopy with linear algebraic model (SLAM), combined with parallel imaging or ‘SENSE’, offers dramatically faster MRS acquisitions than conventional chemical shift imaging (CSI).

METHOD AND MATERIALS
The SLAM method reconstructs spectra from multiple compartments using a small subset of CSI phase-encodes from central image k-space. Components are segmented from co-registered MRI, and compartment-average spectra are reconstructed using linear algebra. 8 patients with brain tumors were scanned with a 32-channel head coil in a 3T Philips MR system. A ~6 min three-slice conventional proton MRS SENSE CSI sequence and a five-slice pro-active SENSE SLAM sequence providing whole-brain coverage (thickness 83.6 mm) in ~1.5 min were acquired. Five compartments were segmented on a multi-slice ‘FLAIR’ image: tumor; contra-lateral brain; rest of the brain; scalp; and background. For quantitative validation, retrospective SENSE SLAM spectra were reconstructed retroactively from the central 20% of k-space extracted from the SENSE CSI acquisition, for an effective scan-time of 1.1 min. Choline (Cho); creatine (Cr); and n-acetyl aspartate (NAA) levels were quantified in SENSE SLAM spectra; and compared to those from compartmental average SENSE CSI spectra in tumor and contra-lateral brain compartments.

RESULTS
The validation analysis revealed differences between SENSE SLAM and SENSE CSI (percentage mean ± standard deviation) of: Cho, -4.2 ±4.5%; Cr, -3.1 ±5.7%; NAA, 1 ±10%, which are considered negligible. Applied pro-actively, SENSE SLAM could achieve whole-brain coverage in just 1.5 min, which was not feasible for SENSE CSI due to the limited time available for spectroscopy in the current study protocol.

CONCLUSION
SLAM combined with SENSE can produce quantitatively the same results as the standard CSI method much faster (5-fold demonstrated). This speed advantage enables inclusion of brain MRS in studies that may otherwise be precluded by scan-time limitations. SENSE SLAM could potentially supplant CSI for clinical studies in which lesion-averaged MRS measures can suffice.

CLINICAL RELEVANCE/APPLICATION
With SLAM, whole-brain proton MRS studies of brain tumor patients can be conducted within 1-2 min, greatly increasing its potential clinical utility.

SSM15-06  •  Effect of 3T Contrast-enhanced 3D Fast Spin-echo Imaging on the Detection of Small Brain Metastases In a Prospective Multicenter Trial

Minako Azuma (Presenter); Toshinori Hirai MD; Masayuki Maeda MD; Yoshiyuki Watanabe MD; Mika Kitajima MD; Yasuyuki Yamashita MD *; Yoshikazu Uchiyama MD; Junji Shiraiishi *

PURPOSE
To evaluate the effect of contrast-enhanced three-dimensional (3D) T1-volume isotropic turbo spin-echo acquisition (T1-VISTA) imaging
METHOD AND MATERIALS
We enrolled 200 consecutive patients with suspected brain metastases who underwent contrast-enhanced brain MRI on 3T units at 3 sites in Japan. We used 3D T1-VISTA and 3D turbo field echo (TFE) sequences. Conventional gadolinium doses were delivered and the order of the two 3D MR sequences was randomized. When the size of the lesion was decreased after therapy or increased on follow-up MRI it was regarded as metastatic. Our observer performance study included 24 metastatic lesions less than 5 mm in diameter in 10 patients and 6 patients with no metastases. The number of metastatic lesions ranged from 1 to 8, (mean, 3). Six radiologists (3 neuroradiologists, 3 radiology residents) interpreted the 3D TFE images first without- and then with 3D T1-VISTA images and their performance without and with these images was evaluated using the jack-knife free-response receiver operating characteristic method (JAFROC 4.1).

RESULTS
For all 6 observers, the figure of merit (FOM) values for the detection of brain metastases was increased significantly (from 0.757 to 0.897, P = 0.002) when they used the 3D T1-VISTA images. The FOM values for the residents and neuroradiologists increased from 0.704 to 0.871 (P = 0.008) and from 0.811 to 0.923 (P = 0.008), respectively. In terms of the FOM value, the performance improvement was much greater for the residents than the neuroradiologists and the performance of residents using 3D T1-VISTA (FOM = 0.871) was slightly better than of neuroradiologists without 3D T1-VISTA (FOM = 0.811).

CONCLUSION
3T contrast-enhanced 3D T1-VISTA images improved the performance of neuroradiologists and radiology residents for the detection of small brain metastases. The addition of the 3D T1-VISTA sequence holds promise for the better assessment of brain metastases.

CLINICAL RELEVANCE/APPLICATION
The contrast-enhanced 3D fast spin-echo sequence is useful for evaluating small brain metastases and adds information to the contrast-enhanced 3D gradient-echo sequence.
METHOD AND MATERIALS

RESULTS
We identified decreased correlations of a set of regions with the PCC/PCu, including the medial orbitofrontal cortex (mOFC) and bilateral medial temporal cortex, and increased correlations with the partial orbitofrontal cortex particularly in the bilateral orbital superior frontal gyrus (Figure (a)). The decreased correlations mainly involved with the mOFC, temporal lobe and occipital lobe, while increased correlations were mainly located within the limbic system (Figure (b)). More importantly, the number of significantly altered connectivities was positively correlated with an increase in executive control reaction time (Figure (c)).

CONCLUSION
The changes in the functional connectivity network might be a possible explanation for the cognitive and behavior alteration.

CLINICAL RELEVANCE/APPLICATION
The clear recognition for the potential mechanisms of the effects of passive hyperthermia may provide new evidence for protections of heat exposure in many extremely hot work environments.

SSM16-04 ● Functional Connectivity of Resting State Networks in Spinocerebellar Ataxia Type 6 Correlates with Fractional Anisotropy of Cerebellar White Matter

Licia P Pereira (Presenter); Haris I Sair MD; Raag D Airan MD, PhD; Sarah H Ying

PURPOSE
To determine brain regions that have abnormal white matter and resting-state functional MRI (rs-fMRI) internetwork connectivity (IC) in patients with spinocerebellar ataxia type 6 (SCA6) and whether these measures correlated.

METHOD AND MATERIALS
Nine patients (age 45 to 68) with SCA6 underwent 3T MRI including 7 min BOLD fMRI (TR=2.5 sec) and Diffusion Tensor Imaging (DTI; 32 gradient directions) acquisitions. Four controls (group-matched for age) were studied for comparison. Rs-fMRI data were preprocessed using FSL (FMRIB, Oxford, UK), SPM8 (Wellcome Trust, UK) and custom MATLAB (Mathworks, MA) scripts. Inter-network characteristic path length was used to calculate IC for 21 different networks. DTI studio (http://www.mri.kennedykrieger.org) was used to create fractional anisotropy (FA) maps from diffusion images. Functional staging score for ataxia (FSFA is a clinical scale from 0 to 6 that emphasizes mobility) was also correlated with FA values and rs-fMRI data.

RESULTS
FA values were decreased in SCA6 compared to controls for both cerebellar hemispheres (p

CONCLUSION
Cerebellar fractional anisotropy alterations in patients with SCA6 are correlated with specific rs-fMRI IC modules, while supratentorial DTI measures are not. Motor, cingulate, and attention networks are particularly involved and correlate with clinical dysfunction. This pilot study supports the use of network analysis in SCA6 and may help elucidate the pathophysiology of these complex degenerative diseases.

CLINICAL RELEVANCE/APPLICATION
Some specific rs-fMRI networks are correlated with DTI measures in posterior fossa and with clinical dysfunction in SCA6 patients. This may help elucidate the pathophysiology of these complex diseases.

SSM16-05 ● Resting State Neural Network in Monolateral and Central Tinnitus

Chang-Woo Ryu MD (Presenter); Hye Soo Koo MD; Seong Jong Yun; Moon Suh Park; Geon-Ho Jahng PhD

PURPOSE
The neuronal activity in tinnitus was investigated with a task-based fMRI paradigm by using auditory or somatic modulation. However, few studies have investigated the resting-state neuronal activity in tinnitus. The objective of this study is to identify the difference of resting-state networks among patients with monolateral and central tinnitus, and matching healthy control by using resting-state fMRI.

METHOD AND MATERIALS
Total 53 patients (18 left-sided, 16 right-sided, and 19 central tinnitus) and age-matched 20 healthy controls underwent resting-state fMRI scan. We computed the connectivity in default mode and auditory networks using the group independent component analysis, and the networks were compared among groups.

RESULTS
In the default mode network, the connectivity in the bilateral inferior frontal, prefrontal, and motorsensory areas were increased in tinnitus groups. Connectivity in the central tinnitus had increased at the bilateral angular gyri compared with the monolateral tinnitus and the healthy control. In the auditory network, the reduced functional connectivity of auditory network and increased functioning were found, including the prefrontal, and middle temporal regions.

CONCLUSION
These results suggested that the chronic tinnitus may be related to aberrant functioning of the default mode network. Alteration of the default mode and auditory networks between monolateral and central tinnitus imply that the two tinnitus may have different mechanism.

CLINICAL RELEVANCE/APPLICATION
Our research suggested that resting-state fMRI would be useful to lateralize tinnitus and analyze the mechanism of tinnitus without a task-based paradigm.

SSM16-06 ● Mapping Functional Reorganization of the Motor Network Connectivity after Training with a Novel MR-compatible Hand Induced Robotic Device

Asimina Lazaridou; Phaethon Philbrook (Presenter); Loukas Astrakas; Dionyssios Mintzopoulos PhD; Aneesh B Singhal MD; A. Aria Tzika PhD; Azadeh Khanicheh MS, PhD *; Michael Moskowitz MD; Bruce R Rosen MD, PhD *

PURPOSE
After stroke, the connectivity in the primary motor cortex (M1), supplementary motor area (SMA) and the cerebellum (Ce) are affected. This has been observed as a decrease in intrinsic neural coupling between M1 and Ce. Using fMRI and dynamic causal modeling (DCM) with a novel MR-compatible hand-induced robotic device (MR_CHIROD), this functional reorganization of the motor systems in the brain was further examined in chronic stroke patients.

METHOD AND MATERIALS
Healthy volunteers (n=12) and chronic stroke patients (n=5; = 6 months poststroke) were studied. fMRI was performed on a 3T Siemens using a block paradigm at baseline, during, and after 8 weeks of training, which consisted of squeezing a gel ball with the paretic hand at approximately 75% of maximum strength for 1 hour/day, 3 days/week. Patients squeezed and released the MR_CHIROD during the action period at increments of 45%, 60%, and 75% of their maximum grip force. DCM of fMRI data was used to model the task-dependent influences that one area exerts over another to infer connectivity strengths. Connectivity region stimulation and posterior probability was calculated using the DCM SP5 utility.

RESULTS
Results indicated that in healthy volunteers performing a simple motor resulted in a minimum effective connectivity for the Ce to M1 pathway. However, in patients, M1 to SMA increased 98%, SMA to M1 increased 616% (p

CONCLUSION
We suggest that training can induce functional connectivity in both healthy individuals and chronic stroke patients.

CLINICAL RELEVANCE/APPLICATION
fMRI is a clinically relevant personalized medicine approach, which will allow caregivers to select the most appropriate rehabilitation, and to fine-tune it based on brain maps obtained during therapy.
LEARNING OBJECTIVES
View learning objectives under main course title.

MSCN51C • Common Misdiagnoses
Pamela W Schaefer MD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

Alzheimer's Disease
Thursday, 08:30 AM - 10:00 AM • S405AB

RC605 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1

RC605A • Neurobiology and Imaging Research in Alzheimer's Disease
Sterling Johnson PhD (Presenter)

RC605B • Multimodal Amyloid Imaging
Mykol Larvie MD, PhD (Presenter)

LEARNING OBJECTIVES
1) Understand current evidence regarding the amyloid hypothesis with respect to Alzheimer's disease. 2) Understand the major Alzheimer's disease syndromes, including early onset AD, late onset AD and AD related to specific mutations. 3) Understand the concept and development of amyloid PET imaging radiotracers. 4) Understand the application of amyloid PET imaging in the evaluation of neurodegenerative disease. 5) Understand the principles of interpretation of amyloid PET imaging. 6) Understand the correlation of amyloid PET imaging with multi-modal MRI and FDG PET imaging.

RC605C • Perspectives and Directions in Dementia Imaging
Jeffrey R Petrella MD (Presenter)*

LEARNING OBJECTIVES
1) To review the current role of CT and MR in the workup of the patient with dementia. 2) To understand how a recently revised definition of Alzheimer's disease is leading to a new paradigm in the workup of patients with dementia, and those at risk. 3) To describe the role of biomarkers, including advanced imaging, in early diagnosis and development of the next generation of therapeutics for Alzheimer's disease and related disorders.

Neck Imaging
Thursday, 08:30 AM - 10:00 AM • S402AB

RC606 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

RC606A • Cystic Lesions of the Neck
Wendy R Smoker MD (Presenter)

LEARNING OBJECTIVES
1) Identify branchial cleft cysts (Types II-IV) and their mimics. 2) Recognize common and uncommon locations of simple and complicated thyroglossal duct cysts. 3) Identify a variety of less common cystic neck lesions such as thymic cysts, obstructed laryngoceles, necrotic SCCa lymph nodes.

ABSTRACT
Second branchial cleft cysts and fistulae account for 92%-99% of branchial cleft anomalies. They are thought to be remnants of the cervical sinus of His with no internal or external communication. They are usually lined by stratified squamous epithelium of ectodermal origin and lie lateral to the post-styloid carotid sheath structures, posterior to the submandibular gland, and anterior to the sternocleidomastoid muscle. They are unilocular and do not enhance unless infected. Third and fourth branchial cleft anomalies are extremely rare. Thyroglossal duct cysts are the most common congenital cystic lesions. Suprahoid cysts are typically midline which infrathyroid cysts (50%-65%) are frequently off-midline deep to, or embedded within, the infrathyroid strap muscles. They are found anywhere along the course of the thyroglossal duct from the foramen cecum to the thyroid gland. These cysts are usually unilocular and do not enhance. ‘Complicated-appearing' cysts should be viewed with suspicion as thyroid carcinomas (typically papillary carcinoma) may occur within these cysts. A variety of relatively uncommon 'cystic' neck lesions are occasionally encountered including thymic cysts, thyroid cysts, complicated laryngoceles, completely necrotic lymph nodes, lymphatic malformations, etc. A number of these lesions will be presented and discussed as time permits.

RC606B • Neck Tumors
Deborah L Reede MD (Presenter)

LEARNING OBJECTIVES
1) Learn the CT and MR appearance of common non cystic neck masses in the infrahyoid neck. 2) Learn to develop a differential diagnosis for lesions based on location and imaging appearance. 3) Review the anatomy in the region of the thoracic Inlet and location of major nerves in the infrahyoid neck to improve the detection of tumor spread and prediction of potential nerve involvement.

ABSTRACT
Common non cystic neck masses are discussed with an emphasis on differential diagnosis bases on lesion location and imaging appearance. Knowledge of this anatomy will enhance your ability to detect tumor spread beyond the confines of the neck and help identify lesions originating in or potentially involving major nerves. Information presented is important for surgical planning and may improve patient outcomes.

RC606C • Lymph Nodes
Peter M Som MD (Presenter)

LEARNING OBJECTIVES
1) The attendee will learn the function and anatomy of the cervical lymph nodes. 2) The attendee will be able to understand the differences between nodal staging and classification. 3) The attendee will know the criteria for assessing metastatic adenopathy.
The anatomy and function of the cervical nodes will be discussed and special attention will be given as to how cancer enters these nodes. The classification and staging of the cervical nodes will be discussed and the differences between them noted. How this information is then utilized in treatment planning will be highlighted. Criteria for the imaging assessment of the presence of nodal metastases will be discussed and examples will be given. Both morphologic and functional criteria will be presented.

**Image-guided Biopsy of the Spine (Hands-on Workshop)**

**Thursday, 08:30 AM - 10:00 AM • E260**

**RC650 • AMA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5**

**Moderator**

John L Go, MD

**LEARNING OBJECTIVES**

1) Discuss and demonstrate spine biopsy techniques including CT and fluoroscopic approaches, anatomic landmarks, needle selection, special technical considerations for dealing with soft tissue masses, and fluid accumulations, lytic and blastic lesions, and hypervascular conditions. 2) Hands on exposure will be provided in order to familiarize participants with the vast number of biopsy devices that are clinically available. 3) Training models will also be used in order to teach technical skills with respect to approach and technique. 4) Advantages and disadvantages of various biopsy devices and techniques, and improve their understanding of how to maximize the reliability and safety of these spine biopsy procedures.

**ABSTRACT**

**RC650A • Pre- and Postbiopsy Assessment**

Richard Silbergleit MD (Presenter)

**LEARNING OBJECTIVES**

1) Be familiar with all required aspects of the pre-biopsy work-up, including medications, laboratory values, and review of relevant prior imaging. 2) Be familiar with solutions to address to complications or other unexpected events which may arise during the course of spine biopsy. 3) Be comfortable in performing the post procedure assessment of the patient after spinal biopsy.

**RC650B • Equipment Used for Image-guided Biopsies of the Spine**

Michele H Johnson MD (Presenter)

**LEARNING OBJECTIVES**

1) Demonstrate the types of needles used for spine biopsy. 2) Selecting the proper types of needles used for spine biopsy. 3) Case demonstration of the proper use of single or coaxial needle sets for spine biopsy and the advantages or disadvantages of each.

**RC650C • Thoracic and Lumbar Biopsies**

John L Go MD (Presenter)

**LEARNING OBJECTIVES**

1) Review the anatomy of the thoracic and lumbar spine relevant to spine biopsy. 2) Describe the approaches used to approach various anatomical regions within the thoracic and lumbar spine. 3) Provide case examples of various approaches used to biopsy the thoracic and lumbar spine.

**ABSTRACT**

**RC650D • Cervical Biopsies**

A. Orlando Ortiz MD, MBA (Presenter)

**LEARNING OBJECTIVES**

1) Demonstrate the various approaches used to biopsy lesions of the cervical spine. 2) Determine the selection of the proper needles to use to biopsy the spine. 3) Provide case examples of cervical biopsies and the thought process used to perform these procedures.

**RC650E • Disk Biopsies**

Chi-Shing Zee MD (Presenter)

**LEARNING OBJECTIVES**

1) Demonstrate the various approaches used to biopsy the disc. 2) Determine the selection of the proper needles to use to biopsy the disc. 3) Provide case examples of disc biopsies and the thought process used to perform these procedures.

**ABSTRACT**

**Case-based Review of Neuroradiology: Spine (An Interactive Session)**

**Thursday, 10:30 AM - 12:00 PM • S100AB**

**MSCN52 • AMA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5**

**Director**

Pina C Sanelli, MD

**MSCN52A • Adult Spine**

Suresh K Mukherji MD (Presenter)

**LEARNING OBJECTIVES**

1) Review the common infectious processes of the adult spine. 2) Review the common inflammatory processes of the adult spine. 3) Review the common neoplastic processes of the adult spine.

**ABSTRACT**

1. Review the common infectious processes of the adult spine
2. Review the common inflammatory processes of the adult spine
3. Review the common neoplastic processes of the adult spine
LEARNING OBJECTIVES
1) Identify the key imaging features of various common pediatric spine diseases. 2) Identify the basic anatomic, physiologic and pathologic features of diseases affecting the pediatric spine. 3) Highlight primary imaging techniques used for assessment, clinical practice, problem-solving and patient management.

Common Misdiagnoses
Gordon K Sze MD (Presenter)

LEARNING OBJECTIVES
1) To recognize common patterns for spine and spinal cord pathology and to organize these patterns into categories of diseases processes. 2) To be aware of subtle findings that can lead one to favor one category of disease over another. 3) To be able to differentiate MR artifacts from true pathology in the spine and spinal cord.

Neuroradiology (Advances in Brain CT Imaging)
Thursday, 10:30 AM – 12:00 PM • N228

SSQ14 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

Moderator
Rajan Jain, MD *

SSQ14-01 • Design and Prototyping of a Portable Solid State Head CT

Yuxuan Mao MD, MS (Presenter) ; Jing Shan ; Andrew Tucker ; Laurel Burk ; Pavel Chtcheprov BS ; Jianping Lu * ; Otto Zhou PhD * ; Yueh Z Lee MD, PhD *

PURPOSE
This study describes the design of a novel carbon nanotube (CNT) based head CT. Current CT scanners are relegated to hospital use due to their size and moving gantry. CNT based x-ray sources allow novel gantry geometries unattainable by conventional sources. The lack of moving parts and ability to fit sources closely improve robustness and portability. A vehicle based CT scan to exclude hemorrhagic stroke enables early thrombolytic treatment, which is critical for better outcomes. Vehicle based CT scanners have already been demonstrated in limited applications. We evaluated a prototype CNT head CT scanner, with a conventional circular and a novel 16-sided polygon geometry, using standard phantoms and cadaveric heads.

METHOD AND MATERIALS
Imaging was performed with a linear array of 75 CNT cone beam sources (80 kVp) placed 1m opposite a digital detector. A rotation stage with either a Gammax 464 phantom, a skull phantom, or a cadaveric head was placed 25m from the detector. In the conventional CT setup, the object was rotated 200° while being scanned by a single source. In the 16-sided geometry (8 source-detector pairs), 20 sources in the array were fired in succession. The object was then rotated 22.5°. This was repeated 8 times until the object was scanned 200°. Exposures varied between 25-100 mAs. The reconstructed images were compared to those from a clinical Siemens Definition CT scanner using standard head protocol.

RESULTS
The SNR for Bone, Acrylic, Polyethylene, and Air elements of the Gammax 464 at 100 mAs were 10.4, 8.8, 7.6, and 4.0 respectively. CNR's were 4.7, 1.0, 0.6, 4.2, and CT numbers were 898, 191, -106, and -799 respectively. lp/cm was 10. Radiation dose was 17 mGy. This compared favorably to conventional cone beam CT's. The different geometries produced images using skull phantom and cadaveric heads with good osseous detail.

CONCLUSION
This study is the first demonstration of a CNT based CT scanner for clinical applications. The images produced are on par with conventional CT in quality and dose. This is also the first report of a novel polygon geometry producing clinically useful CT images with cadaveric heads, showing that polygon geometries are feasible in general.

CLINICAL RELEVANCE/APPLICATION
This study demonstrates the potential imaging utility of the carbon nanotube based x-ray sources in a clinical CT application.

SSQ14-02 • Paired, Low and High kV, Conventional Polychromatic Non-Enhanced Head CT in the Same Patients - Image Quality Analysis

Elieh Ben-David MD ; S. Nahum Goldberg MD * ; Jacob Sosna MD (Presenter) * ; Isaac Leichter PhD ; Reuven Levinson MSc * ; John M Gomori MD *

PURPOSE
To determine whether low energy, 80kV, polychromatic, non-enhanced head CT has better image quality than standard high energy, 120kV, scans performed on the same patients.

METHOD AND MATERIALS
IRB waiver was obtained. A retrospective comparison and image quality analysis was made between non-enhanced head CT scans performed at 80kV and at 120kV between June 2006 and November 2012. 30 consecutive scans performed at both energy settings, at different times, were included in the study. We evaluated the cerebral hemispheres by measuring the gray and white matter signal (HU), noise (sd) and contrast to noise ratio per dose (CNRD). The posterior fossa was evaluated using PFAI (posterior fossa artifact index). To evaluate whether time effected changes, a control group of 10 patients who had two scans performed at 120kV over a period of 1.5±1.2 years was selected. Data were analyzed using paired t-test.

RESULTS
At 80kV, average signal was 33.9±3.5HU for gray matter and 22.5±3.1HU for white matter; whereas at 120kV, average signal was 29.4±4.6HU and 21.6±4.6HU for gray and white matter, respectively (p

CONCLUSION
When performed at identical CTDIvol, conventional polychromatic, non-enhanced head CT at 80kV results in improved CNRD compared to scans performed at 120kV. Although a minimal increase in noise and PFAI was noted in the 80kV scans, improved image quality is attainable on commercially available CT scanners.

CLINICAL RELEVANCE/APPLICATION
80kV, non-enhanced head CT results in improved CNRD compared to 120kV, which potentially increases the conspicuity of gray-white matter differences, which is diagnostically important in acute stroke.

SSQ14-03 • Cerebral Computed Tomography Angiography Using a 70 kVP: Improved Vascular Enhancement or Reduced Contrast

John M Gomori, MD * ; Andrew Tucker ; Laurel Burk ; Pavel Chtcheprov BS ; Jianping Lu * ; Reuven Levinson MSc *

PURPOSE
To determine whether low energy, 70 kVP, conventional, non-enhanced head CTA has improved vascular enhancement or reduced contrast compared to standard high energy, 120 kVP, head CTA.

METHOD AND MATERIALS
A prospective comparison and image quality analysis was made between standard 120 kVP, non-enhanced head CTA and low energy 70 kVP, non-enhanced head CTA at the same time interval. 30 consecutive scans performed at both energy settings, at different times, were included in the study. We evaluated the cerebral hemispheres and posterior fossa by measuring the vascular signal (HU), noise (sd) and contrast to noise ratio per dose (CNRD). To evaluate whether time effected changes, a control group of 10 patients who had two scans performed at 120kV over a period of 1.5±1.2 years was selected. Data were analyzed using paired t-test.

RESULTS
At 120kV, average signal was 42.9±14.1HU for large arteries and 21.8±11.5HU for small arteries; whereas at 70kV, average signal was 33.4±12.9HU and 16.5±8.2HU for large and small arteries, respectively (p

CONCLUSION
When performed at identical CTDIvol, conventional, non-enhanced head CTA at 70 kVP results in improved CNRD compared to scans performed at 120kV. Although a minimal increase in noise and PFAI was noted in the 70kV scans, improved image quality is attainable on commercially available CT scanners.

CLINICAL RELEVANCE/APPLICATION
70kV, non-enhanced head CTA results in improved CNRD compared to 120kV, which potentially increases the conspicuity of large-vessel differences, which is diagnostically important in acute stroke.
To prospectively compare cerebral computed tomography angiography (CTA) at 70 and 120 kVp for vessel contrast, image quality and radiation dose. In addition, to assess the feasibility of reducing contrast medium (CM) volume from 64 to 40 mL at 70 kVp protocol.

