Sunday, December 01, 2013
10:45-12:15 PM • SPOI11 • Room: E353C • Oncodiagnosis Panel: Pediatric Sarcoma (An Interactive Session)
10:45-12:15 PM • SSA13 • Room: E451A • Musculoskeletal (Shoulder I)
10:45-12:15 PM • SSA14 • Room: E451B • Musculoskeletal (Tumor I)
12:30-01:00 PM • LL-MKS-SU • Room: Lakeside Learning Center • Musculoskeletal - Sunday Posters and Exhibits (12:30pm - 1:00pm)
01:00-01:30 PM • LL-MKS-SUB • Room: Lakeside Learning Center • Musculoskeletal - Sunday Posters and Exhibits (1:00pm - 1:30pm)
02:00-03:30 PM • RC104 • Room: E335C • Sports Injuries in the Chest and Abdominal Wall: A Core Curriculum of the Body's Core
02:00-03:30 PM • RC108 • Room: E353B • Imaging of the Traumatized Spine (Traditional) (An Interactive Session)
02:00-03:30 PM • VSPD12 • Room: S102AB • Pediatric Radiology Series: Pediatric Musculoskeletal

Monday, December 02, 2013
08:30-10:00 AM • M5CM21 • Room: S100AB • Case-based Review of Magnetic Resonance: Musculoskeletal (An Interactive Session)
08:30-10:00 AM • RC231 • Room: E264 • Master Class in Musculoskeletal Ultrasound (How-to Workshop)
08:30-12:00 PM • VSMK21 • Room: E451B • Musculoskeletal Radiology Series: Knee Imaging
10:30-12:00 PM • SSC10 • Room: E450B • Musculoskeletal (Interventional I)
12:15-12:45 PM • LL-MKS-MOA • Room: Lakeside Learning Center • Musculoskeletal - Monday Posters and Exhibits (12:15pm - 12:45pm)
12:45-01:15 PM • LL-MKS-MOB • Room: Lakeside Learning Center • Musculoskeletal - Monday Posters and Exhibits (12:45pm - 1:15pm)
03:00-04:00 PM • SSS14 • Room: E450B • Musculoskeletal (Hip)
03:00-04:00 PM • SSE15 • Room: E451B • Musculoskeletal (Metabolic)

Tuesday, December 03, 2013
08:30-12:00 PM • VSMK31 • Room: E451B • Musculoskeletal Radiology Series: Ultrasound
10:30-12:00 PM • SSS110 • Room: E450B • Musculoskeletal (Interventional II)
12:15-12:45 PM • LL-MKS-TUA • Room: Lakeside Learning Center • Musculoskeletal - Tuesday Posters and Exhibits (12:15pm - 12:45pm)
12:45-01:15 PM • LL-MKS-TUB • Room: Lakeside Learning Center • Musculoskeletal - Tuesday Posters and Exhibits (12:45pm - 1:15pm)
03:00-04:00 PM • SSJ16 • Room: E451A • Musculoskeletal (Shoulder II)
03:00-04:00 PM • SSJ17 • Room: E451B • Musculoskeletal (Cartilage, Arthritis)
04:30-06:00 PM • RC404 • Room: E450A • Current Imaging of the Shoulder: Rotator Cuff and Glenohumeral Joint Instability including Normal Variants, Pi...
04:30-06:00 PM • RC450 • Room: E260 • Vertebral Augmentation (How-to Workshop)

Wednesday, December 04, 2013
08:30-10:00 AM • MSCS41 • Room: S406A • Case-based Review of Musculoskeletal Radiology (An Interactive Session)
08:30-10:00 AM • RC504 • Room: N227 • Bone and Cartilage Injury: Traumatic and Stress-related Chondral, Osteochondral and Subchondral Failure with E...
08:30-10:00 AM • RC552 • Room: E264 • Nerve Ultrasound Based on a Regional Approach: Shoulder and Neck (Hands-on Workshop)
10:30-12:00 PM • MSCS42 • Room: S406A • Case-based Review of Musculoskeletal Radiology (An Interactive Session)
10:30-12:00 PM • M5S342 • Room: S100AB • Essentials of Musculoskeletal Imaging
10:30-12:00 PM • SSS13 • Room: E450B • ISP: Musculoskeletal (Knee)
10:30-12:00 PM • SSS14 • Room: E451A • Musculoskeletal (Tumor II)
12:15-12:45 PM • LL-MKS-WEA • Room: Lakeside Learning Center • Musculoskeletal - Wednesday Posters and Exhibits (12:15pm - 12:45pm)
12:45-01:15 PM • LL-MKS-WEB • Room: Lakeside Learning Center • Musculoskeletal - Wednesday Posters and Exhibits (12:45pm - 1:15pm)
01:00-02:00 PM • MSRT41 • Room: N230 • ASRT@RSNA 2013: Musculoskeletal Imaging: New Ways to Image the Same Old Bones
03:00-04:00 PM • SSM13 • Room: E450A • ISP: Musculoskeletal (Ankle/Foot)
04:30-06:00 PM • SPDL41 • Room: E451A • RSNA Diagnosis Live™: Neuroradiology and Musculoskeletal Radiology

Thursday, December 05, 2013
08:30-10:00 AM • RC650 • Room: E260 • Image-guided Biopsy of the Spine (Hands-on Workshop)
08:30-10:00 AM • RC852 • Room: E264 • Dynamic Musculoskeletal US of the Lower Extremity (Hands-on Workshop)
08:30-12:00 PM • VSMK51 • Room: E451B • Musculoskeletal Radiology Series: Pelvis and Hip Imaging
10:30-12:00 PM • MSCP52 • Room: S406A • Case-based Review of Pediatric Radiology: Pediatric MSK Imaging (An Interactive Session)
10:30-12:00 PM • S5SP52 • Room: E451A • Musculoskeletal (Spine)
10:40-11:40 AM • MSRT53 • Room: N230 • ASRT@RSNA 2013: Elbow and Forearm Trauma: Mechanisms of Injury and Patterns of Fractures
12:15-12:45 PM • LL-MKS-THA • Room: Lakeside Learning Center • Musculoskeletal - Thursday Posters and Exhibits (12:15pm - 12:45pm)
12:45-01:15 PM • LL-MKS-THB • Room: Lakeside Learning Center • Musculoskeletal - Thursday Posters and Exhibits (12:45pm - 1:15pm)
03:00-04:00 PM • SPSH51 • Room: E451A • Hot Topic Session: Metal-on-Metal Arthroplasty Complications
03:00-04:40 PM • MSRT56 • Room: N230 • ASRT@RSNA 2013: Improving Practice in Pediatric Skeletal Radiography
04:30-06:00 PM • RC704 • Room: E450A • Interactive Game: Musculoskeletal Pitfalls and Pearls
04:30-06:00 PM • RC708 • Room: E350 • Emergency Musculoskeletal Radiology: The Usual (and Unusual) Suspects
04:30-06:00 PM • RC731 • Room: E263 • Common Spinal Injection Procedures for Diagnosis and Treatment of Back Pain (Hands-on Workshop)

Friday, December 06, 2013
08:30-10:00 AM • RC808 • Room: E353C • Emergency Radiology Case-based Countdown (An Interactive Session)
08:30-12:00 PM • VSMK61 • Room: N228 • Musculoskeletal Radiology Series: Elbow, Hand and Wrist Imaging
12:30-03:00 PM • SPMK61 • Room: E350 • Friday Imaging Symposium: MR Imaging of Common Musculoskeletal Injuries (An Interactive Session)

Musculoskeletal Case of the Day

LL-EDE3008
Moderator
Jonelle M Petscavage-Thomas, MD, MPH *
Stephanie A Bernard, MD
Eric A Walker, MD *
Pamela L Brian, MD

PURPOSE/AIM
Participants will test their diagnostic skills and become familiar with the imaging findings of a variety of challenging and interesting musculoskeletal cases.

Musculoskeletal Case of the Day
The Role of Dual-Energy CT in the Differentiation of Microcrystalline Arthropathies

PURPOSE/AIM
To demonstrate the value of dual-energy computed tomography (DECT) in differentiating microcrystalline arthropathies (gout and pseudogout), correlating with patient’s symptoms, laboratory results and other imaging methods.

CONTENT ORGANIZATION
1. Review of literature on current role of DECT in MSK cases.
2. Review and illustrate several cases which DECT proved useful to reach diagnosis, correlating DECT findings to laboratory results and other imaging methods.
3. Describe the use of DECT scanning of the extremities for the demonstration of uric acid and calcium crystal deposition.
4. Review and discuss the clinical application of this technique and its benefit to patients with atypical inflammatory arthropathies.

SUMMARY
DECT characterizes the chemical composition of material according to its differential x-ray attenuation at two different energy levels. There are different applications of DECT in MSK imaging, however, to date, the most successful is to identify monosodium urate (MSU) crystals in confirming the diagnosis of gout, excluding the main differentials. This essay will present a variety of illustrative cases in which the DECT proved useful in the diagnosis on wrist, knee, foot and ankle correlating with patient’s symptoms, laboratory results and other imaging methods.

In-Vivo MR Imaging of the Triangular Fibrocartilage at 3 and 7 Tesla: Comparison in Anatomic Conspicuity

PURPOSE/AIM
1. To acquire in-vivo images of the human wrist on a 7 Tesla MRI and
2. To compare them to 3T MR images acquired with a dedicated wrist coil.

CONTENT ORGANIZATION
1. Introduction and techniques
2. Review of anatomy of the TFCC
   a. Triangular fibrocartilage (disc proper)
   b. Dorsal radioulnar ligament
   c. Volar radioulnar ligament
   d. Meniscal homologue
   e. Ulnar collateral ligament (UCL)
   f. Triangular ligament
   g. Ulnolunate ligament
   h. Ulnotriquetral ligament
3. Acquisition of images at 7T and 3T
   a. Description of sequences used
      i. Sequences: T1-TSE, PD-TSE with and without SPIR and SPAIR, 3D GRE, STIR TSE
      ii. Similar scan time between 7T and 3T
      iii. Ability to achieve isotropic voxel size on the 3D GRE sequence for multiplanar reconstruction.
4. Discussion of advantages/disadvantages of 7T
   a. Advantages
      i. Increased signal to noise ratio
      ii. Improved spatial resolution
   b. Disadvantages
      i. More susceptible to motion
      ii. More susceptible to chemical shift artifact
      iii. Requires custom built surface coil
5. Assessment of overall quality and tissue depiction
6. Clinical feasibility

SUMMARY
a. It is possible to obtain high quality multislice images of the human wrist at 7T.
b. In-vivo images were comparable to high-resolution images obtained on a 3T system with a smaller FOV and a dedicated extremity wrist coil.

Hiding in the Line of Sight: MRI in Occult Wrist Injuries

PURPOSE/AIM
To acquire in-vivo images of the human wrist on a 7 Tesla MRI and

CONTENT ORGANIZATION
1. Introduction and techniques
2. Review of anatomy of the TFCC
3. Acquisition of images at 7T and 3T
4. Discussion of advantages/disadvantages of 7T
5. Assessment of overall quality and tissue depiction
6. Clinical feasibility

SUMMARY
a. It is possible to obtain high quality multislice images of the human wrist at 7T.
b. In-vivo images were comparable to high-resolution images obtained on a 3T system with a smaller FOV and a dedicated extremity wrist coil.
PURPOSE/AIM
1. Review the traditional imaging for diagnosing scaphoid injuries.
2. Discuss the limited MRI performed at our institution.
3. Review three years data including the increase in diagnostic sensitivity and prevalence of occult scaphoid fractures and other injuries.

CONTENT ORGANIZATION
1. Discussion of the different modalities used in the assessment of scaphoid fractures, including the evidence base for performing two sets of scaphoid x-rays, ten days apart.
2. Describe the current protocol for imaging scaphoid fractures at our institution. We perform a limited two sequence (T1 and STIR coronal sequence) in all patients with a negative plain film at 10 days.
3. Review of three years data. We present 168 consecutive cases, looking at the number and type of occult injuries detected on MRI.

SUMMARY
Traditional imaging of scaphoid fractures misses a significant number of occult injuries. We present our protocol introduced in 2010 to avoid this problem. We discuss the evidence base behind this change in practice and describe our incidence of occult injuries, along with resource and outcome implications.

What do Musculoskeletal Tumors Look Like on Diffusion Weighted Imaging?

Technique
Diffusion weighted images obtained with EPI technique with the following parameters: repetition time, 4500 msec; echo time, 105 msec; directions of the motion-probing gradients, three orthogonal axes; b value, 0, 500 and 1000 sec/mm²; field of view, 220 mm; matrix size, 128 × 80–128; section thickness, 5 mm with 0.2–1.0-mm intersection gaps; and two signals acquired. Parallel imaging techniques (SENSE) with a reduction factor of 1–1.5 were used. Acquisition time was 1–2 minutes. Case samples categories:

Bone tumors
- Benign bone tumors
- Benign bone tumors with condroid matrix
- Primary malignant bone tumors
- Primary malignant bone tumors with condroid matrix
- Secondary malignant bone tumors

Soft tissue tumors
- Cystic soft tissue tumors
- Benign solid soft tissue tumors
- Malign solid soft tissue tumors
- Hematomas

SUMMARY
Diffusion weighted imaging (DWI) is an invaluable tool in diagnosis of musculoskeletal tumors. Although some benign and malignant tumors showed considerable overlap, DWI findings and calculated ADC values of benign and malignant bone tumors are different. Addition of diffusion-weighted MR to routine protocols may increase the accuracy of diagnosis.

Radiofrequency Ablation of Metastatic Osseous Spinal Lesions Using a New Navigational Bipolar Device

Purpose/Aim
Metastatic osseous lesions are a frequent complication of malignant tumors. Radiofrequency ablation (RFA) of metastatic lesions within the spine has been limited by a specific transpedicular approach and proximity to sensitive neural tissues. This exhibit is to inform radiologists of a new safe and effective approach to RFA of spinal metastasis using a device that contains a navigable osteotome as well as two active thermocouplers that provide real-time monitoring of the peripheral edge of tumor ablation and ablation size.

Content Organization
Relevant Anatomy/Demographics
Traditional Technique
New Novel Device/Technical Differences
Advantages/Disadvantages

Summary
RFA of metastatic spinal tumors has been limited in application due to complex anatomy and concern for damage to neural tissue. Using the same transpedicular approach, a novel device uses a tip that can be steered within the vertebral body to increase the ablation size as well as reach lesions that were previously untreated. Proximal and distal thermocouplers provide real-time monitoring of the ablation edge and an accurate size of the ablation cavity. This exhibit is to inform the radiologist about a new device which allows treatment of osseous lesions that were previously untreated due to their location, size, and proximity to neural tissues.

Development of a Diffusion Weighted Imaging MRI Sequence for Juvenile Idiopathic Arthritis on an Open-bore 1.0 T MRI

Purpose/Aim
The purpose of this exhibit is to share the experience of developing a diffusion weighted imaging (DWI) MRI sequence for the knee of patients with juvenile idiopathic arthritis (JIA).

Content Organization
1. JIA pathophysiology
2. The role of MRI in JIA
3. Diffusion weighted imaging in JIA
   a. DWI technique (T2 single-shot EPI DWI performed on an open-bore 1.0T scanner)
   b. The effects of test scan and final scan parameters on SNR and image quality.
   c. DWI test scans and scans of first JIA patients included in the study.
d. Demonstration of DWI applicability, post-processing options and data extraction on preliminary DWI patient material. Clinical relevance: DWI could provide an imaging biomarker for assessing synovitis in JIA without IV contrast administration. To omit contrast administration would markedly increase patient comfort for children suffering from JIA.

SUMMARY

The most important goal of this exhibit is to share our experiences in developing an imaging biomarker for assessing JIA by using a DWI sequence, thereby contributing to the expansion of knowledge on musculoskeletal DWI.

Visiting this exhibit, the viewer will accomplish the following:
1. Gain knowledge about the use of MRI in JIA.
2. Gain knowledge on DWI sequence development for patients with JIA.
3. Gain insight into the applicability of DWI in JIA.

Emerging Molecular Imaging Methods in Rheumatoid Arthritis

LL-MKE1097
Ali Salavati, MD, MPH
Babak Saboury, MD, MPH
Joshua Baker, MD
Abass Alavi, MD

PURPOSE/AIM

To provide an overview of the clinically available molecular imaging technique for detection and therapy monitoring of patients with rheumatoid arthritis.

CONTENT ORGANIZATION
1. Early detection and monitoring of biological activity in rheumatoid arthritis
2. Systemic inflammatory biomarkers
3. Clinical scoring systems
4. PET/CT
   a. 18F-fluorodeoxyglucose
   b. Other radiopharmaceuticals
   c. Semi-quantitative and quantitative PET/CT imaging biomarkers
5. PET/MRI

SUMMARY

After reviewing this exhibit, the radiologist will gain an understanding new molecular imaging approaches can be used to guide the choice, and early application, of the most efficacious biologic therapies, and thus secure the optimal chance for long-term disease remission in patients with rheumatoid arthritis.

Going Overboard: Water Submerged Ultrasound Transducers to Enhance High Resolution Soft Tissue Imaging

LL-MKE1098
Hernan D Paez Rueda, MD
Diana C Florez Cardenas, MD
Nelson D Bedoya, MD
Humberto Rivera, MD

PURPOSE/AIM

The purpose of this exhibit is:
1. To explain the utility of water submerged ultrasound transducers for enhancing the quality and resolution of images in routing ultrasound exploration of skin and soft tissue.
2. To discuss the safety of this technique for patient and ultrasound equipment.
3. To assess the utility of this technique for different ultrasound frequencies.

CONTENT ORGANIZATION
1. Technique and indications.
2. Physical principles.
3. Patient and equipment safety.
4. Sample cases:
   - Skin.
   - Nails.
   - Muscle.
   - Tendons and cartilage.
5. Utility with different frequency transducers.

SUMMARY

The major teaching points of this exhibit are:
1. This technique is easy to use and produces exquisite images with excellent contrast and resolution.
2. This technique is safe for ultrasound equipment, we do not report any damage to the ultrasound transducers we use routinely.
3. Small skin, nail and cartilage lesions are well characterized using low frequency transducers; this may be used in centers that lack advanced ultrasound equipment.

Computed Tomography Positioning and Technique of Skeletal Remains for Quantifying Musculoskeletal Conditions

LL-MKE1099
Les R Folio, DO, MPH
Vana M Derderian, BS
Marcus Y Chen, MD
Franklin Damann, PhD
Brian Spatola, MA

PURPOSE/AIM

There is a paucity of information available regarding postmortem technique and positioning of skeletal remains. We describe a positioning method resulting in a full body CT dataset including Dual Energy (DE) that allow for Quantitative CT (QCT) of musculoskeletal pathological conditions that may facilitate forensic investigation, clinical research and identification of skeletal remains.

CONTENT ORGANIZATION

Images were obtained with a Toshiba Aquilion ONE Vision CT applying DE. Museum anthropologists positioned remains with stacked ethafoam allowing for single pass including all bones in close anatomic approximation; similar to how anthropologists and forensic pathologists position a body for postmortem investigations.

SUMMARY

We present an atlas of gross pathology and CT images including axial, coronal, sagittal, and 3D volume renderings ideal for forensic investigation, QCT / ground truth specimens and museum archiving. The pathologic section of thoracic spine correlated with gross inspection. Post processing DE highlighted areas of exostosis and other abnormal bone formation not apparent with single energy imaging. Improved delineation of cortex and heterotopic bone is likely due to negating artifacts bone / air interface with DE. Our stacked foam approach allowed for arms and ribs to remain in upper body and single scan acquisition; given limited FOV.

Patellar Sleeve Injury and the Radiologic Correlate
How Is Magnetic Resonance Helping Diagnose Osteoarthritis (OA) in Earlier Stages?

**PURPOSE/AIM**
The aim of this study is to state the technical needs in magnetic resonance imaging (MRI) for knee cartilage evaluation. Review semi-quantitative MRI scales for osteoarthritis (OA) diagnose and changes in knee cartilage volume ranges in healthy and OA patients.

**CONTENT ORGANIZATION**
A. Osteoarthritis diagnose
   a. Clinical
   b. X-ray diagnose Kellgren and Lawewnce Scale - KandL
   c. Magnetic Resonance knee evaluation. B. Magnetic Resonance OA Scales
   a. WORMS (whole-organ MR imaging score)
   b. BLOKS (Boston-Leeds osteoarthritis Knee score)
   c. KISS (knee osteoarthritis scoring system) C. Knee cartilage volume ranges
   a. What factor affect knee volume
   b. What are the ranges for healthy knee cartilage volume
   c. What are the ranges for knee cartilage volume in osteoarthritis patients

**SUMMARY**
1. Viewer should be able to assess knee MRI with technical suggestions included in the content of this review
2. Understand the benefits of using MRI to diagnose OA in earlier stages when compared to x-rays
3. Used accepted MRI scales to evaluate knee cartilage
4. Know the normal ranges of cartilage and the factors such as trauma, gender, obesity, hormones, drugs and many other elements that constantly affect cartilage volume
5. Determine early MRI knee cartilage changes in patients to help clinicians’ determine which patients will probably develop early OA

An Interactive CT Atlas of Musculoskeletal Anatomy and Pathology of the Hand and Wrist for the iPad

**PURPOSE/AIM**
To create an interactive atlas of musculoskeletal anatomy, trauma, and pathology of the hand and wrist for use on the iPad. This interactive educational application will utilize the iPad’s functionality to interact with high-resolution case studies, illustrations and animations.

**CONTENT ORGANIZATION**
This exhibit will provide: 1. Detailed and schematic medical illustrations, video lecture, animations, and illustrative corollary CT. 2. High Resolution state-of-the-art 3D MDCT volume rendered cases and animation showing normal and pathological states of hand and wrist. 3. Comprehensive video lectures, syllabi, articles, and references detailing and demonstrating complex anatomy and pathology of the hand and wrist.

**SUMMARY**
Understanding complex musculoskeletal anatomy and pathology of the hand and wrist is essential to the interpretation of musculoskeletal CT. This exhibit aims to educate the radiologist with respect to normal and pathological anatomy through video lectures, case studies, and artist rendered interactive 3D models and illustrations.

Simplifying the Understanding of Shoulder Labral Tears Using a Multimedia Reporting Enabled PACS

**PURPOSE/AIM**
Tears of the shoulder labrum occur in many age groups, including young throwing athletes. Diagnosis can be challenging due to the complex anatomy and pathology as well as variants and pitfalls. Standard methods of learning such as books and journals are limited relative to learning at the workstation. We present a tutorial and self assessment module to facilitate the understanding of shoulder labrum using a multimedia reporting enabled PACS.

**CONTENT ORGANIZATION**
1. Proposed role for using multimedia reporting enabled systems for creating learning modules of radiology topics that may require an understanding of complex 3 dimensional anatomy. 2. Normal MRI shoulder anatomy. 3. Superior labral anteroposterior (SLAP) lesion
classifications: features, prevalence, and mechanisms. 4. Suggested approach to MRI evaluation of the shoulder labrum. 5. Cases and self assessment modules using a multimedia reporting enabled PACS.

**SUMMARY**

Tears of the shoulder labrum are not infrequent but difficult to accurately stratify due to the complex anatomy and pathology as well as variants and pitfalls. Multimedia reporting enabled PACS are potentially useful for creating learning modules for radiology topics that require understanding of complex 3 dimensional anatomy.

### MR Imaging of Traumatic First Metatarsophalangeal Joint Injuries: Technique, Anatomy, Injury Spectrum and Surgical Correlation

**LL-MKE1104**  
Matthew S Layman, MD  
Peter T Petruzzi, MD  
Rashad Daker, MD

**PURPOSE/AIM**
- Discuss the MR technique for imaging the first MTP joint, including coil placement and sequence acquisition
- Review the anatomy of the first MTP and the variety of injuries to the joint
- Compare imaging with operative findings for patients requiring surgical treatment

**CONTENT ORGANIZATION**
- Discussion of optimal MR technique for imaging the first MTP joint
- Review the anatomy and the variety of injuries to the joint
- Comparison of MR images with operative findings for patients requiring surgical treatment

**SUMMARY**

Traumatic injury to the first metatarsophalangeal joint is a common clinical entity that can cause significant patient morbidity and can potentially lead to joint destruction. MRI plays an important role in defining the extent of injury. This poster will review MR imaging of joint injury and correlate imaging findings with operative findings and surgical management.

### Anterior Inferior Tibiofibula Ligament (AITFL) Injuries in Professional Athletes

**LL-MKE1105**  
Simon J Prowse, FRCR, MBBS  
Teck Yew Chin, MBBCh, MSc  
Andrew J Dunn, MBBCh

**PURPOSE/AIM**
- Describe MRI features and characterise injury patterns of the AITFL in professional athletes in the acute setting and later stages of rehabilitation. We aim to identify features that may predispose to a prolonged rehab period or be associated with re-injury.

**CONTENT ORGANIZATION**
- MRI is the most common imaging modality performed for assessment of acute and chronic syndesmotic injury as it demonstrates quantification of tears, ligament scarring and associated osseous injury such as bone avulsions and bone oedema patterns. Cases of symptomatic AITFL injury were compared with normal asymptomatic controls for comparison of anatomy. Some previously undescribed imaging features were observed. Injury severity and patterns have also been correlated with rehabilitation progress including the return to training (RTT) in our study group consisting of Professional Soccer and Rugby League athletes,

**SUMMARY**

- Review the normal anatomy of the AITFL with particular reference to the oblique orientation on multi-planar imaging.
- Describe common and clinically important injury patterns to the AITFL, including acute and chronic appearances.
- Highlight associated osseous injury such as bone oedema in the posterio-medial corner of the distal tibia with chronic AITFL injury.

### Musculoskeletal Ultrasound Procedure Tutorial Website

**LL-MKE1108**  
Neil P Shah, MD  
Gina A Ciavarra, MD  
Jodi B Cohen, MD  
Ronald S Adler, MD, PhD

**PURPOSE/AIM**
- To demonstrate how to perform Musculoskeletal Ultrasound Procedures in a step by step fashion. The intended audience is all radiologists at various levels of training with focus on MSK radiology fellows starting to perform these procedures. Additionally, this website may be useful for referring physicians and patients to better understand the procedures.

**CONTENT ORGANIZATION**
- A website, mskultrasoundprocedures.com, demonstrates each procedure. At this time, the following procedures are outlined with descriptions of patient positioning, equipment used including ultrasound probe, medications, needle lengths and gauges: Shoulder arthrogram/therapeutic injection  
- Bicep’s Tendon Sheath Injection  
- Acromioclavicular Joint Infection Hip Arthrogram/therapeutic injection Knee Baker’s Cyst Aspiration  
- Foot Morton’s Neuroma Injection As time permits and content becomes available, other procedures such as Shoulder Calcific Tendinosis Aspiration and Lavage, Elbow, Wrist, Iliopsoas, Greater Trochanter, and various Ankle joint injections will be added.

**SUMMARY**

This website, mskultrasoundprocedures.com, will provide a central tutorial for MSK ultrasound guided procedures.

### A Web-based Approach for Learning and Reviewing the Appearance of Benign Lucent Bone Lesions as Shown by Radiograph, CT, and MRI

**LL-MKE1109**  
Micah Cohen, MD  
Serge Sicular, MD  
Sridhar Vatti, MD  
Darren Fitzpatrick, MD

**PURPOSE/AIM**
- To provide quick, easy access to an online educational tool and reference guide that addresses most of the common benign lucent bone
lesions as evaluated by modern imaging modalities. 2. To provide a reference tool that addresses the limitations of other online reference tools, which can be cost-prohibitive, require log-ins or registration, lack interactivity, and are often slow to engage the end user. 3. To provide imaging of both the specific and non-specific imaging features of a given benign lucent bone lesion.

CONTENT ORGANIZATION

Review of imaging findings of numerous benign lucent bone lesions (for full list please refer to http://www.radcharts.org/Bone/FEGNOMASHIC/Bone_FEGNOMASHIC.html) on Radiograph, CT, and MRI (T1, T2, and post-contrast).

SUMMARY

The major teaching points of this exhibit are: 1. Providing a quick and easy reference tool for common benign lucent bone lesions. 2. Reviewing the diagnostic as well as non-specific imaging findings of multiple bony lytic pathologies on all modern imaging modalities. 3. Providing a comprehensive reference guide for benign lucent bone lesions.

Imaging Evaluation and Management of Calcaneal Fractures

LL-MKE1110
Matthew R Skalski, BS
Hector Riveramelo, BS
Varsha Kumar, BS
Shery Assal, BS
Matthew Eurich, BS
Curtis Yomtob, BS

PURPOSE/AIM
The purpose of this exhibit is to provide an overview of typical imaging features of calcaneal fractures, their classification, and how this may be used as a predictive indicator of fracture management and prognosis.

CONTENT ORGANIZATION
1. Imaging features of calcaneal fractures on plain film, CT and MRI 2. Classification systems for calcaneal fractures and their use in orthopedic management. (Sander’s, Carter Rowe, and Essex Lopresti classification systems) 3. Expected outcomes based on classification and management strategy.

SUMMARY
Understanding the subtle differences in fracture patterns of calcaneal fractures, and using this to classify these fractures accurately, can have important implications for patient management and outcomes.

MRI of Paget’s Disease of Bone: Common and Uncommon Presentations of the Musculoskeletal System

LL-MKE1111
Adam Fang, MD
Steven P Meyers, MD, PhD
Steven D Weiss, MD

PURPOSE/AIM
The purpose of this exhibit is the following: 1) Illustrate the varied appearances of Paget’s disease of bone with emphasis on magnetic resonance imaging (MRI). 2) Highlight the characteristics of Paget’s disease including the morphological bony changes and marrow characteristics that distinguish Paget’s disease from other bony entities.

CONTENT ORGANIZATION
1. The educational goals of this exhibit will be: 1) Describe the clinical and pathologic features of Paget’s disease. 2) Illustrate the varying sites of involvement of the skeletal system. 3) Review the typical and atypical MRI features with illustration of the different phases of the disease (lytic, mixed, and blastic phase), as well as complications including malignant transformation. 4) Discuss the imaging characteristics of Paget’s disease that differentiate it from other benign and malignant entities.

SUMMARY
Paget’s disease of bone is a common skeletal disorder that varies in severity and differs based on the various stage of disease. Understanding the important MRI appearances of Paget’s disease can help differentiate it from other benign and malignant bone lesions. In addition, MRI can help better delineate pagetic bone changes and identify early sarcomatous transformation.

Recurrent Dislocation of Shoulder: What Can the Ultrasound Probe Detect?

LL-MKE1112
Srinadh Boppana, MD
Eshwar C Nandury, MD
Krishna Subrahmanyam, MS
Denis Thomas

PURPOSE/AIM
To assess the usefulness of sonography in evaluating the labral and bony changes in shoulder dislocation. To educate upon the right technique for evaluation of glenoid labrum.

CONTENT ORGANIZATION
Ultrasound technique
Normal anatomy of labrum on ultrasound
Pathophysiology
Imaging clues for detecting Bankart’s and Hill sachs lesions.
Role of dynamic imaging
SUMMARY
Sonography has a promising role in the evaluation of the glenoid labrum. This exhibit teaches
a) The systemic approach and technique for evaluation of the glenoid labrum.
b) The various imaging appearances of labral pathologies in shoulder dislocation.

Lieberman’s Scrollable Seminars in Radiology

LL-MKE1113
Zachary Abramson, DMD
Graham Lieberman, BA
Gillian B Lieberman, MD

PURPOSE/AIM
Our purpose was to create a dynamic, radiology, educational, touch-enabled, mobile web app. A web app runs on the internet and is compatible with tablets and phones of all brands. This is in contrast to current phone apps that are device and even brand specific. To increase the utility of the web app, “scrollability” was encoded into all CTs and MRIs to accurately mimic the radiology work environment.

CONTENT ORGANIZATION
Features: 1) touch-enabled site navigation; 2) searchable diagnoses; 3) scrollable and zoom-able CT/MRI. Content offered: 1)
multidisciplinary interactive seminars offered by diagnosis or unknowns; 2) quiz questions which enforce efficacious image ordering and accurate diagnosis; 3) comprehensive image libraries for all diagnoses; 4) detailed discussions on all diagnoses; 5) self-testing image galleries with capability to view labeled/unlabeled; 6) downloadable summaries.

SUMMARY
Radiology at the workstation involves scrolling through many images acquired by CT/ MRI. Digital methods of teaching radiology with scrollability are therefore optimal. We created a user-friendly, highly-detailed, interactive, mobile web app targeting medical students, residents and faculty across many specialties.

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Are These Skeletal Holes, Clefts and Notches Normal?

**LL-MKE1114**  
**Sarah M Yu**, MD  
**Joseph S Yu**, MD

**PURPOSE/AIM**
1. To review the anatomic variants in the skeleton that manifest as holes, cleft or notches in the bone.  
2. To specify differentiating features of these variants from those of true pathologic conditions.

**CONTENT ORGANIZATION**
Skeletal Development
Nutrient foramina and other mimics
Skull
--C1 arcuate foramen and arch clefts
--Foraminal notch
--Absent pedicle
--Endplate depressions
Mandible
--Mental foramina
Spine
--C1 arcuate foramen and arch clefts
--Foraminal notch
--Absent pedicle
--Endplate depressions
Sacrum
--Fusion defects
--Alar fossa
--Asymmetric development
Pelvis
--Paraglenoidal sulcus
--Synchondrosis fusion defects
Scapula
--Scapular hole
--Superior angle notch
--Glenoid notch
--Transverse ligament ossification
Clavicle
--Rhomboid fossa
--Developmental grooves
Sternum
--Sternal foramen
--Bifid sternum/xyphoid
Patella
--Bipartite patella
--Dorsal defect
Incomplete physeal plate closure
Differentiating features and sample cases
Summary

**SUMMARY**
It is important to remember normal skeletal variations that have the appearance of a hole, cleft or notch to avoid the pitfall of misdiagnosing a fracture or an aggressive process such as a neoplasm.

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Whose Line Is It Anyway?! Review of Important Lines and Angles of the Hip Using Multi Imaging Modalities

**LL-MKE1115**  
**Charlotte F Longman**, MBChB, MRCS  
**Sean Flanagan**, MBBS, MRCS  
**Rohit Malliwal**, MBBS, BSc  
**Rosy Jalan**, MBBS, FRCR

**PURPOSE/AIM**

**CONTENT ORGANIZATION**
Anatomy of the pelvis
Pictorial explanation of most commonly used pelvic lines and angles
Coxa va valga vs coxa varus deformity. Explanation of the meanings and common causes
Developmental dysplasia of the hip: how to image, when to image, important lines and angles to be aware of
Trauma: pelvic fractures. Lines to be aware of on cross-sectional imaging to aid assessment of severity of trauma
FAI: types, how to image and recent developments in imaging

**SUMMARY**
By the end of the review, the viewer should: 1. Appreciate the anatomy of the pelvis and commonly used lines and angles across imaging modalities to assess variance from the norm  
2. Increased knowledge and assessment of common hip pathologies; development dysplasia, trauma, FAI
3. Be aware of up to date imaging preferences and optimisation of cross sectional imaging

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Does Dark Matter? Understanding T2-dark Cartilage Lesions

**LL-MKE2039**  
**Robert D Wissman**, MD  
**Eric B England**, MD  
**Kaushal Mehta**, MD  
**Joshua K Apgar**, DO  
**Eric Langenderfer**, MD  
**Margaret D Phillips**, MD
Feeling the Pinch: Ankle Impingement Syndromes - What Can the MRI Show?

PURPOSE/AIM
Radiologists are most familiar with cartilage lesions that are high in signal on T2-weighted images. Several cartilage lesions have been described as dark on T2-weighted images. The purpose of our exhibit is to review these T2-dark lesions as well as the normal MR appearance of cartilage with an emphasis on T2-dark cartilage.

The teaching points are: 1. A significant portion of normal hyaline cartilage is low in signal on T2-weighted images. 2. There are several T2-dark normal variations of hyaline cartilage. 3. Cartilage degeneration, fissures and delamination may all appear low in signal on T2-weighted images.

CONTENT ORGANIZATION
1. Review of cartilage histology.
2. Review the MR appearance of cartilage with an emphasis on normal T2 dark cartilage variations.
3. T2-dark cartilage lesions may appear round, oval or linear on MR. Such lesions have been shown to represent cartilage degeneration, fissures and delamination at arthroscopy.
4. The pathogenesis of T2-dark cartilage is unclear.

SUMMARY
Most radiologists are unaware that virtually every T2-bright cartilage lesion has a corresponding T2-dark counterpart. T2-dark cartilage lesions are not uncommon. An awareness of these abnormalities will aid in the diagnosis of cartilage pathology.

An Update; Anatomy and MR Arthrographic Evaluation of the Biceps Pulley

PURPOSE/AIM
The purpose of this exhibit is: 1. To review updated anatomical concepts regarding the biceps pulley and rotator interval 2. To discuss pathology and evidence based techniques for interpretation of the biceps pulley and rotator interval 3. To explain the clinical utility of identifying biceps pulley lesions

CONTENT ORGANIZATION
1. Clinical context Isolated tears of the Superior glenohumeral ligament can undergo primary repair, leading to superior clinical outcomes and preventing rotator cuff tears 2. Anatomy of the biceps pulley Superior glenohumeral ligament, direct and oblique components Coracohumeral and coracoglenoid ligaments Subscapularis Cadaveric, illustrative and Magnetic Resonance arthrographic correlation 3. Review of pathology Habermeyer classification of Biceps pulley lesions Rotator interval lesions Evidence based interpretation techniques Case examples

SUMMARY
The major teaching points of this exhibit are: 1. Understand updated anatomical concepts of the biceps pulley 2. Recognise pathology of the biceps pulley and apply evidence based interpretation techniques 3. Recognise the clinical relevance of identifying pulley lesions

Sclerosing Bone Dysplasias: Example Based Review of Hereditary and Nonhereditary Disorders

PURPOSE/AIM
The purpose of this educational exhibit: - To give an overview in pathophysiology and radiological signs of hereditary bone dysplasias subdivided into primary and secondary spongiosa and intramembranous ossification disorders - To give an overview in pathophysiology and radiological signs of non-hereditary bone dysplasias

CONTENT ORGANIZATION
I. Hereditary Dysplasias
A. Failure in resorption of the primary spongiosa - Osteopetrosis:
   - infantile (malign) autosomal recessive type
   - adult (benign) autosomal dominant type (Albers-Schönberg disease) type I and II
B. Failure in resorption of the secondary spongiosa - Osteopoiikilosis - Osteopathia striata or Voorhoeve disease
C. Disorder of the intramembranous ossification - Progressive diaphyseal dysplasia or Camurati-Engelmann disease - Multiple diaphyseal sclerosis or Ribbing disease - Hyperostosis corticalis generalisata

II. Non-hereditary disorders
- Intramembranous osteosclerosis - Melorheostosis or Lent disease - Overlap syndromes

SUMMARY
- Non-acquired sclerosing bone dysplasias have a wide variety in age of onset and severity, radiographic appearance and distribution
- Non-acquired bone dysplasias are scarce, awareness of their existence is important in the differentiation with acquired bony sclerosis

Postoperative Imaging of the Forefoot

PURPOSE/AIM
Numerous surgeries have been performed to correct first tarsometatarsal degenerative joint disease. Knowledge of pre-operative imaging findings, indications for the major types of surgery, as well as correlational post-operative imaging findings, allows imagers to help guide operative approach and to assess resultant complications. This education exhibit will focus on assessment and treatment of hallux valgus (bunion deformity) and hallux rigidus (osteoarthritis) as examples of common pathology.