METHOD AND MATERIALS

Attenuation values and contrast-to-noise ratio (CNR) were determined in a head phantom with 70 and 120 kVp. Forty-two volunteers were randomly assigned to three cerebral CTA protocols. Of 30 volunteers, 64 mL CM was administered at 4.0 mL/s, 15 were scanned with 70 kVp and the other 15 with 120 kVp. The rest of the 12 volunteers were scanned with 70 kVp after administration of 40 mL CM at 2.5 mL/s. The Hounsfield unit (HU) of the internal carotid artery T junctions and CNR were assessed, and the volume CT dose index (CTDvol) and effective dose were compared. Objective arterial enhancement, sharpness of the arterial boundary and overall image quality were assessed by two radiologists using 5-point scale.

RESULTS

The mean arterial attenuation and CNR of 70 kVp protocol (718.4 ± 102.5 HU and 31.7 ± 7.9, respectively) were significantly higher than those of 120 kVp protocol (384.4 ± 76.1 HU and 24.7 ± 6.2, respectively) when 64 mL CM was administered. 70 kVp protocol using 40 mL CM had significantly higher arterial attenuation (586.3 ± 98.2 HU) and no difference in CNR (24.1 ± 5.2), compared to 120 kVp protocol using 64 mL CM. The CTDvol and effective dose of 70 kVp (15.27 mGy and 0.64 mSv), respectively. Both 70 kVp protocols using 64 or 40 mL CM resulted in significantly higher score in arterial enhancement, sharpness of arterial boundary and overall image quality, compared to 120 kVp protocol.

CONCLUSION

The use of 70 kVp significantly improved arterial enhancement and CNR, and provided superior quality images using lower radiation dose, compared to conventional 120 kVp protocol. The 70 kVp protocol allowed 38% volume reduction of CM, while improving arterial enhancement and maintaining CNR with a lower radiation dose.

CLINICAL RELEVANCE/APPLICATION

The use of 70 kVp in cerebral CT angiography significantly improves arterial enhancement, CNR, and image quality. Also the volume of contrast medium could be reduced to 38% while maintaining CNR.

SSQ14-04 • Improved Image Quality for Improved Diagnostic Accuracy of Cranial Computed Tomography Using Sinogram-affirmed Iterative Image Reconstruction

Holger Haubenreisser (Presenter) ; Christian Fink MD ; Paul Apfaltrer MD ; Martin U Sedlmair MS * ; Bernhard Schmidt PhD * ; Stefan O Schoenberg MD, PhD * ; Thomas Henzler MD

PURPOSE

To prospectively compare image quality of contrast and non-contrast enhanced cranial computed tomography (cCT) with thin slice widths using traditional filtered back projection (FBP) and sinogram-affirmed iterative image reconstruction in the raw data space (IR).

METHOD AND MATERIALS

29 consecutive patients (19 men; 71.6 ± 16.6 years) referred for native cCT were prospectively included. 11 (38%) patients also received contrast-enhanced studies and were also included. Each cranial CT raw data set was reconstructed with FBP and sinogram-affirmed IR in the raw data space with decreasing slice widths (5 mm ± 1 mm). Objective image quality was assessed by measuring image noise in three predefined brain regions (white matter, thalamus, cerebellum) using identical regions of interests (ROIs). Subjective image quality was assessed by 2 experienced radiologists by scoring the reconstructed data sets with respect to subjective image noise, subjective image sharpness, diagnostic acceptability and the presence of artifacts.

RESULTS

Image noise was significantly lower in all IR images at identical slice widths when compared to images reconstructed with FBP (4.25 ± 0.49 HU vs. 7.56 ± 1.10 HU non-contrast enhanced, 4.30 ± 0.26 HU vs. 7.97 ± 1.43 HU contrast-enhanced, 1mm slice width; p<0.5). Subjective image quality of IR images especially at thinner slice widths of 1-3 mm were consistently higher than those of FBP reconstructions (p<0.5). Sinogram-affirmed IR significantly reduces image noise in contrast enhanced and non-contrast enhanced studies, while increasing objective and subjective image quality. In cCT this may be used to decrease slice width and thus reduce partial volume effects, which may lead to increased diagnostic accuracy of smaller lesions.

CONCLUSION

IR techniques should be used routinely in cCT if thin slice reconstructions are required in order to improve image quality and potentially diagnostic accuracy of small lesions.

SSQ14-05 • CT Angiography of Head with Dual-source CT: Comparison of Image Quality and Radiation Dose between Prospective ECG-triggered and Conventional Protocols

Nong Qian (Presenter) ; Yuejun Xue BEng, MD ; Changjie Pan

PURPOSE

Experiments were carried out to test the hypothesis that using prospective ECG-triggering acquisition, also called step-and-shoot (SAS) mode on head can reduce radiation dose without compromising image quality compared with using conventional dual-energy CT scan.

METHOD AND MATERIALS

Eighty-four patients with clinically suspected or confirmed cerebrovascular disease were randomly divided into 2 groups: Group A (43 patients underwent prospective ECG-triggering combined with step-and-shoot acquisition) and Group B (41 patients, underwent conventional dual-energy scanning). Images were reconstructed at 60% R-R interval. All images were processed on workstation and the image qualities of these images were scored by two experienced radiologists. These image scores and radiation doses used in each group were subjected to statistical analysis using the paired-sample t-test.

RESULTS

The image quality score for group A was 4.72 ± 0.50 with a good rate of 97.7% (42/43) and 4.71±0.51 for group B with a rate of 97.6% (40/41). The difference in the scores of image quality, between two groups was not statistically significant (P = 0.903). The average effective dose was (0.216 ± 0.01) mSv in group A and (0.541 ± 0.04) mSv in group B. T-test results showed that the effective dose for the two groups are statistically different (P = 0.000).

CONCLUSION

Compared with conventional mode, SAS mode with a narrow R-R interval can be applied to perform cerebral CTA with a dose reduction by 60.01% and produced similar image quality.

CLINICAL RELEVANCE/APPLICATION

When applying SAS mode and conventional model with a narrow R-R interval to perform cerebral CTA, SAS mode results in radiation dose reduction of approximately 60% without compromising image quality.

SSQ14-06 • Application of a Novel Metal Artifact Correction Algorithm in Flat-panel CT after Coil-embolization of Brain
Aneurysms: Intraindividual Comparison

Jan-Hendrik Buhk MD (Presenter) *; Michael Groth; Susanne Sehner; Jens Fiehler; Nils O Schmidt; Ulrich Grzyska MD

PURPOSE
To evaluate a novel algorithm to correct for beam hardening artifacts caused by metal implants in computed tomography performed on a flat panel equipped c-arm angiography system (FP-CT).

METHOD AND MATERIALS
16 datasets of cerebral FP-CT acquisitions after coil-embolization of brain aneurysms in the context of acute subarachnoid hemorrhage have been reconstructed applying a soft tissue kernel with and without a novel reconstruction filter for metal artifact correction, resulting in high-resolution isotropic datasets. Image reading was performed in multiplanar reformations (MPR) in average mode on a dedicated radiological workplace in comparison to the preinterventional native multi-section CT (MS-CT) scan serving as anatomic Gold standard. Two independent radiologists performed image reading following a defined scale in direct comparison of the image data with and without artifact correction. For statistic analysis, a random intercept model was calculated.

RESULTS
Inter-rater agreement was very high (ICC = 86 %). Soft tissue image quality at the level of the implants was substantially improved. The additional metal artifact correction algorithm did not induce impairment of the subjective image quality in all other brain regions.

CONCLUSION
Adding metal artifact correction to FP-CT in an acute postinterventional setting helps visualizing the close vicinity of the aneurysm at consistent over all image quality.

CLINICAL RELEVANCE/APPLICATION
Further development of reconstruction filters for perinterventional brain FP-CT will help spreading the applicability of this still relatively new technique into more clinical settings.

SSQ14-07 • Cross-modalities Comparative Study of Post-SAH Cerebral Hemodynamics: CT Perfusion versus Flat Detector DSA

Chung-Jung Lin MD, PhD; Wan-Yuo Guo MD, PhD (Presenter) *; Wei-Fa Chu BA; Sheng Che Hung MD *; Markus Kowarschik PhD *; Janina Beilner MD *; Cheng-Yen Chang MD

PURPOSE
Conventional digital subtraction angiography (DSA) helps to evaluate the severity of vascular spasm after subarachnoid hemorrhage (SAH). Being equipped with flat detector (FD), DSA is able to provide in-room assessment of peri-therapeutic cerebral hemodynamics and help tailoring endovascular treatments. The aim of current study is to compare the cerebral circulation time (CCT) that derived from color-coded quantitative FD-DSA and CT perfusion (CTP) in SAH patients.

METHOD AND MATERIALS
Nineteen SAH patients entered our neurovascular service in 8 months interval and with available CCT derived from diagnostic FD-DSA and MDCT, were retrospectively recruited. The mean time interval between two examinations was 19 (4-36) hours. The CCT derived from FD-DSA was defined as the difference of Tmax (Time of maximum intensity) between the region-of-interest (ROI) of selected arteries and superior sagittal sinus (SSS). Four CCT were defined accordingly, namely, RA-CCT and LA-CCT (arterial ROI placed on the second portion of right and left anterior cerebral arteries), RM-CCT and LM-CCT (arterial ROI placed on the second portion of right and left middle cerebral artery). The CCT from MDCT was defined as the difference of time-to-peak between corresponding arterial (RM, LM) and SSS ROI. For CCT of anterior cerebral artery, only the dominant was defined due to limited spatial resolution.

RESULTS
The mean of RA-CCT, LA-CCT, RM-CCT and LM-CCT defined by FD-DSA were 5.6±1.5, 6.0±1.8, 5.9±1.9, 6.0±2.3 seconds respectively. The mean of RA-CCT, LA-CCT, RM-CCT and LM-CCT defined by MDCT were 6.0±2.3, 5.9±2.3, 6.0±2.3 seconds respectively. The correlations of RA-CCT, LA-CCT, RM-CCT, and LM-CCT between two modalities were 0.70, 0.76, 0.70, 0.80, respectively. The correlation got worse when the CCT became longer.

CONCLUSION
With no extra radiation dose, FD-DSA provides CCT of SAH patients with comparable results as CTP. It facilitates the feasibility of both in-room peri-therapeutic hemodynamic monitoring and tailoring endovascular treatments.

CLINICAL RELEVANCE/APPLICATION
The CCT measured by QDSA provides additional hemodynamic information in SAH patients in addition to vascular morphology. It confirms the reproducibility of intra-arterial hemodynamic models.

SSQ14-08 • Noise and Radiation Dose Reduction Using a Partial Temporal Profile Non-local Means (PATEN) Filter in CT Brain Perfusion

Zhoubi Li (Presenter); Lifeng Yu PhD; Shuai Leng PhD; Armando Mandauro PhD *; Amy L Kotsenas MD; David R De Lone MD; Cynthia H McCollough PhD *

PURPOSE
To develop a 4 dimensional (3D spatial + 1D temporal) noise reduction filter that is not sensitive to patient motion and to perform a retrospective clinical evaluation on its performance in CT brain perfusion.

METHOD AND MATERIALS
A partial temporal profile non-local means (PATEN) filter was developed in our lab that uses redundant information to reduce image noise, in which the pixel value in the filtered image is a weighted average of similar pixels and the weight is calculated by comparing their partial temporal profiles. This approach can reduce noise in a time series of perfusion images, even when there is significant motion during the time-series scans. A feasibility test was performed using 5 brain perfusion cases acquired with our routine protocol (CTD1vol = 300 mGy).

We intentionally selected those cases in which the patient moved substantially during the scan, making the data difficult to process with the commercial perfusion software, despite the fact that it already incorporates anatomic registration to compensate for patient motion. A validated noise insertion technique was used to simulate images at a low-dose level (25% of full dose). PATEN was applied to the low dose images. Image quality and perfusion parameter maps were compared among low-dose, low-dose+PATEN filter, and full dose images.

RESULTS
The PATEN filter achieved a 76.2 to 85.3% decrease in image noise. Radiologist evaluation revealed no spatial or motion blurring in the PATEN images. The mean perfusion parameters calculated from the PATEN images closely matched those determined from full dose data: Root mean squared error between the PATEN filtered data and full dose data for CBF, CBV and MTT were 6.32, 4.94 and 14.67% for healthy tissue, respectively. For tissues with pathology, the errors were 13.43, 20.84 and 13.76%. The PATEN filtered data were deemed to be clinically equivalent to those from the full dose data and much superior to those from the original low-dose images.

CONCLUSION
A newly developed PATEN filter can reduce radiation dose by 75% in CT brain perfusion while maintaining image quality without causing spatial or temporal blurring of anatomy, even when significant patient motion occurs during the scan.

CLINICAL RELEVANCE/APPLICATION
Dramatic radiation dose reduction can be achieved in CT brain perfusion by applying the PATEN filter, which is insensitive to patient motion while maintaining image quality. This can help in reducing the overall radiation exposure to patients.
SSQ14-09 • CT Image Quality Improvement and Dose Reduction Potential with Model-based Iterative Reconstruction Using Autopsy Imaging in the Brain: Evaluation of Image Noise and DOSE Estimation with Different Noise Index

Takashi Takahata RT ; Yue Dong (Presenter) ; Tomokatsu Tsukamoto ; Ye Ju ; Keisuke Nishihara MD ; Hiroki Mori MD ; Kazunari Mesaki MD ; Katsuhide Ito MD

PURPOSE
To assess the dose reduction potential and image quality improvement with model-based iterative reconstruction algorithm (Veo) by comparing image noise and DOSE (DLP mGy-cm) with the adaptive statistical iterative reconstruction (ASiR) and the filtered back projection (FBP) reconstruction, using autopsy imaging.

METHOD AND MATERIALS
With institutional review board approval, 8 brain CT autopsy imaging (AI) cases with different noise index (NI: 2.8, 3.2, 4.5, 6.0, 8.5) were performed on Discovery CT750 HD. For comparison, 3 sets of 0.625mm slice thickness CT images were reconstructed with FBP, 50% ASiR and Veo. The image noise (SD) was measured with the same size of regions of interest at the same slice in 3 locations. The image noise reduction ratio was defined by SD (at NI8.5)/SD (at NI2.8). Using a 5-point score (1: poor; 3: diagnosis, 5 excellent), 3 radiologists independently and graded overall noise and delineation of the head image.

RESULTS
For the comparison with same image slice thickness, the image noise reduction with Veo compared with FBP and 50%ASiR for the NI2.8, 3.2, 4.5, 6.0, 8.5 and the average were (15.0%, 22.2%, 35.4%, 42.9%, 50.5% and 33.2±14.6%) and (-2.6%, 5.7%, 19.7%, 27.5%, 34.8% and 17.0±15.4%), respectively. The noise reduction ratio (NI8.5/NI2.8) for the Veo, 50%ASiR and FBP were 1.7, 2.7 and 2.9, respectively. The average scoring for the Veo, 50%ASiR and FBP at NI3.2 were 3.7±0.7, 3.3±0.7, and 2.8±0.6, respectively. All the differences were statistically significant (p < 0.05).

CONCLUSION
Veo advanced reconstruction algorithms greatly reduced image noise over FBP and ASiR. With Veo reconstruction, it was possible to reduce dose (DLP) by 71.7% if the noise of the current FBP images was acceptable.

CLINICAL RELEVANCE/APPLICATION
Veo reconstruction technique has the ability to reduce radiation dose through their improvement in image quality compared with the current algorithms such as FBP and ASiR.

SSQ15-01 • Physiologic Variability in Internal Jugular Venous Caliber: A Retrospective Review

Karen Buch MD (Presenter) ; Raymond Groller ; Rohini N Nadgir MD ; Akifumi Fujita MD ; Osamu Sakai MD, PhD *

PURPOSE
Chronic cerebrospinal vascular insufficiency (CCSVI) is a proposed condition described as intra-luminal stenosis of the internal jugular (IJV) resulting in impeded venous flow from the brain and has been linked to pathologies such as multiple sclerosis (MS). However, calculations of IJV stenosis are vague and typically described in veins with at least a 50% reduction in luminal caliber. The purpose of this study is to assess normal anatomic and physiologic caliber changes of the IJV over its course.

METHOD AND MATERIALS
Following IRB approval, 500 consecutive neck CT angiograms from January-July 2012 were retrospectively reviewed. Images were helically acquired at 1.25mm slice thickness on 64-detector row CT scanners. IJV surface areas were calculated at the jugular foramen, C1-C7 levels, and jugular angles bilaterally. Electronic medical records were reviewed for clinical parameters including age, gender, neurologic history including MS, neck mass, and neck surgery/dissection. Severely motion limited studies, subjects with limited clinical data, history of radical neck dissections, and known IJV occlusions were excluded. Statistical analysis was performed using a t-test.

RESULTS
383 patients were included (202 females, 181 males), ranging in age from 2-89 years (mean 47.3 years). Mean area was 66 mm² at the jugular foramen, 56.9 mm² at C1, 66 mm² at C2, 80 mm² at C3, 96 mm² at C4, 126 mm² at C5, 164 mm² at C6, 176 mm² at C7, and 128 mm² at the jugular angle. Degree of IJV narrowing was calculated at each vertebral body level using the IJV area at C7 as the denominator: 63% at the jugular foramen, 68% at C1, 62% at C2, 55% at C3, 45% at C4, 28% at C5, and 7% at C6. Statistically significant differences were observed between mean IJV areas at the C1-C5 levels compared to C7 level (p < 0.05).

CONCLUSION
The IJV demonstrates marked variability in its course in the neck, with areas of narrowing greater than 50% in cervical and skull base regions. Given the normal physiologic variation in the caliber of this vessel, diagnosis and treatment of stenosis should proceed with caution.

CLINICAL RELEVANCE/APPLICATION
Given the marked normal physiologic variation in the caliber of the IJV, diagnosis and treatment of stenosis should proceed with caution.

SSQ15-02 • Arterial Remodeling of Intracranial Atherosclerosis: Detection and Characterization Using 3D High Resolution Black Blood MRI

Ye Qiao (Presenter) ; Jarunee Intrapromkul MD ; Zeeshan Anwar ; Li Liu ; Bruce A Wasserman MD

PURPOSE
To determine the ability and extent of intracranial arteries to accommodate plaque formation by outward (positive) remodeling using 3D high resolution black blood MRI (BBMRI).

METHOD AND MATERIALS
Thirty-one patients (22 male; mean age 57.6±12.2 years) with cerebrovascular ischemic events underwent 3D time-of-flight MRA and contrast-enhanced BMBMRi examinations for intracranial atherosclerotic disease at 3T. The 3D BBMRI sequence was acquired using a volumetric isotropic TSE acquisition with the following parameters: TR/TE, 2000ms/38ms; TSE factor, 56 echoes; acquired resolution, 0.4x0.4x0.4 mm3; scan time, 7.5 minutes. Each identified plaque was classified based on location (i.e., posterior vs. anterior circulation). Lumen area (LA), outer wall area (OWA), and wall area (WA) at the most stenotic site and reference site were measured. Normalized wall index (NWI) was calculated as WA divided by OWA at the lesion site divided by OWA at the reference site, after adjusted for vessel tapering. Arterial remodeling was categorized as: positive if RI >1.05, intermediate if 0.95 =RR =1.05, and negative if RI >1.05.
RESULTS
One hundred and five plaques were identified in 31 patients, with multiple plaques seen in 23 patients. Forty-two were detected in the posterior circulation (basilar, 19; PCA, 6; and vertebral, 17), and 63 in the anterior circulation (ACA, 9; ICA, 34 and MCA, 20). Compared with anterior circulation plaques, posterior circulation plaques had larger NWI (i.e., plaque burden) (posterior vs anterior: 0.77±0.20 vs. 0.68±0.16, p<0.035), greater RI (posterior vs anterior: 1.22±0.56 vs. 1.04±0.27, p=0.042), and more frequently exhibited positive remodeling (posterior vs anterior: 50% vs.39%). Reliability for wall morphology measurements was excellent (ICCs ranged from 0.95 to 0.98).

CONCLUSION
Arterial remodeling of intracranial atherosclerosis appears to be geographic. Compared with anterior circulation arteries, posterior circulation arteries appear to have a greater capacity to remodel in response to plaque formation.

CLINICAL RELEVANCE/APPLICATION
These findings yield important information necessary for the interpretation of angiographic images, as posterior circulation plaques are probably underestimated by angiography.

SSQ15-03 • An MRI Pulse Sequence for Whole-brain Bolus Tracking at High Frame Rates: RAZER (RAdial kz-blipped 3D GRE-EPI for Whole-brain Perfusion)

Sameer A Ansari MD, PhD; Amir R Honarmand MD (Presenter); Biraj M Patel MD; Can Wu; Susanne Schnell; Pegah Entezari; Parmede Vakil PhD; Michael Helle PhD; Sameer A Ansari MD, PhD; Timothy J Carroll PhD

PURPOSE
To measure cerebral perfusion, bolus tracking with DSC-MRI demands rapidly acquired T2*-weighted MR images. Current implementations of DSC-MRI are constrained by a temporal resolution of no more than 2 s (0.5 FPS) to adequately characterize a contrast agent bolus, with tradeoffs in SNR and spatial resolution. We introduce RAZER, a pulse sequence that obtains whole-brain DSC-MRI perfusion measurements at 6.2 FPS and 1.7 mm isotropic voxel resolution.

METHOD AND MATERIALS
Sequence design: RAZER uses in-plane radial sampling and through-plane 3D GRE-EPI Cartesian sampling to produce a cylindrical 3D k-space. Consecutive frames are acquired in 10.3 s (0.09 FPS) for bolus tracking, but dynamic bolus information is recovered at 0.16 s per frame (6.2 FPS) prior to perfusion analysis using sliding window view-sharing in k-space. Subject selection: 1 patient with angiographically-confirmed Moyamoya disease.

Image acquisition: In vivo bolus tracking was performed using RAZER and a typical 2D GRE-EPI pulse sequence (voxel size = 1.7 × 1.7 × 5.0 mm3) as a reference standard. RAZER scan parameters: second injection, TE/TR = 36/81 ms, flip angle = 45°, slices = 76, voxel size = 1.7 × 1.7 × 1.7 mm3, repetitions = 12, 3.0 T Tim Trio. Images were acquired with a single-dose injection of 0.1 mmol/kg Gd-DTPA at 4 mL/s. Both acquisitions were automatically processed online to produce parametric maps of relative cerebral blood flow (rCBF), relative cerebral blood volume (rCBV), and mean transit time (MTT).

RESULTS
Figure 1 compares coronal, sagittal, and axial perfusion maps in RAZER (a) and the 2D GRE-EPI reference (b) with angiographic assessment (c) consistent with Moyamoya disease. Increased coverage in RAZER allows for fine resolution of the perfusion metrics in the through-plane direction while the reference is blurred. There is strong agreement in perfusion metrics using Bland-Altman correlation (r2 = 0.91, mean bias in MTT measurements = -0.01 ± 0.89 sec). Perfusion maps were coregistered prior to correlation using SPM.

CONCLUSION
RAZER obtains whole-brain perfusion measurements with good reference standard agreement. Sliding window view-sharing in k-space permits the use of a large temporal resolution for DSC-MRI without sacrifices in SNR and spatial resolution.

CLINICAL RELEVANCE/APPLICATION
RAZER is recommended for whole-brain MR perfusion study of central nervous system tumors, stroke, cerebrovascular occlusive disease, and Alzheimer's.

SSQ15-04 • In-Vivo Visualization of the PICA Perfusion Territories with Super-selective Pseudo-continuous Arterial Spin Labeling MRI

Nolan Hartkamp MD (Presenter); Laurens J De Cocker MD; Michael Helle PhD; Matthias Van Osch; Jaap Kappelle; Reinoud P Bokkers MD, PhD; Jeroen Hendriks MD

PURPOSE
To develop the first technique to visualize the cerebellar perfusion territories in-vivo.

METHOD AND MATERIALS
The perfusion territories of the vertebral arteries (VAs) were examined in 14 healthy subjects with four super-selective p-CASL MRI sequences (with labeling of both internal carotid arteries and both VAs). The following arterial perfusion territories in the cerebellum were distinguished: (1) territory exclusively fed by one vertebral artery (VA), namely the PICA territory in subjects with normal anatomy; (2) territory exclusively fed by the contralateral VA (contralateral PICA territory); (3) territory fed by both VAs after mixing in the basilar artery (bilateral AICA and SCA territories). The territorial perfusion maps were superimposed on anatomical T1WI and the PICA territories distinguished: (1) territory exclusively fed by one vertebral artery (VA), namely the PICA territory in subjects with normal anatomy; (2) territory exclusively fed by the contralateral VA (contralateral PICA territory); (3) territory fed by both VAs after mixing in the basilar artery (bilateral AICA and SCA territories).

RESULTS
The vast majority of PICA perfusion territories could be identified. In 10 out of 14 subjects, both PICA perfusion territories could be distinguished. One subject had a missing VA, and one subject had a missing or hypoplastic PICA on one side. Two subjects did not have a discernible PICA territory on one side, either secondary to tiny anastomoses between the PICA and AICA, or either secondary to insufficient mixing of blood in the basilar artery.

CONCLUSION
We postulate that a selective labeling of each vertebral artery (VA) allows distinguishing the cerebellar territories that are exclusively fed by one VA (PICA in subjects with normal vascular anatomy) from those territories supplied by the basilar artery (AICA and SCA).

CLINICAL RELEVANCE/APPLICATION
The ability to link a cerebellar infarct with a particular perfusion territory may yield information on infarct pathogenesis and may refine treatment planning.

SSQ15-05 • 4D Flow MRI Indicates Changes in Intracranial Hemodynamics in Arteries Supplying Arteriovenous Malformations

Amir R Honarmand MD (Presenter); Biraj M Patel MD; Can Wu; Susanne Schnell; Pegah Entezari; Parmede Vakil PhD; Michael C Hurley MBCh; Bernard Bendok MD; Ali Shalbani MD; Timothy J Carroll PhD; Michael Markl PhD; Sameer A Ansari MD, PhD

PURPOSE
To evaluate peak velocity (PV) and net flow (NF) in arteries supplying intracranial arteriovenous malformations (AVMs) using 4D flow MRI.