CONTENT ORGANIZATION
Surgical treatment planning and characterization of postoperative complications of forefoot pathology requires understanding the most common radiographic imaging findings and measurements. Surgical options for hallux valgus include soft tissue reconstruction, a variety of first metatarsal and first proximal phalangeal osteotomies and implant arthroplasty, while surgical options for hallux rigidus include cheilectomy, arthroplasty and arthrodesis. Finally, this exhibit will review many of the most important complications of these procedures, such as recurrent deformity and hallux varus, nonunion, transfer lesions, peri-hardware osteolysis and silicone synovitis.

SUMMARY
Knowledge of imaging findings in hallux valgus and hallux rigidus, as well as their surgical treatments, allows for successful pre-operative and post-operative characterization.
**Purpose/Aim**
The aim of the presentation is to: 1. Review the pathology, classification and clinical aspects of Ankle impingement syndrome. 2. Discuss the relevant MR anatomy of the ankle. 3. Describe the various MRI features of ankle impingement with appropriate MR images and graphics that help the radiologist in identifying the entity.

**Content Organization**
- Introduction to the ankle impingement syndromes
- General pathology
- Classification of the types of ankle impingement: Anterior, Anterolateral, Posterior, Posteromedial, Medial, & Talocalcaneal subfibular
- Each type of ankle impingement shall be discussed under the following headings: 1. Etiology 2. Relevant anatomy to the type of impingement (Anterior talofibular ligament, Posterior talofibular and calcaneofibular ligaments, Steida's process, Anterolateral gutter). 3. MRI findings (synovial hypertrophy, osseous spurs, Steida's process, chondromalacia) along with accompanying MR images and graphics.

**Summary**
Summary: Ankle impingement is an important and an often under-recognized cause of chronic ankle pain. The imaging diagnosis of ankle impingement syndrome must be matched with the relevant clinical findings and history. Pattern recognition of the various imaging findings is the key to diagnosis of type of ankle impingement syndrome and its management.

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**High T2 Signal or Fat Atrophy of the Supraspinatus and/or Infraspinatus Muscle: Suprascapular Neuropathy and Its Mimickers**

**Purpose/Aim**
High T2 signal intensity or fat atrophy of the supraspinatus and/or infraspinatus is a nonspecific MR imaging finding. There are neuropathic and non-neuropathic causes for this finding. The purpose of this education exhibit is to review the causes for suprascapular neuropathy and other non-neuropathic mimickers.

**Content Organization**
The cases will be presented in quiz format. The relevant anatomy and key differentiating imaging features will be highlighted in each case.

Neuropathic causes: Impingement of the suprascapular nerve
- Proximal to suprascapular notch
- At suprascapular notch
- At spinoglenoid notch

Non-neuropathic causes:
- Rotator cuff tear
- Superior shoulder impingement/acromioclavicular (AC) joint osteoarthritis
- Rupture of hydroxyapatite deposition
- AC joint separation
- Intramuscular hemangioma
- Aggressive fibromatosis
- Radiation myositis

**Summary**
High T2 signal intensity within the supraspinatus and/or infraspinatus muscle can be due to either neuropathic or non-neuropathic etiologies. Careful evaluation of the MR images of the potential sites of entrapment of the suprascapular nerve and for non-neuropathic pathology about the shoulder girdle is essential to arrive at the correct diagnosis. Radiography is also helpful in cases of hydroxyapatite deposition and intramuscular hemangioma.

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**Evaluation of Non-DVT Causes of Lower Limb Pain**

**Purpose/Aim**
The purpose/Aim of this exhibit is: 1. To evaluate patients with lower limb pain in whom DVT has been ruled out. 2. To explain the utility of high frequency Ultrasonography in evaluation of the lower limb pain. 3. To compare the ultrasonography results with MRI in cases of non-DVT lower limb pain.

**Content Organization**
- To discuss causes of lower limb pain
  1. Types of muscle injuries in lower limb - strains, contusions, tears.
  2. Grading of Muscular Strain.
  3. Role of USG in evaluation of strain and other muscle injuries.

**Summary**
The major teaching points are:
- Alternative diagnosis in patients with lower limb pain and who have no DVT is necessary.
- Such findings are clinically relevant and have therapeutic repercussions, particularly related to anticoagulants.
- High Frequency Ultrasonography plays a vital role in follow up cases of lower limb muscular injuries.

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**Tackling Traumatic Talar Injuries: A Review of Talar Anatomy and Traumatic Pathology**

**Purpose/Aim**
The purpose/Aim of this exhibit is: 1. To discuss traumatic injuries to the talus. 2. To explain the usefulness of high frequency Ultrasonography in evaluation of talar pathology. 3. To compare the ultrasonography results with MRI in cases of traumatic injuries to the talus.
Srinivas Kolla, Atabak Allaei, Andrew Kesselman

In addition to imaging of primary HOA. This presentation will review both the pulmonary as well as the many other causes of secondary HOA in a case-based approach.

Even though hypertrophic osteoarthropathy is commonly associated with primary lung processes, there are many other causes that deserve attention. This presentation will provide tools for predicting the type of talar pathology based on mechanism of injury and describe the appropriate treatment.

SUMMARY
This exhibit will review talar anatomy, improve detection of traumatic talar injuries, instruct on how to utilize mechanism of injury to predict the type of talar fracture, and educate regarding treatment of talar fractures. Improved detection of traumatic talar injuries can prevent delays in treatment that could result in long-term disability.

Diagnosing Osteomyelitis in the Diabetic Foot
Craig Wilson, MD
Gordon J Boyd, MD

PURPOSE/AIM
The purpose of this exhibit is to re-visit talar anatomy, review the diagnosis of talar trauma on various imaging modalities, and describe the mechanism of injury and treatment options for traumatic talar injuries.

CONTENT ORGANIZATION
The talus is one of the most commonly injured tarsal bones in cases of ankle trauma. However, detection of these often subtle injuries to the talus can be difficult. This exhibit will review talar anatomy and examples of different types of traumatic talar injuries, including: 1) talar head fracture; 2) talar neck fracture; 3) lateral process fracture; 4) posterior process fracture; 5) avascular necrosis of the talus; 6) osteochondral lesions of the talus; and 7) subtalar dislocation. In addition, this exhibit will provide tools for predicting the type of talar pathology based on mechanism of injury and describe the appropriate treatment.

SUMMARY
This exhibit will review talar anatomy, improve detection of traumatic talar injuries, instruct on how to utilize mechanism of injury to predict the type of talar fracture, and educate regarding treatment of talar fractures. Improved detection of traumatic talar injuries can prevent delays in treatment that could result in long-term disability.

Imaging Appearances of Chronic Osteomyelitis and Its Implications
Atabak Allaei, MD
Andrew Kesselman, MD
Scott A Lehto, MD
Srinivas Kolla, MD

PURPOSE/AIM
1. Review the wide variety of imaging characteristics of chronic osteomyelitis.
2. Discuss the complications of chronic osteomyelitis and its imaging findings.
3. Understand the management of chronic osteomyelitis.

CONTENT ORGANIZATION
1. Pathophysiology of chronic osteomyelitis.
2. Imaging findings on plain radiography, CT, and MRI.
3. Other imaging techniques: Gallium scintigraphy, three-phase bone scintigraphy, In Vitro–labeled and In Vivo–labeled leukocyte imaging, FDG-PET, radiolabeled antibiotics and immunoglobulins.
4. Imaging findings: Sequestra, pseudoarthrosis, sinus tracts, intraosseous abscess.
6. Clinical management.

SUMMARY
1. Chronic osteomyelitis results when there is continuation of the inflammatory process leading to sclerosis and bony deformity, which can have a variety of findings on different imaging modalities.
2. Long standing osteomyelitis can lead to formation of bony sequestrum, sinus tracts, and soft tissue and bony abscesses.
3. Preoperative MRI is imperative for assessment of extent and activity of disease process.
4. If not adequately treated, chronic osteomyelitis can lead to significant morbidity and mortality.

Case-based Approach in Evaluating Primary and Secondary Causes of Hypertrophic Osteoarthropathy
Aaron J Gonzalez, DO
Jason D Sweet, MD

PURPOSE/AIM
1. Discuss the imaging findings seen with hypertrophic osteoarthropathy using a multimodality approach.
2. Provide a systematic stepwise approach to assist the radiologist when searching for possible causes in secondary HOA.

CONTENT ORGANIZATION
- Brief review of the pathophysiology behind the radiographic findings of diffuse periosteal proliferation seen in hypertrophic osteoarthropathy.
- Present a systematic approach to assist the radiologist in discriminating between the multiple causes of secondary HOA.
- Cases reviewed include pachydermoperiostitis, hypertrophic pulmonary osteoarthropathy (to include several different lung processes), congenital heart disease, inflammatory bowel disease, as well as GI neoplasms and infections.

SUMMARY
Even though hypertrophic osteoarthropathy is commonly associated with primary lung processes, there are many other causes that deserve attention. This presentation will review both the pulmonary as well as the many other causes of secondary HOA in a case-based approach, in addition to imaging of primary HOA.

Extremity Soft Tissue Complications Specific to Penetrating Trauma
Andrew Kesselman, MD
Atabak Allaei, MD
Srinivas Kolla, MD
When the Foot Goes Flat: MR and Ultrasound Imaging of Tibialis Posterior Dysfunction

**PURPOSE/AIM**

The purpose of this exhibit is to: - Review the anatomy of the tibialis posterior tendon and the pathoanatomy of tibialis posterior dysfunction (TPD) as the medial arch collapses. - Explain the clinical significance of TPD - Review and illustrate the Ultrasound (US) and Magnetic Resonance Imaging (MRI) features of TPD in its various stages

**CONTENT ORGANIZATION**

- Introduction. Demographics and clinical presentation of TPD. - Anatomy of the tibialis posterior muscle and tendon and its normal appearance on US and MRI. - Pathology of TPD. - Staging of TPD - Imaging features of the tibialis posterior tendon and its tendon sheath i.e. tendinosis, partial and complete tears and tenosynovitis. - Evaluation of the talonavicular joint derangements, spring ligament, marrow abnormality of the hind foot and mid foot bones, tibial spurs, accessory navicular bone and heel vagus. - Sequelae of untreated TPD.

**SUMMARY**

- TPD represents a challenging problem for the orthopaedic surgeon and the radiologist, often resulting in significant disability for the patient and progressive loss of function. - Knowledge of the Tibialis posterior tendon anatomy and the TPD pathoanatomy is of paramount importance in recognising the imaging abnormalities. - Identification of secondary findings aids in early intervention to halt the disease process.

Turf Toe in Collegiate Athletes

**PURPOSE/AIM**

1. To review the normal MRI anatomy of the first metatarsophalangeal joint, with focus on the capsuloligamentous-sesamoid complex.
2. To review the clinical presentation of turf toe.
3. To review MRI imaging of turf toe in high-level college athletes and correlate with radiographs and CT imaging.
4. To discuss surgical and non-surgical management of these athletic injuries.

**CONTENT ORGANIZATION**

1. To discuss the normal MRI anatomy of the first metatarsophalangeal joint, with focus on the capsuloligamentous-sesamoid complex.
2. To discuss the clinical presentation of turf toe including appearance on physical exam.
3. To review MRI imaging findings of turf toe and its appearance on radiographs and CT imaging.
4. To review MRI cases of turf toe in high-level college athletes and correlate with radiographs and CT imaging, when available.
5. To discuss treatment of these athletic injuries, including surgical management.

**SUMMARY**

At the end of the presentation, the viewer will be able to:
1. Know the normal MRI anatomy of the first metatarsophalangeal joint capsuloligamentous-sesamoid complex.
2. Recognize turf toe and identify associated injuries.
3. Know surgical and non-surgical treatment options for turf toe.

Imaging Findings of Altered Foot and Ankle Biomechanics

**PURPOSE/AIM**

The human foot is a remarkable organ, in which osseous, muscular, and ligamentous structures combine to provide mobility, flexibility, and strength. The purpose of this presentation is to discuss the function of the many structures of the foot during the gait cycle and to provide examples of the use of imaging to diagnose conditions that may impair its biomechanics.

**CONTENT ORGANIZATION**

1. The human gait cycle
2. Anatomy and Biomechanics of the ankle/foot joint complex:
3. Review of normal MRI findings
4. Overview of diseases that may disrupt the normal foot biomechanics
   - Tarsal coalition
   - Achilles’ tendinopathy
   - Peroneal tendinopathy
   - Plantar fasciopathy
   - Adult cavovarus foot
   - Adult acquired flatfoot deformity (tibialis posterior insufficiency)
   - Hallux valgus
   - Hallux rigidus

**SUMMARY**

- The "heel first" human gait is energetically more efficient for walking as opposed to running.
Many diseases commonly seen in imaging studies, such as tarsal coalition, plantar fasciopathy, cavovarus foot, flatfoot deformity and hallux valgus, may impair the normal foot/ankle biomechanics.

**Systematic Approach to the Imaging Diagnosis of Presacral Space Masses: What the Surgeon Wants to Know from the Radiology Report!**

**LL-MKE2054**  
Michael J Reiter, MD  
Liem T Mansfield, MD  
Ryan B Schwope, MD  
Christopher J Lisanti, MD*

**PURPOSE/AIM**  
1. To review anatomy of presacral space  
2. To know most common causes of presacral mass  
3. To provide differential diagnosis of presacral mass based on origin of mass  
4. To know surgical approach to resection of presacral mass  
5. To report important information from the imaging exams to the surgeons

**CONTENT ORGANIZATION**  
1. Anatomy of presacral space  
2. Imaging evaluation of presacral mass  
3. Common causes of presacral mass  
4. Differential diagnosis based origin  
   A. Rectum  
   B. Presacral space  
   C. Sacrum  
5. Role of pre-op biopsy  
6. Surgical approach to resection of presacral mass  
   A. Technique  
   i. Laparoscopy  
   ii. Laparotomy  
   A. Approach  
   i. Anterior  
   ii. Posterior  
   iii. Combined  
7. Important information to report to operating surgeons  
   A. Origin  
   B. Characteristics  
   C. Extent  
   D. Invasion of adjacent structures

**SUMMARY**  
Presacral mass is rare, presenting a challenge for physicians to diagnose, radiologists to characterize, and surgeons to manage. Information that the radiologists must convey in the radiology report are origin, characteristics and extent of presacral mass with respect to S3, a key criterion on which the surgeon will base their choice of approach. Lastly, invasion of any adjacent pelvic structures needs to be identified so that the required surgical subspecialists will be included in the multidisciplinary team.

**MR Classification of Soft Tissue Sarcomas: Emphasis on Tumor Grade**

**LL-MKE2055**  
Shivani Ahlawat, MD  
Fang Zhao, MD  
Laura M Fayad, MD

**PURPOSE/AIM**  
1. To review the grading scheme of sarcomas.  
2. To understand the role of MR imaging and the importance of grade in the treatment planning of newly diagnosed malignant soft tissue masses.  
3. To describe the key MR imaging features of low, intermediate and high grade sarcomas

**CONTENT ORGANIZATION**  
A. Clinical features and classification of sarcomas  
B. Approach to diagnosing a sarcoma  
C. Impact of tumor grade on management and prognosis  
D. Review of MR imaging techniques for sarcoma assessment  
   Basic sequences  
   Advanced sequences  
E. Characteristic MR imaging features:  
   Low grade sarcomas  
   Intermediate grade sarcomas  
   High grade sarcomas

**SUMMARY**  
Knowledge of basic and advanced MR imaging features of sarcomas can assist in classifying soft tissue sarcoma histology and grade.  
MR Imaging has a central role in the evaluation of tumor extent of sarcomas for operative planning. However, MR imaging features exist which help to classify tumor grade.  
MR imaging features can guide the percutaneous biopsy of suspected sarcomas to increase yield. In cases of discordant MR imaging features and biopsy results, repeat can be recommended.

**Posteromedial Corner of the Knee: The Neglected Corner**

**LL-MKE2056**  
Ryan B Lundquist, MD  
George R Matcuk, MD  
Eric A White, MD  
Deborah M Forrester, MD  
Christopher J Gottsegen, MD  
Dakshesh B Patel, MD

**PURPOSE/AIM**  
Review the anatomy of the posteromedial corner (PMC) of the knee, describe and illustrate the radiographic appearance of common injuries and pathologies, and discuss treatment
Imaging Findings of Bisphosphonate-related Proximal Femoral Insufficiency Fractures (BPFIFs)

**PURPOSE/AIM**

The purpose of this exhibit is to provide a comprehensive pictorial overview of BPFIFs using multiple imaging modalities including radiography, computed tomography (CT), magnetic resonance imaging (MRI) and nuclear imaging.

**CONTENT ORGANIZATION**

This exhibit will discuss the theories behind the pathophysiology of BPFIFs. A pictorial review of specific imaging findings of BPFIFs will be illustrated using radiography, CT, MRI and nuclear imaging. Imaging data will be collected from three patient cases at our institution. A short summary of the findings and future aims will then conclude this exhibit.

**SUMMARY**

The major teaching points of this exhibit are: 1) There are specific imaging characteristics on radiographs, CT, MRI and nuclear imaging that can suggest the diagnosis of BPFIFs. 2) Two of the patients cases had similar findings in the contralateral femur, supporting previous research that reported a high incidence of bilateral involvement. 3) These types of fractures, although rare, should always be considered during low-energy inciting or spontaneous events. Review of the patient's medication history should be warranted in suspected cases. Knowing their characteristic imaging appearance can potentially result in the revision of patients' osteoporotic management, thus helping to prevent further patient morbidity in the future.

Here Today, Gone Tomorrow: MRI Evaluation of Normal and Abnormal Bone Marrow

**LL-MKE2060**

**PURPOSE/AIM**

The purpose of this exhibit is to provide a comprehensive pictorial overview of MRI used in the evaluation of bone marrow. MRI is the gold standard modality for the evaluation of bone marrow as it can provide information about the composition and architecture of the bone marrow. MRI can be used to evaluate the bone marrow in a variety of clinical settings, such as in the evaluation of bone metastases, osteoporosis, and in the follow-up of patients with bone marrow transplants.

**CONTENT ORGANIZATION**

This exhibit will provide a comprehensive pictorial overview of MRI used in the evaluation of normal and abnormal bone marrow. MRI can provide information about the composition and architecture of the bone marrow, which can be used to identify changes in bone marrow that may be due to disease. The exhibit will include images of normal bone marrow, as well as images of abnormal bone marrow that may be due to disease. The exhibit will also include images of bone marrow transplants, which can be used to evaluate the success of the transplant.

**SUMMARY**

The major teaching points of this exhibit are: 1) MRI is the gold standard modality for the evaluation of bone marrow. 2) MRI can be used to evaluate the bone marrow in a variety of clinical settings, such as in the evaluation of bone metastases, osteoporosis, and in the follow-up of patients with bone marrow transplants. 3) MRI can provide information about the composition and architecture of the bone marrow, which can be used to identify changes in bone marrow that may be due to disease. 4) The exhibit will include images of normal bone marrow, as well as images of abnormal bone marrow that may be due to disease. 5) The exhibit will also include images of bone marrow transplants, which can be used to evaluate the success of the transplant.