METHOD AND MATERIALS
With IRB approval, baseline 4D flow MRI was performed at 1.5T or 3T MR systems for a prospective study. Flow quantification was performed using ECG gated three-directional velocity encoding with full 3D coverage of the AVM nidus, feeding and draining vessels, and...
Intraplaque Hemorrhage (IPH) in carotid artery atherosclerosis is strongly associated with previous and future stroke. Carotid plaque hemorrhage at 3.0T was investigated in 17 arteries (5 ICAs, 9 MCAs, 2 PCAs, and 1 ACA) supplying the AVM nidus, normal contralateral equivalent arteries, and corresponding sinus draining the AVM were quantified. PV and NF were significantly higher in AVM arteriovenous fistulas (AFs) compared with normal contralateral equivalent arteries (EA) (mean: 0.96 Vs. 0.66 m/s, P = 0.001; 5.2 Vs. 3.0 ml/cycle, P = 0.004, respectively). No significant difference was observed between AFs on PV, NF, and sinus PV based on AVM SM classification (P = 0.08, P = 0.1, P = 0.4, respectively). Stepwise multiple regression and univariable models identified nidus volume and EA PV to be positively correlated with PV in AFs (P = 0.01, r = 0.6; P = 0.003, r = 0.7, respectively). NF was the significant factor for predicting PV in EAs (P = 0.001, R = 0.7). Positive direct correlation was observed between AFs PV and sinus PV (P = 0.01, R = 0.6).

CONCLUSION

4D flow MRI is feasible for monitoring of cerebral AVM hemodynamic parameters and illustrates subtle, but distinct hemodynamic changes in arterial feeders compared to a normal equivalent arteries.

CLINICAL RELEVANCE/APPLICATION

These findings may have implications in novel characterization schemes for risk stratification based on quantitative flow analysis.

SSQ15-06 • Diagnosis of Carotid Artery Dissection with CT: Does the Contrast Material Really Help?

Lucia Saba MD (Presenter) ; Eytan Raz MD ; Mario Piga ; Roberto Montisci MD ; Eugenio A Genovese MD

PURPOSE

The purpose of this work was to evaluate if the use of contrast material in the MDCTA study of carotid artery dissection (CAD) modify the diagnostic performance

METHOD AND MATERIALS

One hundred patients (61 men, 39 women; mean age, 51 years; range, 25 ± 78 years) 40 with and 60 without CAD, that underwent MDCTA for suspected CAD formed the study cohort. In this study patients from three different groups were included (patients with MR confirmation of CAD, n = 40; patients with MR confirmation of CAD absence, n = 20; patients that underwent MDCTA of carotid arteries for atherosclerosis analysis, n = 40). Three blinded observers with different level of expertise analyzed the randomized basal scan and after 3 months the observers evaluated the same datasets by using basal scans (BS) and after administration of contrast material (CM). Statistical analysis included Receiver Operating Characteristics (ROC) curve analysis and the Cohen weighted test.

RESULTS

The ROC curve analysis showed that for the 3 observers the use of BS versus BS and CM produced an improvement of the diagnostic confidence with AUC values from 0.894 to 0.926 (p value = 0.91) ; from 0.856 to 0.879 (p value = 0.365); and from 0.819 to 0.982 (p value = 0.01). The Cohen kappa analysis showed no significant difference in concordance with the use of BS versus BS and CM. The prevalence of uncertain findings was in 16%, 20.5% and 33% in the BS and 15%, 17.5% and 29% in BS and CM for observer 1, 2 and 3 respectively.

CONCLUSION

Results of our study suggest that the use of BS instead the classic BS and CM determines a small reduction in the diagnostic confidence of the readers, that is statistically significant in the only the junior one. Therefore the use of the only BS in the suspect of CAD may help in reducing cost and risk related to the administration of contrast material.

CLINICAL RELEVANCE/APPLICATION

Results of our study suggest that the use of the only basal in the suspect of CAD can be used and this approach may help in reducing cost and risk related to the administration of contrast material.

SSQ15-07 • Carotid Artery Stenosis: Comparison of 3D Time-of-Flight MR Angiography and Contrast-enhanced MR Angiography at 3.0T

Ivan Platzek MD (Presenter) ; Dominika Sieron MD ; Philipp Wiggermann ; Michael Laniado MD

PURPOSE

To compare 3D time-of-flight MR angiography (TOF MRA) and contrast-enhanced MR angiography (CEMRA) for quantification of carotid artery stenosis at 3.0T.

METHOD AND MATERIALS

Twenty-three patients (5 F, 18 m; mean age 61 y, age range 45-78 y) with external carotid artery stenosis detected with Doppler ultrasonography were examined on a 3.0T MR system. The MR examination included both 3D TOF MRA and CEMRA of the carotid arteries. MR images were evaluated independently by two radiologists. Stenosis evaluation was based on a four-point scale: 0 = normal, 1 = mild stenosis, less than 50%; 2 = moderate stenosis, 50-69%, 3 = severe stenosis, more than 70% but less than full occlusion, 4 = occlusion. TOF MRA and CEMRA were evaluated separately, with a four-week time interval between evaluation sessions. While evaluating TOF MRA, the readers were blinded for CEMRA images and vice versa. Furthermore, the readers were blinded for other imaging or clinical data. In cases of interrater differences concerning the same MR angiography type, stenosis grade was determined by the readers in consensus.

RESULTS

Statistical analysis included Receiver Operating Characteristics (ROC) curve analysis and the Cohen weighted test. The ROC curve analysis showed that for the 3 observers the use of BS versus BS and CM produced an improvement of the diagnostic confidence with AUC values from 0.894 to 0.926 (p value = 0.91) ; from 0.856 to 0.879 (p value = 0.365); and from 0.819 to 0.982 (p value = 0.01). The Cohen kappa analysis showed no significant difference in concordance with the use of BS versus BS and CM. The prevalence of uncertain findings was in 16%, 20.5% and 33% in the BS and 15%, 17.5% and 29% in BS and CM for observer 1, 2 and 3 respectively.

CONCLUSION

Results of our study suggest that the use of the only basal scan in the suspect of CAD can be used and this approach may help in reducing cost and risk related to the administration of contrast material.

SSQ15-08 • Intraplaque Hemorrhage on Routine 3D-Time-of-Flight MR Angiography Is Strongly Associated with Symptomatic Status in Carotid Artery Stenosis

Hediyeh Baradaran MD (Presenter) ; Hooman Kamel MD ; Atul Mangla MD ; Ankur Pandya PhD, MPH ; Allison Dunning ; Vito Fodera MD ; Pina C Sanelli MD ; Ajay Gupta MD

PURPOSE

Intraplaque hemorrhage (IPH) in carotid artery atherosclerosis is strongly associated with previous and future stroke. Carotid plaque imaging has previously relied on high-resolution imaging using dedicated surface coils or MRA sequences not routinely obtained to measure stenosis. Recent reports suggest 3D-time-of-flight (TOF) imaging can accurately predict IPH compared to histopathology. We investigated the association between IPH determined on routinely acquired, 3D-TOF MRA neck images and prior stroke or TIA in patients with high-grade carotid stenosis.
METHOD AND MATERIALS

Subjects were screened after review of consecutive MRA neck exams performed from 8/2009 through 8/2012. Patients were included if they had high-grade carotid artery stenosis (70-99%) on non-contrast 3D-TOF MRA and documentation of prior stroke/TIA and vascular risk factors. IPH was determined by a validated technique assessing carotid plaque signal 50% more hyperintense than adjacent muscle. Assessments were made by two independent, blinded neuroradiologists with a third used as a tie-breaker. Clinical data was determined by consensus of two stroke neurologists. Statistical analysis was performed using univariate and multivariate logistic regression analysis with adjustment of statistically significant covariate risk factors.

RESULTS

After reviewing 4895 consecutive neck MRAs, 51 subjects with 53 carotid arteries met inclusion criteria. Vascular risk factors were not significantly different between groups. IPH was present in 24 carotid arteries. Of patients with IPH-positive exams, 15 had prior events (10 strokes, 5 TIAS). Of those with negative exams, 4 had prior events (3 strokes, 1 TIA). In the univariate logistic regression analysis, the OR of the association of IPH to any prior ischemic event was 14.5 (95% CI 3.6-57.6) and the age- and sex-adjusted OR was 14.2 (95% CI 3.3-60.5). The association was preserved across magnet field strengths.

CONCLUSION

Our study demonstrates a strong association between ischemic events and IPH as determined on widely available, standard, large field-of-view neck coils using a 4-minute MRA sequence which is commonly used for screening exams.

CLINICAL RELEVANCE/APPLICATION

With prospective validation of our findings, regular reporting of IPH on neck MRA studies can be used as a risk stratification tool to complement measures of luminal diameter stenosis.

SSQ15-09 • CTA vs. 3T Black-Blood MRI for Identification of Symptomatic Carotid Plaques: A Comparative Study

Jochen M Grimm MD (Presenter); Andreas Schindler; Florian Schwarz MD; Clemens C Cyran MD *; Martin Dichgans MD; Tobias Saam MD *; Tobias Freiling ; Maximalien F Reiser MD; Konstantin Nikolaou MD *; Fabian Bamberg MD, MPH *

Chun Yuan PhD *

PURPOSE

The purpose of this prospective comparative study was to evaluate CT angiography (CTA) and black-blood 3T-MRI (bb-MRI) regarding their respective ability to identify symmetrical carotid plaques.

METHOD AND MATERIALS

20 patients with unilateral symptomatic carotid disease who underwent extensive clinical workup at our stroke unit to exclude other causes of ischemic stroke underwent standard CTA and bb-MRI with TOF, pre- and post-contrast fsT1w-, fsT2w- and fsPDw- sequences within 7 days of symptom onset. Both symptomatic and contralateral asymptomatic sides were evaluated. By bb-MRI, plaque morphology and composition and prevalence of complicated type VI lesions (AHA-LT6) with haemorrhage, thrombus and/or ruptured fibrinous cap were evaluated. By CTA, plaque type (soft, mixed, hard), plaque density in HU and presence of ulceration and thrombus were evaluated. Sensitivity (SE), specificity (SP), positive and negative predictive value (PPV, NPV) were calculated using a two-by-two table.

RESULTS

For identifying the symptomatic side AHA-LT6 was the best bb-MRI variable and presence of plaque ulceration was the best CTA variable, resulting in a SE, SP, PPV and NPV of 80%, 80%, 80% and 80% for AHA-LT6 as assessed by bb-MRI, 40%, 95%, 65% and 71% for plaque ulceration as assessed by CTA. The SE, SP, PPV and NPV for the combination of AHA-LT6 as determined by bb-MRI and ulceration as determined by CTA was 85%, 75%, 77% and 83%, respectively.

CONCLUSION

BB-MRI delivered a better sensitivity, NPV and PPV compared to CTA at identifying the symptomatic side, while CTA offered an excellent specificity at the cost of low sensitivity and moderate PPV and NPV. Results were only slightly improved over bb-MRI when combining both techniques.

CLINICAL RELEVANCE/APPLICATION

This study shows that bb-MRI is better suited to detect symptomatic carotid plaques than CTA. A combination of both techniques is only marginally superior to bb-MRI alone.

ISP: Nuclear Medicine (Neurologic Imaging)

Thursday, 10:30 AM - 12:00 PM • SS05SAB

SSQ16 • AMA :1.5 • ARRT:1.5

Moderator

Satoshi Minoshima, MD, PhD *

Moderator

Alexander Drzezga, MD *

SSQ16-01 • Nuclear Medicine Keynote Speaker: State-of-the-Art Molecular Neuroimaging

Alexander Drzezga MD (Presenter) *

SSQ16-03 • Does Computer Aided Diagnostic (CAD) Software Decrease Inter-reader Variability of Florbetapir PET Brain Scan Interpretation?

Ameya Nayate MD (Presenter) *; Jacob G Dubroff MD, PhD *; James E Schmitt MD, PhD; Rekha I Kishore MD *; Ilya M Nasrallah MD, PhD; David A Mankoff MD, PhD; Daniel Pryma MD *

PURPOSE

METHOD AND MATERIALS

29 patients enrolled in the Alzheimer’s disease neuroimaging initiative (ADNI 2) were included. Readers classified each case using a binary system, positive or negative for significant beta amyloid deposition. Each case was interpreted twice by each reader, once qualitatively and once with the aid of SUVr measurements generated by Scenium software (Siemens Medical). Cases were randomly assigned to 4 reading sessions separated by a washout period and interpreted by 5 blinded, board certified and Florbetapir-interpretation trained readers. No case was repeated within an individual session. To quantify inter-rater agreement, a kappa coefficient was calculated for the raters with and without the use of Scenium.

RESULTS

When Florbetapir PET brain studies were read qualitatively, there was inter-rater disagreement in 8/29 cases. When the same Florbetapir PET studies were read with SUVr, there was inter-rater disagreement for only 1 case. The kappa coefficient for the studies read with SUVr (0.94) was statistically significantly higher compared to the qualitatively only read studies (0.71), p < 0.005.

CONCLUSION

The use of semi-quantitative indices (SUVr) to aid the interpretation of Florbetapir images improves inter-reader agreement. Further
RESULTS

Eighteen interictal PET-CT scans of brain in patients who had also undergone iEEG were retrospectively reviewed. All patients originally had MR and qualitative PET interpreted as negative. The studies were then processed with quantitative analysis software (MimNeuro 5.6; Hamilton E Reavey, PhD, MD, PhD). The measurements demonstrated spatial resolution of 2-3mm across the field of view, energy resolution of less than 13% for all detector blocks, image uniformity of better than 15%. Quantitative accuracy is better than 10% after calculated attenuation correction as benchmarked against the whole-body PET scanner.

CONCLUSION

Novel dedicated brain PET imaging device provides an acceptable alternative to whole-body PET machines at reduced cost to the healthcare facility. The device does not obstruct patient line of sight and could, potentially, eliminate claustrophobia.

CLINICAL RELEVANCE/APPLICATION

New PET imaging device could be used for F18-FDG and F18-florbetapir imaging in evaluation of Alzheimer’s disease, and clinical neuroscience research with novel CNS radiotracers.

SSQ16-06 • Quantitative Analysis of FDG PET Hypometabolism in Pre-operative Identification of Seizure Foci Not Detected on Routine MR and Qualitative PET

Bhawana Rathore MD (Presenter); Vina Ravichandran BA; Pearce Korb MD; James R Galt PhD; Robert E Gross; David M Schuster MD; Bruce J Barron MD; Larry Olson; Jonathon Nye PhD; Hamilton E Reavey MD

PURPOSE

Approximately 30% of patients with epilepsy are refractory to medications and may require resective brain surgery. Identification of candidate regions of seizure onset is crucial to successfully guide resection or placement of surgically implanted electrodes for intracranial electroencephalography (iEEG). However many patients do not have visually identifiable lesions on brain MRI or PET making it a challenge for surgical planning. The primary aim of this proof of concept study is to determine if the most hypometabolic regions of the interictal brain PET using quantitative analysis software correlates with the seizure onset zone determined by subsequent iEEG.

METHOD AND MATERIALS

Eighteen interictal PET-CT scans of brain in patients who had also undergone iEEG were retrospectively reviewed. All patients originally had MR and qualitative PET interpreted as negative. The studies were then processed with quantitative analysis software (MimNeuro 5.6; Cleveland, Ohio) which compares PET images to a normal database. The 10 most hypometabolic foci were recorded on a scale of 1-10 with 1 being most hypometabolic. Foci which corresponded to white matter or cerebellum on co-registered CT were eliminated from analysis since these are rare locations for origin of seizures. Candidate foci based on rank order of hypometabolism were then compared to the actual location of the seizure onset zone as identified on iEEG.

RESULTS

Mean (+SD) age was 43.6 (+11.7); range 24-60 years. Ten patients were male and 8 female. For all 18 patients the seizure onset zone from the iEEG correlated with one of the hypometabolic foci on the quantitative PET analysis. Mean (+SD) rank order of hypometabolism
SSQ16-07 • PET/CT versus PET/MR for the Clinical Evaluation of Patients with Dementia: Comparison of Visual Interpretation by Two Experienced Readers

Kent P Friedman MD (Presenter) ; Rajan Rakheja ; Timothy M Shepherd MD, PhD ; Rachel Bartlett PhD ; Yu-Shin Ding PhD ; Fernando Boada

PURPOSE
Simultaneous PET/MR is a new technology that may be used in the evaluation of dementia patients. There are few data in the literature regarding quantitative differences between PET data obtained at PET/CT versus PET/MR and how this may impact image interpretation. This study compared the PET interpretation of PET/CT versus PET/MR by two independent experienced nuclear medicine physicians.

METHOD AND MATERIALS
Forty-five minutes following injection of 10 mCi of FDG, 19 patients with clinically-suspected dementia underwent a 15-minute clinical brain PET/CT. Simultaneous PET/MR scanning was subsequently performed (60 minute list-mode) at approximately 90 minutes post-injection. Two experienced nuclear medicine physicians blindly interpreted the PET portion of all PET/CT scans, attributing a specific diagnosis (normal, AD, FTD, LBD, other dementia, mixed phenotype or unspecified disease) and severity scale (mild, moderate or severe abnormality). The readers then blindly interpreted the PET data obtained from PET/MR. Concordance between PET/CT (reference standard) and PET/MR with respect to diagnosis and disease severity was assessed for each reader.

RESULTS
Reader A classified 12 PET/CT scans as AD, 5 as unspecified dementia, 1 as LBD and 1 as normal with a mean severity score of 2.0. Reader B classified 10 PET/CT scans as AD, 3 as unspecified, 1 as LBD and 5 as normal with mean severity score of 2.1. PET/MR interpretations with comparison to PET/CT yielded an 84% (16/19) intra-reader concordance of diagnosis, with 95% (18/19) of severity scores varying by one point or less. Reader B exhibited 84% intra-reader concordance of dementia pattern diagnosis, with 89% (17/19) of all scores varying by one point or less.

CONCLUSION
Our preliminary analysis in clinically-suspected dementia patients showed a relatively high concordance of intra-reader assignment of diagnostic and severity findings between PET/CT and PET/MR when evaluated by two blinded experienced nuclear medicine physicians. These results suggest PET/MR brain scans acquired on hybrid PET/MR are of diagnostic quality and interpretation results compare favourably to PET/CT.

CLINICAL RELEVANCE/APPLICATION
Prior to widespread implementation of PET/MR for dementia evaluation; PET results obtained by PET/MR need to be validated and compared to PET/CT.

SSQ16-08 • A Novel MR Atlas-based Method Outperforms the Silver-standard CT Segmentation-based Method in PET Attenuation Correction

Meher Juttukonda (Presenter) * ; Yasheng Chen PhD ; Yueh Z Lee MD, PhD * ; Felipe Espinoza ; Weili Lin PhD ; Dinggang Shen PhD ; David Lalush ; Hongyu An DSc

PURPOSE
Since MR signal depends on proton (not electron) density and tissue relaxation, MR-based attenuation correction (AC) for MR/PET imaging is challenging. In this study, we have developed an atlas-based MR method for PET AC and have evaluated its accuracy using simulations.

METHOD AND MATERIALS
In a group of 10 patients with paired MR and CT images, 3 AC maps were generated for each patient. First, gold-standard maps (CTSC) were derived using bilinear scaling of their CT images. Second, nonlinear registration was performed to generate a T1w-MR and CT atlas. A hidden Markov random field method was then used in a leave-one-out scheme to derive a pseudo-CT (pCT) for each patient using the atlas and their MR image. These pCTs were then scaled to obtain MR-based AC maps (MRAC). Last, the original CTs were segmented into 3 classes (bone, air, soft tissue) and each class was assigned its attenuation value to yield a third AC map (CTSEG). The CTSEG method is considered the silver standard because it represents the best possible outcome of using an MR-segmentation-based AC method. Realistic, patient-specific PET simulations were then conducted to evaluate the performance of MRAC and CTSEG in the 10 patients for two cases: 1) normal brain and 2) brain with a focal lesion added. Attenuation was applied at the sinogram stage using the CTSC map and was corrected for using CTSEG and MRAC. The results were reconstructed and a percent-error analysis against the gold standard was performed.

RESULTS
The MRAC method resulted in a lower average whole-brain absolute percent-error (WBAE) across patients of 1.84% compared to the 4.57% achieved by the CTSEG method (p

CONCLUSION
We have developed a MR T1w-based AC method that outperforms the silver standard. In addition, the presence of a focal lesion does not affect the accuracy of the proposed method.

CLINICAL RELEVANCE/APPLICATION
An accurate MR-based AC method allows the MR/PET to become quantitatively reliable and opens the door for simultaneous quantitative-PET and MR applications.

SSQ16-09 • Serial Brain SPECT Imaging Using Neurogram Software to Monitor Treatment Response to Stem Cell Therapy in Patients with Cerebral Palsy

Parul Mohan MBBS, MD (Presenter) ; Geeta Shroff MBBS, MD ; Harsh Mahajan MD, MBBS

PURPOSE
Hypoxic brain injury is one of the major causes of cerebral palsy. Stem cell therapy has shown promise in clinical trials and is sought by many parents of children with cerebral palsy (CP). Brain perfusion studies with single photon emission computed tomography (SPECT) have been applied in these patients and have been evaluated either by visual interpretation or using semiquantitative analysis. Several processing protocols for 3D voxel-by-voxel analysis of brain perfusion SPECT have been applied, mainly the three-dimensional stereotactic surface projection (3DSSP) and the statistical parametric mapping (SPM) and recently the NeuroGam software. Although many studies have been published dealing with brain perfusion abnormalities in various neurological disorders, there is negligible literature concerning the interval changes in perfusion in cortical functional areas, pre and post therapy. The present study was to evaluate the treatment response (improvement or deterioration) in perfusion of specific areas of the brain cortex using Tc-HMPAO brain SPECT.
RESULTS
The results were elaborated as mild improvement when 10%-30% changes were noted, moderate improvement when 30%-60% changes were noted and significant improvement when 60%-90% changes were noted. Thirty six patients had a normal brain SPECT after treatment. Seventeen patients had minimal residual hypoperfusion after treatment. The rest showed significant improvement after treatment with mild to moderate hypoperfusion. None of the patient in the series showed deterioration or no improvement.

CONCLUSION
Brain SPECT is an extremely useful tool in monitoring the treatment response to stem cell therapy in patients of cerebral palsy. It showed changes at the molecular level, hence indicating improvement even before the clinical changes were manifested.

CLINICAL RELEVANCE/APPLICATION
Brain SPECT showed changes at the molecular level, hence indicating improvement even before these changes became clinically apparent.

SSQ17-01 • Assessment of White Matter Integrity Using Tract-based Spatial Statistics in Lennox-Gastaut Syndrome

**Mina Park** MD; **Injoong Kim** (Presenter); **Kwon Joon Ho** MD; **Yoon Seong Choi** MD; **Na-Young Shin** MD; **Kyung-Eun Kim** MD; **Jinna Kim** MD; **Seung-Koo Lee** MD, PhD

**PURPOSE**
Lennox-Gastaut syndrome is a severe form of epilepsy with childhood onset, accompanying with moderate to severe cognitive dysfunction. However white matter disruption of the patients remains unclear. The aim of this study was to evaluate white matter integrity by using DTI in patients with Lennox-Gastaut syndrome without morphologic abnormalities in conventional imaging.

**METHODOLOGY**
In a retrospective study, diffusion tensor images from 11 patients of Lennox-Gastaut syndrome without morphologic abnormalities on conventional MRI were processed. Eleven clinical control subjects were matched for age, sex, and scanning parameters. Paired TBSS was performed to evaluate differences in FA.

**RESULTS**
In patients with Lennox-Gastaut syndrome, FA value clusters in the white matter was significantly decreased compared to the healthy controls. Significant FA value reduction in patients with Lennox-Gastaut syndrome were found in the right middle frontal gyrus, left superior frontal gyrus, bilateral anterior thalamic radiations, corpus callosum, external and internal capsules, inferior fronto-occipital fasciculus, and corticospinal tracts.

**CONCLUSION**
Despite qualitatively normal-appearing white matter tissues, patients with Lennox-Gastaut syndrome have widespread microstructural changes measurable with quantitative DTI. Although the pathologic-anatomic correlation of theses findings remains, these regions are strongly suggested to be related to cognitive impairments in these patients.

**CLINICAL RELEVANCE/APPLICATION**
Fractional anisotropy evaluated using tract-based spatial statistics can be used to show abnormalities in the patients with Lennox-Gastaut syndrome who have normal findings at conventional MRI imaging.

SSQ17-02 • Functional Connectivity in Children with Sickle Cell Anemia and Normal Brain MRI

**Kathleen J Helton** MD (Presenter); **Diana Fridlyand** BS; **Matthew Scoggins** PhD; **Ping Zou** PhD; **Jane Hankins** MD; **Banu Aygun** MD; **Jane Schreiber** PhD; **Robert J Ogg** PhD

**PURPOSE**
Children with sickle cell anemia (SCA) are at risk for cognitive impairment, but the etiology of cognitive dysfunction in patients without visible evidence of brain injury remains unknown. We have shown that intelligence quotient in children with SCA is associated with altered blood-oxygenation level dependent (BOLD) functional MRI response to visual stimulation, findings that suggest chronic anemia alters the neural-hemodynamic coupling that supports healthy brain function. We used BOLD fMRI to test the hypothesis that cognitive dysfunction in SCA is associated with altered brain network connectivity.

**METHODOLOGY**
Following IRB-approval and written informed consent, 15 untreated children (12.37±3.39 years) with SCA underwent fMRI (resting-state and Nback) and neuropsychological testing (IQ, Wechsler Intelligence Scale for Children, 2003). After realignment, slice time correction, spatial normalization and smoothing(SPM8, http://www.fil.ion.ucl.ac.uk/spm/), spatially independent brain regions with correlated temporal patterns of activity (components) were identified with independent component analysis (ICA) of resting and task data (GIFT link?). Adjacency matrices were constructed based on pair-wise correlation of component time courses. Networks metrics (modularity, cost-integrated average degree, cost-integrated average local efficiency, cost-integrated global efficiency) were analyzed in relation to published healthy normal (N) values, age, and IQ.

**RESULTS**
Global efficiency (SCA=0.4, N=0.6) and modularity (SCA= 0.16, N=0.4-0.6) were lower than normal, and global efficiency was negatively correlated with modularity (p < 0.05). Decline of IQ with age shows adverse effects of disease on cognitive function. Network analysis revealed altered organization of brain networks in children with SCA, and graph-theoretical network metrics reflected abnormal age-related decline in IQ. The connectivity patterns we observed may help to elucidate the mechanism of cognitive dysfunction in SCA.

**CONCLUSION**
Functional connectivity analysis holds great promise as a clinical adjunct in future studies of patients with SCA to assess effectiveness of treatment in improving neurocognitive function.

SSQ17-03 • 3T Apparent Kurtosis Coefficient (AKC) in Pediatric Brain: Preliminary Results

**Marzia Mortilla** MD (Presenter); **Antonio Ciccarone** MD, PhD; **Marco Esposito**; **Claudio Fonda** MD
SSQ17-04 • Alteration of Regional Low-frequency Fluctuation in Very Young Autistic Children: A Sedated-state fMRI Study

Hua Cheng MD (Presenter) ; Jishui Zhang ; Hao Huang PhD ; Gaolong Gong ; Yun Peng MD

PURPOSE
So far, it remains largely unknown how the regional functional patterns are altered in very young autistic children. The present study aims to determine if there are functional changes in social cognition-associated brain areas in autistic patients at very young stage.

METHOD AND MATERIALS
Sedated-state fMRI (5-30 ml/kg of 5% propofol) data of 33 treatment-naïve male autism (2-6 years) and 26 age-matched controls were collected from a 3T clinical scanner using EPI sequence. The patients were diagnosed according to the ADI-R. Amplitude of low-frequency fluctuations (ALFF) and fractional ALFF were calculated using the REST software and analyzed in two different frequency bands (slow-5: 0.01-0.027 Hz, slow-4: 0.027-0.073 Hz). To detect the group difference of ALFF or fALFF between autistic children and controls, a general linear model was applied to all voxels in grey matter. Statistical significance were determined by a cluster extent threshold of p < 0.05 (supplementary Figure).

RESULTS
We have found significant differences of frequency-dependent ALFF/fALFF in multiple brain regions between autistic children and controls (supplementary Figure) which are associated with social cognition. Compared to controls, the patients showed similar decreased patterns of ALFF of slow-4 band in left temporal gyrus (p = 0.01) (supplementary Figure).

CONCLUSION
Our study reveals the abnormalities of functional activity of very young autistic children in multiple brain regions, which possibly underlies core symptoms of autism. The ALFF in left temporal lobe could be an imaging maker for autism evaluation. Therefore, the ALFF/fALFF analysis based on S-fMRI can be utilized as a potential method to evaluate brain functional development in very young children.

CLINICAL RELEVANCE/APPLICATION
The ALFF under sedated state could be a new imaging marker for evaluating functional abnormalities of autism in very young age.

SSQ17-05 • Biotin-responsive Basal Ganglia Disease (BBGD): Neuroimaging Features before and after Treatment

Hassan Kassem MD ; Sari s Alsuhibani MBBS, MD (Presenter) ; Sherif Abdelfattah MD, PhD ; Fahad Alsheikh ; Ayman H Gaballah MD, FRCR

PURPOSE
The purpose is to assess the clinical and neuroimaging features of a biotin-responsive basal ganglia disease before and after treatment of a subacute encephalopathy and to compare the disease with the other basal ganglia diseases of childhood.

METHOD AND MATERIALS
We retrospectively reviewed the clinical, laboratory and neuroimaging features of fifteen (15) genetically proven cases of biotin-responsive basal ganglia. All patients were of Arab ancestry and have consanguineous parents. Recessive genetic defect was detected in all cases. The clinical, laboratory and imaging features were compared with those of other basal ganglia diseases of childhood.

RESULTS
We have examined 47 children (aged 15 days - 14yrs) with different pathologies (12 tumors, 4 vascular, 9 metabolic, 7 cognitive defects) and with no pathology (15).

CONCLUSION
It is important to check for the presence of this disease in children with acute extrapyramidal symptoms or subacute encephalopathy as it can be managed without further neurological deterioration.

CLINICAL RELEVANCE/APPLICATION
It is important to check for the presence of this disease in children with acute extrapyramidal symptoms or subacute encephalopathy as it can be managed without further neurological deterioration.
SSQ17-07 • A Novel MRI Sequence ("Black Bone") Offering an Alternative to Ionising Radiation in the Investigation of Craniosynostosis

Karen A Eley MBChB, DPhil (Presenter) ; Fintan Sheerin MBChB ; Stephen R Watt-Smith MD, MBBS ; Stephen J Golding MD

PURPOSE

Periventricular leukomalacia (PVL) is the major cause of neurodevelopmental problems encountered in survivors of premature birth. The aim of this study was to evaluate the ultrasound texture analysis as a potential imaging tool for quantitative assessment of periventricular white matter (PVWM) injury in preterm infants.

METHOD AND MATERIALS

73 preterm infants (median gestational age; 28wks, median birth weight; 905.2g) who were treated in the neonatal intensive care unit and had serial cranial US and brain MR obtained at near term period (38.0 ± 3.7wks) were included in our study. Periventricular echogenicity (PVE) on serial cranial US were evaluated qualitatively by visual grading as grade 1, 2, and 3 compared to echogenicity of the choroid plexus and quantitatively using Gray Level Co-occurrence Matrix (GLCM) method; a second order statistical method of texture analysis. These features were selected based on empirical observation that the normal PVWM exhibits homogeneous echotexture, whereas the abnormal PVWM often exhibits heterogeneous echotexture. Four GLCM textual features which represent homogeneity of an image was measured: (1) angular second moment (ASM), (2) inverse differential moment (IDM), (3)contrast, and (4) entropy. Quantitative and qualitative US features of PVE were compared between two groups (group 1: PVL on MRI(10), group 2; no PVWM abnormality on MRI(63)).

RESULTS

All GLCM features did not show statistically significant difference between two groups, although mean value of ASM and IDM were higher in group 1 than those of group 2 (ASM p-value; 0.176, IDM p-value; 0.52). Contrast (degree of heterogeneity) and entropy (degree of randomness) were lower in group 1 than those of group 2 (contrast p-value; 0.68, entropy p-value; 0.221). IDM and entropy values of PVE grade 1 (less than choroid plexus) showed statistically significant difference between two groups. (IDM p-value; 0.006, entropy p-value;

CONCLUSION

Texture analysis using GLCM matrix method may serve as a complementary tool for quantitative assessment of PVE in selected cases of increased PVE. It is still questionable whether US screening of PVWM in premature infants can be a sensitive predictor of the PVWM injury in preterm infants.

CLINICAL RELEVANCE/APPLICATION

Off-line texture analysis of PVE utilizing GLCM matrix might be a complementary tool for quantitative approach to vulnerable brain structures in preterm infants.

SSQ17-08 • Amide Proton Transfer MR Imaging of the Brain in Children at 3T: A Preliminary Study

Hong Zhang MD (Presenter) ; Jinyuan Zhou PhD ; Na X Zhao PhD ; Yun Peng MD

PURPOSE

APT imaging is able to extend the achievable magnetic resonance imaging (MRI) contrast to the protein level. The aim of this study was to investigate APT effect in healthy children.

METHOD AND MATERIALS

Nineteen healthy children were investigated. All subjects were scanned on a Philips 3T MRI scanner (Achieva 3.0T TX). Single-slice APT imaging was acquired. All data processing procedures were performed using the interactive data language (IDL). The MTR asym(3.5 ppm) image was calculated. Regions of interest were carefully chosen by experienced radiologists. The regions of interest were drawn on relatively homogenous white and gray matters of bilateral cerebral hemispheres. SPS11.3 for Windows was used for data analysis. The distribution of the data was tested using the Shapiro-Wilk normality test. All values are expressed as mean±standard deviation. Then, paired t-test was done to show if there was significant difference in MTR asym(3.5 ppm) values between white and gray matters. Statistical significance was accepted at p < 0.05.

RESULTS

Fig.1 shows an example of APT images for a volunteer. As shown in Fig.1, the APT signal intensities was greater in gray matter compared to white matter in volunteers. There was no statistically significant difference between the left and the right side of the brain in volunteers. So, the values from both sides were combined. The units of APT are percentage points in the water signal intensity, the values are -0.62±0.20 (white matter) and 0.25±0.34 (gray matter). There was statistically significant difference of APT signal intensities between white and gray matters. (t=-12.24, p=0.000).

CONCLUSION

We have demonstrated the feasibility of APT imaging of normal brain in healthy children on a clinical 3T scanner. APT imaging at 3T revealed significant contrast between white and gray matters, with a higher APT signal apparent within the gray matter. These preliminary data from healthy children show that the APT is a unique contrast that can provide complementary information to standard clinical MRI measures.

CLINICAL RELEVANCE/APPLICATION

APT imaging is able to extend the achievable MRI contrast to the protein level. We believe that APT imaging at 3T has the potential to become a noninvasive biomarker for some pediatric diseases.

SSQ17-09 • A Novel MRI Sequence ("Black Bone") Offering an Alternative to Ionising Radiation in the Investigation of Craniosynostosis

Karen A Eley MBChB, DPhil (Presenter) ; Fintan Sheerin MBChB ; Stephen R Watt-Smith MD, MBBS ; Stephen J Golding MD

PURPOSE

"Black Bone" MRI is a novel gradient echo sequence providing improved definition of the bone-soft tissue margin by minimising soft tissue contrast. We sought to determine the potential of "Black Bone" MRI as a non-ionising alternative to CT in the identification of cranial sutures and diagnosis of craniosynostosis.

METHOD AND MATERIALS

A prospective study of 4 children with normal cranial sutures and 13 children with a clinical diagnosis of craniosynostosis was conducted following initial investigation of the "Black Bone" sequence in an animal model. Normal cranial sutures were assessed by measurement of suture width with reference to normative data. "Black Bone" datasets in the 13 children with craniosynostosis were compared to CT of and clinical findings. Blinded review of 12 "Black Bone" datasets from children was completed by 3 assessors, grading each cranial suture on a scale of 0 to 2. To provide comparable imaging to CT and enhance visualisation of the cranial sutures, techniques were developed to produce three-dimensional rendered images of the craniofacial skeleton.

RESULTS

Patent cranial sutures were consistently identified on the "Black Bone" datasets as areas of increased signal distinguished from the signal void of the cranial bone. In children with craniosynostosis the affected suture was absent, whilst the remaining patent sutures could be visualised. These findings were consistent with those on CT. On independent review, synostosed sutures received the lowest mean scores. Three-dimensional rendered images permitted visualisation of the cranial sutures throughout their course.

CONCLUSION

Patent cranial sutures appear as areas of increased signal on "Black Bone" MRI clearly distinguished from the cranial bone. The sequence accurately differentiates the normal suture from the prematurely fused, demonstrating considerable clinical potential as a non-ionising alternative to CT in the diagnosis of craniosynostosis.

CLINICAL RELEVANCE/APPLICATION

"Black Bone" MRI offers a non-ionising alternative to CT in the investigation of craniosynostosis, with the ability to produce...
To evaluate the utility of the histogram-based analysis of multidetector row CT images in diagnosing otosclerosis.

**PURPOSE**
To evaluate the visualization of the temporal bone using low-dose 256-slice CT, we scanned one exsomatized cadaveric head at multiple levels of mAs and kV. This optimized protocol was used to examine pediatric patients. We analyzed the feasibility of low-dose temporal bone CT in children and evaluate the image quality and radiation dose of a low-dose versus.

**METHOD AND MATERIALS**
One exsomatized cadaveric head was scanned repeatedly at three levels tube tensions from 120 to 800 kV. And at every kV, multiple mAs were used from 250 mAs until the image quality was insufficient. Noise was measured as the standard deviation in HU within the region of the brain stem. All databases were subjectively evaluated by 2 experienced radiologists. The visibility of 16 anatomical landmarks was scored using a five point scale. The noise and effective dose were compared with each other. The optimized low dose protocol was used to examine 27 consecutive children. We retrospectively analyzed 36 examinations underwent a standard temporal bone CT acquired with 120 kV, 250 mAs. The image quality and the effective dose were analyzed. Image quality score frequencies were calculated for each group. The children were then divided into 5 groups according to age-specific effective dose conversion coefficient. The effective dose of different age groups were compared in both low and high protocol. And then we compared the effective dose between the two protocols at the same age.

**RESULTS**
CT radiation dose was significantly reduced when the parameters was selected 100 kV, 70 mAs. Most of the anatomical landmarks were delineated no significantly difference though the increased noise. The frequency of score 5 was significantly lower for the low-dose scans versus high, however the frequency of 4 was significantly higher. The frequency of the scores 1 and 2 was none for both protocols.

**CONCLUSION**
Low-dose temporal bone CT scans allow an accurate evaluation of middle and inner ear structures in children though reduced image quality compared with that in high-dose scans. The radiation dose was 5–6 times below standard protocol used in daily work. The effective dose for infants is higher than the older children underwent the same protocol.

**CLINICAL RELEVANCE/APPLICATION**
Postoperative CT of cochlear implants should provide information on the precise localization of the implant and its individual electrode.

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**Neuroradiology/Head and Neck - Thursday Posters and Exhibits (12:15pm - 12:45pm)**

**LL-NRS-THA • AMA PRA Category 1 Credit ™:0.5**

**Host**
Pratik Mukherjee, MD, PhD *

**LL-NRE-TH10A • Unusual Sellar-suprasellar Lesions-Key Imaging Features and Diagnostic Challenges**

Zarina A Assis MBBS, MD (Presenter); Sunitha P Kumaran MBBS, MD; Sanjaya Viswamitra MD; Nandita Ghosal MD

**PURPOSE/AIM**
To illustrate the MRI features of the less described sellar-suprasellar lesions. To provide MRI differentiators to narrow down the differential diagnosis.

**CONTENT ORGANIZATION**
We present MRI features of rarely encountered sellar-suprasellar entities with an incidence of 1-2%. Retrospective review of MRI of pathologically proven uncommon sellar-suprasellar lesions from 2006 to 2013 revealed a wide plethora of diagnosis like pituitaryomas, granular cell tumours, angiolipomas, granulomatous hyponogonadism, choroiditis, choroid meningioma, co-existent granuloma, meningioma with co-existent breast carcinoma metastasis, medulloblastoma metastasis, hypothalamic cavernoma, rosai dorfman disease, gangliocytoma, glioblastoma multiforme (GBM) and tuberculosis. We put forth certain key imaging MRIdifferentiators like presence of fat in angiolipomas; purely suprasellar and homogeneous solid mass with intense post contrast enhancement in granular cell tumour, choroid gliomas and meningiomas; thick enhancing infundibular stalk in granulomatous hypophysitis.

**SUMMARY**
This educational exhibit intends to familiarize readers to the key imaging features of uncommon sellar-suprasellar lesions rarely encountered in radiology practice.

**LL-NRE-TH11A • Thyroid Ultrasound Elastography: Why, How, When? Tips and Tricks**

Vito Cantisani MD (Presenter); Pietro Lodise; Ester Mancuso MD; Mattia Di Segni MD; Carlo Catalano MD; Paolo Ricci MD; Elena Maggini

**PURPOSE/AIM**
To show main features, diagnostic accuracy and main recognized limitations of different elastographic techniques, suggesting how we can improve their diagnostic performance.

**CONTENT ORGANIZATION**
By assessing hardness as indicator of malignancy, elastography has recently become an additional tool for thyroid nodule differentiation and nowadays also in evaluation of diffuse thyroid diseases, in combination with base ultrasound and FNAC. The different techniques of elastography applied to the thyroid base their analysis on two different types of compression force. Free hand compression force includes the strain elastography (SE), with its qualitative and semi quantitative variants and the q-static analysis that uses the pulsation of the carotid artery (ECI index). The quantitative approach with compression induced by an acoustic pulse of the probe includes shear wave elastography (SWE) and Acoustic Radiation Force Impulse (ARFI).

**SUMMARY**
Considering literature updates and our experience we will present the feasibility, limitations of different techniques showing some tips and tricks to better improve the quality of each examination technique.

**LL-NRS-TH1 • Diagnosis of Otosclerosis: The Utility of Histogram-based Analysis of Multidetector Row CT Images**

Koji Yamashita MD (Presenter); Takashi Yoshiura MD, PhD; Akio Hiwatashi MD; Osamu Togao MD, PhD; Kazufumi Kikuchi MD; Seiji Kumazawa PhD; Takashi Inoguchi; Hiroshi Honda MD

**PURPOSE**
To evaluate the utility of the histogram-based analysis of multidetector row CT images in diagnosing otosclerosis.
Magnetic Resonance Imaging in Differentiation of Benign and Malignant Thyroid Masses

To compare the accuracy of ultrasound color doppler, conventional magnetic resonance imaging and diffusion weighted MRI. Ultrasound doppler features evaluated were shape, margin, halo, echogenicity, echotexture, calcification, extrathyroid spread, lymphadenopathy, pattern of vascularity and RI. Features studied on conventional MRI were shape, margin, halo, pseudocapsule, internal architecture, haemorrhage, cystic change, calcification, lymphadenopathy, extrathyroid spread, contrast enhancement and pattern. Based on these, each mass was

RESULTS
Fifty one temporal bones of 38 patients with otosclerosis (mean age: 49.0 ± 12.4 years old) and 30 control subjects (mean age: 44.6 ± 17.0 years old) were included. The mean CT value, contrast, and energy were significantly lower in otosclerosis cases than normal controls (p<0.05).

CONCLUSION
Our results demonstrated that the histogram-based analysis of CT images is useful to diagnose otosclerosis. In particular, the mean CT value and the contrast showed higher diagnostic values.

CLINICAL RELEVANCE/APPLICATION
The histogram-based analysis of multidetector row CT images can be an effective and operator independent tool for diagnosis of fenestral otosclerosis.

LL-NRS-TH2A • The Infraorbital Nerve Canal: Anatomic Considerations

Merve Gursoy MD ; Emanuele Orru MD (Presenter) ; Lukasz Babiarz MD, MBA ; Roxana Rivera-Michlig MD ; David M Yousem MD *

PURPOSE
To assess the impact of race, sex, and ethnicity on the location of the infraorbital nerve canal (IOC) in the orbital floor.

METHOD AND MATERIALS
This study was HIPAA compliant and approved by the institutional IRB. Non contrast maxillofacial CT scans of patients without orbital pathology performed at our Institution in the past 5 months were retrospectively reviewed. To assess the location of the IOC on the orbital floor, we measured the distance between the medial orbital wall and the medial margin (medio-medial distance, MMD) of the IOC and the lateral orbital wall and the lateral margin of the IOC (latero-lateral distance, LLD) on coronal images bilaterally. The results were analyzed to determine if there are significant (p<0.05) differences among the race, sex, and ethnicity groups.

RESULTS
We conducted measurements on 240 patients, 162 (67.5%) F and 78 (32.5%) M with an average age of 50.4 years (range: 18-92 years, SD: 16.6). There were 7/78 (8.9%) AAM, 71/78 (91.1%) CM, 31/162 (19.1%) AAF, and 131/162 (80.9%) CF. There was a significant (p<0.05) difference in the location of the IOC.

CONCLUSION
The IOC location on the orbital floor measured in normal subjects is more medial in the general groups of C vs AA and in CF vs AAF. This finding has implications on the pattern of orbital floor fractures that occur in these patient populations.

CLINICAL RELEVANCE/APPLICATION
Knowledge of differences based on ethnicity and sex in the location of the IOC on the orbital floor can help preoperative planning for surgery in this area and predict patterns of orbital floor.

LL-NRS-TH3A • Primary Squamous Cell Carcinoma in Intracranial Epidermoid with Review of Literature

Jignesh Modi MD (Presenter) ; Dee H Wu PhD ; John T Doan MD

PURPOSE
We report an extremely rare case of primary intracranial squamous cell carcinoma arising from a pre-existing benign epidermoid cyst follow by literature review of published cases of primary intracranial squamous cell carcinoma.

METHOD AND MATERIALS
Retrospective review of the brain MRIs, whole-body PET/CT and Pathology report after surgery of a case of primary squamous cell carcinoma. Images were reviewed from PACS system, patient’s electronic medical record and Meditech system. We performed OVID literature search for all reported cases of malignant transformation of primary intracranial squamous cell carcinoma from epidermoid cyst and did not find any cases with the presentation in location and imaging that we report in this work.

RESULTS
A 29 yr old female presented with severe headaches. Brain MR showed lobulated lesion in left medial temporal lobe with increased signal intensity on T2 weighted images and Diffusion weighted images (DWI). Lesion showed decreased signal on T1 weighted images with no abnormal post contrast enhancement. Findings are consistent with an epidermoid cyst. Subsequently the patient presented after 6 yrs with recurrent seizures. Brain MR revealed heterogeneously enhancing mass in the left medial temporal lobe. Biopsy of the left temporal mass revealed squamous cell carcinoma arising from epidermoid cyst with possibility of metastatic squamous cell carcinoma was not excluded. A whole-body positron emission tomography scan showed hyper metabolic uptake of 18F-FDG in the left temporal lobe mass without evidence of distant metastasis. The patient was treated with chemotherapy and radiation therapy.

CONCLUSION
Literature review showed very few reported cases of primary intracranial squamous cell carcinoma arising from a pre-existing epidermoid cyst. None of the reported cases were in temporal lobes as per our knowledge. Our case shows malignant transformation of an epidermoid cyst in the temporal lobe into a primary squamous cell carcinoma. Imaging findings of malignant transformation were demonstrated brain MR and whole body PET/CT with diagnosis confirmed by histological examination.

CLINICAL RELEVANCE/APPLICATION
MRI can demonstrate typical features of epidermoid cyst with the help of Diffusion weighted imaging. Primary Squamous cell carcinoma in brain is unusual and PET-CT should be performed in all cases.

LL-NRS-TH4A • Comparison of Ultrasound Color Doppler, Conventional Magnetic Resonance Imaging and Diffusion Weighted Magnetic Resonance Imaging in Differentiation of Benign and Malignant Thyroid Masses

Charu Paruthi MBBS, MD (Presenter) ; Umesh C Garga MBBS, MD

PURPOSE
To compare the accuracy of ultrasound color doppler, conventional magnetic resonance imaging and diffusion weighted magnetic resonance imaging in differentiating benign and malignant thyroid masses.

METHOD AND MATERIALS
44 patients with thyroid masses were evaluated with ultrasound doppler, conventional and diffusion weighted MRI. Ultrasound doppler features evaluated were shape, margin, halo, echogenicity, echotexture, calcification, extrathyroid spread, lymphadenopathy, pattern of vascularity and RI. Features studied on conventional MRI were shape, margin, halo, pseudocapsule, internal architecture, haemorrhage, cystic change, calcification, lymphadenopathy, extrathyroid spread, contrast enhancement and pattern. Based on these, each mass was
assigned a score from 0 (1) 8 and was classified as benign (0 (2)) indeterminate (3 (5)) or malignant (6 (8)) on each modality. Diffusion weighted images were acquired at b values 100, 300 and 800. ADC values were calculated and masses classified as benign or malignant. Final diagnosis was confirmed on histopathology or FNAC. Accuracy of the results of ultrasound doppler, conventional MRI and diffusion weighted MRI was calculated.

RESULTS
68.2% (30) of the studied masses were benign and 31.8% (14) malignant. The accuracy of Ultrasound Doppler, conventional MRI and diffusion weighted MRI in diagnosing thyroid masses was 70.4%, 63.6% and 81.1% respectively. The mean ADC values of benign and malignant lesions were 1.82±10.3 mm/s and 0.89±10.3 mm/s respectively. The overall sensitivity, specificity, NPV and PPV in diagnosing malignant masses were 64.2%, 73.3%, 75% and 95.6% respectively for US Doppler; 57.1%, 66.6%, 80% and 86.9% respectively for conventional MRI and 85.7%, 80%, 66.7% and 92.3% respectively for DW-MRI.

CONCLUSION
Ultrasound Doppler was found to be more accurate than conventional MRI in diagnosing thyroid masses. However, diffusion MR was the most accurate. Conventional MRI had a slightly greater negative predictive value in diagnosing malignant lesions than US Doppler. Positive predictive value of DWI was less than the other two. This was due to the overlap of ADC values between some malignant and benign diffuse masses.

CLINICAL RELEVANCE/APPLICATION
Ultrasound doppler, being more accurate than conventional MRI, should be preferred over it for initial evaluation of patients with a thyroid mass. Diffusion weighted MRI, however, is the most accurate.

LL-NRS-THSA • Organ Specific Dose Reduction in Head and Neck CT Angiography-Impact on Image Quality
Patric Kroepil MD ; Lars Schimmoeller MD (Presenter) ; Philipp Heusch MD ; Sebastian Dietrich ; Gerald Antoch MD * ; Rotem S Lanzman MD

PURPOSE
Organ specific dose reduction (OSDR) algorithms can reduce radiation on radiosensitive organs up to 59%. This study evaluates the influence of a new OSDR algorithm on image quality (IQ) of head and neck CT-angiography (CTA) in clinical routine.

METHOD AND MATERIALS
62 consecutive patients (68±13 years) were randomized into 2 groups and imaged on a 128-row CT-scanner. Group A (n=31) underwent conventional CTA and group B (n=31) CTA with a novel OSDR algorithm (XCare®, Siemens), which lowers the radiation exposure of superficial radiosensitive organs (e.g. eye lens, thyroid gland) by reducing the tube current time product (mAs) for anterior 120° projections. Subjective and objective IQ was statistically compared. Subjective IQ was rated on a 5-point-scale (1_non diagnostic; 5_excellent). Signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) was calculated using ROI measurements.

RESULTS
SNR of the common carotid artery and middle cerebral artery was 53.6±22.7 and 43.3±15.3 (group A) versus 54.1±20.5 and 46.2±14.6 (group B). CNR was 40.0±19.3 and 29.7±12.0 (group A) compared to 40.7±16.8 and 32.9±10.9 (group B). Subjective IQ was excellent in both groups (mean score 4.4±0.7 versus 4.4±0.6). Differences between the two groups were not significant.

CONCLUSION
The OSDR algorithm XCare® does not compromise image quality of head and neck CTA.

CLINICAL RELEVANCE/APPLICATION
The application of this novel OSDR device can be recommended for CTA in clinical routine to reduce the radiation to thyroid gland and ocular lenses.

LL-NRS-TH6A • The Preliminary Study of Using Lower Contrast Concentration (Iodixanol, 270mgI/mL) Combined with 80kVp and 80% ASIR in CTA for Head and Neck
Shan Hu (Presenter) ; Wenzhen Zhu MD, PhD ; Daoyu Hu MD, PhD ; Jinhua Zhang ; Weijia Wan ; Qi X Wang

PURPOSE
To explore the clinical value of using iodixanol (270mg I/mL) combined with 80kVp and 80%ASIR in CTA for head and neck.