LL-MKE2063

Dakshesh B Patel, MD
George R Matcuk, MD

PURPOSE/AIM
MRI is an important noninvasive technique for evaluating the bone marrow. The purpose of this exhibit is to review the MRI findings of normal bone marrow anatomy and how they are altered by specific marrow pathologies, which can be broadly classified into four categories: marrow proliferative disorders, marrow replacement disorders, marrow depletion, and vascular/miscellaneous disorders.

CONTENT ORGANIZATION

SUMMARY
Deep gluteal syndrome (DGS) is an underdiagnosis entity characterized by pain/dysesthesias in the buttock area, hip or posterior thigh and/or radicular pain, due to a nondiscogenic sciatic nerve entrapments in the subgluteal space. Its etiology encompasses a broad spectrum of musculoskeletal and extraskeletal pathology. Because of the ever-increasing use of advanced MRI techniques and the excellent outcomes of the endoscopic treatment, radiologists must be aware the anatomy and pathologic conditions of this space. MRI is the diagnostic procedure of choice for assessing the DGS and may substantially influence the management of these patients. This presentation makes a literature review and presents our experience in DGS treated arthroscopically.

A Pictorial Essay of Different CT Patterns of Skeletal Muscle Metastasis

LL-MKE2061

Michael G Fox, MD
Nicholas C Nacey, MD
Rupak Dutta, FRCR
Mathew George, FRCR, MMed

PURPOSE/AIM
We report a series of CT cases of skeletal muscle metastases (SMM) with different forms and appearances. We have categorized them into 5 types depending on the CT findings. We describe the 5 different types of SMM on CT 1) focal intramuscular masses with homogeneous contrast enhancement. Benign diseases, such as muscle haemangiomia, intramuscular ganglion, and myxoma can manifest as intramuscular masses. Type 2 - abscess-like intramuscular lesions. Radiologically and clinically these lesions can be mistaken for abscesses. Type 3 - diffuse metastatic muscle infiltration. These are characterized by muscle swelling and diffuse heterogeneous contrast enhancement. Differentials are primary sarcomas and lymphomas. Type 4 - multifocal intramuscular calcification. Differential is myositis ossificans. Type 5 - local or diffuse intramuscular bleeding.

SUMMARY
This poster exhibit demonstrates the CT appearance of different types of SMM, differentials, common primary tumours resulting in SMM and common muscles involved.

Building and Maintaining an Interventional Musculoskeletal Radiology Practice

LL-MKE2062

Nicholas C Nacey, MD
Michael G Fox, MD *

PURPOSE/AIM
Describe the factors involved in establishing an interventional musculoskeletal radiology practice with an emphasis on our experience over a 2 year period.

CONTENT ORGANIZATION
A. Business plan B. Clinic Space C. Equipment D. Staff E. Supplies F. Marketing G. Competition H. Reimbursements

SUMMARY
The development of a thorough business plan is the key to establishing a successful interventional musculoskeletal radiology practice. Adequate clinic space must be procured which satisfies building codes and allows for patient privacy. Fluoroscopy is the modality used for most interventional musculoskeletal applications at our institution, with the utilization of ultrasound increasing over time. Recurring expenses consist primarily of staff salaries and supplies. The majority of referrals usually come from orthopedic surgery, but marketing to other referrers can help increase patient volume and distinguish oneself from nonradiologists who provide similar services. Knowledge of typical Medicare and private insurance reimbursements specific to one's geographic area is critical when generating a business plan. We have analyzed our own practice where we annually perform over 3,500 procedures including 2,364 therapeutic injections (1052 spine; 1312 non-spine), 1,035 arthrograms, and 121 aspiration to help provide a model for others.


LL-MKE2063

Moises Hernando, MD
Luis Cerezal, MD
Faustino Abascal, MD
Rosa Dominguez-Oronoz, MD
Antonio Saiz Ayala, MD
Elena Santamarta, MD
Ana Canga, MD

PURPOSE/AIM
1. To describe the anatomy of the subgluteal space
2. To review known and new etiologies of deep gluteal syndrome
3. To assess the role of radiologist in the diagnosis, treatment and postoperative evaluation in the sciatic nerve entrapments

CONTENT ORGANIZATION

SUMMARY
Deep gluteal syndrome (DGS) is an underdiagnosis entity characterized by pain/dysesthesias in the buttock area, hip or posterior thigh and/or radicular pain, due to a nondiscogenic sciatic nerve entrapments in the subgluteal space. Its etiology encompasses a broad spectrum of musculoskeletal and extraskeletal pathology. Because of the ever-increasing use of advanced MRI techniques and the excellent outcomes of the endoscopic treatment, radiologists must be aware the anatomy and pathologic conditions of this space. MRI is the diagnostic procedure of choice for assessing the DGS and may substantially influence the management of these patients. This presentation makes a literature review and presents our experience in DGS treated arthroscopically.
Radiologic Evaluation of Prosthetic Joints

Michael McConnell, DO

PURPOSE/AIM
The purpose of this exhibit is to:

1. Review the various types of joint prostheses,
2. Outline the essential elements of the plain radiograph prosthesis evaluation,
3. Discuss the proper utilization of additional imaging techniques for suspected prosthesis complications.

CONTENT ORGANIZATION

1. Review of different types of joint prostheses and important variations in prosthetic components.
2. Plain film evaluation of joint prostheses.
   - type of prosthesis
   - alignment
   - evidence of complications
3. Use of additional imaging in evaluation of prosthesis complications.
   - CT and MRI
   - nuclear medicine three phase bone scan, tagged WBC scan, sulfur colloid scan

SUMMARY
The major teaching points in this exhibit are:

1. Important elements of the plain radiograph evaluation of prostheses include a description of the components, alignment relative to normal anatomic alignment, periprosthetic lucency relative to initial post-op radiographs, evidence of periprosthetic or prosthetic fracture, and evaluation of the adjacent soft tissues.
2. CT can be useful in evaluation of periprosthetic fracture. MRI and US are useful in evaluation of the adjacent soft tissues.
3. Three phase bone scan, tagged WBC scan, and sulfur colloid scan are most useful in distinguishing between loosening, infection, and marrow proliferation.

A New Position of Scapula for a Scapular Body Lesion (Scapula AP Modify View)

Byoung Jun Hwang, RT
Nam Soo Cho
Yeoun Soo Kim, BSc
Kye Sun Kim, BSc
Boram Choi

PURPOSE/AIM
We are trying to introduce a Scapula AP modified view to supplement the difficulties of accurate Scapula body diagnosis due to the character of its position, body and superior border can overlap or become a blind spot between the lungs and ribs from its existing position.

CONTENT ORGANIZATION

1. Anatomical structure of the Scapula
2. Fracture distribution of the Scapula
3. Imaging type of the Scapula
4. Scapula AP view (position, image, problem)
5. Scapula AP modify view (position, image, benefit)
6. Discussion and Suggestion

SUMMARY
Most scapula fractures involve the body and superior border (~50%). The remaining 50% involve its three processes. The current AP view takes the Scapula image in raise the arms to minimize overlap of the lungs and ribs. However this position can limit the movement of the Scapula so most of the time the Scapula can be viewed as overlap between the lungs and ribs. The modified Scapula AP view is to take the image during an Erect AP condition, when the problem side of the arm is internal rotation as much as possible while the back of the hand is holding the hipbone area and keep the center line with the middle of the Scapula. This method can limit the overlapping of body and superior border between the lungs and ribs, so we anticipate that it will be helpful when observing fractures or metastasis lesion in body.

Working Up an Apatite: The Dynamic Nature of Hydroxyapatite Crystal Deposition Disease

Malka B Finkelstein, MD
Shlomit Goldberg-Stein, MD*
Shari Friedman, MD
Netanel Berko, MD
Beverly A Thornhill, MD

PURPOSE/AIM
The purpose of this exhibit is to: 1) Provide an overview of the pathophysiology of hydroxyapatite deposition disease (HADD) 2) Review imaging findings of HADD with emphasis on the less commonly encountered dynamic behavior of HADD (acute and evolving disease) 3) Discuss the differential diagnosis pertinent to HADD

CONTENT ORGANIZATION

Pathophysiology of HADD Imaging findings including examples of dynamic behavior of HADD such as: Acute wrist pain and digital tingling due to acute hydroxyapatite rupture into carpal tunnel (serial imaging) Acute shoulder pain due to rupture of hydroxyapatite into the adjacent bursa (serial imaging) Rotator cuff hydroxyapatite erosion into greater tuberosity (serial imaging) Acute neck pain caused by HADD of the longus colli Examples of mimics including gout, heterotopic ossification, calcium pyrophosphate deposition (CPPD) SUMARY
The classic appearance of HADD is well recognized among radiologists. However, HADD can have less typical imaging appearances in cases of dynamic behavior, and familiarization with these findings is essential in making the correct diagnosis. The exhibit is aimed at increasing awareness of the spectrum of imaging findings in HADD, thereby improving confidence levels when diagnosing HADD, particularly in its dynamic form.

Multimodality Imaging Strategy for the Characterization of Peripheral Nerve Sheath Tumors in the Neurofibromatosis Type 1

Shivani Ahlawat, MD

PURPOSE/AIM
The purpose of this exhibit is to:

1. Provide an overview of the pathophysiology of hydroxyapatite deposition disease (HADD) 2) Review imaging findings of HADD with emphasis on the less commonly encountered dynamic behavior of HADD (acute and evolving disease) 3) Discuss the differential diagnosis pertinent to HADD

CONTENT ORGANIZATION

Pathophysiology of HADD Imaging findings including examples of dynamic behavior of HADD such as: Acute wrist pain and digital tingling due to acute hydroxyapatite rupture into carpal tunnel (serial imaging) Acute shoulder pain due to rupture of hydroxyapatite into the adjacent bursa (serial imaging) Rotator cuff hydroxyapatite erosion into greater tuberosity (serial imaging) Acute neck pain caused by HADD of the longus colli Examples of mimics including gout, heterotopic ossification, calcium pyrophosphate deposition (CPPD) SUMARY
The classic appearance of HADD is well recognized among radiologists. However, HADD can have less typical imaging appearances in cases of dynamic behavior, and familiarization with these findings is essential in making the correct diagnosis. The exhibit is aimed at increasing awareness of the spectrum of imaging findings in HADD, thereby improving confidence levels when diagnosing HADD, particularly in its dynamic form.
The purpose of this exhibit is to examine the advantages associated with various anatomic, functional and metabolic imaging techniques using MR and PET for the characterization of peripheral nerve sheath tumors (PNST) in patients with Neurofibromatosis type 1 (NF1).

**Summary**

1. The characterization of PNST by imaging as benign or malignant in patients with NF 1 continues to be a challenging problem.
2. A multimodality imaging approach provides anatomic, metabolic and functional information about peripheral nerve sheath tumors in patients with NF1.
3. Utilizing qualitative and quantitative indices derived from various functional imaging techniques enhances the characterization of peripheral nerve sheath tumors for malignancy in these patients.

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**Classification of Peripheral Nerve Injury on MR Neurography according to Seddon and Sunderland Grading Systems**

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**High Resolution 3T MR Neurography of Suprascapular Neuropathy- Normal and Abnormal Imaging Appearances**

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**AHLM and PHMM Root Ligament Anatomic and Structural Characterization at 11.7T: A Window to Understand Patterns of Pathology**
will be profiled, as well as the relationship of the root ligaments to surrounding structures. Commonly encountered patterns of AHLM and PHMM root ligament failure documented on clinical MR studies will be demonstrated. Patterns of failure will be related to AHLM and PHMM anatomy and structure, and classification systems will be proposed.

SUMMARY
AHLM and PHMM Root ligament anatomic and structural characterization will facilitate a better understanding of patterns of failure in these tissues and allow development of clinical classification systems that better characterize disease.

Preoperative and Postoperative Radiographic Evaluation of Reverse Total Shoulder Arthroplasty (RTSA) from an Orthopedic Surgeon’s Perspective: Changes in Prosthetic Design, Positioning, Imaging Appearance, Complications and Normal Post-surgical Changes

LL-MKE2071
Katia Kaplan-List, MD
Roman M Kowalchuk, MD, PhD
Scott G Kaar, MD
Steven J Posnick, MD

PURPOSE/AIM
1. Review the anatomy of the shoulder joint, including pathological changes associated with rotator cuff deficiency arthritis.
2. Discuss the findings of preoperative and postoperative imaging evaluation from an orthopedic surgeon’s perspective.
3. Review changes in RTSA prosthetic design, positioning and imaging appearance.

CONTENT ORGANIZATION
1. Biomechanics of the Shoulder Joint.
2. Pathology of Rotator Cuff-Tear Arthropathy and Arthritis.
3. Changes in RTSA design and surgical technique from 2004 to present developed to prevent scapular notching.
4. Preoperative imaging evaluation.
5. Postoperative imaging evaluation.
6. Complications.

SUMMARY
1. Learn and describe the main assessment points on preoperative imaging of the shoulder joint from an orthopedic surgeon’s perspective.
2. Understand normal postoperative imaging assessment and measurements, as well as complications in order to provide a meaningful radiologic evaluation of a reverse total shoulder arthroplasty.
3. Learn about the key changes in prosthetic design and surgical technique that have been developed to prevent complications associated with older generation of RTSA prosthesis.

MR Imaging of Knee Arthroplasty

LL-MKE2072
Jan Fritz, MD
Brett Lurie, MBBS
Hollis G Potter, MD *

PURPOSE/AIM
1. Discuss optimization strategies for MRI of knee arthroplasty and the utility of dedicated metal artifact reduction pulse sequences
2. Review the normal MRI appearances of knee arthroplasty
3. Systematically illustrate the MRI diagnoses of arthroplasty-associated complications

CONTENT ORGANIZATION
The role of MRI following knee arthroplasty
Optimized MR imaging protocol, MR angiography and dedicated metal artifact reduction pulse sequences
Normal MRI appearances and MRI diagnosis of complications:
- Fibrous membrane formation, bone resorption and aseptic loosening
- Polyethylene wear-induced synovitis and osteolysis
- Infection, non-specific synovitis and arthrofibrosis
- Impingement syndromes and patellar clunk
- Recurrent hemorrhaxis – MR angiography assessment
- Stress reactions and fractures
- Component rotational alignment
- Polyethylene displacement
- Instability and excessive soft tissue balancing
- Musculotendinous abnormalities
- Neurovascular compromise

SUMMARY
1. Optimized and dedicated MRI techniques reduce metal artifacts and improve our ability to assess and differentiated knee arthroplasty-associated complications.
2. MRI is accurate for the diagnosis of bone resorption, synovitis, malalignment and hemorrhaxis and can detect infection, muscle, tendon and nerve abnormalities.

The Histological Variants of the Liposarcoma: Predictive MRI Findings with Prognostic Implications

LL-MKE2073
Ravi Dalal, MD
Adam D Singer, MD
Jonathan Tresley, MD
Evans R Finkelstein, MD
Yaxia Zhang, MD
Paul D Clifford, MD
Sheila Conway, MD
Ty K Subhawong, MD

PURPOSE/AIM
1. Make the reader familiar with the different subtypes of the liposarcoma and the variable behavior related to histology and location of origin 2. Discuss treatment implications of differentiating low versus high grade liposarcoma, particularly those with round cell component 3. Describe MRI findings that aid in distinguishing low from high grade liposarcoma and in biopsy planning

CONTENT ORGANIZATION
1. Lipoma and Liposarcoma: terminology and clinical information 2. Different histological subtypes of liposarcoma 3. Clinical information for each type of liposarcoma including, but not limited to, age or gender predilection, risk factors, common locations and prognosis 4. MRI
Ultrasound of Giant Cell Tumor of the Tendon Sheath Arising about the Foot and Ankle with MRI Correlation

LL-MKE2074
Nizar Almakshabandi, MD, FRCP
Mohamed Sherif Elsharkawy, MSc, MD

PURPOSE/AIM
The purpose of this exhibit is: 1. To review the geography of land of Arabia and how barefoot Nomads feet would be affected by it. 2. To discuss the relationship of different pathogens from different regions. 3. To explain the utility of plain radiographs and MRI in the diagnosis.

CONTENT ORGANIZATION
The major teaching points of this exhibit are: 1. Different organisms grow in different parts of the world. 2. Knowing where the patient is from can help the Radiologist shortlist the differential diagnosis. 3. Certain signs on plain films and MRI can pinpoint the diagnosis in the appropriate clinical setting.

Peculiar Foot Infections from the Land of Arabia

LL-MKE2075
Jonathan Tresley, MD
Scott Schoenleber, MD
Adam D Singer, MD
Priyanka Grover, MD
Paul D Clifford, MD

PURPOSE/AIM
1) Describe the circular external fixator technique and its clinical applications.
2) Understand the normal radiographic appearance and progression of expected findings during therapy.
3) Identify radiographic signs of circular external fixator complications.

CONTENT ORGANIZATION
1) Brief history of external fixation.
2) Clinical application and hardware components of the circular external fixator.
3) Radiographic examples of circular external fixators of which the radiologist must be aware with modifications such as the Taylor Spatial Frame.
4) Pitfalls in radiographic evaluation.
5) Complications of circular fixator technique the radiologist must recognize.

SUMMARY
1) Circular external fixation technique is an intricate method to treat complex periartricular fractures, limb length discrepancy, angular/rotational deformity, bone loss, and soft tissue protection.
2) Be familiar with the hardware to properly describe radiographic appearance and pertinent interval changes, such as angulation/rotation, quality of regenerate bone for transport frames, docking site fusion, and radiographic signs such as necortex that the frame may be removed.
3) Identify surrounding lucency, wire bowing, periosteal reaction, and docking site hypertrophy which are radiographic indicators of infection, early consolidation, and nonunion.

Ultrasound of Giant Cell Tumor of the Tendon Sheath Arising about the Foot and Ankle with MRI Correlation

LL-MKE2076
David Melville, MD
Jon A Jacobson, MD *
Corrie M Yablon, MD
Yoav Morag, MD
Sybil Biermann

PURPOSE/AIM
Giant cell tumor of the tendon sheath (GCTTS) is a focal soft tissue mass belonging to the spectrum of benign proliferative synovial lesions along with PVNS. GCTTS is rare entity, which occurs most frequently about the hand and wrist, but uncommonly at the foot and ankle. Ultrasound (US) examination with Doppler imaging allows rapid, direct evaluation of masses about the foot and ankle to determine if they are solid, allowing exclusion of ganglion cysts and distended bursa. Further, US can be used to evaluate relationship of lesion with adjacent tendon, as well as guide percutaneous biopsy for tissue diagnosis. The purpose of the exhibit is to review US features of GCTTS with correlative MRI imaging, as well as discuss key differential diagnoses.

CONTENT ORGANIZATION
The goal of this exhibit is to demonstrate the US appearance of GCTTS about the foot and ankle, including associated osseous and soft tissues changes, as well as discuss important differential diagnostic considerations. Important anatomical features will also be discussed, particularly relationship with adjacent tendons and other foot and ankle soft tissues. Findings will be correlated with MRI and other imaging when available, as well as clinical and surgical results.

SUMMARY
Ultrasound can be an effective imaging method for evaluation of masses about the foot and ankle, including GCTTS.

Knee Realignment Surgery - Radiologist's Guide

LL-MKE2077
Natasa Devic, MBBS, MRCs
Sahar Naaseri, MBBS, BSc
Jasna Cehara
Adrian J Wilson, MBBS, BSc *
PURPOSE/AIM
To illustrate the basic principles of lower limb alignment, indications for re-alignment surgery, as well as the use of x-rays and CTs in pre-operative planning, intra-operative monitoring and follow-up of the knee osteotomy patient.