METHOD AND MATERIALS
RESULTS
The mean CT value of Group B was significantly higher than Group A (447.40±100.45HU vs 330.05±78.80HU) (P

CONCLUSION
The applications of iodixanol 270mg I/mL combined with 80kVp and 80%ASIR in CTA for head and neck provided acceptable image quality, with contrast dose reduction of 27% and radiation dose reduction up to 61%.

CLINICAL RELEVANCE/APPLICATION
The applications of iodixanol 270mg I/mL combined with 80kVp and 80%ASIR in CTA for head and neck can achieve acceptable image quality.

LL-NRE-TH7A • Imaging of Emergent Neuro-ophthalmology: A Pictorial Review
Bradford D Moore MD (Presenter) ; Yang Tang MD, PhD

PURPOSE/AIM
Acute visual complaints such as sudden vision loss, orbital pain, diplopia, and ophthalmoplegia are common indications to obtain emergent orbital imaging. The purpose of this exhibit is to review the common emergent orbital and intracranial pathologies that may be diagnosed by cross-sectional imaging.

CONTENT ORGANIZATION
1. We will first adopt a compartmental approach to review the relevant MRI/CT anatomy of the orbits, optic pathway, and CN III, IV, V and VI. 2. Then acute pathologies that affect each compartment will be discussed using a case-based format, including: a. Orbit: Optic neuritis, idiopathic orbital inflammatory disease and mimickers, infection including orbital cellulitis, herpetic ophthalmicus and encephalitis, thyroid ophthalmopathy, and vascular pathology including thrombosis of orbital varix b. Sella/cavernous sinus/skull base: Pituitary apoplexy, lymphocytic hypophysitis, cavernous sinus thrombosis, cavernous-carotid fistula, invasive sinusitis, and skull base osteomyelitis c. Vascular: Amaurosis fugax, dural sinus thrombosis, pseudotumor cerebri, aneurysm, infarction affecting the optic pathway, and PRES

SUMMARY
Knowledge of the anatomy and imaging features of common pathologies involving the orbits, optic pathway, and skull base is essential to triage patients with acute neuro-ophthalmologic symptoms.

LL-NRE-TH8A • It’s Not a Tumor: How to Recognize Brain Tumor Mimics Using 5 MR Imaging Features
Jay Starkey MD (Presenter) ; Tarik Tihan ; Soonmee Cha MD

PURPOSE/AIM
Tumors and their mimics are difficult to distinguish at MR evaluation. Of 956 patients with a new diagnosis of brain tumor referred to our institution for surgical resection from July 2002 to June 2012, we found 120 cases (12%) where mimics were misdiagnosed as tumor on initial imaging (proven by pathology and/or clinical course), with tumor mimics being infectious (n=56), demyelinating (n=25), vascular (n=15), radiation necrosis related to non-brain malignancy (n=8), subacute ischemia (n=7), and other (n=9). We aim to demonstrate MR findings that differentiate brain tumors from mimics.

CONTENT ORGANIZATION
We begin with a series of unknown tumor mimics and similar appearing brain tumors. We then present the general approach to MR evaluation of brain parenchymal lesions and 5 imaging features to help distinguish brain tumors from their mimics: T1 shortening, T2 shortening, homogenously reduced diffusion, leading edge reduced diffusion, and cystic mass with incomplete rim enhancement. Pathologic correlation is included wherever. Finally, we return to the original unknowns which become easy to distinguish.

SUMMARY
A systematic approach and 5 imaging features help differentiate brain tumors from their mimics at MR imaging.

**LL-NRE-TH9A • Head and Neck Manifestations of Sexually Transmitted Infections**

**Kira Melamud** MD (Presenter) ; **Asim Mian** MD *

**PURPOSE/AIM**
To describe the clinical and multimodality imaging features of head and neck manifestations of sexually transmitted infections.

**CONTENT ORGANIZATION**
Review of clinical and imaging patterns of complications of different types of sexually transmitted infections in the head and neck. Discuss multimodality imaging approach including CT, MRI, and nuclear medicine to diagnose and identify extent of these infectious complications in the head and neck. Differential diagnosis for the nonspecific imaging patterns of these infections will be discussed.

**SUMMARY**
20 million new sexually transmitted infections occur yearly in the US. Infections that a neuroradiologist may encounter in the head and neck include HIV, HPV, HHV, and syphilis. Common imaging findings on CT or MR may include oral or lingual lesions, as can be seen in syphilis, cervical lymphadenopathy as can be seen with HIV or from superimposed opportunistic infections such as tuberculosis or MAI. Soft tissue or mucosal lesions like HHV related Kaposi’s sarcoma or HPV related squamous cell carcinoma can be seen. Imaging plays an important role in noninvasive diagnosis of these infections. Although imaging characteristics of these infections are nonspecific, a multimodality approach and careful consideration of clinical history is critical for prompt diagnosis and treatment.

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**Neuroradiology/Head and Neck - Thursday Posters and Exhibits (12:45pm - 1:15pm)**

**Thursday, 12:45 PM - 01:15 PM • Lakeside Learning Center**

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**LL-NRS-TBH • AMA PRA Category 1 Credit ™:0.5**

**LL-NRE-TH9B • Sialography: Past and Present**

**Santanu Chakraborty** FRCR ; **Wayd Williams** ; **Joseph P O’Sullivan** MD ; **Alain Berthiaume** BSc, RT (Presenter)

**PURPOSE/AIM**
Sialolithiasis is the most common disorder of major salivary glands. Sialography is used to diagnose a blocked salivary gland or duct and has evolved through conventional catheter contrast enhanced radiography to use of digital subtraction radiography, non-enhanced CT, CT sialography and more recently non-invasive MR sialography. In this review we will discuss the technical aspects, procedural failure and complications, benefit and limitations of each modality.

**CONTENT ORGANIZATION**
We will describe the technical aspects with images describing normal anatomy in each modality. Multiple cases including sialolithiasis, papillary stenosis, strictures, intraglandular sialectasis and changes related to external compression by tumor will be shown. We will describe the value of lemon juice in MR sialography to stimulate salivation that improves detection of strictures and functional obstruction. Use of interventional sialography procedure for treatment will be reviewed.

**SUMMARY**
We describe the evolution of different techniques including conventional and CT or MR sialography to image salivary ducts and salivary stone diseases.

**LL-NRE-TH10B • Intrathyroid Fat-containing Lesions Using CT Imaging with Systemic Literature Review**

**Hyung Suk Seo** (Presenter) ; **Ki Hwan Kim** ; **Younghen Lee** MD ; **Sang-Il Suh**

**PURPOSE/AIM**
Fat-containing thyroid lesions have known to be very rare and only several pathologic reports were published. The purposes of this study were to determine the prevalence of intrathyroid fat lesions on CT imaging, to analyze the CT appearances and the pathology, and to review previous reports systematically.

**CONTENT ORGANIZATION**
In 1,205 patients who underwent neck CT scanning for 1 year, 13 patients(M:F=4:9; mean age 44.6±15.2 years) had intrathyroid fat-containing lesions, a prevalence of 1.2%. Mean size of the intrathyroid fat-containing lesion was 5.7 mm (range: 2.6-10.6 mm). Most of them were nodular-shaped (92%) and homogeneous (92%) with a band connecting to extrathyroid fat (77%) like scoop (Figure). Posterior (85%), medial (85%), and upper (92%) locations of the both thyroid lobes were common. In 4 patients who underwent surgery, a fat-containing nodular hyperplasia, an ectopic thymic tissue with mature fat, and an only mature fat tissue were confirmed. In 40 fat-containing lesions, a prevalence of 1.2%. Most of them were nodular and homogeneous with fatty bands in postero medial location of both upper thyroid lobes. These finding may support the developmental anomaly hypothesis and might prevent unnecessary invasive procedures.

**SUMMARY**
The prevalence of intrathyroid fat-containing lesions was 1.2%. Most of them were nodular and homogeneous with fatty bands in postero medial location of both upper thyroid lobes. These finding may support the developmental anomaly hypothesis and might prevent unnecessary invasive procedures.

**LL-NRE-TH7B • Something Worth Seeing: Postoperative Imaging of the Orbit**

**Brett Searcey** MD ; **Michael J Reiter** MD (Presenter) ; **Ryan B Schwype** MD ; **Jonathan Kini** ; **Gerald E York** MD

**PURPOSE/AIM**
1. Review recently performed ophthalmologic procedures
2. Become aware of the postoperative imaging appearances of the globe and adnexa
3. Become familiar with implanted devices used by ophthalmologists so as to not mistake them for foreign bodies
4. Review the MRI safety profile of these implanted devices

CONTENT ORGANIZATION
1. Surgical treatment of glaucoma: trabeculectomy with Ex-PRESS device and glaucoma drainage devices
2. Surgical treatment of retinal detachment: scleral buckling and vitrectomy with gas or silicone oil tamponade
3. Imaging appearance of artificial intraocular lens after cataract treatment
4. Diverse types of orbital implants and their imaging appearances
5. Eyelid weights for facial nerve paralysis
6. Punctal plugs for dry eyes
7. Surgical options for strabismus repair
8. Mimics

SUMMARY
As the orbit is frequently visualized in routine radiologic examinations, postsurgical changes of the globe and adnexa will invariably be encountered. The radiologist’s knowledge of expected imaging findings after orbital interventions and the associated implanted devices can prevent confusion and misdiagnosis, and aid in patient safety.

LL-NRE-TH8B • Imaging of Petrous Apex
Hazem M Matta DO; Vijay K Mittal MD; Sangam G Kanekar MD (Presenter)

PURPOSE/AIM
1) To learn the radiological anatomy of petrous apex and its relationship with surrounding brain structures and cranial nerves. 2) To highlight the important and salient differentiating points between the various petrous apex pathologies

CONTENT ORGANIZATION
Petrous apex (PA) lies anteromedial to the inner ear between the sphenoid bone anteriorly and occipital bone posteriorly. It has close anatomic relationship with the brainstem and cranial nerves. Pathology in the PA could manifest into various neurological and cranial nerve deficits. We retrospectively reviewed the imaging studies from our PACS system of 53 patient with PA lesion. Clinical features included cranial neuropathies, vertigo, dizziness and fullness in the ear. All patients had high resolution CT scan of the temporal bone and contrast enhanced high resolution MRI for IAC. Lesions are classified into a) anatomic variation: asymmetric fatty marrow, trapped fluid; b) infection; c) cholesteatoma and cholesterol granuloma; d) neoplastic lesions: primary involving the bone and secondary/metastasis to apex; e) vascular f) osseous.

SUMMARY
Imaging plays a vital role in diagnosing the normal anatomical variation, classifying the various pathologies and avoiding potentially unnecessary complex surgery in this location. This exhibit will be core learning module for anatomy and pathologies of petrous apex.

LL-NRS-TH1B • High-resolution Three-dimensional Diffusion-weighted MRI/CT Image Data Fusion for Cholesteatoma Surgical Planning: A Feasibility Study
Koji Yamashita MD (Presenter); Takashi Yoshiura MD, PhD; Akio Hiwatashi MD; Osamu Togao MD, PhD; Kazufumi Kikuchi MD; Hiroshi Honda MD; Nozomu Matsumoto MD

PURPOSE
To assess the feasibility of high-resolution three dimensional diffusion-weighted images (HR3D-DWI) / multi-detector row CT (MDCT) images data fusion for surgical planning for cholesteatoma.

METHOD AND MATERIALS
A total of 14 patients (M/F= 7/7, age 11 to 72 years, mean 42.5 years) with acquired cholesteatoma underwent preoperative MRI using a 3.0 T clinical unit and an 8-channel head coil. For each subject, HR3D-DWIs were obtained using a turbo field-echo with diffusion-sensitized driven-equilibrium preparation with following parameters: TR/TE = 6.2/3ms, FA = 10°, ETL = 75, b factor = 800s/mm2, voxel size = 1.5×1.5×1.5mm3, NEX = 2, SENSE factor = 2, and acquisition time = 5min19s. These patients also underwent MDCT with a slice thickness of 0.5mm. Fusion of the HR3D-DWIs and MDCT images was performed using a landmark rigid registration method by an experienced neuroradiologist on a workstation. The location and extent of cholesteatomas on the fused images was compared with the intraoperative findings.

RESULTS
On the fused images, the extent of the cholesteatoma, which was depicted as a conspicuous high intensity lesion could be easily evaluated with background bony structures. In all patients, the location and extent of the cholesteatoma on the fused images corresponded well with the intraoperative findings.

CONCLUSION
Image fusion between HR3D-DWI and MDCT images is feasible, and provides valuable preoperative information for surgical planning to otolaryngologists.

CLINICAL RELEVANCE/APPLICATION
Our HR 3D-DWI has isotropic voxel dimensions that enables reformation in any arbitrary plane. It makes easier anatomical registration with CT images and leads to advantages of preoperative planning.

LL-NRS-TH2B • Clinical Implication of Highly Sensitive Detection of the BRAFV600E Mutation in Fine-Needle Aspirations in Patients with Conventional Papillary Thyroid Carcinoma according to the Thyroid Bethesda System
Jae Young Seo; Keum Won Kim MD (Presenter); Hee Jung Moon MD; Eun-Kyung Kim; Jin Young Kwak MD

PURPOSE
Combination of the BRAFV600E mutation with cytologic results can improve the diagnostic performance of papillary thyroid carcinoma (PTC). However, it is unclear whether routine molecular tests should be done considering cost-effectiveness. Therefore, we investigated the additional diagnostic yield of the mutation test and evaluated the frequency of the BRAF mutation in conventional PTC (cPTC) according to US features and the Bethesda System for Reporting Thyroid Cytopathology (BSRTC) based on the BRAFV600E mutation status confirmed through cytologic or resected tumor samples.

METHOD AND MATERIALS
During the study period, 279 patients who underwent FNA with an additional BRAFV600E mutation test were diagnosed as conventional PTC after surgery. We analyzed the association between the mutation and several clinical factors.

RESULTS
Of the 279 cPTCs, 250 (89.6 %) had the BRAFV600E mutation. Among the clinicopathologic features, only taller than wide shape showed a statistically significant association with the mutation (P= 0.029). Among PTCs with the BRAFV600E mutation, the highest detection rate of the mutation in FNA washouts was 96.2 % in PTCs with malignant cytology. The detection rates of the mutation in FNA washouts of PTCs with the BRAFV600E mutation were statistically different according to the BSRTC. Among PTCs except for ones of malignant cytology, 53 PTCs showed the mutation in FNA washouts. The BRAF mutation test was helpful in diagnosing an additional 19% (53/279) of PTCs. When we evaluated the frequency of the BRAF mutation in cPTCs based on US features according to the BSRTC, the frequency of the BRAF mutation in cPTCs with suspicious US features was higher than that of cPTCs with negative US features regardless of the BSRTC.
CONCLUSION
A routine additional BRAFV600E mutation test may have a limited role in diagnosing PTCs. Instead, suspicious US features may be helpful in deciding whether an additional BRAFV600E mutation test should be done in thyroid nodules with indeterminate cytology.

CLINICAL RELEVANCE/APPLICATION
The BRAFV600E mutation test is a very useful additional tool to FNA for diagnosing papillary thyroid carcinoma (PTC).

LL-NRS-TH3B • Application of Serial Dynamic Contrast-enhanced Magnetic Resonance Imaging (DCE-MRI) in Early Predicting Chemoradiotherapy Response of Nasopharyngeal Carcinoma

Chen Yunbin MD ; Dechun Zheng MS (Presenter) ; Xiangyi Liu BS ; Luying Xu BS ; Weibo Chen MSc ; Queenie Chan PhD ; Jianji Pan

PURPOSE
To prospectively evaluate the feasibility of acquiring serial DCE-MRI in early predicting chemoradiotherapy (CRT) response of nasopharyngeal carcinoma (NPC).

METHOD AND MATERIALS
Thirty-five patients with stage III and IV NPC underwent 5 MRI scans at baseline (Pre-Tx), 3 days (Day3-Tx) and 20 days (Day20-Tx, one cycle of NAC) after neoadjuvant chemotherapy (NAC) initiation, 6 days after radiotherapy initiation (Day50-Tx) and at terminal of CRT (Post-Tx) respectively. Kinetic parameters (Ktr, Kep, Ve, and Vp) were calculated based on extended Tofts model. Tumor response after NAC and definitive CRT were assessed and categorized respectively into stable disease (SD), partial response (PR) or complete response (CR) based on WHO criteria. Kinetic parameters at Pre-Tx and Day20-Tx and their changes during chemo-radiotherapy (0-X) were compared between responders and non-responders using student t test or Mann-Whitney U test. The diagnosis accuracies of kinetic parameters were calculated with receiver operating characteristic curve (ROC) analysis.

RESULTS
A total of 146 scans were acquired. Two patients withdrew due to serious motion. After NAC, 8 of 33 patients were categorized into PR; and 21 of 31 into CR at the end of CRT. The PR group after NAC had significantly higher median Ktr and Kep values at Pre-Tx (p = 0.003). This pioneering DCE-MRI based study showed that early non-invasive monitoring of NPC therapy response was feasible. Particularly, pretreatment Ktr and Kep and earlier changes during therapy were valuable imaging predictors of NPC.

CLINICAL RELEVANCE/APPLICATION
Serial DCE-MRI scan and analysis during CRT process is useful strategy to evaluate and predict tumor response to NAC and CRT in NPC. Ktr and Kep might become potential prognostic indicators of NPC.

LL-NRS-TH4B • Changes in Resting-state Functional Connectivity Following BCI-EEG Based Intervention in Sub-acute and Chronic Stroke Patients

Veena A Nair PhD (Presenter) ; Jie Song MS ; Brittany Young ; Leo Walton ; Scott Grogan BS ; Justin Sattin ; Dorothy Farrar-Edwards ; Justin Williams ; Vivek Prabhakaran MD, PhD

PURPOSE
We used BCI-EEG driven functional electrical stimulation(FES) of the affected arm, and tongue stimulation(TS) to facilitate upper extremity movement following ischemic stroke. We examined changes in resting state functional connectivity MRI (rs-fcMRI) in the sensorimotor network using 10 minutes eyes-close resting fMRI. Additionally, we investigated brain-behavior correlation between rs-fcMRI and self-reported measures of hand strength as assessed by the Stroke Impact Scale(SIS).

METHOD AND MATERIALS
Seven patients(mean age = 64 yrs, 4 males, 6 left hemisphere strokes; between 3 months to 23 months from stroke onset) with persistent mild to severe upper extremity impairment following ischemic stroke received intervention(2 hrs/session, maximum of 15 sessions (3-5 weeks) using BCI-EEG driven TS and FES. rs-fcMRI images were acquired on a GE 3T MRI scanner as subjects lay in the scanner with eyes closed at 3 time-points- pre(M1), mid(M2), and immediately post intervention(M3). Rs-fcMRI involving connections among 22 regions in the sensorimotor network were examined. The SIS was administered before each scanning session.

RESULTS
Four out of 7 subjects showed significant increase in connection strength from M1 to M2 and from M1 to M3(individual analysis corrected for multiple comparisons, fdr method, p < .01). Five of 7 subjects showed increase in number of connections among regions in the sensorimotor network from M1 to M3. Change in connection strength from M1 to M2 moderately correlated with change in hand strength domain of the SIS(r = 0.42, r = 0.65).

CONCLUSION
BCI-EEG driven intervention targeted at the sensorimotor network leads to increase in functional connectivity strength as well as the number of connections. These data suggest that BCI-EEG driven FES and TS intervention may promote brain plasticity in sub-acute and chronic stroke patients with variable clinical characteristics.

CLINICAL RELEVANCE/APPLICATION
Analysis of resting state functional connectivity in the sensorimotor network following post-stroke therapy using a brain-computer-interface (BCI)-EEG driven intervention may identify functional conne

LL-NRS-TH5B • Evaluation of WBAA with Registration-based Cube Propagation for Brain Atrophy Quantification

Martin Lillholm MSc, PhD (Presenter) * ; Akshay Pai ; Lauge Sorensen ; Mads Nielsen PhD * ; Jon Sporring * ; Sune Darkner ; Erik B Dam PhD *

PURPOSE
Atrophy for the whole brain and sub-structures is becoming common as study outcome in clinical trials assessing the efficacy of potential treatments for diseases involving dementia. In this study, we evaluated the sensitivity to change related to progression of Alzheimer’s disease of a novel software framework, WBAA.

METHOD AND MATERIALS
The recently defined Alzheimer’s disease neuroimaging initiative (ADNI) standardized collection (’ADNI1: Annual 2 Yr 1.5T’ at adni.loni.ucla.edu) with 504 subjects (169 normals, 234 mild cognitively impaired, and 101 alzheimer) including baseline and 12-month 1.5T T1 magnetic resonance imaging (MRI) scans were used. The MRI data were processed using longitudinal FreeSurfer and the whole brain atrophy application (WBAA 1.0 by Biomediq) that performs non-rigid registration followed by atrophy estimation quantification using cube propagation (CP). The WBAA was also evaluated with CP replaced by the common Jacobian integration (JI) method. Sensitivity to change was evaluated by atrophy differences between healthy and Alzheimer subjects quantified using Cohen’s D and required study sample sizes.

RESULTS
As example, quantifications of the hippocampus atrophies estimated using WBAA were -1.3% and -0.6% for the Alzheimer and healthy subjects whereas the ventricle estimates were +9.3% and +4.1%, respectively. Corresponding Cohen’s D for WBAA on these two regions were 1.1 and 1.0. For whole-brain, hippocampus, ventricles, and medial temporal lobe, the WBAA Cohen’s D were 0.7, 1.1, 1.0, and 1.3. The corresponding sample sizes were 173, 124, 113, and 87. For WBAA with JI, Cohen’s D were 0.5, 1.1, 1.0 and 1.2; with sample sizes 230, 139, 112, and 101. For longitudinal FreeSurfer, Cohen’s D were 0.7, 1.0, 1.0, and 1.3; with sample sizes 183, 152, 118, and 102.

CONCLUSION
Evaluation of WBAA with Registration-based Cube Propagation for Brain Atrophy Quantification
CONCLUSION
The WBAA using CP for brain atrophy quantification provided sensitivity equal or superior to leading, competing methods. Specifically, the WBAA sample sizes were generally lower.

CLINICAL RELEVANCE/APPLICATION
Unlike longitudinal FreeSurfer, WBAA allows quantification of final atrophy estimates directly after each visit. Adding the matching/improved sensitivity, WBAA seems appropriate for clinical trials.

LL-NRS-TH6B  •  The Role of US Elastography in the Differential Diagnosis of Nodules Associated with Chronic Thyroiditis

Evens Polattas Solak MD (Presenter); Suna O Oktar MD; Emetullah Cindil MD; Doga Ozdemir MD; Cem Yucel MD

PURPOSE
The aim of this study was to evaluate diagnostic performance of US elastography in differentiating benign and malignant thyroid nodules in the background of chronic thyroiditis and to compare it with grey scale US and Doppler findings.

METHOD AND MATERIALS
Patients with chronic thyroiditis who had a coexisting nodule that was proven by fine needle aspiration or surgical pathologic analysis to be benign or malignant were included in the study. The US elastographic image was matched with an elasticity color scale and nodules were classified into 4 groups using elasticity score. In addition, parenchyma to tumor strain ratio (strain index) was calculated. Grey scale properties (internal structure, echogenicity, presence or absence of hypoechoic halo sign, microcalcifications, & thinner than wide sign ), vascularity scores, elasticity scores and mean strain ratios of all nodules were compared with their pathologic diagnosis.

RESULTS
Sixty seven of all nodules were benign and seven were malignant. Five of all malignant nodules were papillary carcinoma, one of them was lymphoma and one of them was thyroid carcinoma including different differentiation areas (papillary carcinoma+epidermoid carcinoma+sarcomatous component). Hypoechoicinity, absence of halo sign, microcalcifications, & thinner than wide sign and irregular course of vascular structures were statistically related with malignancy. There was a statistically significant relation between high elasticity score and malignancy. We determined 6.16 as the cut-off point of the strain ratio. There was a statistically significant difference between the nodules with the strain ratio above and below 6.16. Solid internal structure, hypoechoegenity, absence of hypoechoic halo sign and irregular course of vascular structures in nodule had the highest sensitivity (100%); the strain ratio above 6.16 had the highest specificity (100%) among all nodule characteristics.

CONCLUSION
Strain ratio values of malignant nodules with chronic thyroiditis is higher than the values of malignant nodules developing at the background of normal thyroid parenchyma. US elastography is an assisting imaging technique to differentiate benign and malignant nodules associated with chronic thyroiditis.

CLINICAL RELEVANCE/APPLICATION
US elastography can be used to differentiate malignant nodules from benign nodules associated with chronic thyroiditis, especially in focal thyroiditis which can mimic carcinoma in gray scale features.
Moderator
Kejal Kantarci, MD, MS *
Moderator
Satoshi Minoshima, MD, PhD *

LEARNING OBJECTIVES
1) Describe the role of amyloid and FDG PET imaging for tracking the progression of Alzheimer's disease from preclinical stage to dementia.
2) Properly choose amyloid imaging, MRI and FDG PET for the differential diagnosis of dementia. 3) Learn the appropriate use criteria for amyloid PET.

SPSH54A • Amyloid PET and FDG PET across the AD Spectrum: Redundant or Complementary?
Alexander Drzezga MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSH54B • Multimodality Imaging and the Role of Amyloid PET in Differential Diagnosis of Dementia
Kejal Kantarci MD, MS (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSH54C • Appropriate Use Criteria of Amyloid PET
Satoshi Minoshima MD, PhD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT
This session will review the Appropriate Use Criteria for Amyloid PET Imaging published in 2013 by the Amyloid Imaging Task Force jointly supported by the Society of Nuclear Medicine and Molecular Imaging (SNMMI) and Alzheimer's Association (AA) and discuss various clinical scenarios in which amyloid PET imaging is appropriate and not appropriate in dementia workup.

URL

Case-based Review of Neuroradiology: Interventional Image-based Diagnosis (An Interactive Session)
Thursday, 03:30 PM - 05:00 PM • S100AB

MSCN54 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5
Director
Pina C Sanelli, MD

MSCN54A • Spine Interventional
A. Orlando Ortiz MD, MBA (Presenter) *

LEARNING OBJECTIVES
1) A comfortable handle on the approach to the typical spine patient. 2) An understanding of the commonly present variations that can affect diagnostic or treatment outcome.

MSCN54B • Neurovascular Interventional
Michele H Johnson MD (Presenter) *

LEARNING OBJECTIVES
1) An understanding of the variety of endovascular interventions. 2) Comprehension of how diagnostic neuro-imaging affects intervention. 3) Knowledge of the common variations that can affect diagnostic or treatment outcome.

Non-Traumatic Neuro Emergencies
Thursday, 04:30 PM - 06:00 PM • E451A

RC705 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

RC705A • Non-traumatic CNS Hemorrhage
Patrick A Turski MD (Presenter) *

LEARNING OBJECTIVES
1) At the end of this lecture the participant should be able to recognize the variable appearance of parenchymal and subarachnoid hemorrhage on CT/CTA and MRI/MRA imaging. 2) In addition, the learner should be able to provide a differential diagnosis based on imaging characteristics and location. 3) The clinical examples will also include cases that allow the learner to become familiar with the complications of non traumatic intracranial hemorrhage.

ABSTRACT
The lecture begins with an overview of the common causes of non-traumatic intracranial hemorrhage. The pathophysiology of hypertensive hemorrhage is discussed followed by a series of examples demonstrating the classic locations and appearance on CT and MR imaging. The presentations of aneurysmal and non aneurysmal subarachnoid hemorrhage will be reviewed with emphasis on the evaluation of vasospasm using CTA and CT perfusion imaging. Vascular malformations are discussed by using clinical cases that show hemorrhages from feeding artery aneurysms, intra-nidal aneurysms and venous outflow obstruction/thrombosis. Advanced 4D MRA techniques are introduced that use compressed sensing, under-sampling, and constrained reconstruction to provide time resolved whole brain images to aid in the diagnosis and characterization of intracranial hemorrhage. To complete the review, additional examples of hemorrhage from vasculitis, amyloid angiopathy and neoplastic diseases are presented.

RC705B • Emergency CNS Infections
LEARNING OBJECTIVES

1) Select and apply proper imaging technics and modalities. 2) Identify the basic imaging findings of the CNS infectious diseases. 3) Understand important clues for differential diagnosis. 4) Develop an overall perspective concerning image-guided procedures.

ABSTRACT

Central nervous system (CNS) infections remain an important cause of morbidity and mortality worldwide. Altered immune status due to HIV infection, immunosuppressive therapies, the increase in international travel and widespread use of antibiotics contribute the emergence of CNS infections. Patient demographics (age/immune status), the pace of the clinical presentation (altered mental status or focal neurologic findings) and laboratory data are the main determinants when evaluating CNS infections. Rapid diagnosis and initiation of appropriate therapy are at utmost importance for patient outcome. CNS infections that commonly present in urgent care settings include meningeitis, cerebritis, encephalitis, periventricular abscess and subdural empyema. Meningitis is an acute or chronic inflammatory infiltrate of the meninges and CSF. Most cases are caused by acute pyogenic infections. However, meningitis can also be acute lymphocytic (viral) or chronic. Streptococcus pneumoniae and Neisseria meningitides are the most common responsible agents in adults, whereas group B beta hemolytic streptococcus and gram-negative enteric microorganisms are the most prevalent agents in newborns in developing and developing countries, respectively. CT is commonly used as a screening test in patients with a suspicion of meningitis. MRI is the imaging modality of choice for the diagnosis of acute manifestations, and secondary complications, as well as treatment monitoring. Unenhanced MR examinations of patients with early meningitis may be unremarkable. The purulent exudates of acute meningitis are isointense with underlying brain that give rise to a 'dirty' appearance on T1WI. On FLAIR, the exudates do not suppress and hyperintensity on FLAIR is a typical but nonspecific finding of acute meningitis. Purulent exudates usually are restricted in diffusion on DWI. Postcontrast images demonstrate intense and uniform meningeal enhancement. Imaging also plays a major role to demonstrate the development of complications, including infarction, cerebritis, abscess, subdural empyema or effusion, hydrocephalus, ventriculitis, myelitis and vasculopathy. Cerebritis is poorly localized perivascular inflammatory infiltrations with minimal scattered necrosis, edema, and perivascular enhancement. Most are caused by a hematogenous spread of a remote infection, whereas some cases may be caused by tomatoid infections or direct inoculation. Cerebritis are usually bacterial in origin but they can also be fungal, parasitic or granulomatous. Cerebritis in newborn and infants differs from the adults. They are relatively larger in size with relatively poor capsule formation and typically originate in the periventricular WM. There are four stages in the evolution of a cerebritis: early cerebritis, late cerebritis, early capsule, late capsule. Imaging findings vary according to the stage. MRI shows surrounding edema, mass effect, capsule (thicker rim border near cortex, thinner near endpemyda) hypointense on T2WI, hyperintense on T1WI with central necrotic area, satellite lesions, daughter rings, petechial hemorrhage, heterogeneous enhancement of the rim, restricted diffusion on DWI with high signal intensity while ADC maps show low signal at the corresponding areas. MRS shows lactate and amino acids. Ventriculitis occurs most likely after a brain intervention (lumbar puncture, CSF aspiration). Flavivirus infections such as enteroviruses (e.g. coxsackie), echovirus, parovirus, West Nile virus may cause encephalitis and meningitis. Enterovirus, Coxviirus, Toxoplasma, fungi, Listeria, Rickettsia, Borrelia. Slow virus encephalitides as SSPE, Rasmussen, Prion disease. Herpes simplex encephalitis is caused by DNA virus HSV-1 in more than 95% of the cases. Mortality is high with significant morbidity. There is predilection for limbic system (the anterior and medial temporal lobes, insular cortex, cingulum, subfrontal region). It is unilateral initially and progresses to bilateral in the advancing stage and causes hemorrhagic, necrotizing encephalitis. MRI shows gyral edema with hypointensity on T1WI, high signal on T2WI, mass effect, patchy enhancement, petechial hemorrhages. The basal ganglia are usually spared. Despite vaccination, VZV still causes neurologic clinical problems, including Bell’s palsy, Ramsay-Hunt syndrome, meningitis, encephalitis, myelitis, Reye syndrome, and postherpetic neuralgia. Meningitis is the most common presentation in immunocompromised individuals. VZV encephalitis is the second most common presentation. Acute disseminated encephalomyelitis is seen in 8% of the cases. Cerebritis is common with diffuse cerebellar swelling and hyperintensities on T2WI/FLAIR images. Enhancement is variable. Restriction on DWI is common. Rabies encephalitis is caused by a neurotropic RNA virus of the Rhabdoviridae family and is a rapidly progressing fulminant disease remaining to be a significant health problem in developing countries. Basal ganglia, thalamus, hippocampus and brain stem are the main sites of involvement. MRI demonstrates hyperintensities in the affected regions. Hemorrhage and enhancement are usually West Nile virus (WNV) is a mosquito-borne Flavivirus, leading to periodic epidemics of febrile illness and encephalitis. WNV is now the most common cause of epidemic meningoencephalitis in North America. Most of the infected patients are asymptomatic. Less than 1% of patients develop neurologic disease, manifesting as meningitis, encephalitis, and acute poliomyelitis. Bilateral inflammation of the basal ganglia, thalamus and brain stem is typical. Central to the practice of emergency medicine is to identify the patients that would benefit from immediate treatment and intervention. Regarding CNS infections, imaging findings should always be evaluated with clinical data and laboratory findings.

RC705C • ENT Emergencies-Cases NOT to Miss!

Wendy R Smoker MD (Presenter)

LEARNING OBJECTIVES

1) Select and apply proper imaging technics and modalities. 2) Identify the basic imaging findings of the CNS infectious diseases. 3) Understand important clues for differential diagnosis. 4) Develop an overall perspective concerning image-guided procedures.

ABSTRACT

The category of ENT emergencies encompasses a variety of pathologies, only a few of which can be addressed in the time allotted. This discussion will focus on: 1) Pathology (potentially) affecting vision acutely and including orbital trauma, orbital infections, and carotid cavernous fistulas 2) Infections that may compromise the airway including masticator space, peritonsillar, retropharyngeal and parapharyngeal abscesses, Ludwig angina, and necrotizing fasciitis. 3) Traumatic hematoma affecting the retropharyngeal and pterygopalatine spaces 4) Temporal bone infections (petrous apicitis, Bezdol abscess...) and traumatic injuries (fractures affecting the facial nerve canal, cochlear hemorrhage, ...) 5) Vascular emergencies such as impending 'blow-out' lesions

RC706B • Parapharyngeal Spaces

Bronwyn E Hamilton MD (Presenter)

LEARNING OBJECTIVES

1) The participant will be able to recognize the normal anatomical landmarks that define the parotid, submandibular, and sublingual spaces. 2) The participant will recognize common inflammatory, infectious, and neoplastic diseases affecting the salivary glands. 3) The participant will understand the respective roles for CT and MRI in salivary gland imaging.

Salivary Glands

Thursday, 04:30 PM - 06:00 PM • N228

RC706 • AMA PRA Category 1 Credit™:1.5 • AART Category A+ Credit:1.5
LEARNING OBJECTIVES
1) The participant should be able to separate lesions that occur in the prestyloid parapharyngeal space from those in the post or retrostyloid parapharyngeal (carotid) space and from those in the masticator space. 2) The participant will be able to identify the major landmarks for assessing masses in the parapharyngeal region, the carotid artery, the styloid process, the parapharyngeal fat, and the stylo-mandibular tunnel are the most important. 3) The participant will be able to identify and will understand the importance of the trigeminal fat pad in the masticator space.

ABSTRACT
The parapharyngeal region is separable into three major compartments. Substantial fascial layers organize these compartments and have a substantial effect on the imaging appearance of lesions occurring in each. The compartments are the prestyloid parapharyngeal space, post or retrostyloid parapharyngeal space and the masticator space. The carotid space used in an alternative classification is very similar to the poststyloid parapharyngeal space but emphasizes a slightly different fascial layer. As both systems use the same imaging landmarks, either classification can be used in clinical imaging. The most important landmark in designating the location of a lesion is the carotid artery. Other important landmarks are the styloid process, the posterior margin of the mandible, the medial pterygoid muscle and the fat in the parapharyngeal space. Lesions in the prestyloid parapharyngeal space are almost always salivary gland in origin. They are anterior to the carotid artery and push the parapharyngeal fat antero-medially. Lesions in the poststyloid parapharyngeal compartment push the carotid artery anteriorly compressing the parapharyngeal fat antero-laterally. Masses in this space are usually nerve sheath tumors or paragangliomas (glomus vagale).

Lesions of the masticator space compress the parapharyngeal fat posteromedially and distort the fat planes between the pterygoid muscles. These lesions are not salivary tumors but may be of osseous, odontogenic, neural or mesenchymal origin. Temporomandibular joint pathology also occurs here. The third division of the trigeminal nerve passes into the trigeminal fat pad located along the medial margin of the lateral pterygoid muscle just inferior to foramen ovale. Perineural spread can reach the trigeminal fat pad and foramen ovale by following the auriculo-temporal nerve from the parotid gland or the other major branches of the third division of trigeminal.

RC706C • Perineural Spread
Lawrence E Ginsberg MD (Presenter)

LEARNING OBJECTIVES
1) Review the various cutaneous malignancies that may affect the face and scalp, focusing on imaging appearance and staging evaluation. 2) Understand the clinical circumstances and imaging appearance and strategies related to perineural tumor spread in head and neck malignancies. 3) Understand the spectrum of upper aerodigestive tract malignancy attributable to minor salivary glands, including the anatomic distribution, imaging appearance including non-specificity, and patterns of spread, particularly by perineural mechanism.

Head and Neck Cancer PET Interpretation with Case Examples (An Interactive Session)

Thursday, 04:30 PM - 06:00 PM  •  S505AB

RC7011 • AMA PRA Category 1 Credit ™  •  ARRT Category A+ Credit: 1.5

LEARNING OBJECTIVES
1) Recognize the strengths of FDG PET/CT and dedicated CT imaging in head and neck cancer. 2) Recognize the false positives and false negatives associated with FDG PET/CT and CT imaging. 3) Understand the importance of combining PET and dedicated CT imaging findings for a thorough interpretation.

ABSTRACT
Accurate staging and timely detection of recurrence are of prime importance for improving outcome in head and neck cancer patients. FDG PET/CT imaging helps in staging and detecting persistent or recurrent disease, estimate its extent and monitor tumor response and occasionally detect synchronous second primary tumors. After radical surgery or radiation therapy for HNC, conventional imaging modalities can be highly inaccurate in differentiating tumor from non-neoplastic post-treatment changes as normal tissue planes are altered substantially. FDG-PET has higher sensitivity and specificity for detecting metastatic lesions in HNC than conventional imaging modalities including CT. Although in some instances PET can be false negative without the existence of a morphologic imaging component. Combined PET/CT scanners overcome some of these limitations by fusing the morphologic data obtained by CT with the functional data of PET. In this session case examples will be presented to highlight the superior sensitivity and specificity of FDG PET/CT imaging. In addition, case examples of dedicated CT will be presented in those cases when FDG PET imaging can be misleading with false positive or negative results.

RC711A • Correlative CT and PET Imaging: Superiority of CT
Peter M Som MD (Presenter)

LEARNING OBJECTIVES
1) The attendee will learn from case examples how the morphologic information of CT and MR imaging are a critical part of a PET study. 2) The attendee will learn by case examples the imaging findings on CT and MR that should make one question the pathologic significance of PET avidity.

ABSTRACT
Although PET avidity can identify head and neck cancers that may be poorly seen on morphologic imaging, there are times when the PET findings may be misleading. These include PET avidity in non-cancerous lesions, apparant PET avidity related to artifact, and the absence of PET avidity due to altered normal planes in necrotic lesions. Case examples will be presented to illustrate these points.

RC711B • Correlative CT and PET Imaging: Superiority of PET
Lale Kostakoglu MD,MPH (Presenter)

LEARNING OBJECTIVES
1) Recognize the strengths of FDG PET/CT imaging over CT imaging in head and neck cancer. 2) Recognize the false positives and false negatives associated with FDG PET/CT imaging. 3) Understand the importance of combining PET and CT imaging findings for a thorough interpretation.

RC711C • Correlative PET and MRI Imaging: Superiority of MRI
John A Arrington MD (Presenter)

LEARNING OBJECTIVES
1) Understand and recognize the advantages and strengths of MRI as well as the complementary roles of MRI, CT, and FDG PET/CT in the diagnosis and treatment of head and neck cancer. 2) Attendee will learn through case studies the areas of superiority of MRI as well as evaluating and correlating MRI examinations with false positive and false negative PET examinations.
MRI, CT, and FDG PET/CT have strengths and weaknesses in the detection and staging head and neck carcinoma. While PET/CT is highly sensitive in the detection of primary head and neck carcinoma and metastatic nodal disease, there are limitations including avidity in muscle activation and inflammatory lesions as well as the detection of perineural tumor spread and metastatic necrotic nodal disease. MRI case studies will be presented highlighting the areas of superiority of MRI over FDG PET/CT.

Pediatric Neuroimaging II

Thursday, 04:30 PM - 06:00 PM • S102AB

RC713 • ARA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5

RC713A • MRI Imaging of Brain Development

Robert C McKinstry MD, PhD (Presenter) *

LEARNING OBJECTIVES
1) Describe how water and myelin content influence the T1 and T2 relaxation times. 2) Describe the time course and regional variation of brain maturational changes. 3) Use a systematic approach to determine the child's brain age.

RC713B • Congenital Brain Malformations

Sarah S Milla MD (Presenter)

LEARNING OBJECTIVES
1) Understanding the classification of congenital brain malformations, particularly cortical malformations. 2) Comprehension of the genetic undertones of congenital brain malformations. 3) Ability to identify imaging appearance of common cortical malformations on brain MR imaging.

Common Spinal Injection Procedures for Diagnosis and Treatment of Back Pain (Hands-on Workshop)

Thursday, 04:30 PM - 06:00 PM • E263

RC731 • ARA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5

A. Orlando Ortiz, MD, MBA *
John M Mathis, MD, MSc
Chi-Shing Zee, MD
Bassem A Georgy, MD, MSc *
Allan L Brook, MD *

LEARNING OBJECTIVES
1) Describe and demonstrate methods for patient selection, evaluation and technique for Image-guided injection procedures used in spine pain management. 2) These procedures will include epidural steroid injections, nerve root blocks, facet blocks, sacroiliac joint injections, lumbar synovial cyst therapy, radiofrequency ablations, and discography. 3) Review procedural complications and how to avoid them. 4) Discuss pertinent anatomy, instruments and pharmacology. 5) These objectives will be accomplished using didactic lectures complemented by procedure videos, supervised hands on lab work with training models and round table case discussions.

ABSTRACT

Neck and back pain complaints are very common in the general population. Radiologists can contribute to the diagnosis and management in patients who are not responding to conservative management. Spine injection procedures can frequently be performed on an outpatient basis with a brief recovery phase. These procedures are performed with imaging guidance, often a multi-directional fluoroscope, in order to correctly localize the specific anatomic sites in or about the spine for diagnostic and or therapeutic needle localization. An understanding of patient selection, indications and contraindications, are paramount to the safety and success of these procedures. The diagnostic and therapeutic potential of these procedures is also facilitated by a thorough evaluation of the spine, with respect to both anatomy and potential pathology, with cross sectional imaging techniques as well as other radiologic tests. Communication of these results between the Radiologist and the spine proceduralist will contribute to optimal patient outcomes.

Brain Aneurysms

Friday, 08:30 AM - 10:00 AM • N227

RC805 • ARA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5

RC805A • Diagnostic Evaluation of Brain Aneurysms

Juan P Villablanca MD (Presenter)

LEARNING OBJECTIVES
The course will review the relative strengths and limitations of current imaging techniques for the detection and follow-up of patients with symptomatic and asymptomatic cerebral aneurysms. A practical strategy for image review and analysis will be provided that ensures complete lesion characterization and minimizes operator error. A rubric for the analysis of the pre- and post-operative aneurysm patients will also be presented with an emphasis on a practical clinical approach. A brief natural history and modality based literature review will also be provided.

ABSTRACT

ABSTRACT

RC805B • Intervention for Brain Aneurysms

Steven W Hetts MD (Presenter) *

LEARNING OBJECTIVES
1) Discuss the current endovascular interventional approaches to both ruptured and unruptured brain aneurysm treatment. 2) Critically evaluate recent clinical trial results regarding interventional brain aneurysm treatment. 3) Appreciate the limitations to endovascular brain aneurysm treatment using current technologies. 4) Understand that cerebral vasospasm is the leading cause of mortality and morbidity for hospitalized patients with aneurysmal subarachnoid hemorrhage, and appreciate current approaches to treating vasospasm.

ABSTRACT
Sinonasal Imaging

Friday, 08:30 AM - 10:00 AM • S406B

RC806 • AMA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5

LEARNING OBJECTIVES

RC806A • Anatomy and Developmental Problems

C. Douglas Phillips MD (Presenter) *

LEARNING OBJECTIVES

1) Discuss the role of imaging in evaluating sinonasal neoplasms. 2) Describe the risk factors and histologic classification of sinonasal malignancies. 3) Demonstrate the imaging features of a variety of sinonasal neoplasms. 4) Review staging, treatment, and prognosis of sinonasal neoplasms.

ABSTRACT

Although sinonasal malignancies are rare and they account for less than 1% of cancer deaths in western countries, these tumors arise in a complex anatomic location and are histologically diverse. In addition to new histologic and clinical classifications, the last decade has brought new insights into the etiologic risk factors, tumor biology, and therapeutic options of these lesions. Sinonasal malignancies have a relatively poor prognosis and many present at an advance stage due to delay in diagnosis. This talk will review imaging findings of sinonasal neoplasms.

Sinonasal Masses

Michelle A Michel MD (Presenter) *

LEARNING OBJECTIVES

1) To understand the basic concepts behind selection of patients for revascularization based on physiologic criteria. 2) To understand the capabilities of measuring brain perfusion using C-arm CT. 3) To appreciate the potential value of using a single modality environment for the diagnosis, triage and treatment of patients with an acute ischemic stroke.

ABSTRACT

The Neurointerventional Suite of the Future

Charles M Strother MD (Presenter) *

LEARNING OBJECTIVES

1) To understand the basic concepts behind selection of patients for revascularization based on physiologic criteria. 2) To understand the capabilities of measuring brain perfusion using C-arm CT. 3) To appreciate the potential value of using a single modality environment for the diagnosis, triage and treatment of patients with an acute ischemic stroke.
SST09-01 • Vascular Communications between Donor and Recipient Tissues One Year after Successful Full Face Transplantation

Kanako K Kumamaru, MD, PhD (Presenter) • Geoffrey C Sisk • Michael L Steigner MD * • Elizabeth George MBBS • Bohdan Pomahac MD • Frank J Rybicki MD, PhD * • Kurt Schultz RT * • Dimitris Mitsouras PhD • David S Enterline MD * • Ericka M Bueno PhD

PURPOSE
To noninvasively study vascular changes that have implications on graft survival and rejection, future surgical planning, and our understanding of the underlying biology changes after full face transplantation.

METHOD AND MATERIALS
Three full face transplant patients (single anastomosis bilaterally of artery and vein) for whom clinical findings were previously reported (NEJM 2012; 366:715-22) were, for the first time, evaluated for vascular reorganization 1 year after successful transplantation using a previously described 320 x 0.5 mm detector row dynamic CT angiography protocol (AJNR 2012, Aug 9, PMID 22878008).

RESULTS
Consistent, extensive vascular re-organization was observed among the recipients. Diverted external carotid artery (ECA) or facial artery angiosomes were found to be perfused from newly opened, elaborate collateral circulation. Using the metric of arterial blood flow (BF) at the temporal region expressed as the percentage of the BF at the internal carotid artery, allograft tissue was slightly less perfused when the facial artery was the only donor artery when compared to an ECA-ECA anastomosis (4.4±0.4% vs 5.7±0.7%). However, allograft BF was higher than the recipient normal neck soft tissue. Blood flow to the recipient's tongue was maintained, despite the fact that the recipient lingual arteries were not always preserved. On the side where the lingual artery was ligated, blood flow was redistributed from a contralateral artery. Venous drainage was adequate for all patients, including patients for whom the recipient internal jugular vein was anastomosed in end-to-end fashion on one side.

CONCLUSION
Despite extensive surface contact between the donor and the recipient, disruption of recipient's blood supply depends on extensive collateralization rather than new vessel ingrowth from the donor tissues. These findings guide both surgical planning and the assessment of potential complications for larger scale face transplant studies.

CLINICAL RELEVANCE/APPLICATION
A single anastomosis bilaterally of artery and vein is adequate for full face transplantation, evidenced by substantial arterial flow demonstrated on dynamic CT angiography.

SST09-02 • Value of Dynamic Volume Imaging with 320-detector Row CT in the Pre-transplantation Evaluation of Head and Facial Skin Flap: Initial Experience

Kaiyuan Xu (Presenter) • Xuelin Zhang • Xing Chen *

PURPOSE
To investigate the value of dynamic volume perfusion CT scanning in the pre-transplantation evaluation of blood supply of head and facial flaps with 320-Detector row computed tomography (CT).

METHOD AND MATERIALS
Whole-head dynamic volume perfusion CT scan was performed in 576 patients with a 320-Detector row CT system. All the patients enrolled had normal internal carotid arteries but due to other reasons referred to CT perfusion examination. Volume perfusion data were generated and then analyzed with the body perfusion software. BF (Blood Flow) value of each separate skin flap within the scan region was measured. The numbers of flap arteries and veins that can be found in dynamic CTA images are summarized.
RESULTS
We succeeded to measure BF value of each skin flaps in the head or face for all the patients. BF value of the forehead flap, the eyelid flap, the nasal dorsum flap, the buccal flap, the parietal flap, occipital flap, cervical flap was (127 ± 7.7)ml/min, (268.0 ± 31.1)ml/min, (229.0 ± 50.9)ml/min, (67.8 ± 9.5)ml/min, (140.3 ± 5.5)ml/min, (163.8 ± 15.5)ml/min, (123.5 ± 12.5)ml/min, respectively. There are significant difference between the flaps in different region, among which BF value of the buccal flap was the lowest. Arteries and vein of flaps were observed through different phases. Display rate of arteries and vein that can be found on dynamic CTA image was 100% for all flaps.

CONCLUSION
Whole-head dynamic volume CT perfusion using 320-detector row MDCT is able to offer effective reference for assessing blood supply and vessel anatomy of different skin flaps for patient who is going to undergo skin flap autotransplantation. Fusion of perfusion map and CT anatomical images were helpful to the analysis and orientation of flaps.

CLINICAL RELEVANCE/APPLICATION
Whole-head perfusion can be used as a method of preoperative assessment of the skin flap perfusion and avoid operation complications effectively, which has the potential to improve diagnostic utility.

SST09-03 • MRI Displays Affection of the Deep Temporal Artery and the Temporal Muscle in Patients with Giant Cell Arteritis

Simon Veldhoen MD (Presenter) ; Thorsten Klink MD ; Julia Geiger MD ; Peter Vaitl ; Cornelia Glaser ; Thomas Neuss ; Dirk Duwendag ; Marcus Both MD ; Thorsten A Bley MD

PURPOSE
Giant cell arteritis (GCA) is a vasculitis of large and medium-sized arteries. Dedicated MRI protocols have been developed to detect vasculitic changes of the superficial cranial arteries noninvasively. This study assesses the involvement of the deep temporal artery and the temporal muscle in MRI of patients with active GCA.

METHOD AND MATERIALS
99 patients who received MRI and subsequent temporal artery biopsy (TAB) were included. TAB was positive in 61 and negative in 38 patients. TAB negative patients served as reference group. Contrast enhanced T1-weighted spin-echo images were acquired utilizing 1.5T and 3T MRI scanners at three academic medical centres. Mural contrast enhancement and wall thickening of the deep temporal artery and contrast enhancement of the temporal muscle were defined as their inflammatory involvement and assessed by two radiologists with experience in vasculitis imaging. Correlation analyses between individual MRI results and jaw claudication were performed to test for a concordance of clinical symptoms and MRI findings.

RESULTS
Patients with active GCA showed inflammatory affection of the deep temporal artery in 34.4% (n=21) and 49.2% (n=30). Bilateral involvement was found in 80% (n=19) and 90.5% (n=24). Temporal muscle involvement was observed in 19.7% (n=12) and 21.3% (n=13), respectively, and occurred bilaterally in all cases. Relative risk for jaw claudication was increased to 2.1 [1.5; 3.1] for GCA patients. Its presence correlated with inflammatory MRI findings in the deep temporal artery (r=0.38; p=0.01) as well as in the temporal muscle (r=0.31; p=0.05).