CONTENT ORGANIZATION
We plan to include indications for knee realignment surgery and details of pre-operative planning with the aid of plain films (long leg views). We will explain the fundamentals of the weight bearing axis and varus and valgus mal-alignment. The modern pre-operative planning is very scientific and uses complex computer programmes to analyse the location of the bony deformity and the subsequent correction required. We will include the plain film appearances of common osteotomy techniques (both femoral and tibial) and implants, and explain the role of x-rays in peri-operative correction analysis. Post-operatively, we will explain the follow-up protocol and the correlation of realignment correction and procedure success. We will also cover the influence of radiological parameters on clinical outcome in opening wedge high tibial osteotomy, including tibial metaphyseal varus and weight bearing axis.

SUMMARY
We aim to provide a comprehensive review of knee osteotomy, with the emphasis on the use of x-rays for pre-operative planning, intra-operative monitoring and post-operative follow-up of knee deformity correction.

Lesser Toe Deformities: The Etiology and Complications of Claws and Hammers

LL-MKE2078

Jacquelyn Copeland, MD
Sana Ali, MD
Faisal M Shah, MD
Javier Beltran, MD

PURPOSE/AIM
1. Review the pathophysiology and prevalence of lesser toe deformities as a commonly seen spectrum of diseases in radiology.
2. Pictorial review of the foot anatomy and lesser toe deformities on radiograph and MRI.
3. Review of the associated complications.

CONTENT ORGANIZATION
   - Pain, arthralgias and metatarsalgia
   - Dislocation/subluxation and ligamentous injuries
   - Development of additional foot deformities and gait abnormalities
   - Ulcerations and osteomyelitis
5. Treatment/Post surgical imaging 6. Compendium

SUMMARY
1. There are significant complications that can result from chronically uncorrected lesser toe deformities in addition to pain such as osteomyelitis and gait abnormalities.
2. The defining criteria for hammer toe is flexion at the proximal interphalangeal joint. Hammer toe is associated with an elongated second ray or hallux valgus.
3. Claw toe is less commonly seen than hammer toe and is mainly defined as MTP extension by the extensor digitorum longus tendon. Claw toe is associated with neuropathic diseases.
4. Hammer toe and claw toe are diseases along a spectrum and have overlapping features that make the diagnosis challenging.

Vascular Findings on Knee MRI: From Normal Variant to Limb Threatening

LL-MKE2079

Kara G Udager, MD
David P Fessell, MD
Peter S Liu, MD
Yoav Morag, MD
Monica Kalume Brigido, MD
Corrie M Yablon, MD
Jon A Jacobson, MD*

PURPOSE/AIM
Patients who undergo knee MRI for musculoskeletal disease can also have pathology related to the popliteal and associated vessels. Such findings can range from incidental to symptomatic and can include variant anatomy, aneurysmal dilation, deep venous thrombosis, traumatic injury, and neoplasm. These entities can easily be overlooked by the radiologist, who may be unaware of such findings and are focused on more common and more familiar pathology.

CONTENT ORGANIZATION
To illustrate the normal appearance, normal variants, and important pathologic processes that can occur in the popliteal and associated vessels on a knee MRI, including variant anatomy, aneurysm and deep venous thrombosis, traumatic injury, popliteal entrapment syndrome, and neoplasms such as hemangioendothelioma and cystic adventitial disease. We will discuss the clinical significance of these findings and offer guidance to radiologists in making appropriate recommendations to clinicians.

SUMMARY
A thorough knowledge of vascular anatomy and pathology is important in evaluation of a knee MRI. Seemingly incidental findings such as variant vascular anatomy can have major clinical implications. The vasculature should be a key component of a radiologist’s search pattern when reading knee MRI.

Many Unorthodox Imaging Faces of Osteoid Osteoma: The ‘Catch Me If You Can Lesion and the Masquerader’ Revisited

LL-MKE2080

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Srinivasa Rao Akella, FFRRCSI
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Abhinav Sriram S Vadapalli
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P. K Reddy, MD
Abdul Hameed Hameed, BMedSc

PURPOSE/AIM
Learning Objectives: 1. To show case the atypical findings and Locations of the Most common 'Catch me If you can Lesion' and the
Masquerader'-The Osteoid Osteoma 2. To highlight the radiographic, scintigraphic and MRI findings of these Unorthodox facets at unusual locations. 3. To elucidate The Differential Diagnosis and the overlap features which can lead to a misdiagnosis

CONTENT ORGANIZATION
1. Classic and Unorthodox features of Oseoid osteoma are listed specific to location with clinical examples (Subperiosteal, intra cortical, Intra articular, Intra medullary Varieties) 2. Osteoid osteomas from acetabular floor, talar neck, Dorsal Spinal lamina, Pedicle, Sinus Tarsi, Sacrum, Carpal and tarsal bones as illustrated to name a few. 3. Osteoid osteoma mimic Patterns: The various mimicking skins are showcased: The infection mimicker, Brodies mimicker, The overuse syndrome mimicker, the arthritis mimicker, Synovitis mimicker, The Marrow edema mimicker, Koch's mimicker, The sacro ilitis and sacral insufficiency mimicker, The Painful scoliosis mimicker, The sinus tarsi syndrome mimicker, Metatarsalgia mimicker,

SUMMARY
This exhibit gives the viewer the comprehensive list of the Unorthodox imaging Manifestations of Osteoid Osteoma with pathological correlation with emphasis on checklist of differential diagnosis and tips and tricks to look for it.

Watch Your Child's Elbow Grow

LL-MKE2081
David C Wang, MD
Anish Ghodadra, MD
Robert G Rasmussen
Sameh Tadros, MD, MSc

PURPOSE/AIM
To review the highly consistent order of elbow ossification centers: capitellum, radial head, medial (internal) epicondyle, trochlea, olecranon, and lateral (external) epicondyle (hence the CRITOE mnemonic).

CONTENT ORGANIZATION
100 frontal radiographs of the elbows between birth and 12 years of age are selected from the Children’s Hospital at the University of Pittsburgh Medical Center. Male and female elbows of the same age are presented side-by-side with brief annotations, focusing on the appearance and growth of the ossification centers. Users page through the slides as if scrolling through frames of a movie. The images are scaled, aligned, and windowed to provide smooth transitions between frames.

SUMMARY
The ages at which the elbow ossification centers appear are highly variable. In particular, there is marked gender difference with girls developing up to 2 years before boys. However, the order of appearance of the ossification centers is highly reliable and follows the CRITOE mnemonic: capitellum, radial head, medial (internal) epicondyle, trochlea, olecranon, and lateral (external) epicondyle.

Crowned Dens Syndrome: Spectrum of Imaging Findings, Differential Diagnosis, and Clinical Correlation

LL-MKE2082
Hitoshi Takeuchi, MD
Tomonari Seki
Ai Masukawa, MD
Junko Araki
Shichiro Katase
Yukari Takada, MD
Takayuki Kurinobu
Yasuyuki Sonoyama

PURPOSE/AIM
The purpose of this exhibit is: 1. To review the pathophysiology and imaging appearances of crowned dens syndrome 2. To provide multiple imaging examples of crowned dens syndrome on 33 cases collected in our institution, and provide the relevant differential diagnosis 3. To review the clinical management of crowned dens syndrome.

CONTENT ORGANIZATION
Pathophysiology and background of crowned dens syndrome
Typical Imaging appearances of crowned dens syndrome
Differential diagnosis with sample cases
Clinical management
Summary

SUMMARY
Crowned dens syndrome is characterized by recurrent neck pain related to deposits of calcium pyrophosphate dihydrate crystal around the odontoid process that appears as a crown on radiologic imaging. Radiologist should be familiar with various imaging features and their changes during the course of treatment.

High-Resolution Ultrasonography of Rheumatologic Diseases

LL-MKE2083
Miha S Taljanovic, MD
Andrea Klauser, MD
Luke R Scalciene, MD
Lana H Gimber, MD
Margaret M Miller, MD

PURPOSE/AIM
- Show high-resolution ultrasonography (US) examination technique with gray scale and power Doppler imaging and normal US anatomy of the wrist, hand, ankle, and foot joints.
- Show US findings in different rheumatologic diseases including rheumatoid arthritis (RA), psoriatic and reactive arthritis, calcium pyrophosphate deposition disease (CPPD), gouty arthropathy, and osteoarthritis (OA).
- Discuss added value of contrast enhanced US (CEUS) in evaluation of rheumatologic diseases.

CONTENT ORGANIZATION
1. High-resolution US examination technique in the hand and foot (gray scale, power Doppler, normal anatomy)
2. Radiographic findings in RA
3. US findings in psoriatic and reactive arthritis
4. US findings in CPPD
5. US findings in gouty arthropathy
6. US findings in OA
7. CEUS in evaluation of rheumatologic diseases

SUMMARY
In the past two decades, high-resolution US has been increasingly used in the initial evaluation and treatment follow-up of several rheumatologic diseases. This exhibit will discuss high-resolution US technique (gray scale, power Doppler, CEUS) in the evaluation of RA, psoriatic and reactive arthritis, CPPD, and OA. Normal anatomy and various pathologic findings including joint effusion, synovitis, tenosynovitis, erosive changes, gouty tophi, crystal deposition in CPPD, enthesopathy, and marginal osteophytes will be shown.
Ultrasound Guided Procedures of the Foot and Ankle

LL-MKE2084
David Brandel, MD
Corrie M Yablon, MD
David P Fessell, MD
Yoav Morag, MD
Sung Moon Kim, MD
Jon A Jacobson, MD *

PURPOSE/AIM
1. To demonstrate the utility and versatility of ultrasound in guiding interventions in the foot and ankle.
2. To exhibit the range of ultrasound guided interventions of the foot and ankle.

CONTENT ORGANIZATION
This exhibit will discuss the basic ultrasound techniques of scanning and needle placement in the foot and ankle. Pre-procedural considerations, complications, and contra-indications will be reviewed. The exhibit will review the literature, and show examples of the following techniques: tendon sheath, bursal and joint injections; Achilles paratenon injection and high-volume image guided injection; Achilles fenestration; and Morton neuroma and plantar fascial injection.

SUMMARY
Ultrasound guidance is superior to the traditional landmark approach to interventions of the foot and ankle. It is important for radiologists to consider expanding their practice to include ultrasound guided interventions of the foot and ankle, for the reasons of improved patient care and documentation, in addition to more accurate needle localization.

Imaging Features of Ankle Impingements: Advances in Diagnosis Using 3T MRI and Four-dimensional (4D) CT Imaging

LL-MKE2085
Shadpour Demehri, MD
Gaurav K Thawait, MD
Lew Schon, MD
John A Carrino, MD, MPH *

PURPOSE/AIM
The purpose of this exhibit is:
1. To review the pathophysiology of different types of ankle impingement including anterior, posterior, anteromedial, and anterolateral impingements.
2. To discuss the proper diagnostic approach and treatment for each type of ankle impingement
3. To explain the improved quality of 3T MRI in delineating the soft tissue structures involved in impingement process.
4. To demonstrate the potential role of four-dimensional (4D) CT examination in correlating pathoanatomy with patients symptoms

CONTENT ORGANIZATION
1. Pathophysiology of different types of ankle impingement
2. Role of plain film, static CT and Static MRI in delineating the etiology for impingement
3. Brief demonstration of ankle 4D-CT acquisition protocol: patient instruction and positioning, radiation dose, post-processing, and image interpretation.
4. Review of imaging findings with emphasis on:
   - 3T MRI
   - 4D-CT imaging

SUMMARY
1. Plain film is adequate in evaluating patients with anterior impingement
2. In patients with posterior impingement MRI can be helpful in delineating the etiology
3. In selected patients with discrepant clinical and MRI findings, 4D CT may improve diagnostic yield by showing the soft tissue and/or osseous abnormalities directly related to symptoms as demonstrated by CT image acquisition during pain provocative maneuvers.

Review of Quantitative Radiological Imaging Techniques to Assess Articular Cartilage Composition and Quality

LL-MKE3086
Edwin H Oei, MD, PhD
Jasper Van Tiel, MD
Stephen Matzat
Garry E Gold, MD *

PURPOSE/AIM
The purpose of this exhibit is to:
- Emphasize the importance of quantitative imaging techniques to assess cartilage biochemical composition and quality for research on osteoarthritis (OA), the most common joint disease with tremendous consequences for patients and healthcare.
- Learn about basic principles, and
- Review a wide range of novel MRI and CT-based quantitative imaging techniques for cartilage composition.

CONTENT ORGANIZATION
1. Impact of OA and need for quantitative imaging techniques in OA research
2. Basic principles of quantitative radiological imaging techniques for cartilage composition
3. Review of the following quantitative imaging techniques for cartilage composition:
   - Delayed gadolinium enhanced MRI of cartilage (dGEMRIC)
   - T2 mapping
   - T1rho
   - Ultrashort echo time (UTE)
   - GAG-specific chemical exchange saturation transfer (gagCEST)
   - Sodium MRI
   - Quantitative CT arthrography

Of each technique we discuss outcome measures, biochemical correlates, pros/cons, reported applications in clinical research and typical outcome values for healthy and OA cartilage.

SUMMARY
A variety of novel quantitative radiological imaging techniques are currently available to measure cartilage composition and quality. These techniques are likely to play a pivotal role in OA research and possibly in patient care.
POSTERIOR MEDIAL MENISCAL ROOT AVULSION TEARS: AN EDUCATIONAL EXHIBIT

Matthew Teng, MD
Michael Starc, MD
Carlos L Benitez, MD

PURPOSE/AIM
- To review the various imaging findings of posterior medial meniscal root avulsion tears, as it is easily missed.
- To discuss the importance of accurate diagnosis and clinical implications and treatment.

CONTENT ORGANIZATION
1. Review the relevant anatomy of the knee, using anatomical diagrams and imaging.
2. Review the relevant biomechanics.
3. Review the spectrum of imaging findings on MRI, including the truncation sign, ghost meniscus sign, and meniscal extrusion. Review associated findings, including tibial marrow edema and myxoid changes of the meniscus.
4. Distinguish from meniscal vertical radial tears, which can mimic avulsion tears.
5. Examine the clinical relevance of early diagnosis and potential orthopedic treatment options.

SUMMARY
1. Medial meniscal root avulsions are common and they are often difficult to visualize on imaging. The diagnosis is often missed. Subsequent inappropriate treatment may lead to early, severe arthritic changes.
2. Direct visualization of the meniscal root can be difficult during arthroscopy and repair can be technically challenging. As such, an accurate diagnosis is instrumental in guiding the preoperative planning for the orthopedic surgeon.
3. By the end of this exhibit, the reviewer should have a understanding of the spectrum of imaging features of posterior medial meniscal root avulsion tears.

UPPER EXTREMITY COMPOSITE TISSUE ALLOTRANSPLANTATION IMAGING

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Katherine Mullen, MD
Marie Gerhard-Herman
Edwin C Gravereaux, MD
Ericka M Bueno, PhD
Simon Talbot

PURPOSE/AIM
Background and Purpose: Upper extremity (UE) amputation has extraordinary costs; patients require significant lifestyle modification. UE Transplantation (UET) has been successfully explored. Imaging is fundamental to positive outcomes; there is a new and unmet need to describe and standardize protocols for both surgical planning, follow-up, and imaging UET patients with complications. This exhibit draws on the success of a multidisciplinary allograft restoration service to review UET imaging.

Aims:
1. Review strategies for uniform surgical planning and post-operative imaging in UET.
2. Describe imaging protocols and post-processing methods for catheterization, CT, standard and custom MR sequences, and clinical plus high frequency sonography.
3. Demonstrate imaging findings after successful UET.

CONTENT ORGANIZATION
1. Background: UET procedure
2. Vascular anatomy, bone structure, and functional assessment
3. Imaging for surgical planning and follow-up, including imaging findings
4. Future directions in UET imaging, including imaging for complications

SUMMARY
1. Given the large increase in UET, there is a large, unmet need to standardize imaging protocols.
2. Initial demonstration of imaging findings in successful hand transplantation will guide future post-operative protocols.

ONE STEP BEYOND: NON-LIGAMENTOUS PATHOLOGY IN ACUTE ANKLE SPRAIN AND TREATMENT IMPLICATIONS

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Nabil Jomaah, MD
Michel D. Crema, MD *
Wolfgang Fischer, MD
Pieter D'hooghe, MD
Ali Guermazi, MD, PhD *

PURPOSE/AIM
To highlight commonly observed pathology on MRI in acute ankle sprains beyond the lateral and syndesmotic ligament complex and discuss relevance for treatment.

CONTENT ORGANIZATION
1. Describe potential involvement of joint structures after acute ankle sprain beyond commonly involved lateral and syndesmotic ligaments in ankle sprain based on mechanism of injury. 2. Discuss and illustrate traumatic pathology of the peroneal tendons, the flexor and extensor tendons, osteochondral injury of the talus, associated occult fractures and subchondral bone contusions. 3. Present involvement of the sinus tarsi and spring ligaments.

SUMMARY
Ankle sprains are amongst the most common sports injuries and the lateral ankle ligaments including the syndesmotic ligaments are most
often involved. Associated pathology is underdiagnosed but might have treatment implications. Associated non-ligamentous injury includes involvement of the peroneal and flexor tendons, acute osteochondral lesions of the talus, subchondral bone contusions and occult ankle and tarsal fractures. In addition, ligaments beyond the ankle might be affected such as injury to the spring ligament complex or the sinus tarsi structures. Treatment may include surgery (e.g. in acute osteochondral fractures) or specific conservative approaches including prolongend absence from training and return to play.

CT or Not CT? - CT and MRI Shoulder Arthrography: A Matched Descriptive Illustration

LL-MKE2090
Mohamed Jarraya, MD
Frank W Roemer, MD *
Ali Guermazi, MD, PhD *
Emad Almusa, DO
Bernard Roger, MD
Nabil Jomaah, MD

PURPOSE/AIM
To present CT and MRI shoulder arthrography findings performed on the same patients at the same day for a spectrum of clinical diagnoses and to give an overview of potential advantages and drawbacks of each technique.

CONTENT ORGANIZATION
1. Discuss indications for CT and MRI shoulder arthrography (CTA / MRA).
2. Present technical aspects including anatomic approaches
3. Describe common findings using both methods, focusing on superior labral pathology (SLAP lesions), cartilage damage and acute and chronic Bankart injuries.
4. Highlight the potential value of CTA especially in circumstances where MRI is contraindicated.

SUMMARY
The improved contrast due to joint distension optimizes visualization of various intraarticular structures. Although MRA is the first choice modality for detailed shoulder assessment, CTA may be used alternatively or in a complementary fashion. The use of iodinated contrast material for fluoroscopic confirmation of correct intraarticular contrast distribution prior MRA offers an opportunity to directly compare CTA and MRA in many cases. This exhibit illustrates capabilities and limits of MRA and CTA with a focus on superior labral lesions, cartilage assessment and acute and chronic Bankart injury. CTA may offer additional information especially in regard to assessment of bony involvement in instability and evaluation of the glenoid labrum.