CONCLUSION
MRI is able to assess vasculitic changes in the deep temporal artery and in the temporal muscle. Both structures were affected simultaneously in a remarkable number of GCA patients. A substantial correlation of clinical symptoms and MRI results was observed.

CLINICAL RELEVANCE/APPLICATION
MRI is able to display the involvement of the deep temporal artery and the temporal muscle in patients with active GCA.

SST09-04 • Evaluation of Head and Neck Arteriovenous Malformations with 4D Contrast-enhanced MR Angiography at 3T

Yasuhiko Iryo (Presenter) ; Toshinori Hirai MD ; Mika Kitajima MD ; Yoshinori Shigematsu ; Minako Azuma ; Yasuyuki Yamashita MD *

PURPOSE
Four-dimensional contrast-enhanced MR angiography (4D CE-MRA) at 3T may replace digital subtraction angiography (DSA) for certain diagnostic purposes in patients with arteriovenous malformations (AVMs) in the head and neck region. The purpose of this study was to compare the agreement between DSA and 4D CE-MRA findings for the evaluation of head and neck AVMs.

METHOD AND MATERIALS
Six patients with facial AVMs (4 men, 2 women; aged 15 - 83 years, mean 39.2 years) underwent 4D CE-MRA at 3T and DSA. The AVMs were located tongue, lip, scalp, orbit, nose and cheek in one each. 4D CE-MRA combined randomly segmented central k-space ordering, keyhole imaging, sensitivity encoding, and half-Fourier imaging; it yielded total acceleration factor was 88. We obtained 30 dynamic scans every 1.9 sec at an acquired spatial resolution of 0.9×0.9×1.5 mm; the matrix was 256×256. Two independent observers reviewed 4D CE-MRA images with regard to the nidus size, main arterial feeders and venous drainage. The venous drainage was recorded as being extracranial, intracranial, or extra- and intracranial veins. Interobserver and intermodality agreement was assessed by ? statistics.

RESULTS
On 4D CE-MRA, the interobserver agreement was excellent for main arterial feeders (r = 1.0) and good for the nidus size and venous drainage (r = 0.63 and 0.67, respectively). Intermodality agreement was excellent for main arterial feeders and venous drainage (r = 0.92 and 1.0, respectively) and good for the nidus size (r = 0.63).

CONCLUSION
The agreement between 4D CE-MRA and DSA findings was good to excellent with respect to the nidus size, main arterial feeders and venous drainage in head and neck AVMs.

CLINICAL RELEVANCE/APPLICATION
4D CE-MRA is a reliable tool for assessing head and neck AVMs, although it is not able to replace DSA for the detailed evaluation.

SST09-05 • Visualization of the Intraparotid Facial Nerve with 3T MRI

Hiroyuki Fujii MD (Presenter) ; Akifumi Fujita MD ; Yukio Kimura MD ; Edward K Sung MD ; Osamu Sakai MD, PhD * ; Hideharu Sugimoto MD

PURPOSE
It is important to know the spatial relationship of the intraparotid facial nerve to a parotid tumor since the location of the tumor influences the duration and difficulty of the surgery. Recently, several study have proposed MRI techniques to visualize the intraparotid facial nerve by 3-dimensional reversed fast imaging with steady-state precession with diffusion weighted imaging (3D-PSIF-DWI) and three-dimensional double-echo steady-state with water excitation (3D-DESSWE). The purpose of this study is to evaluate the visualization of the intraparotid facial nerve with both sequences using 3T MRI, and compare the utility of this application in clinical practice.

METHOD AND MATERIALS
We evaluated 72 parotid glands of 36 consecutive patients during routine clinical MR examination. We performed both 3D-PSIF-DWI and 3D-DESSWE sequences using our 3T MR scanner (MAGNETOM Skyra, Siemens). Two observers initially assessed the images independently, but later resolved inconsistencies by collaborative review and consensus agreement. The certainty of identifying the intraparotid facial nerve was evaluated and divided into four categories; (1) Excellent: branch of the facial nerve identified; (2) Good: distal facial nerve trunk identified; (3) Fair: proximal facial nerve trunk identified; and (4) Poor: intraparotid facial nerve not identified.
RESULTS
Both 3D-PSIF-DWI and 3D-DESSWE were successfully obtained in all 36 patients (72 parotid glands). The intraparotid facial nerve was identified in 62 parotid glands (86.1%; Excellent:17, Good:25, Fair:20) with 3D-PSIF-DWI sequence and in 71 parotid glands (98.6%; Excellent:40, Good:15, Fair:16) with 3D-DESSWE sequence.

CONCLUSION
Using 3T MRI, both 3D-PSIF-DWI and 3D-DESSWE sequences can adequately demonstrate the course of the intraparotid facial nerve. 3D-DESSWE demonstrated better than 3D-PSIF-DWI in visualization intraparotid facial nerve.

CLINICAL RELEVANCE/APPLICATION
Knowledge about the course of the intraparotid facial nerve in relation to a parotid tumor is important for preoperative planning, and can optimize the surgical approach to prevent facial nerve damage.

SST09-06 • High Resolution Diffusion-weighted MR Imaging in the Head and Neck: A New Approach

Thorsthen Klink MD (Presenter) ; Daniel Chong ; Dechen W Tshering-Vogel ; Nedelina Slavova ; Berthold Kiefer PhD * ; Harriet C Thoeny MD

PURPOSE
To evaluate whether diffusion-weighted MR images acquired with readout-segmented echo planar imaging (RESOLVE) are superior to single-shot echo planar imaging (ssEPI) in the head and neck region.

METHOD AND MATERIALS
After ethics committee approval and written informed consent, 10 volunteers were prospectively included in our MRI study of the head and neck region. The 3T MR study protocol included axial T2w-TSE, ssEPI, and RESOLVE acquisitions. Image analysis was performed by two independent observers. DWI was qualitatively evaluated by visual assessment using a 10-point score, and quantitatively by measuring SNR and ADC values of various predefined structures. Image distortion was assessed qualitatively and quantitatively by measuring the diameter of anatomical structures on RESOLVE and ssEPI images in comparison to T2w images. The RESOLVE sequence was additionally tested in four patients. Differences were considered statistically significant, when p=0.05 applying the non-parametric Mann-Whitney-U test.

RESULTS
Quality of RESOLVE images was significantly higher in comparison to ssEPI (Quality scores, RESOLVE 7.51 ±0.18 and ssEPI 4.50 ±0.32; p

CONCLUSION
DWI of the head and neck acquired with the RESOLVE sequence had superior image quality at comparable SNR and ADC levels in ten healthy volunteers, and were of diagnostic quality in four patients. Significant less image distortion is the key advantage of RESOLVE over ssEPI and may therefore improve image interpretation of DWI in this challenging region.

CLINICAL RELEVANCE/APPLICATION
RESOLVE produced superior image quality and less distortion; this new approach for DWI in the artifact- and distortion-susceptible head and neck region may improve image interpretation.

SST09-07 • Objective Evaluation of Salivary Gland Function Using Diffusion-weighted MR Imaging: Follow-up of Radiation-Induced Xerostomia

Yun-Yan Zhang (Presenter) ; Dan Ou ; Yajia Gu MD ; Xia-Yun He ; Weijun Peng MD ; Jian Mao BA ; Lei Yue

PURPOSE
To investigate the value of diffusion-weighted (DW)-MRI as a noninvasive tool to assess salivary gland function for follow-up of patients with radiation-induced xerostomia.

METHOD AND MATERIALS
A HIPAA-compliant waiver of authorization was granted by the institutional review board. Twenty-three consecutive patients with nasopharyngeal carcinoma were examined with a 3T unit pre-radiotherapy (RT), and 1 week and 1 year post-RT. Clinical xerostomia was also assessed according to the Radiation Therapy Oncology Group/European Organization for Research and Treatment of Cancer morbidity scoring system. A DWI sequence was performed once on the salivary glands at rest, then continually repeated on the parotid glands immediately after oral ascorbic acid stimulation over a mean period of 21 minutes. Apparent diffusion coefficient (ADC) maps for salivary glands before and after stimulation were calculated. The maximum ADC of the parotid glands (pADCmax) and the time to pADCmax (pTmax) during stimulation were also obtained. Findings before and after RT were compared.

RESULTS
The ADC value is a sensitive indicator for salivary gland dysfunction, and it changes earlier than clinical xerostomia. DW-MRI is potentially useful for noninvasively evaluating the severity of radiation-induced xerostomia.

CLINICAL RELEVANCE/APPLICATION
DW-MRI could noninvasively evaluate the functional changes of salivary glands before and after RT and the ADC value may be a early prediction for the severity of radiation-induced xerostomia.

SST09-08 • Evaluation of Enhanced Modernize Collaborative Management of Neck Lumps

Kit H Chow MBChB, FRCR (Presenter) ; Rathinavelu Balamurugan MBBS ; Unnikrishnan Anoop MBBS, FCR ; Saravanan Ammamuthu MBBS ; Jyothi Rao

PURPOSE
Chesterfield Royal Hospital (CRH) implemented an enhanced modernized collaborative one-stop system in 2008, which included the use of specialist neck ultrasound (US) and US-guided biopsy. We evaluated this innovative model of diagnostic management of neck lumps.

METHOD AND MATERIALS
1. Prospective Survey of Patient’s Satisfaction (n=100) 2. Prospective 3 months study of impact of US and US guided biopsy on patients referred to CRH rapid access H&N lump clinic 3. Retrospective study of 60 patients with H&N Lymphoma in CRH presented over a 4 years period. This provides an evaluation of effectiveness of core biopsy provided by this radiology service.

RESULTS
The result shows this of model managing neck lumps is faster, cheaper, clinically less invasive and represents a successful formula for patients, radiologists, referring clinicians and commissioners of services.

CLINICAL RELEVANCE/APPLICATION
Radiologists should develop an ambition to work beyond their traditional boundary and use their skills to extend their role by running neck lump clinics, which, offer H&N US and US guided biopsy.

SST09-09 • Preliminary Prospective Study on Contrast-enhanced Ultrasound (CEUS) in the Quantitative Assessment of Uveal Melanoma (UM) Response to Gamma Knife Radiosurgery (GKR): Do Changes in Tumor Vascularization Precede Diameter
Reduction?

Caterina Colantoni (Presenter) ; Massimo Venturini MD ; Giulio Moderatori ; Maura Di Nicola ; Giulia Agostini ; Alessandro Del Maschio MD

PURPOSE
Tumor thickness is worldwide accepted as the most useful parameter to evaluate UM response to GKR, which on average occurs at 12 months. According to the modified response evaluation criteria in solid tumors (mRECIST), in case of hypervascular lesions, changes in vascularization precede diameter reduction after treatment. Our aim was to prospectively analyze CEUS as a tool to quantitatively assess the response of UM to GKR, investigating if changes in quantitative parameters expressing tumor vascularization precede diameter reduction.

METHOD AND MATERIALS
Our study had institutional review board approval, and written consent was obtained. From 2012 to 2013, 10 patients (mean age, 66 years) affected by UM were enrolled and submitted to a complete ophthalmological examination before and after GKR. US and CEUS (ATL-Philips, IU-22, 5-9 MHz linear probe; Sonovue, Bracco) were performed by the same experienced radiologist at baseline (b-GKR), 3 (3-GKR), and 6 (6-GKR) months after GKR. UM transverse diameter (TD), thickness (Th), and different quantitative parameters (area under the curve in the wash-in phase; wash-in perfusion index (WiPI); peak enhancement (PE); mean transit time; wash-in rate (WiR); rise time (RT); time to peak) were calculated by the same operator using a dedicated and off-line imaging software (Sonotumor, Bracco). Comparisons between each parameter were made using the Wilcoxon analysis.

RESULTS
At US the mean tumor diameters (TDxTh, mm) were: b-GKR=10.7x8.3, 3-GKR=8.8x7.4, 6-GKR=9.4x6.6, with statistical significance at 6 months (P=.031).

At CEUS the quantitative parameters were: PE (arbitrary units, a.u): b-GKR=2*10^7, 3-GKR=3*10^7, 6-GKR=8*10^5 (P=.018); WiR: b-GKR=4*10^6, 3-GKR=5*10^6, 6-GKR=8*10^4 (P=.028); WiPI (cm3/sec): b-GKR=6*10^7, 3-GKR=1*10^8, 6-GKR=2*10^6 (P=.028). At 6-GKR tumor mean diameters decreased in 8/10 patients, while UM enhancement in 10/10.

CONCLUSION
CEUS is a feasible and reproducible method for the quantitative assessment of UM vascularization; it showed a reduction in UM enhancement at 6 months after GKR, earlier than tumor diameter changes, even though further studies with a larger population and a longer follow-up are needed.

CLINICAL RELEVANCE/APPLICATION
CEUS could be a useful additional tool to conventional US or the first choice technique to monitor UM response to GKR, in order to better predict the long-term survival of patients.

Neuroradiology (Cerebral Ischemia, Hemorrhage and Vessel Wall Imaging)

Friday, 10:30 AM - 12:00 PM • N227

SST10 • AMA PRA Category 1 Credit™:1.5 • ARRT Category A+ Credit:1.5

Moderator
Ashok Srinivasan , MD *

Moderator
Jalal B Andre , MD

SST10-01 • Does Transfer Status Affect Outcomes in Acute Ischemic Stroke Patients Treated Endovascularly?

Maryam Soltanolkotabi MD (Presenter) ; Farnoosh Feiz MD ; Ali Shaibani MD ; Michael C Hurley MBBCh ; Yvonne Curran MD ; Sameer A Ansari MD, PhD

PURPOSE
To study the effect of transfer status on endovascularly treated AIS patients’ outcomes.

METHOD AND MATERIALS
We retrospectively analyzed consecutive anterior circulation AIS patients that underwent IAT at 4 institutions from 2006-2011. We excluded patients selected using perfusion imaging. Patient demographics, medical risk factors, presentations, technical, and clinical (NIHSS and mRS scores) outcomes, complications, and mortality were studied. Symptom-onset, groin puncture, and end-of-procedure times were recorded. THRIVE scores were calculated. Successful recanalization was defined as TIC I=2b. Good functional outcome was defined as mRS 0-2 at 90 days. Patients were categorized into those who were transferred from outside institutions and those who presented directly to the CSCs.

RESULTS
116 patients were studied. 68 (58.6%) were transferred from outside institutions. Transfers and nontransfers were similar in THRIVE scores (p=0.300), median symptom-onset to groin puncture times (306 vs. 315 minutes; p=0.572), successful recanalization (p=0.574), and symptomatic IC H (13.2 vs. 10.4, p=0.776), but differed by age (59 vs. 69 years; p=0.002), prior stroke (3% vs. 22%, p=0.002), cardiac history (17.9 vs. 36.6%, p=0.040), baseline NIHSS (20 vs. 17, p=0.005), and location of occlusion (45.6% vs. 22.9% IC A, p=0.012). Transfer patients had significantly worse outcomes at 90 days (mRS 0-2: 16.2% vs. 60.4%, p In multivariate analysis, transfer status was an independent predictor of poor functional outcome (adj. OR 0.05, 0.011-0.222), adjusting for relevant covariates.

CONCLUSION
Transfered AIS patients have worse functional outcomes at 90 days than non-transfers, independent of baseline risk factors, stroke severity, time to IAT, and procedural success/complications. Further investigation should focus on residual factors that may contribute to our findings such as baseline/final infarct volumes, pre-morbid functional status, and post-stroke care.

CLINICAL RELEVANCE/APPLICATION
Access to intra-arterial therapy (IAT) for acute ischemic stroke (AIS) is limited to comprehensive stroke centers (CSCs) with timely access deemed critical for success. Inter-hospital transfers rep

SST10-02 • Diffusion Tensor Imaging Study on Wallerian Degeneration of Pyramidal Tract after Pontine Infarction

Miao Zhang (Presenter) ; Jie Lu MD ; Dongdong Rong ; Zhilian Zhao PhD ; Yanxiang Cao ; Kuncheng Li MD

PURPOSE
To investigate dynamic process in Wallerian degeneration (WD) of the pyramidal tract after pontine infarction using diffusion tensor imaging (DTI), as well as its relationship with clinical progosis.

METHOD AND MATERIALS
Nineteen patients with pontine infarction underwent five DTI examinations during a period of 6 months (7, 14, 30, 90 and 180 days after imaging (DTI), as well as its relationship with clinical progosis.
SST10-03 • Functional MRI (fMRI) in Patients with Spastic Hemiplegia after Stroke, Treated with Botulinum Toxin: The Role of ‘Motor Imagery’ in the Demonstration of Central Effects and Brain Plasticity

Alessandro Stecco MD (Presenter) ; Roberta Matheoud ; Stefano Carda ; Marco Perchinunno ; Emanuele Malatesta ; Alessandro Carriero MD ; Carlo Cisari

PURPOSE
Botulinum toxin is considered a first-line treatment of focal spasticity in post-stroke patients. The aim of our study is to describe the central nervous system effects of botulinum toxin by a fMRI analysis, assuming that in case of absence of influence, the brain fMRI pattern should not be modified after therapy.

METHOD AND MATERIALS
We enrolled 17 patients (10 healthy volunteers as a control group and 7 patients with ischemic stroke with hemiplegia spastic upper limb). All patients underwent three fMRI with execution of a motor imagery task (finger tapping), one before starting treatment with botulinum toxin (T0), one after 4 weeks (T1) and the last after 8 weeks (T2), the task was repeated twice every same session.

RESULTS
The analysis on the healthy volunteer sample confirmed that the motor imagery paradigm showed efficacy and reliability in activating the motor cortex. The group analysis on the patients sample showed activation but with a progressive focalization of cerebral activations, in particular a progressive reduction of the supplementary motor area (SMA and Brodmann 6 areas).

CONCLUSION
First of all our data confirmed the efficacy of motor imagery fMRI paradigms as a window to study the brain after stroke and its motor recovery. We demonstrated a kind of modification induced on the brain cortical reorganization after stroke, by mean of a peripheral therapy as botulinum toxin injection.

CLINICAL RELEVANCE/APPLICATION
These data, with the pattern of progressive reduction and delimitation of corticai activations during therapy, are in line with the small world network theory of cortical reorganization after stroke.

SST10-04 • Dual-energy CT (DECT) and Non-enhanced CT (NECT) in the Characterization of Intracerebral Hemorrhage (ICH) or Isodinated Contrast Material in CT Follow-up after Endovascular Treatment for Acute Ischemic Stroke

Federico X Zarco Contreras MD (Presenter) ; Antonio Lopez Rueda ; Camilo Pineda Ibarra MD ; Sebastian Capurro ; Miren L Olondo MD ; Sergio Amaro MD ; Luis San Roman MD ; Jordi Blasco MD * ; Juan Miguel Macho ; Laura Oleaga

PURPOSE
To assess the accuracy of DECT and NECT in the characterization of hyperattenuation areas on CT follow-up after endovascular treatment for acute ischemic stroke, in order to determine the start of early heparin treatment.

METHOD AND MATERIALS
A retrospective study in 35 patients with hyperattenuation areas on CT follow-up after endovascular treatment for acute ischemic stroke were reviewed. DECT was used for imaging at 80 and 140kV, and a three-material decomposition algorithm was used to obtain virtual unenhanced images and iodine overlay images. Source images (mixed 140/80 kV) were considered as NECT. Two neuroradiologists with over 10 years of experience were designated for double-blind readings. DECT and NECT were used in order to classify the findings into 6 categories: Contrast Extravasation (CE), Hemorrhagic Infarction (HI) types 1 and 2, Parenchymal Hemorrhage (PH) types 1 and 2, and Remote Hematoma (RH). CT/MRI Follow-up images were used as the standard of reference. According to our clinical management protocol, early heparin treatment is indicated to CE, HI1 and HI2.

RESULTS
The sensitivity, specificity, and accuracy of DECT were 83% (10 of 12 areas), 100% (23 of 23 areas), and 95% (33 of 35 areas), respectively. According to the agreement, the kappa-weight index between readers was 0.71, and the kappa index in the dichotomization sample was 0.60. The sensitivity, specificity, and accuracy of DECT were 83% (10 of 12 areas), 100% (23 of 23 areas), and 95% (33 of 35 areas), respectively. According to the agreement, the kappa-weight index between readers was 0.71, and the kappa index in the dichotomization sample was 0.85.

CONCLUSION
DECT is more accurate and more consistent than NECT in the characterization of hyperattenuation areas on CT follow-up after endovascular treatment for acute ischemic stroke.

CLINICAL RELEVANCE/APPLICATION
DECT is more accurate than NECT, achieving an excellent agreement, in the purpose of decide early heparin treatment after endovascular approach for acute ischemic stroke.

SST10-05 • Initial Findings of Blood-brain Barrier Permeability in Predicting Delayed Cerebral Infarction in Aneurysmal Subarachnoid Hemorrhage

Jana Ivanidze MD, PhD (Presenter) ; Kartik Kesavabhotla ; Sirish Kishore MD ; Ajay Gupta MD ; Pina C Sanelli MD
Aneurysmal subarachnoid hemorrhage (aSAH) patients are at increased risk of delayed cerebral ischemia (DCI) resulting in infarction. Since its pathophysiology is not well understood, early detection and treatment of DCI remains challenging. We hypothesize that blood brain barrier permeability (BBBP) increases prior to occurrence of infarction related to DCI. The purpose of this study is to assess whether alterations in BBBP, measured as permeability surface (PS) using CTP, precede development of infarction related to DCI in aSAH patients.

**METHOD AND MATERIALS**
This is a retrospective study of aSAH patients included in an IRB-approved clinical trial. Inclusion criteria are patients with CTP performed with extended scanning technique for analysis of PS. Exclusion criteria were patients who did not develop an infarction related to DCI, based on follow-up CT. All CTP data were post-processed using CT perfusion 4D software (GE Healthcare) for generation of PS, CBF, CBV and MTT maps. Using the integrated registration tool, the NCCT with the infarction region was superimposed on the CTP maps for co-registration of the exact infarct location. As an internal control for each patient, a “mirror ROI” was placed in the contralateral non-infarcted region. Paired t-tests were performed for each CTP parameter.

**RESULTS**
A total of 13 patients were included in the statistical analysis with 13 infarction (delayed cerebral ischemia, DCI) regions. PS elevation was observed in all cases in ROI that represented subsequently developed DCI compared to the contralateral brain parenchyma without DCI (mean DCI 0.449; mean control 0.198; p = 0.0002). By contrast, the conventional clinically used CTP parameters CBF, CBV and MTT did not show any significant difference to the contralateral ROI on pre-DCI CTP (CBF mean DCI 15.76; mean control 16.34; p = 0.9296; CBV mean DCI 1.89; mean control 1.54; p = 0.0528; MTT mean DCI 9.76; mean control 7.89; p = 0.0917).

**CONCLUSION**
These preliminary data show that a relative increase in blood brain barrier permeability compared to the contralateral brain parenchyma appears to precede the development of delayed cerebral ischemia in patients with aneurysmal subarachnoid hemorrhage.

**CLINICAL RELEVANCE/APPLICATION**
Permeability changes prior to the development of irreversible cerebral infarction may lay the foundation for the development of new treatment strategies targeted towards stroke prevention.

**SST10-06 • 3T High Resolution Vessel Wall Imaging in Acute Perforator Infarction within the Territory of Middle Cerebral Artery**

**Younghen Lee** MD (Presenter) ; **Doran Hong** MD ; **Hyung Suk Seo** ; **Bo-Kyung Je** MD, PhD ; **Sang-II Suh** ; **Jin Man Jung** ; **Do Young Kwon** ; **Moon Ho Park**

**PURPOSE**
Recently, 3T high-resolution vessel wall imaging (HRVW) has been introduced to compensate limitation of 3-dimensional time-of-flight magnetic resonance angiography (TOF MRA) which only shows the vascular lumen of intracranial artery diseases by demonstrating wall appearances. We aimed to evaluate the vessel wall characteristics of the ipsilateral middle cerebral arteries (MCA) in acute striatocapsular infarction presumed to be perforator occlusion using HRVW in addition to TOF MRA.

**METHOD AND MATERIALS**
Forty-seven consecutive patients (M:F=31:16, mean age=59.6±12.9 years) with acute striatocapsular infarctions presumed by perforator occlusion, displayed on the DWI, were retrospectively enrolled. According to the lesion diameter, we classified them either 1) perforator arterial infarction (PAI50%,n=7). Additionally stroke risk factors including atherosclerosis and cardioembolic indicators were assessed.

**RESULTS**
Of the included 47 patients with acute PAI within MCA territory, 25 showed wall enhancement, 10 showed wall thickening, and 9 showed eccentric narrowing. HRVW demonstrated additional vessel wall abnormalities in eighteen (45.0%) from 40 patients classified as normal M1 on TOF MRA, moreover, 12 (41.4%) from twenty-nine patients with PAI< 2cm whose ipsilateral MCA was normal on TOF-MRA. Abnormal vessel wall findings to suggest intracranial atherosclerosis were more commonly depicted by HRVW than TOF MRA in patients (p<0.05).

**CONCLUSION**
Based on our preliminary results, HRVW imaging could provide more additional findings to suggest relationship of intracranial atherosclerosis in acute PAI.

**CLINICAL RELEVANCE/APPLICATION**
HRVW imaging could provide more additional findings beyond the scope of TOF-MRA.

**SST10-07 • Temporal Patterns of Intracranial Vessel Wall Imaging Using High Resolution MRI: A Follow-Up Study**

**Emmanuel C Obusez** MD (Presenter) ; **Ferdinand K Hui** MD * ; **Rula Hajj-Ali** ; **Stephen E Jones** MD, PhD

**PURPOSE**
High-Resolution Magnetic Resonance Imaging (HRMRI) is an emerging tool for evaluating intracranial artery disease. Vessel wall characteristics of intracranial vasculopathy have been described on HRMRI. We investigated HRMRI arterial wall characteristics of non-atherosclerotic intracranial diseases to determine wall pattern changes over a follow up period.