Are You Confused? A Review of Rare and Unusual Presentations of Congenital Carpal Coalition

LL-MKE2091
Derik L Davis, MD
Melanie Ehinger, MD

PURPOSE/AIM
The purpose of this exhibit is:
1. To review the embryology, pathophysiology, genetics, classification, clinical presentation and complications of congenital carpal coalition
2. To gain an awareness of rare examples of congenital carpal coalition on radiographs, CT and MRI
3. To highlight uncommonly encountered imaging findings of pathologic processes and developmental anomalies found in association with congenital carpal coalition

CONTENT ORGANIZATION
Embryology / Pathophysiology
Brief review of common congenital carpal coalitions
Clinical presentation(s), classification and imaging examples of rare congenital carpal coalitions
- Pisiform-Hamate
- Distal carpal row: Capitate-Trapeziod, + others
- Proximal carpal row: Scaphoid-Lunate, + others
- Proximal-Distal rows: Scaphoid-Trapeziod-Trapezium, + others

SUMMARY
The major teaching points of this exhibit are:
1. Knowledge of rare congenital carpal coalitions can help avoid confusion when found incidentally
2. Rare congenital carpal coalitions can be symptomatic
3. Congenital carpal coalition may uncommonly present in combination with other abnormal processes at the wrist

A New Technique for Ultrasound of the Temporomandibular Joint (TMJ): A Proposed Screening Tool for TMJ Dysfunction

LL-MKE2092
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PURPOSE/AIM
To demonstrate normal anatomy of TMJ on US with MRI correlation, show common pathology, and teach US exam technique with the goal of using US as the initial screening method for assessing TMJ dysfunction.

CONTENT ORGANIZATION
Method and Materials
Ten volunteers were imaged using both US and MRI to demonstrate normal anatomy. US probe positions correspond to a clock face at 7 o'clock, 9 o'clock, and 11 o'clock. We followed 85 patients using MRI for internal TMJ derangement over 18 months and any US scans were obtained within 2 weeks of the MRI. Results

Articular disc position and angle using the US technique were validated against previously described MRI techniques. Only 35% of patients had abnormal MRI suggesting need for a better screening tool. Pathology could successfully be seen using US and all normal patients were correctly called. US provided the ability to converse with patients, to identify the exact pain locations, and real-time identification of crepitus, clicking, motion, and snipping sensations.

SUMMARY
US is a good screening tool where sonologists need only detect if the exam is abnormal. If normal and surgery is not contemplated, no
further investigation is necessary. If abnormal or if a patient is scheduled for surgery, they must be referred for MRI. Abnormal anteromedial and medially-displaced discs may be missed or misinterpreted.

A Spectrum of Common Injuries in the Head, Pelvis and Lower Limbs in Soccer Players

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Nabil Jomaah, MD
Cristiano Eirale
Bernard Roger, MD
Frank W Roemer, MD *

PURPOSE/AIM
To present pictorial overview of injuries seen in soccer players with multimodality imaging including radiography, ultrasound, CT and MRI

CONTENT ORGANIZATION
1. Describe the epidemiology of different types of injuries seen in soccer players
2. Illustrate common injuries of the bone (fracture, dislocation, stress reaction, contusion) and soft tissue (muscle strain/contusion/avulsion, tendon/ligament rupture, tear of meniscus and labrum, bursitis), and associated findings (effusion, hematoma, injuries to internal organs) that are characteristic to the following anatomical locations:
   a. Head
   b. Pelvis
   c. Lower limbs
3. Discuss the role of different imaging modalities in the diagnosis of suspected injury
4. Conclusion

SUMMARY
Soccer players are prone to injuries due to minimal protective gear. The most common injuries are thigh strain and ankle sprain but purposeful use of the unprotected head for controlling and advancing the ball places the players at risk of head injury too. Data from the FIFA 2010 World Cup showed 82 match injuries occurred with an incidence of 40.1 injuries per 1000 hours. Subtle bony injuries may not be evident on radiography and require CT for detection. Ultrasound allows quick and dynamic imaging of soft tissue injuries, but MR offers more accurate diagnosis and allows prognostication of time required for return to play.

Beware of Subtrochanteric Femoral Fractures without Significant Trauma! Pathologic Spectrum with Emphasis on Distinguishing Imaging Features

Robert E Watts, MD
Michael J Reiter, MD
Seth D O'Brien, MD
Liem T Mansfield, MD
Joseph Alderete

PURPOSE/AIM
1. To review the anatomy of the subtrochanteric region of the femur
2. To discuss the spectrum of causes of subtrochanteric fractures
3. To highlight the imaging features which allow differentiation of the various etiologies of subtrochanteric fractures
4. To describe how the pathogenesis of the fracture impacts the orthopedic surgeon’s choice of treatment

CONTENT ORGANIZATION
1. Anatomy of the subtrochanteric femur
2. Management of subtrochanteric fractures
3. Spectrum of etiologies resulting in subtrochanteric fracture
   A. Trauma
      i. High energy mechanism
      ii. Low energy mechanism
      iii. Longitudinal stress fracture
   B. Insufficiency fractures
      i. Bisphosphonate-associated
      ii. Paget disease
      iii. Osteomalacia
   C. Pathologic (focal underlying bone lesion)
   D. Iatrogenic
      i. Intraoperative
      ii. Subsidence
      iii. Loosening

SUMMARY
Subtrochanteric femoral fractures are complex injuries that are challenging to manage given their unique biomechanical and anatomical features. While most subtrochanteric fractures result from high energy trauma, there is actually a broader range of causes that should be considered given the potential effects on treatment and patient outcomes. The radiologic appearance allows for distinction between these various entities.

The Tibial Tubercle-Trochlear Groove Distance: Error Analysis and Correction for Variances in Axial Scan Orientation

Lawrence Yao, MD
Robert D Boutin, MD

PURPOSE/AIM
The tibial tubercle-trochlear groove distance (TT-TG) has gained popularity as a metric in the assessment of patellofemoral dysfunction, and is routinely measured on axial MRI and CT scans. This study examines potential error in the TT-TG caused by variance in extremity positioning for MRI, and presents a method of normalizing the TT-TG to standard coordinates.

CONTENT ORGANIZATION
The exhibit will:

- Review the clinical application of the TT-TG to the diagnosis and management of patella-femoral dysfunction.
- Present the methods of measuring the TT-TG, and the related patellar tendon-TG and TT-PCL distances.
- Illustrate the relative errors in the TT-TG related to variances in axial scan orientation, or alternatively, relative femoral abduction or adduction.
- Present analytical methods of correcting the observed TT-TG.
- Illustrate the adequacy of a simple correction model, which ignores the femoral inter-condylar angle and the antero-posterior offset of the TT from the TG.
1. The TT-TG is conveniently measured on routine axial MRI or CT scans, but is influenced by relative femoral abduction or adduction if axial scan orientation is not standardized.
2. The TT-TG can be effectively normalized to standardized coordinates, using a simplified correction model.

The Spectrum of Lisfranc Injury

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PURPOSE/AIM
The Lisfranc spectrum of injury often poses a diagnostic dilemma to many radiologists and is missed in up to *20% of cases. Both a delay of diagnosis or misdiagnosis can lead to devastating chronic disability and is responsible for one of the leading causes of litigation against radiologists and emergency room physicians. This module aims to offer a focused pictorial review of normal Lisfranc joint anatomy, range of injury, and post-treatment imaging with an emphasis on plain film radiography.

CONTENT ORGANIZATION
A multimodality approach including plain radiographs, CT with 3D rendered imaging, and MRI will be utilized to highlight both normal and pathologic Lisfranc anatomy. The full gamut of injury ranging from Lisfranc ligament sprain to both homolateral and divergent fracture-dislocation type injuries will be covered in a case based format followed with supplemental discussion. Additionally, a brief review of common classification schemes, gradation of injury, and postoperative imaging will be presented.

SUMMARY
As Lisfranc injuries comprise of only a small fraction of overall foot injuries, a periodic review of the salient imaging findings is essential. Given the often subtle initial radiographic findings, maintaining a high index of suspicion with a low threshold to obtain supplemental imaging is key in reducing miss rates.

An Image Based Guide to the Principle of Advanced MR Imaging Techniques of Articular Cartilage

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Frank L Goerner, PhD *
Abraham Padua *
Xiaoming Li, MD
Val M Runge, MD *

PURPOSE/AIM
1) To understand the biochemical basis of MR mapping of articular cartilage;
2) To introduce technical principles of each approach for mapping normal and abnormal articular cartilage;
3) To compare the advantages and disadvantages of different techniques for functional cartilage imaging, offering a suggestion for clinical routine.

CONTENT ORGANIZATION
1) Basic introduction of the structure and function of the articular cartilage;
2) Overview of current MR techniques for articular cartilage imaging: morphologic assessment and functional assessment;
3) Detailed technical principles, current status and clinical applications (case-orientated) for each technique, including: DWI, T2 mapping, T1rho, dGEMRIC, Magnetization transfer and gagCEST.
4) Conclusions.

SUMMARY
Because of its flexibility and superior soft tissue contrast, MR imaging is an important modality in the diagnosis of joint diseases. Currently, quantitative MR techniques have been developed for the diagnosis of early cartilage degeneration and to monitor cartilage repair. An understanding of the physical principles and imaging potentials of each technique in particular advanced functional imaging for cartilage evaluation will aid radiologists in diagnosis and orthopedic surgeons in their treatment decisions.

Improved Value of MDCT for Determination of Tendon Abnormalities: Emphasis on Three-dimensional (3D) CT, Dual-Energy CT, and Four-dimensional CT Acquisition Techniques

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Elliot K Fishman, MD *
Majid Chalian, MD
Sahar J Farahani, MBBS

PURPOSE/AIM
1. CT protocol for tendon imaging 2. CT findings for various tendon pathologies 3. New advances in CT acquisition such as dual energy (DE) CT or four-dimensional (4D) CT examinations

CONTENT ORGANIZATION
- Demonstrate the role of volume rendering (VR), shaded surface display (SSD), and maximum intensity projection (MIP) in depiction of tendons and its abnormalities.
- Provide examples of CT images for various tendon pathologies.
- Discuss the potential added values of dual energy MDCT in assessment of certain tendon pathologies such as tendon tears and calcific tendinopathy and examples of 320 multidetector dynamic-kinematic CT in demonstration of tendon adhesions and subluxations.

SUMMARY
- Tendon evaluation by CT is feasible.
- With CT protocol modifications, including the creation of 3D CT images, diagnostic yield for tendon pathologies can be improved.
- Kinematic 4D CT imaging is useful for identifying tendon subluxation or dislocation.

Are You Stressed? Stress Injuries in Young Athletes

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Kristen A Lee, MD
Travis J Hillen, MD *
Jonathan C Baker, MD *
Michael V Friedman, MD
**PURPOSE/AIM**
To review the clinical presentation, imaging features and management of osseous stress injuries in young athletes.

**CONTENT ORGANIZATION**
With increasing demands placed upon pediatric and adolescent athletes, stress injuries have become a major source of pain and disability. Each sport places unique stresses on the bone and leads to typical stress-related injury patterns. Imaging evaluation begins with radiographs, and the general radiologist is often the first to encounter these disorders, which include stress reaction, stress fracture, and growth plate injury. This topic reviews stress injuries of the axial and appendicular skeleton, emphasizing the clinical presentations, key radiographic and cross-sectional imaging findings, and role of imaging in directing management.

**SUMMARY**
Young athletes are commonly referred to the radiologist for evaluation of stress injuries. Knowledge of the clinical presentation and salient imaging features of common stress-related injuries is essential to make a timely and accurate diagnosis and direct appropriate therapy.

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**Why Not Fibrous Dysplasia? A Comprehensive Review. What We Know and What We Have Learned?**

**LL-MKE2100**
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Cheryl H Lin, MD
Hiten B Patel, MD
Mingqian Huang, MD
Douglas S Katz, MD
Kevin S Baker, MD

**PURPOSE/AIM**
- Present a review of clinical and imaging findings of fibrous dysplasia (FD)
- Discuss various appearances of FD on plain film, CT and MRI
- Discuss differential diagnoses
- Review syndromes and associated findings
- Describe histologic features

**CONTENT ORGANIZATION**
A. Pictorial of various imaging features of fibrous dysplasia in various locations
B. Present histologic appearances of FD
C. Discuss differential diagnoses
D. Discuss polyostotic fibrous dysplasia, McCune-Albright syndrome and Mazabraud syndrome
E. Review potential complications: fracture, deformity, malignant degeneration
F. Present a systemic approach in the imaging evaluation of FD

**SUMMARY**
- Fibrous dysplasia has a variety of imaging appearances from focal to diffuse, ground-glass, lytic, sclerotic or mixed. Some may present a diagnostic dilemma. A systematic approach should aid.
- Imaging mimickers include Paget’s, adamantinoma, non-ossifying fibroma, giant cell tumor, simple bone cyst and chondroid or osteoid containing lesions.
- McCune-Albright syndrome comprises a clinical spectrum of polyostotic fibrous dysplasia, precocious puberty with Café-au-lait spots.
- Mazabraud syndrome comprises spectrum of polyostotic fibrous dysplasia and intramuscular myxomas.
- Sarcomatous degeneration is rare

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**The Finger: the Good, the Bad, the Ugly**

**LL-MKE2101**
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Samantha Muhlrad, MD
Hiten B Patel, MD
Mingqian Huang, MD
Kevin S Baker, MD

**PURPOSE/AIM**
- Pictorial of the myriad of osseous and periosseous lesions that affect the finger with differential diagnoses
- Discuss clinical issues and appropriate actions including further testing and treatment

**CONTENT ORGANIZATION**
A. Pictorial imaging review as unknown and known cases followed by discussion of entities B. Selected imaging examples:
- Hyperparathyroidism
- Parosteal chondroma
- Amniotic Band Syndrome
- Scleroderma
- Enchondroma
- Glomus tumor
- Thyroid acropathy
- Giant cell tumor
- Metastatic disease
- Multiple hereditary exostosis
- Hypophosphatasia
- Infection
- Acroosteolysis
- Inflammatory arthropathies
- Depositional processes
- Giant cell tumor of the tendon sheath
- Sarcoid
- Leprosy

**SUMMARY**
- A myriad of lesions and processes affect the fingers.
- These process run the gamut of tumor (primary/meastatic), infection, collagen vascular, arthropathy, depositional, metabolic/endocrine, trauma, occupational, congenital/developmental.
- A thorough evaluation of the finger is critical in the diagnosis not only of subtle lesions but processes that may be part of more generalized or systemic disease states.
Skeletal Muscle MRI - Great Potential for Future Clinical Application

PURPOSE/AIM
1) Procedure and basic concept of DTI in skeletal muscle MRI
Content Organization
1) Synovial cyst disease: Review anatomy, pathophysiology and clinical manifestations. 2) Discuss current standard of care for operative and non-operative management of synovial cyst disease. 3) To highlight imaging signs of calcaneus reduction and fixation failure
SUMMARY
-Complications after reduction and fixation and diagnostic approach (nerve injury/entrapment, anterolateral impingement, malposition of fragments with flattening of long arch, arthritis, malunion).-Review of normal anatomy of the calcaneus and mechanisms of injury -Radiographic signs of calcaneus fracture and CT classification schemes (i.e. Sanders classification) with emphasis on surgical decision-making. - Closed reduction/percutaneous fixation appearance and radiographic analysis -Review of normal anatomy of the calcaneus and mechanisms of injury -Radiographic signs of calcaneus fracture and CT classification schemes (i.e. Sanders classification) with emphasis on surgical decision-making. - Closed reduction/percutaneous fixation appearance and radiographic analysis

The Extensor Carpi Ulnaris Pseudolesion: Evaluation with MicroCT, Histology, and MRI

PURPOSE/AIM
1. To provide an explanation for the commonly seen central increased T1 and T2 signal (pseudolesion) within the extensor carpi ulnaris (ECU) tendon
2. Review the "magic angle phenomenon" and explain why it does not apply to the ECU pseudolesion
3. Review mucoid degeneration and its imaging characteristics
4. Explain the utility of microCT in the analysis of tendon morphology
CONTENT ORGANIZATION
Examples of increased MRI signal in the ECU: magic angle versus mucoid degeneration versus tendinosis/tear
-Complications after reduction and fixation and diagnostic approach (nerve injury/entrapment, anterolateral impingement, malposition of fragments with flattening of long arch, arthritis, malunion).

Calcaneus Fracture Reduction and Fixation: What the Radiologist Needs to Know

PURPOSE/AIM
1. To discuss radiographic studies and parameters important for surgical decision-making
2. To discuss surgical versus non-surgical management of extraarticular and intraarticular calcaneus fractures
3. To highlight imaging signs of calcaneus reduction and fixation failure

CONTENT ORGANIZATION
1) Synovial cyst disease: Review anatomy, pathophysiology and clinical manifestations. 2) Discuss current standard of care for operative and non-operative management of synovial cyst disease. 3) Create familiarity with alternative percutaneous treatment options for successful synovial cyst decompression. 4) Present images from multiple case examples of successful CT-guided percutaneous synovial cyst rupture. 5) Outcomes and interval follow up, highlighting pain resolution and the potential for long-term avoidance of invasive operative procedures.
SUMMARY

Skeletal Muscle MRI - Great Potential for Future Clinical Application

PURPOSE/AIM
Recently, skeletal muscle MRI has been applied for acquiring anatomical and metabolic information at the microscopic level by diffusion tensor imaging (DTI) and proton MR spectroscopy (H-MRS). Moreover, muscle perfusion has been tried to measure base on intravoxel incoherent motion (IVIM) concept and BOLD. Additionally, we are trying to assess hardness of muscle by using T1-rho. Integration of these parameters may produce new biological information for skeletal muscle. This presentation shows future clinical application of skeletal muscle MRI by getting information at the microscopic level.

CONTENT ORGANIZATION
1) Procedure and basic concept of DTI in skeletal muscle MRI
2) IMCL measurement and its clinical application
3) Indirect skeletal muscle perfusion by IVIM and BOLD
4) Trial of assessment of hardness of muscle by using T1-rho value
5) Comprehensive clinical application of these techniques

SUMMARY
Future advance may enable acquisition of above information simultaneously without changing coil. It means we may be able to obtain several micro level information of skeletal muscle from anatomical, functional and metabolic points.

**Utility of DWIBS as a Problem Solving Tool in Musculoskeletal MRI: Seeing the Whole Picture!**

**LL-MKE2106**  
Moomal Haris, MBChB  
Richard J Robinson, MBBCh  
Jonathan Sharpe, MBChB

**PURPOSE/AIM**
The purpose of this exhibit is to:
1. Explain the concept of diffusion-weighted whole body imaging with background body signal suppression (DWIBS).
2. Review the current evidence for use of DWIBS, the normal imaging appearances and highlight our experience of using DWIBS as a problem solving tool in multiple real musculoskeletal MRI cases from our centre enabling more accurate diagnosis or improved diagnostic confidence.
3. Compare the specificity and sensitivity of DWIBS imaging in detecting pathology against nuclear imaging and what this means in terms of follow up for patients with specific pathologies.
4. Future use of DWIBS specific to musculoskeletal cases.

**CONTENT ORGANIZATION**
1. What is DWIBS and its uses.
2. DWIBS as a musculoskeletal problem solving tool.
3. Multiple real case images highlighting the use of DWIBS and its potential drawbacks.
4. Future direction for DWIBS in musculoskeletal radiology.

**SUMMARY**
Take home messages:
1. DWIBS is a relatively new concept in MR imaging- it is becoming an increasingly useful tool to use for various pathologies such as in oncology imaging and now in musculoskeletal cases.
2. Using DWIBS alongside other imaging modalities such as nuclear imaging may increase specificity and sensitivity of detecting pathology.
3. Established pattern recognition in DWIBS musculoskeletal cases.