**METHOD AND MATERIALS**
We retrospectively reviewed high resolution 3-tesla MRI vessel wall studies performed on 29 patients with confirmed diagnosis of large to medium cerebral vessel disease over a follow up period. The high resolution vessel wall imaging protocol included black-blood contrast-enhanced T1-weighted sequence with fat suppression and time-of-flight (TOF) MRA of the circle of Willis. Clinical and demographic data and vessel wall characteristics including enhancement, wall thickening, and lumen narrowing were collected.

**RESULTS**
Clinical and radiographic diagnosis included CNS vasculitis (13), RCVS (13), moyamoya (2), intracranial dissection (1). In the CNS vasculitis group, 9 showed smooth, concentric wall enhancement and thickening, 3 with smooth, eccentric wall enhancement and thickening, and 1 without wall enhancement and thickening. Six of 13 had follow-up imaging, 4 showed stable smooth, concentric enhancement and thickening consistent with initial imaging findings and 2 with resolution of initial imaging findings. For RCVS, 10 showed diffuse, uniform wall thickening without and with mild enhancement. Nine of 10 had follow-up imaging, 8 with complete resolution of initial findings. For moyamoya, 2 of 2 patients at initial and follow-up imaging showed severe, irregular, vessel narrowing and occlusion without wall thickening, while 1 of 2 showed patchy wall enhancement. Intracranial dissection showed irregular, eccentric enhancement and wall thickening with a dual lumen separated by an enhancing intimal flap and attenuation of initial findings at follow-up imaging.

**CONCLUSION**
Post-gadolinium high-resolution 3-tesla MRI appears to be a feasible tool in differentiating vessel wall patterns of intracranial arteriopathy over a follow up period.

**CLINICAL RELEVANCE/APPLICATION**
Study of the evolution of HRMRI wall patterns may improve radiographic diagnoses and may serve as a surveillance modality to identify changes in wall morphology with intracranial disease progression.

**SST10-08 • Wall Enhancement of the Cerebral Arteries after Gadolinium Injection: Evaluation by MRI Using MSDE-3D-TSE Sequence**

**Morio Nagahata** MD (Presenter) ; **Makoto Obara** ; **Yasuko Minagawa** ; **Seina Sato** ; **Satoko Nagahata** MD ; **Rei Kondo** MD, PhD ; **Shinjiro Saito** MD, PhD ; **Takamasa Kayama** MD, PhD
Purpose

Motion sensitized driven equilibrium (MSDE) method can reduce the intraluminal blood signal, even in the post-contrast MR imaging. In this paper, we investigate the wall enhancement of cerebral arteries after injection of gadolinium using MSDE-3D-TSE sequence.

Method and Materials

A retrospective review was undertaken of consecutive 231 Gd-enhanced brain MR examinations with additional post-contrast MSDE-3D-TSE scan from May 2011 to March 2013. MSDE-3D-TSE sequence was performed in three directions (axial, coronal, and sagittal) with a high resolution protocol consisting of Tiw 3D-TSE sequence, TR/TE 425/12.8, 50 sections, 0.72x0.95x0.70mm voxel size, and a 394x342-imaging matrix on a 3T Achieva scanner (Philips). Among the 231 brain examinations, we evaluated the wall enhancement of each main arterial segment such as ICA (C1), M1, vertebral artery (VA), and basilar artery (BA) on MSDE-3D-TSE images. All images were analyzed by experienced neuroradiologist and neurosurgeons in consensus and classified as strong wall enhancement (equal to choroid plexus), faint enhancement (increased wall signal than pre-contrast scan), and no enhancement. In this study, we excluded the abnormal arterial segments such as occlusion, existing stenosis, fusiform dilatation, and dissection. Objective vessels of almost-normal morphology, which we could evaluate on post-contrast MSDE images, were 341 ICAs, 310 M1s, 78 VAs, and 122 BAS.

Results

Strong wall enhancement, equally to choroid plexus, was observed in 0.86% of ICAs, 3.2% of M1s, 23.1% of VAs, and 0.82% of BAS. Faint enhancement was observed in 5.6% of ICAs, 4.3% of M1s, 30.8% of VAs, and 3.3% of BAS. Strongly enhancing M1 wall was observed only at the affected side of distal cortical embolism or perforating arterial infarcts in our series. Wall enhancement of VA was, however, observed frequently without symptoms suggesting vascular pathology.

Conclusion

We could evaluate the enhancement of cerebral arterial wall using MSDE-3D-TSE sequence. In MCA, strong enhancement may mean some pathological change. In VA, strong enhancement does not always mean the vascular pathology, although it is often observed.

Clinical Relevance/Application

Wall enhancement of normal cerebral arteries revealed by post-contrast MSDE-3D-TSE sequence should be an important data for evaluating the pathological wall enhancement by post-contrast MRI in future.

SST10-09 • Effect of Insurance Status on Imaging Utilization for Acute Ischemic Stroke

Waleed Brinjikji (Presenter); Abdulrahman M El-Sayed DPhil; Jennifer S McDonald PhD *; Alejandro A Rabinstein MD; Harry J Cloft MD, PhD *

Purpose

Previous studies have demonstrated that socioeconomic disparities exist in imaging utilization for both acute and chronic disease. We studied a large nationwide database to determine if insurance-based disparities exist in the utilization of imaging for acute ischemic stroke.

Method and Materials

Inpatients with a primary diagnosis of acute ischemic stroke from 11/2005 through 12/2011 were identified from the Perspective database. Patients were stratified into four groups according to insurance status: 1) uninsured, 2) Medicaid, 3) Medicare and 4) private insurance. Utilization rates of head CT, CT perfusion, head MRI, non-invasive head angiography (including head CTA and head MRA), non-invasive neck angiography (including neck CTA and neck MRA), carotid ultrasound, and echocardiography were compared using a chi-squared test. A multivariable logistic regression model adjusting for potential confounding variables was fit to determine the association between insurance status and imaging.

Results

A total of 210212 patients were included in this study. 10396 patients (5.0%) were uninsured, 14243 patients (6.8%) had Medicaid, 153209 patients (72.9%) had Medicare and 32364 patients (15.4%) had private insurance. Utilization rate of MRA/CTA head was 55.9% for private insurance patients compared to 36.1% for Medicare patients (P < 0.001). Significant disparities exist in the utilization of neuroimaging for acute ischemic stroke based on patient insurance status. More research is needed to address these disparities.

Clinical Relevance/Application

Significant insurance-based disparities exist in the utilization of advanced imaging for acute ischemic stroke. Further studies are needed to better understand and address these disparities.

The mean Length of the Superior, Posterior, Lateral, Crus commune SCC of the left Inner Ear was S: 19.66mm (STD:1.64, Range:14-25mm), P: 21.54mm (STD:1.99, Range:17-27mm), L: 13.31mm (STD:1.48, Range:8-18mm) CC: 3.78mm (STD:0.44, Range:3-5mm).

The mean Lengths on the right side were S: 19.47mm (STD:1.67, Range:15-26mm), P: 22.30mm (STD:2.06, Range:16-29mm), L: 13.39mm (STD:1.46, Range:7-18mm), CC: 3.78mm (STD:0.44, Range:2.7-5mm).

**CONCLUSION**

This descriptive study showed that angles between the Semicircular canal planes have a wide range of degrees.

**CLINICAL RELEVANCE/APPLICATION**

Contrary to previous reports in the literature (that the angle between the SCCs is around 90°) the current study results shows a wide range of variations between the angles.

**SST11-02 • Clinical Evaluation of Synthetic Brain MRI at 3.0 Tesla**

Michael Nelles MD (Presenter) ; Juergen Gieseke DSc ; Dariusch R Hadizadeh Kharrazzi MD ; Horst Urbach MD ; Hans H Schild MD

**PURPOSE**

Prospective intra-individual comparison of synthetic quantitative versus regular MR imaging (MRI) of the brain at 3.0T.

**METHOD AND MATERIALS**

A 3.0T MR system (Achieva 3.0T TX, Philips Healthcare, The Netherlands) and a stand-alone postprocessing software (SyntheticMR, Sweden) were used to create T1, T2 and FLAIR contrast-weighted synthetic MRI images of the brain. The quantitative mapping was based on the QRAPMASTER method “(Quantification of Relaxation Times and Proton Density by Multiecho acquisition of a saturation-recovery using Turbo Spin-Echo Readout)”, using a multislice, multiecho, and multidelay acquisition with a scan time of 4:50 minutes. 25 consecutive patients underwent MRI of the brain including synthetic quantitative and regular T1, T2 and FLAIR sequences. Contrast ratios (CRs) were calculated between gray matter (GM) and white matter (WM) for synthetic and regular sequences. Diagnostic quality of synthetic MR examinations was scored as follows: Score of 4, excellent (sharp depiction of the GM/WM junction and subcortical GM without interfering artifacts). Score of 3, adequate for diagnosis (minor artifacts or noise present not interfering with image interpretation). Score of 2, questionable for diagnosis (impaired by artifacts, noise and / or changes in contrast). Score of 1, non-diagnostic.

**RESULTS**

Synthetic quantitative MRI is capable of generating accurate conventional contrast images within a clinically acceptable time.

The diagnostic image quality is readily comparable to that of regular MRI sequences in the majority of cases.

**CLINICAL RELEVANCE/APPLICATION**

Synthetic MRI holds the promise of replacing the acquisition of different regular MR series in selected patients, suitable for disease monitoring in e.g. MS or glioma patients.

**SST11-03 • Multivariate Longitudinal Shape Statistics of Brain Lateral Ventricles during the First Eighteen Months of Human Life**

Lucile Bompard (Presenter) ; Shun Xu ; Martin Styner ; Wei Gao ; Valerie L Jewells DO ; Beatriz Paniagua ; Weili Lin PhD

**PURPOSE**

The human brain undergoes dramatic structural changes in the first few years of life. Of particular interest are the lateral ventricles (LVs) of the brain because of their association with many psychiatric and developmental disorders. The primary aim of this research is to discern the temporo-spatial growth characteristics of the LVs to develop a normative data-base.

**METHOD AND MATERIALS**

24 healthy subjects were imaged using a 3T MR scanner as frequently as 3 months from 2 weeks of age to 12 months of age, and again at 18 months. A minimum of 4 scans was performed per subject. T2- weighted images were employed to segment the LVs, resulting in 127 left and 119 right LVs. Due to significant variation, the tail of the ventricular horn was manually removed. Subsequently, a densely sampled surface representation was computed for each LV using spherical harmonics based point distribution models, allowing group analysis of the spatiotemporal growth of the LVs during the first 18 months of life. Volumetric measures, cross-sectional areas, and growth rates were calculated.

**RESULTS**

Volumetric measurements reveal a continuous growth of the LVs in the first 12 months, followed by 11±27% reduction from 12 to 18 months. In addition, the left LV is consistently larger (10±23% at 2wks and 9±20% at 18month) than that of the right LV. By grossly separating the LVs into the anterior and posterior horns and the mid-body, additional insights are revealed. Measurements of regional cross-sectional areas of LVs, the mid-body mainly elongates and the horns thicken with time. Specifically, the ventricle horns exhibit the fastest growth rates between 0 3 months, followed by a progressively reduced growth rate between 3 12 months. In addition, the posterior horn consistently outgrows the anterior horn. In contrast, the temporal changes of thickness of the mid-body are mainly from dorsal to ventral, with the fastest growth rate between 0 3 months.

**CONCLUSION**

The LV growth exhibits both temporal and regional specific patterns during the first 18 months of life. Our results offer new insights into the unique growth patterns of human ventricle.

**CLINICAL RELEVANCE/APPLICATION**

This detailed normative spatiotemporal growth characteristics of LVs during the first 18 months of life provide important references for the delineation of early abnormal LV growth.

**SST11-04 • Whole Brain Volumetric and Morphometric Analysis of Patients with Maple Syrup Urine Disease**

Emilie R Muelly PhD (Presenter) ; Don Bigler ; Gregory J Moore MD, PhD ; Kevin Strauss ; D. Holmes Morton ; Julie A Mack MD

**PURPOSE**

Maple syrup urine disease (MSUD) is an inherited metabolic disorder that impairs branched chain amino acid metabolism. Rapid elevations of circulating branched chain amino- and ketoacids cause life-threatening encephalopathy. Despite dietary treatment, achievement of metabolic control varies and patients remain at risk for acute decompensation. Liver transplantation has been shown to eliminate metabolic volatility. Reversible decreases in N-acetylaspartate (NAA) have been demonstrating using magnetic resonance spectroscopy during both acute and chronic states of disease. These findings may reflect structural or functional differences. Volumetric analysis may add value to interpretation of neurochemical findings.

**METHOD AND MATERIALS**

Quantitative proton magnetic spectra were obtained for 37 patients (26 on dietary therapy, 11 status-post liver transplantation) and 26 sibling controls using a Siemens Magnetom Trio 3 Tesla scanner. Whole brain and segmented volume calculations of the images were made using SPM5 in Matlab. Brain morphometry dimensional measurements were measured using Osirix. A three-way ANCOVA (accounting for age as a cofactor) with Tukey post-hoc testing were used to identify group differences.
RESULTS
Total brain parenchyma as a percentage of total brain volume was greater in patients on dietary therapy compared to controls (p = 0.02). Gray and white matter percentages of total brain volume individually did not differ between groups. Total whole brain volume and morphometry did not differ between groups.

CONCLUSION
Our results support the hypothesis that low NAA levels in MSUD patients reflect impaired neuronal energy production rather than neuronal loss. However, our methods prevent us from detecting decreases in neuronal density that do not change tissue size and also do not specifically evaluate brain regions in which low NAA levels were detected. Furthermore, increased total brain parenchyma may reflect subtle chronic edema. Further study, such as analysis of T2* and regional morphometric data, is needed to explore these possibilities.

CLINICAL RELEVANCE/APPLICATION
Patients with maple syrup urine disease have increased total brain parenchymal volume.

SST11-05 • DTI Correlates of Cognition in Conventional MRI Normal Appearing Brain in Patients with Vitamin B12 Deficiency

Rakesh K Gupta MD, MBBS (Presenter); Pradeep K Gupta MSc; Ravindra K Garg MD, MBBS; Bhaswati Roy; Abhinav Yadav BS; Yogita Rai PhD; Ram K Rathore DSc; Chandra M Pandey PhD; Ponnada A Narayana PhD

PURPOSE
Deficiency of vitamin B12 may result in neuronal degeneration and brain damage which influences the cognition. We hypothesized that patients with clinical symptoms of subacute combined degeneration (SACD) and biochemical evidence of Vitamin B12 deficiency should have a cognition decline and microstructural brain changes on advanced MRI even when conventional MRI appears normal.

METHOD AND MATERIALS
Patients with SACD of the cord were recruited for the study. Patients underwent nerve conduction velocity and biochemical analysis for serum Vitamin B12, and homocystine. Hematology including the type of anemia was also performed. All patients with Vitamin B12 deficiency and clinical features of SACD were subjected to the complete imaging cervical spine and brain imaging. Patients with normal brain MRI with or without imaging changes in the cervical spine were included for cognition tests. Based on these criteria, 51 patients and 46 age and sex matched controls were enrolled in this study. 3D-T1 weighted and DTI was performed in all these subjects. FSL based VBM and TBSS analysis were performed for volumetric and white matter fibre tracts changes quantification.

RESULTS
No significant changes in grey and white matter volumes were observed in patient compared to control using VBM. Significant reduction of FA and increase in MD and RD values were observed in various brain regions in patients compared to controls. Most of the Neuropsychological score were significantly altered in patients compared to controls and few of these showed significant correlation with FA and RD in some of the brain regions.

CONCLUSION
Increase in FA and increase in MD and RD results of WM microstructure suggests its alteration probably due to demyelination of the fibers secondary to Vitamin B12 deficiency. These patients, though present clinically with SACD, have generalized involvement of the white matter of the CNS and have associated decline in cognition. Correlation of some of the NPT scores with region specific white matter changes confirms that the abnormalities in NPT relate to the changes in the white matter microstructures.

CLINICAL RELEVANCE/APPLICATION
Vitamin B12 deficiency has generalized effect on the CNS white matter even when it manifests as SACD as evidenced by cognition and brain microstructural alteration.

SST11-06 • Reliability of 3D Pseudo-continuous Arterial Spin-labeling MR Imaging for Measuring Visual Cortex Perfusion on Two 3T Scanners

Diandian Huang (Presenter); Xin Lou MD, PhD; Lin Ma MD; Bing Wu; Kai-Ning Shi

PURPOSE
The visual cortex cerebral blood flow (CBF) values are closely associated with visual perception. Perfusion MRI can be used to identify patients with ischemic changes of visual cortex who may benefit from reperfusion therapies. The risk of nephrogenic systemic fibrosis, however, limits the use of contrast agents. Our objective was to evaluate the reliability and reproducibility of three dimensional arterial spin labeling (3D pCASL), an alternative noninvasive perfusion technique, to detect CBF of visual cortex in vivo.

METHOD AND MATERIALS
Twelve healthy subjects were scanned three times on two 3.0T MR scanners with 3D pCASL technique. The 1st test and 3rd test were done on scanner-1, while the 2nd test was on scanner-2. Intervals between tests were among 10-15 days. The 3D pCASL data with two post labeling delay time (PLD) of 1.5 and 2.5 seconds was acquired during every scanning. Volumetric T1-weighted images were also acquired for image registration. The CBF values of visual cortex (included brodmann 17,brodman 18,brodman 19) were extracted for comparison. The intra- and inter-scanner reliability and reproducibility were evaluated with the intraclass correlation coefficient (ICC) and Bland-Altman plot.

RESULTS
The relative CBF values of visual cortex were 16-84 ml/min/100g (PLD=1.5s) and 27-75 ml/min/100g (PLD=2.5s). Compared with 1st test and 2nd test, the ICC was 0.685 at PLD=1.5s and 0.754 at PLD=2.5s. Compared with 2nd test and 3rd test, the ICC was 0.719 at PLD=1.5s and 0.821 at PLD=2.5s. Compared with 1st test and 3rd test, the ICC was 0.719 at PLD=1.5s and 0.831 at PLD=2.5s. Higher reliability (ICC=0.829) for PLD 2.5s compared to PLD 1.5s (ICC=0.743) were demonstrated in inter-scanners. At intra- and inter-scanner, the Bland-Altman showed the reproducibility at PLD=2.5s is better than that at PLD=1.5s.

CONCLUSION
Although inter-scanner reliability is slightly lower than intra-scanner, there is a very high similarity of the outcomes at different time from two scanners. The 3D pCASL technique is available for measuring the CBF at visual cortex with high reliability and reproducibility. It should be used for MR research on blood flow of visual cortex at multiple centers.

CLINICAL RELEVANCE/APPLICATION
The 3D pCASL can measure CBF values of visual cortex with high reliability and reproducibility and offers a noninvasive way to access the etiology and diagnosis of posterior visual pathway disease.

SST11-07 • Adaptation and Slow Recovery of Metabolic Activity in Human Visual Cortex Coupled with a Modest Change in Cerebral Blood Flow

Farshad Moradi MD (Presenter); Richard B Buxton PhD

PURPOSE
We recently demonstrated sub-additive flow and metabolic response non-linearity in human visual cortex consistent with adaptation. A disproportionately larger adaptation of metabolic response compared to blood flow was observed. These results indicate an aspect of metabolic activity corresponding to neural adaptation (or fatigue) that has a different neurovascular coupling from stimulus driven activation. The purpose of this study was to determine if the adaptable aspect of metabolic activity is coupled with high flow and whether or not it recovers during inter-stimulus intervals.

METHOD AND MATERIALS
Six observers participated in the experiment. CBF and BOLD responses to continuous (46 s) and intermittent (7.6 s on and off x 3)
RESULTS
If the adaptable aspect of metabolic activity is coupled with high flow then the neurovascular-coupling ratio is expected to increase over time with prolonged stimulation in the continuous condition. If the adaptable aspect of metabolic activity recovers during interstimulus intervals then the neurovascular-coupling ratio should remain the same over time in the intermittent condition. A positive change in neurovascular coupling would result in a larger proportionately greater than \( \text{CBF} \). Contrary to both predictions, \( \text{BOLD} \) was negative compared to \( \text{CBF} \) in all conditions, indicating a significantly lower neurovascular coupling ratio at the end of each epoch compared to the beginning.

CONCLUSION
The adaptable aspect of metabolic activity is coupled with a lower flow modulation compared to the input-driven modulation and does not recover during short inter-stimulus intervals. Our results are consistent with the hypothesis that cerebral blood flow in human visual cortex is driven by both metabolic activity and visual input via independent mechanisms.

CLINICAL RELEVANCE/APPLICATION
Numerous pathologic conditions affect the regulation of cerebral blood flow. Our results provide insight into physiological modulations of neurovascular coupling and role of adaptation nonlinearity.

SST11-08 • Evaluation of WBAA with Registration-based Cube Propagation for Brain Atrophy Quantification

Martin Lillholm MSc, PhD (Presenter) *; Akshay Pai; Lauge Sorensen; Mads Nielsen PhD *; Jon Sporrin *; Sune Darkner

Erik B Dam PhD *

PURPOSE
Atrophy for the whole brain and sub-structures is becoming common as study outcome in clinical trials assessing the efficacy of potential treatments of diseases involving dementia. In this study, we evaluated the sensitivity to change related to progression of Alzheimer’s disease of a novel software framework, WBAA.

METHOD AND MATERIALS
The recently defined Alzheimer’s disease neuroimaging initiative (ADNI) standardized collection (‘ADNI:Annual 2 Yr 1.5T’ at adni.loni.ucla.edu) with 504 subjects (169 normals, 234 mild cognitively impaired, and 101 Alzheimer) including baseline and 12-month 1.5T T1 magnetic resonance imaging (MRI) scans was used. The MRIs were processed using longitudinal FreeSurfer and the whole brain atrophy application (WBAA 1.0 by Biomediq) that performs non-rigid registration followed by atrophy estimation quantification using cube propagation (CP). The WBAA was also evaluated with CP replaced by the common Jacobian integration (JI) method. Sensitivity to change was evaluated by atrophy differences between healthy and Alzheimer subjects quantified using Cohen’s D and required study sample sizes.

RESULTS
As example, quantifications of the hippocampus atrophies estimated using WBAA were -1.3% and -0.6% for the Alzheimer and healthy subjects whereas the ventricle estimates were +9.3% and +4.1%, respectively. Corresponding Cohen’s D for WBAA on these two regions were 1.1 and 1.0. For whole-brain, hippocampus, ventricles, and medial temporal lobe, the WBAA Cohen’s D were 0.7, 1.1, 1.0, and 1.3. The corresponding sample sizes were 173, 124, 113, and 87. For WBAA with JI, Cohen’s D were 0.5, 1.1, 1.0 and 1.2; with sample sizes 230, 139, 112, and 101. For longitudinal FreeSurfer, Cohen’s D were 0.7, 1.0, 1.0, and 1.3; with sample sizes 183, 152, 118, and 102.

CONCLUSION
The WBAA using CP for brain atrophy quantification provided sensitivity equal or superior to leading, competing methods. Specifically, the WBAA sample sizes were generally lower.

CLINICAL RELEVANCE/APPLICATION
Unlike longitudinal FreeSurfer, WBAA allows quantification of final atrophy estimates directly after each visit. Adding the matching/improved sensitivity, WBAA seems appropriate for clinical trials.

SST11-09 • Tumor Cellularity and the Extravascular-Extracellular Space: Using Quantitative Imaging to Evaluate Correlation Between ADC and DCE MRI in Human Gliomas, Meningiomas and Cerebral Lymphomas

Hannu T Huhtanpaa MD (Presenter); Darryl Hwang PhD; Naira Muradyan PhD *; Steven Cen PhD; Michael Booker; Alexander Lerner MD; Deborah Commins; Anandh G Rajamohan MD; Paul E Kim MD; Orest B Boyko MD, PhD *; John L Go MD; Eu-Meng Law MBBS *; Mark S Shiroishi MD

PURPOSE
The apparent diffusion coefficient (ADC) determined from diffusion tensor (DTI) MR imaging can give an impression of the extravascular-extracellular space (EES) and has been shown to be inversely correlated with tumor cell density. Parametric maps such as EES fraction (ve) derived from dynamic contrast enhanced (DCE) MRI also characterize EES. The purpose of this study was to determine if there is a correlation between ADC and DCE metrics such as ve, blood-brain barrier transfer constant (Ktrans), Kep (Ktrans/ve), and fractional plasma volume (vp) for gliomas, cerebral lymphomas and meningiomas. Figure 1 demonstrates ADC and ve parametric maps for a glioma.

METHOD AND MATERIALS
18 gliomas (grade I-IV), 2 lymphomas and 5 meningiomas were retrospectively evaluated. DTI and DCE images were acquired during the same MRI exam. DCE-MRI images were postprocessed in CADvue. Metrics extracted from DCE MRI were: ve, vp, Ktrans, and Kep. ADC maps were generated by the MR scanner. DCE and ADC images were co-registered and 3-dimensional regions of interest were drawn on parametric maps. Voxel-wise correlation between ADC and DCE parameters were examined using scatter plots and tested by random effects model. Mean and median values were extracted using Spearman correlation.

RESULTS
Overall, mean ADC correlated negatively with mean ve (\( r = -0.48, p = 0.03 \)) as well as with median ve (\( r = -0.52, p = 0.01 \)). The result of voxel level analysis using random effects model did not show significant correlation between ADC and ve (\( r = 0.09, p = 0.09 \)). No statistically significant correlation was observed between ADC and the other parameters, vp, Ktrans, and Kep.

CONCLUSION
Our results showed a negative correlation between ADC and both mean as well as median ve, and no significant correlation between ADC and the other DCE parameters. This is in agreement with a prior study performed in breast cancer, while another study in breast cancer as well as one in glioblastoma found no correlation. These results likely reflect limitations in our understanding of these metrics though limitations in imaging technique may be confounders.

CLINICAL RELEVANCE/APPLICATION
Determination of the relationship between ADC and DCE MRI metrics such as extravascular-extracellular volume fraction (ve) may provide new imaging biomarkers of brain tumor cellularity.
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<td>Consultant, Medpace, Inc Consultant, Bristol-Myers Squibb Company Consultant, Boehringer</td>
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<tr>
<td>Zaharchuk, G.</td>
<td>Research Grant, General Electric Company</td>
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<tr>
<td>Zavarzin, V.</td>
<td>Stockholder, Brain Biosciences, Inc</td>
</tr>
<tr>
<td>Zhou, O.</td>
<td>Board of Directors, XinRay Systems Inc Research Grant, Carestream Health, Inc</td>
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