**Paraneoplastic Syndrome: Musculoskeletal Manifestations**

**LL-MKE2107**  
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Tomoya Nakatsuka, MD  
Kenjirou Ohashi, MD  
Teruo Ito  
Hitoshi Terada, MD  
Masayuki Odashima  
Shusuke Kasuya, MD  
Rumiko Kasai, MD  
Hideyasu Kudo, MD

**PURPOSE/AIM**
The purpose of this exhibit is:
1. To present representative cases of musculoskeletal manifestations of paraneoplastic syndrome with imaging findings
2. To describe the etiology, treatment, and outcomes of musculoskeletal manifestations of paraneoplastic syndrome

**CONTENT ORGANIZATION**
Paraneoplastic syndromes are diseases or symptoms that are the consequences of the presence of tumors or tumor-like lesions in the body. Such phenomena are induced by intrinsic factors (hormones or cytokines) secreted by tumors or tumor-like lesions or by an immune response against the tumors or tumor-like lesions. Several musculoskeletal manifestations have been reported as signs of paraneoplastic syndromes. Many causes that induce paraneoplastic syndromes of musculoskeletal manifestations have been reported:
1. parathyroid hormone-related protein-producing tumors (hypercalcemia)
2. osteolytic lesions induced by adult T-cell leukemia
3. dermatomyositis (lung cancer, ovarian cancer, gastric cancer and so on)
4. oncogenic osteomalacia (phosphaturic mesenchymal tumors)
5. hypertrophic pulmonary osteoarthropathy (lung cancer).

**SUMMARY**
Since musculoskeletal manifestations present and are imaged before the diagnosis of primary lesions, musculoskeletal radiologists should be familiar with the imaging findings in order to reach a rapid and accurate diagnosis.

**Strains in the Athlete: Common Injury in Uncommon Locations**

**LL-MKE2108**  
Michael C Howell, MD  
Bethany U Casagranda, DO  
Adam C Zoga, MD

**PURPOSE/AIM**
Review a common sports related injury in uncommon locations.

**CONTENT ORGANIZATION**
Muscle strains are common injuries in athletes of all types, accounting for up to 30% of the typical sports medicine practice. A muscle strain injury is characterized by disruption of the muscle-tendon unit resulting from distraction or shearing forces. In the skeletally mature athlete, the point of maximum weakness in normal skeletal muscle is the myotendinous junction and hence strains typically arise at this site. Strains tend to occur in muscles that cross two joints, with a high proportion of fast twitch fibers and undergo eccentric contraction. The most commonly strained muscles include the hamstrings, rectus femoris, and gastrocnemius muscles. Of course strains can occur in any muscle. In this presentation we will review strains in uncommon locations, with examples including the sternocleidomastoid, external oblique and sartorius muscles.

**SUMMARY**
While strains most commonly occur in the hamstrings, rectus femoris, and gastrocnemius muscles, they can occur in any muscle. The MR appearance of a strain is very characteristic and it is important to look for it regardless of location to help diagnose what may be a clinically
**Got Calcium? A Simplified Approach to Radiographic Interpretation**

**PURPOSE/AIM**
Soft tissue calcifications are a common incidental finding on musculoskeletal imaging. Not uncommonly, these calcifications may be a manifestation of systemic disease; however, without an appropriate awareness of such disease entities and a pattern - approach to narrow the differential diagnosis, the relationship between the disease process and the soft tissue calcification may not be recognized. This educational exhibit seeks to provide a pattern of approach for diagnosis of calcifications that may be used by both general and subspecialty musculoskeletal trained radiologists.

**CONTENT ORGANIZATION**
I. Introduction with description of the types of soft tissue calcifications and associated disease processes:
   a. Dystrophic
   b. CPPD
   c. Metastatic calcification
   d. Tumoral calcinosis
   e. Neoplasm
   f. Synovial
   g. Calcific tendinopathy
II. Distribution
   a. Diffuse
   b. Multifocal
   c. Focal
III. Morphology
   a. Linear
   b. Reticulated/branching
   c. Punctate
   d. Clustered
   e. Dense
IV. Modalities
   a. Radiography
   b. CT
   c. Ultrasound

**SUMMARY**
After reviewing this exhibit, radiologists will understand the common causes of soft tissue calcifications and will have developed a pattern-approach by which to narrow the differential diagnosis. Radiologists will be familiar with the multimodality appearance of soft tissue calcifications.

**Benign Soft Tissue Masses of the Foot and Ankle - Ultrasound Findings**

**PURPOSE/AIM**
MRI remains the best technique for evaluating soft tissue masses in the foot. However, ultrasound (US) is often the first imaging modality used as it is readily available and offers a unique dynamic assessment. US is extremely useful in localizing and determining if the lesion is cystic or solid. It also allows assessment of tumor vascularity. Furthermore, US facilitates guided biopsy or aspiration. The aim of this exhibit is to:
- Demonstrate the US imaging features of the most common soft tissue masses within the foot
- Correlation of the findings with MRI where appropriate

**CONTENT ORGANIZATION**
Due to the unique load-bearing function of the foot and its compact anatomy, foot lesions tend to present themselves early in their development. In many cases a specific diagnosis can be achieved by considering the location and anatomical relations of the lesion within the foot, its morphology and its configuration. In this exhibit we demonstrate the characteristic ultrasound imaging features of the following:
- Inter-digital/Morton neuromas
- Planter fibromatosis
- Haemangiomas
- Nerve sheath tumours
- Lipomas
- Ganglions
- Abscesses
- Synovial pathology e.g. pigmented villonodular synovitis

**SUMMARY**
Benign masses in the foot are common and US is an excellent tool for evaluating and characterising them.

**Rigid Spine Syndrome in Myopathies and Muscular Dystrophies: Pictorial Review and Diagnostic Strategy with Whole Body Muscle MRI**

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

- To present the experience of whole-body muscle MRI in muscular diseases in a national reference center for these affections
- To depict specific imaging patterns in muscular dystrophies (Ullrich disease, selenoproteinopathy, laminopathy, Pompe disease) and myopathies (central core disease, centronuclear myopathy)
- To propose a practical diagnostic algorithm for myopathies and muscular dystrophies

CONTENT ORGANIZATION

- Myopathies and muscular dystrophies are rare diseases
- Whole-body muscle MRI allows detection and a precise cartography of muscular lesions
- Specific imaging patterns can be observed for each disease

SUMMARY
The major teaching points of this exhibit are:

- Myopathies and muscular dystrophies are rare diseases with diffuse lesions yet there are preferential sites of muscular impairment for each disorder
- Specific imaging patterns are usually found
- The radiologist has a key role in setting a precise cartography of muscular involvement and to orientate diagnostic procedures (biopsy, genetical analysis)

The Efficacy of Ultrasound-guided Needle Lavage in the Treatment of Calcific Tendonitis of the Rotator Cuff - A Systematic Review of Best Evidence

LL-MKE2112
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Nicole Simunovic, MSc
Mohit Bhandari *

PURPOSE/AIM
We conducted a systematic review to examine the efficacy of US-guided needle lavage with saline compared to all other forms of treatment, including alternative interventions such as corticosteroid injection, shockwave therapy, NSAIDs, and no treatment in reducing pain and disability among those with calcific tendinosis of the rotator cuff.

CONTENT ORGANIZATION
We searched electronic databases (including MEDLINE, EMBASE, and Cochrane) and additional unpublished data with no restrictions on study design or language. Two reviewers independently screened articles for study eligibility, extracted relevant data, assessed quality and consensus was reached through discussion. Among the 6681 citations, 11 studies met our inclusion criteria. The sample sizes ranged from 30 to 462 patients. Study designs varied significantly with three randomized controlled trials, two cohort studies, one retrospective chart review, and five case series. Decrease in pain, disability, calcification size, and increase in degree of movement were evaluated.

SUMMARY
Based on this systematic review, the viewer will comprehend the various evidence based approaches to treatment of calcific tendinosis of the rotator cuff. He will be able to compare the efficacy of ultrasound guided needle lavage to the other forms of treatment and appropriately direct this radiological intervention in his practice.

Pudendal Neuralgia; Role of Imaging

LL-MKE2113
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Amir Borhani, MD
Joanna M Costello, MD
Maha Torabi, MD

PURPOSE/AIM
1) Delineate the MRI anatomy of the pudendal nerve.
2) Demonstrate examples of pudendal nerve impingement or abnormality on MR neurography.
3) Describe the role of imaging in management.

CONTENT ORGANIZATION
1) Introduction and review of Nantes criteria for clinical diagnosis.
2) MRI anatomy of pudendal nerve.
3) Case examples with abnormality of the pudendal nerve.
4) Imaging role in diagnosis and therapy.

SUMMARY
The syndrome of pudendal nerve entrapment is relatively uncommon and often misdiagnosed or confused with other diseases. The diagnosis has been essentially clinical using Nantes criteria. MR neurography can be helpful in selected cases demonstrating abnormal caliber and signal intensity of the nerve, or perineural scarring. CT- guided Alcock canal and ischial spine infiltration with corticosteroids is a minimally invasive technique which can be of diagnostic and therapeutic value.

MR and US Soft Tissue Lesions of the Plantar Surface of the Foot

LL-MKE2114
Zoraida Restrepo Velez, MD
Zehava S Rosenberg, MD
Rodrigo Restrepo, MD
Jenny T Bencardino, MD
Victor M Torres, MD

PURPOSE/AIM
PURPOSE: Plantar soft tissue lesions are very common. Careful correlation of MR and US characteristics with clinical history can lend a more specific diagnosis. The main goal of this exhibit is to review the MR and US imaging features as well as histology of soft tissue lesions of inflammatory, infectious, metabolic, vascular, fibromatous, neurovascular and tumoral etiology affecting the plantar surface of the foot.

CONTENT ORGANIZATION
Our exhibit will be divided into 2 sections: 1. Regional anatomy of the plantar surface of the foot; 2. Pathologic conditions of the plantar surface of the foot:
- a) Inflammatory (bursitis, panarctitis-fat necrosis, rheumatoid nodules, foreign body granuloma, abscess, sinus tract, osteomyelitis), b) Metabolic (gout, pseudogout, HAAC) Vascular lesions (hemangioma, vascular malformation)
- Fibromatous lesions (plantar fibromas, fibromatosis)
- Neurovascular disorders (Morton neuroma, schwannoma, neurilemoma, Baxter
neuropathy f) Tumoral (giant cell tumor, fibrohistiocytic tumor, epithelioid and dermatofibrosarcomas).

SUMMARY
After reviewing this exhibit the reader will be familiar with the regional anatomy and pathological conditions affecting the various structures of the plantar surface of the foot.

The New WHO Classification of Soft Tissue Tumors: What Radiologists Should Know

PURPOSE/AIM
1.- To review the new WHO classification of soft tissue tumors up-to-dated in 2013
2.- To show the main features and modifications adopted from the new WHO classification, specifying the new groups of tumors included
3.- To illustrate the radiologic-pathologic appearance of soft tissue tumors according to the new WHO classification

CONTENT ORGANIZATION
This pictorial review will show the new WHO Classification of soft tissue tumors up-to-dated and established in 2013, including the new groups from the previous on: 1) adipocytic tumors, 2) fibroblastic/myofibroblastic tumors, 3) so-called fibrohistiocytic tumors, 4) smooth muscle tumors, 5) pericytic (perivascular) tumors, 6) skeletal muscle tumors, 7) vascular tumors, 8) chondro-osseous tumors, 9) Gastrointestinal stromal tumors, 10) Nerve sheath tumors 11) tumors of uncertain differentiation and 12) Undifferentiated/unclassified sarcomas

The exhibit will depict the modifications of the new classification and the radiologic findings with pathologic correlation of soft tissue tumors.

Classification of soft tissue tumors is difficult. The most effective management decisions are made when a working group participates in the same diagnostic standard criteria in the evaluation of soft tissue tumors. The new classification might serve as a guide for radiologists working in a multidisciplinary committee.

Detailed Bony Landmark of the Ankle; Clues for the Evaluation of Ligaments and Tendons

PURPOSE/AIM
to review the detailed bony landmarks on the drawings, anatomic imaging, US, CT and MR imaging and its clinical significance and the correlation with adjacent ligament and tendons of the ankle joint

CONTENT ORGANIZATION
Bony landmarks medial and lateral malleolus on axial image Lateral malleolus; retromalleolar groove, fossa, anterior border for anterior talofibular ligament (ATFL) Medial malleolus; anterior and posterior colliculus intercollicular groove, posterior process of the talus Talus; medial and lateral tubercle of the posterior process, posterior process of talus, sustentaculum tali, peroneal tubercle, retrotrochlear eminence Calcaneous; small tubercle of the calcaneous lateral surface Distal tibiofibular joint; anterior tubercle and posterior tubercle of tibia and fibula, tibia fibular notch. 1. illustrate the drawings, anatomic imaging of each detailed bony landmark 2. describe the technique and tips how to evaluate the adjacent ligament and tendon using the bony landmark on US and MR study

In some instances, proper diagnosis of ankle ligaments and tendon injury can be difficult due to the extensive edema, the volume averaging effect, and the scarred changes of soft tissues. The knowledge of the detailed bony landmark could provide the proper evaluation of the ankle joint pathology.

Role of MSCT in the Diagnosis of Adult Acquired Flatfoot: Beyond Hindfoot Osteoarthritis

PURPOSE/AIM
1. Review the main features that define adult flatfoot and its etiology
2. Propose a systematic reading of the anatomic structures involved in this entity.
3. Remark those features that could change the therapeutic approach.
4. Show the soft-tissue changes that characterize this entity.

CONTENT ORGANIZATION
In this exhibit we illustrate the bone Multidetector CT (MDCT) findings that characterize the different stages of AAFF: a) stage1 and 2: subtle changes involving the dynamic stabilizes and talocalcaneal impingement b) stage 3: degenerative changes in the subtalar joints and sinus tarsi syndrome c) stage 4: osteoarthritis of the ankle joint We focus on advanced stages with secondary malalignment and degenerative changes of hindfoot joints that determine the different surgical techniques. Finally we review the more frequent bone malformations and soft-tissue abnormalities that are associated to this entity, especially PTT, spring ligament and impingement syndromes.

MDCT provides a detailed information of bone and joint disorders that develop secondary to flatfoot, this information is essential for the surgical planning. MDCT is an excellent technique for the study of other causes of flatfoot in the adulthood, mainly malformations and traumatic sequelae.

Sporting Injuries of the Elbow Joint: Mechanism of Injuries and Imaging Findings

PURPOSE/AIM
1. Review the main features that define adult flatfoot and its etiology
2. Propose a systematic reading of the anatomic structures involved in this entity.
3. Remark those features that could change the therapeutic approach.
4. Show the soft-tissue changes that characterize this entity.

CONTENT ORGANIZATION
In this exhibit we illustrate the bone Multidetector CT (MDCT) findings that characterize the different stages of AAFF: a) stage1 and 2: subtle changes involving the dynamic stabilizes and talocalcaneal impingement b) stage 3: degenerative changes in the subtalar joints and sinus tarsi syndrome c) stage 4: osteoarthritis of the ankle joint We focus on advanced stages with secondary malalignment and degenerative changes of hindfoot joints that determine the different surgical techniques. Finally we review the more frequent bone malformations and soft-tissue abnormalities that are associated to this entity, especially PTT, spring ligament and impingement syndromes.

MDCT provides a detailed information of bone and joint disorders that develop secondary to flatfoot, this information is essential for the surgical planning. MDCT is an excellent technique for the study of other causes of flatfoot in the adulthood, mainly malformations and traumatic sequelae.
Anatomy: Relevant soft tissue and bony anatomy of the elbow will be reviewed including muscles and nerves but emphasizing the collateral ligamentous complexes, which form the primary stabilisers of the elbow. Normal MRI figures will depict the relevant anatomical structures.

Functional biomechanics: Variation in functional biomechanics of the elbow during athletic activity especially during sports and combat sports will be presented. The collateral ligaments and their differential contribution towards stabilisation of the elbow joint against valgus and varus strain are emphasized. Mechanism of injuries and Imaging findings: This section describes and illustrates the most common sports related elbow injuries along with their corresponding mechanisms of injury and pathophysiology. Mechanisms, which particularly occur in specific throwing, power and combat sports, will be presented.

SUMMARY
Knowledge of anatomy, functional biomechanics, mechanism of injury and imaging findings can help improve accuracy of image interpretation. Especially in acute sports trauma imaging features can define the injury process to aid better clinical management.

Lumps and Bumps: Ultrasound to the Rescue!

LL-MKE2119
Brett S Talbot, MD
Daniel C Oppenheimer, MD
Nancy Carson, MBA
Vikram S Dogra, MD *

PURPOSE/AIM
Soft tissue masses are commonly encountered in clinical practice and ultrasound is easily accessible as a problem solving modality. A proper understanding of the wide spectrum of soft tissue masses is necessary. The purpose of this exhibit is to demonstrate a series of challenging cases to improve the radiologist's accuracy in identifying soft tissue masses.

CONTENT ORGANIZATION
The 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 but not limited to: 1) schwannoma 2) fibroma 3) lipoma 4) plexiform neurofibroma 5) synovial cyst 6) cutaneous sarcoid 7) Baker's cyst 8) Morton's neuroma 9) plantar fasciitis 10) olecranon bursitis 11) superficial bursae surrounding the knee 12) hemangioma 13) miscellaneous category (including foreign bodies, metastatic disease, hematoma, etc).

SUMMARY
It's important for a practicing radiologist to be familiar with normal variations and pathologies of soft tissue masses in order to appropriately triage the patients and to avoid misdiagnosis.

Imaging of Winter Sport Injuries

LL-MKE2120
Frank J Simeone, MD
Ambrose J Huang, MD
Connie Y Chang, MD

PURPOSE/AIM
The purpose of the educational exhibit is:
1. Review the common musculoskeletal injuries associated with winter sports trauma
2. Identify imaging features of the these injuries and identify concurrent co-morbid injuries
3. Discuss optimal imaging modalities and techniques for assessing these patients.

CONTENT ORGANIZATION
- Knee injuries including pivot shift
- Skier's thumb
- Leg fractures
- Shoulder dislocation
- Flexion injury of the spine
- Wrist fractures and dislocation

SUMMARY
Skiing trauma results in a variety of different musculoskeletal injuries. This educational review focused on injuries of the knees, thumbs, shoulders, leg and spine. After review, the reader should understand the imaging features of these injuries, associated injuries and the basic mechanism of injuries.

High - Resolution MR Imaging of the Wrist with Arthroscopic Correlation: What the Radiologist Should Know

LL-MKE2121
Matthew J Minn, MD
Daria Motamedi, MD
Michael W Kessler, MD, MPH
Allison Lax, MD

PURPOSE/AIM
The purpose of this exhibit is:
1. Review MR imaging of the wrist. 2. Review the anatomy of the ligaments and TFCC of the wrist and review common pathologies seen on MR imaging. 3. Correlate MR imaging findings with arthroscopic findings.

CONTENT ORGANIZATION
- Technical aspects of high resolution MR imaging of the wrist - Routine and MR arthrogram imaging Normal and abnormal MR appearance of intrinsic and extrinsic ligaments and TFCC of the wrist Intrinsic ligaments: - Scapholunate and Lunotriquetral ligament Extrinsic ligaments: - Volar Radiocarpal - Dorsal Radiocarpal - Volar Ulnocarpal - Radial Collateral MR appearance of the normal and injured TFCC - Normal anatomy of the TFCC - MR appearance of the injured TFCC including the Palmer Classification Clinical Cases: MR with Arthroscopic Correlation

SUMMARY
The major teaching points of this exhibit are:
1. Review anatomy of the wrist and MR imaging techniques using high resolution imaging. 2. Recognize common injuries of the wrist diagnosed with MR imaging with arthroscopic correlation.

Pitfalls of Shoulder MR in Children: A Review of Normal and Abnormal Findings at Pediatric Shoulder MR with and without Arthrogram

LL-MKE2122
PURPOSE/AIM
Shoulder magnetic resonance (MR) imaging interpretation can be challenging in skeletally immature patients. The objective of this presentation is to assist radiologists in interpretation of normal variants vs. abnormal findings on these studies, to increase diagnostic confidence and avoid misdiagnosis. Some of the diagnostic challenges specific to pediatric MRI include incongruency and signal changes at growth plates, the often confusing acromial ossification center, normal age related variation in marrow appearance vs. pathology, apparent malalignment of the acromioclavicular joint, and normal development of the labrum and glenohumeral ligaments vs. tears.

CONTENT ORGANIZATION
We will address the normal appearance of the growth plates, with a special focus on the acromial ossification center/os acromiale. We will review bone marrow signal, AC joint appearance in pediatric patients, and normal variants of the labrum and glenohumeral ligaments seen in children. In each area, normal variation and pathology will be compared and contrasted to each other.

SUMMARY
This presentation will review areas where the distinction between normal variation and pathology is particularly challenging at shoulder MR in children, with the goal of increasing reader diagnostic confidence.

Symptomatic Craniocervical Junction Pathologies: Radiological Features

LL-MKE2123
Ok Hwa Kim
Seon-Jeong Kim, MD
Hye Jung Choo, MD
Sun Joo Lee, MD
In Sook Lee
Hyun Soo Keum
Dong Ho Ha, MD, PhD
Seong Moon Lee, MD, PhD

PURPOSE/AIM
The purpose of this exhibit is to 1. Review and illustrate normal anatomy and essential craniometry of craniocervical junction (CCJ) needed for radiological assessment of CCJ. 2. Discuss various symptomatic pathologies affecting CCJ, including congenital and acquired conditions. 3. Describe their radiographic, CT and MRI appearances.

CONTENT ORGANIZATION

SUMMARY
Many pathologic conditions affecting CCJ may cause cervicomedullary myelopathy and sometimes be asymptomatic. Knowledge of such pathologies and their imaging features is essential for radiologists. After reviewing this exhibit, viewers will be familiar with these pathologic conditions, and be able to discuss and describe their imaging appearances.

Imaging Techniques in the Diagnosis and Monitoring of Multiple Myeloma: Relevance of MRI and 18-FDG PET/CT

LL-MKE2124
Maria Aragones Garcia, PhD
Nieves Gomez Leon, MD
Lourdes Del Campo, PhD
Susana Llorente Galan, MD
Beatriz Aguado, MD, PhD
Elena Ocon Alonso

PURPOSE/AIM
To show the role of MRI and whole body 18FDG-PET/CT in the diagnosis and monitoring of Multiple Myeloma (MM).
To illustrate the spectrum of musculoskeletal disorders in patients with MM.
To describe the advantages and limitations of each technique.

CONTENT ORGANIZATION
An appropriate use of imaging techniques is essential to determine the extent and to evaluate the disease progression in patients with Multiple Myeloma. Imaging techniques also help to identify and characterize musculoskeletal complications in patients with Multiple Myeloma including: fractures, avascular necrosis, myositis, abscesses or spondylodiscitis. Conventional radiography is still considered the "gold standard" for determining the extent of bone disease at diagnosis of MM.
Whole-body MR and 18FDG-PET/CT provide complementary information in the diagnostic and evaluation of patients with MM. The advantages and disadvantages of MRI and 18FDG-PET/CT at diagnosis and follow-up are discussed.

SUMMARY
Conventional radiography is still considered the "gold standard" for determining the extent of MM bone disease at diagnosis.
This exhibit illustrates how Whole-body MR and 18FDG-PET/CT provide valuable complementary information in the evaluation of patients with MM. No one radiological technique in isolation is perfect in the management of patients with Multiple Myeloma.

MRI of Post-operative Shoulder: What the Radiologist Needs to Know

LL-MKE2125
Maria D Lopez Parra, MD
Susana Hernandez Muniz, MD
Jose Acosta Batlle
Ana Garcia De Vicente
Carmen Soteras, MD
Nerea Alava Echevarna, MD
Belen Lopez Parra, MS

PURPOSE/AIM
- to describe surgical procedures used in subacromial impingement, rotator cuff disease and glenohumeral instability - to explain the specific imaging findings in each post-operative situation - to review the most common complications after these procedures

CONTENT ORGANIZATION
MRI of the postoperative shoulder is becoming more common because of the increasing number of surgery procedures, most of them performed with arthroscopy. Review of normal MRI findings in the post-operative shoulder: a) morphologic changes in the acromion and coracohumeral ligament, and widening of the acromioclavicular distance after the impingement surgery b) after rotator cuff surgery the tendon can be irregular and may show areas of low to intermediate signal. The presence of fluid in the subacromial bursa is not a sign of recurrent tear c) the expected findings after instability surgery will depend on the technique. Illustrative examples of more frequent
The complications after these surgical procedures are shown.

**SUMMARY**

The knowledge of surgical techniques in shoulder is essential for an adequate MRI interpretation. A pathologic finding in non-surgical patients may be a normal finding in post-operative situation. Understanding of normal MRI appearance after each surgical procedure help to diagnose complications.

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**MR Imaging of Metallic Prostheses: A Primer**

**Purpose/Aim**

To educate radiologists about recent advances in MR techniques and novel sequences which will allow imaging around large metallic prostheses with an emphasis on basic physics, the clinical imperative and the early NYU experience.

**Content Organization**

A. Basic physics of metallic susceptibility
B. Creating an optimized metal imaging sequence
C. Novel experimental sequences for susceptibility reduction
D. The clinical imperative: Why do we need to image these prostheses?
E. The early NYU experience in imaging complications of implants: What are we looking for?

**Summary**

The major teaching points of this exhibit are:

1. With minor modifications based on the basic physics of MRI, it is possible to significantly reduce metallic susceptibility artifact making it feasible to evaluate patients with arthroplasties.
2. Novel sequences are being developed which may make even more detailed evaluation possible.
3. Recent developments in prosthesis design including metal-on-metal implants have resulted in new complications which require timely imaging diagnosis.
4. Periprosthetic fluid collections, joint effusion with synovitis and cyst-like areas or gaps at the metal bone interface are some of the more common findings in this patient population.

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**Magnetic Resonance Imaging and Ultrasound of the Elbow: Normal Anatomy, Variants, and Common Pathology**

**Purpose/Aim**

1. To illustrate normal magnetic resonance imaging (MRI) and ultrasound (US) anatomy of the elbow.
2. To review MRI and US features of common disorders affecting the elbow joint.

**Content Organization**

Illustrating normal MRI and US anatomy of the elbow, reviewing commonly encountered joint, osseous, and soft tissue pathologic abnormalities around the elbow and their imaging appearance on MRI and US, including joint and osseous related abnormalities such as fracture, joint effusions, intra-articular loose bodies, synovial abnormality, and osteochondral abnormality; injury to tendons and ligaments involving triceps/biceps tendons, common extensor/flexor tendons, and radial/ulnar collateral ligaments; peripheral nerve entrapments; bursae, and mass-like soft tissue lesions around the elbow.

**Summary**

The major teaching points of this exhibit are:

1. Familiarization of anatomy, normal MRI and US appearance of the elbow joint.
2. Recognition of MRI and US features of the common pathologic conditions of the elbow.

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**Closed Soft Tissue Degloving Injuries in Trauma Patients: An Under-recognized CT Diagnosis?**

**Purpose/Aim**

Review the CT findings of 19 trauma patients clinically diagnosed with internal degloving injuries, that underwent subsequent surgical repair or percutaneous intervention.

**Content Organization**

I. Introduction
   a. Anatomy of the subcutaneous soft tissues
   b. Pathophysiology of closed degloving injuries

II. CT imaging findings of the different stages of clinically confirmed closed degloving injuries
   c. Acute
   d. Subacute
   e. Chronic

III. Correlation of CT findings with ultrasound and MRI features

**Summary**

Closed degloving injuries (including Morel-Lavallée lesions) classically occur in trauma patients and are well described on ultrasound and MRI. However, these patients are often imaged acutely and subacutely with trauma CT. The CT findings have not been well described and in our series of patients the injuries were often attributed to contusion, hematoma, seroma or not even mentioned at the time of interpretation. Only two out of nineteen patients were prospectively diagnosed by the radiologist. Moreover, poor recognition may lead to a delay in necessary treatment and subsequent morbidity. Therefore, the purpose of this educational exhibit is to raise awareness by reviewing the evolution of internal degloving injuries on CT, which may go under-described and under-recognized by the imager.

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**Vertebral Body: In Sickness and in Health**

**Purpose/Aim**

Examining the vertebral body in various pathological conditions and normal variations.

**Summary**

The vertebral body, as a constituent of the spinal column, is essential for the support and protection of the spinal cord. Understanding the normal anatomy and variants is crucial for the radiologist to interpret imaging studies accurately.

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Purposes/aims

1. Review the normal radiographic appearance of the vertebral body.
2. Learn imaging features of non-congenital, non-traumatic diseases of the vertebral body.
3. Demonstrate an image-based interpretation of diseases using plain film, CT and MRI.

Content organization
A review of the normal appearance of the vertebral body is followed by a discussion of various extrinsic and intrinsic vertebral body diseases. CT and MR correlation will be provided in select cases. Cases are presented in a quiz format to emphasize major teaching points.

Abnormalities presented include:
- Infectious: Pott’s disease
- Inflammatory: destructive spondyloarthropathy (amyloid)
- Metabolic: osteopetrosis, paget’s disease, renal osteodystrophy
- Neoplasm: metastatic disease, multiple myeloma, lymphoma, fibrous dysplasia
- Hemangioma: sickle cell disease, avascular necrosis

Summary
Many local and systemic disease processes affect the appearance and configuration of the vertebral bodies. After completing this educational exhibit, the participant should have a thorough understanding of the normal radiographic appearance of the vertebral body. Furthermore, the participant should be able to confidently identify pathologic changes which may occur along multiple disease entities on varying imaging modalities.

Knee Joint Evaluation in the Anterior Cruciate Ligament Reconstruction Surgery Using T2 SPACE Sequence 3D-MRI

Purpose/aim
Anterior cruciate ligament (ACL) reconstruction surgery procedure has made dramatic progress recently and a new approach has been continuously sought even today. However, preoperative and postoperative evaluation by MRI is critically important because ACL reconstruction surgery procedure is complicated. Therefore, we examined whether postoperative evaluation of ACL reconstruction surgery procedure by MRI would be useful for T2 SPACE sequence 3D-MRI.

Content organization
A total of 110 patients who got injured in ACL and underwent reconstruction surgery were selected and scanned preoperatively and postoperatively by T2 SPACE sequence. Later, a comparative analysis was conducted to compare the scanned images with the arthroscopic findings and also the evaluation of the reconstructed ligaments was conducted by 5 radiologists, 2 orthopedists, and 15 radiographers. We compared the results of 108 patients with the arthroscopic findings and obtained the result that there was no difference in the shape and length of ACL.

Summary
We could visualize and evaluate the complicated fiber alignment in the reconstructed ACLs by T2 SPACE sequence method. In addition, we could conduct an evaluation of the bone tunnel. We also could evaluate the remaining ligament before the operation, which was also proved useful for selecting an ACL reconstruction surgery procedure.

Imaging of Anterior Cruciate Ligament Reconstruction: Emphasis on Aspects Related to Surgical Techniques and Its Peculiarities

Purpose/aim
To review the anterior cruciate ligament (ACL) reconstruction, using imaging methods (with emphasis on MRI) and surgical illustrations, depicting the different types of surgical techniques related to the types of fixation and tunnel placement.
To demonstrate the normal postoperative appearance of the ACL graft, anatomical relations of the screws, tunnels and adjacent tendon and ligament structures, as well as complications of its malposition.

Content organization
1. Normal anatomy of ACL and its biomechanical properties
2. Surgical techniques (with arthroscopic ACL reconstruction videos)
   2.1 Single vs double bundle techniques
   2.2 Inside-out (transportal and transtibial) vs outside-in techniques
3. Normal post-surgical appearance of ACL reconstruction, emphasizing the positioning of tunnels and screws in relation to adjacent structures
4. Complications of malposition of ACL reconstructions

Summary
ACL is the most commonly injured ligament in the body, leading to a great number of surgical ACL repair and reconstruction. Radiologists must be aware of the different techniques of ACL reconstruction and its normal postoperative appearance and possible complications.

Parasitic Infections of Soft Tissue: Imaging Features and Histopathology

Purpose/aim
1. To review the biologic characteristics and the clinical manifestations of parasites
2. To demonstrate the multimodality imaging features

Content organization
- Normal anatomy of ACL and its biomechanical properties
- Surgical techniques (with arthroscopic ACL reconstruction videos)
- Normal post-surgical appearance of ACL reconstruction, emphasizing the positioning of tunnels and screws in relation to adjacent structures
- Complications of malposition of ACL reconstructions
of parasitic infection. 3. To compare these imaging features with histopathologic findings.

 CONTENT ORGANIZATION

 SUMMARY
 The major teaching points of this exhibit are: 1. To understand imaging characteristics can be useful in establishing the diagnosis of parasitic infection. 2. If a cystic lesion containing scolex is detected in any imaging modality, the diagnosis of cysticercosis can be readily made. 3. If serpiginous tubular or ovoid cystic lesions which are surrounded by multi-layered wall are seen on imaging studies, sparganosis should be included in differential diagnosis. 4. MRI and ultrasound are useful in the diagnosis of soft tissue parasitic infection.

 MR Imaging Findings of the Superficial Soft Tissue Masses of the Extremities: Correlation with Histopathologic Features

 LL-MKE2133
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 Hiroshi Nishimura , MD
 Kimberly K Amrami , MD
 Koji Hiraoka
 Fumitake Ono
 Jun Akiba
 Akiko Sumi , MD
 Tatsuyuki Tonan , MD
 Norimitsu Tanaka , MD
 Kiminori Fujimoto , MD, PhD
 Masafumi Uchida , MD, PhD
 Toshi Abe , MD

 PURPOSE/AIM
 1. To explain spectrum of superficial soft tissue masses that arise in association with the epidermis or dermis, subcutaneous adipose tissue, and fascia overlying the muscle. 2. To review various relevant MR imaging features with pathologic correlation which aid in a correct diagnosis. 3. To discuss the value of new imaging techniques for approaching characterization of tumors.

 CONTENT ORGANIZATION
 We illustrate the masses according to anatomical sites, such as epidermis or dermis (e.g., epidermal cyst, pilomatrixoma), subcutaneous adipose tissue (e.g., lipoma, benign nerve sheath tumor, fibromatosis), and fascia (e.g., nodular fascitis, metastatic tumor). We mention new MR imaging techniques: (a) MR angiography for evaluating vascularity (e.g., glomus tumor) (b) diffusion weighted imaging for evaluating degree of restriction of Brownian motion in the extracellular space (e.g., epidermal cyst, malignant lymphoma) (c) magnetization transfer contrast for assessing collagenous or chondroid matrix (e.g., leiomyoma, chondroma) and (d) susceptibility-weighted image for detecting blood products, calcium, iron, and melanin (e.g., hematomata, pilomatrixoma, malignant melanoma).

 SUMMARY
 This exhibit will provide a comprehensive imaging review and a systematic diagnostic approach to the spectrum of superficial soft tissue masses of the extremities on MR imaging.

 Musculoskeletal Ultrasound in the Urgent Clinical Setting

 LL-MKE2134
 Catherine J Brandon , MD *
 Gandikota Girish , MBBS
 Marnix T Van Holsbeeck , MD *
 Joseph G Craig , MD
 David A Jamadar , MBBS
 Qian Dong , MD
 Yoav Morag , MD

 PURPOSE/AIM
 To review common indications for MSK US in the urgent clinical setting including foreign body evaluation as well as several atypical urgent requests to demonstrate the range of clinical findings. To understand the utility of such evaluations for surgical and clinical management.

 CONTENT ORGANIZATION
 The study will present both normal and pathological imaging so the learner can recognize typical traumatic tendon tears and lacerations for selection of appropriate management: Achilles, distal biceps, flexor tendons of the fingers, patellar and quadriceps tendon injuries. Review imaging and clinical complexities for differentiation of septic joint vs inflammatory or crystal arthropathies or post-operative changes including native and post-arthroplasty hips and shoulders. Discuss imaging characteristics of foreign bodies to aid in their detection and removal. To demonstrate the range of clinical entities for urgent evaluation including spontaneous rupture of the rectus abdominis muscle in debilitated patients or unsuspected partial laceration of the median nerve secondary to industrial accident.

 SUMMARY
 The viewer should be able to list indications for MSK US in the urgent setting, discuss protocols such as acute Achilles rupture evaluation and describe workup of suspected septic joints in several clinical scenarios.

 The Post-operative Ankle and Foot: Good Outcome or Unexpected Complication?

 LL-MKE2135
 Lacey McIntosh , DO, MPH
 Steven J Baccei , MD
 Hartley M Sirkis , MD
 Christopher A Cerniglia , DO, MEng

 PURPOSE/AIM
 Demonstrate the multimodality imaging appearance of common operative procedures performed on the ankle and foot. Evaluate the benefits and limitations inherent to the various radiographic modalities. Explore common clinical presentations and radiographic patterns associated with post-operative complications.

 CONTENT ORGANIZATION
 Review of the normal multimodality imaging appearance of the ankle and foot following common surgical procedures including: arthrodesis, bunioectectomy, cholecystectomy, arthroplasty, common osteotomies, post traumatic fixation, soft tissue and osseous neoplasm resection/treatment. Next, describe the inherent advantages and disadvantages of using the various modalities (radiographs, CT, MRI, bone scan, and ultrasound) for evaluating these postoperative patients. Last, an analysis of post-operative complications including hardware failure/migration, infection, malalignment, and fractures.

 SUMMARY
 After reviewing this exhibit, the participant will: 1. Understand the expected imaging findings following ankle and foot surgery. 2. Correctly recommend the most appropriate imaging modality for various post-operative circumstances. 3. Learn the imaging appearance of post-operative complications.
**Focal Periphyseal Edema on MRI of Young's Joints: Relevant Aspects and Review of the Literature**

**LL-MKE2136**

Vanessa M Finato, MD  
Henrique Metzger, MD  
Andre Y Alhara, MD  
Hamilton Guidorizzi, MD  
Carlos H Longo, MD

**PURPOSE/AIM**
The growth plate of the young is a dynamic structure that is subject to normal physiologic, as well as pathologic, changes. Recently, MRI has been describing a finding commonly seen in the early stages of physiologic closure, characterized by a focal bone marrow edema pattern centered about the closing physis (FOPE), that can be mistakenly confused with a pathological process. The purpose of this study is to clarify the relevance of this finding for physicians.

**CONTENT ORGANIZATION**
- Review of MRI aspects of physiologic and pathologic growth-plate closure.  
- The best MRI sequences to study the physis growth process.  
- Discussion of the causative mechanism of the FOPE zone.  
- Importance of FOPE zone and potentially painful manifestation.  
- Differentiate FOPE from pathologic processes related to growth.  
- Sample cases.

**SUMMARY**
FOPE zone is a finding commonly seen in the early stages of physiologic growth-plate closure process and that may be associated with pain, particularly when no other MRI abnormalities are present. Considering the physiologic nature of this finding, it does not require any additional or invasive diagnostic, treatment or imaging follow-up. Recognize this entity would avoid it to be mistaken with an abnormality and avoid unnecessary procedures.

**Evaluation of Hip Prosthesis with CT-scan: New Reconstruction Algorithms and New Application**

**LL-MKE2137**

Jean-Baptiste Meyer  
Pedro A Gondim Teixeira, MD  
Sophie Lecocq, MD  
Sabine Aptel  
Matthias Louis, MD  
Alain G Blum, MD

**PURPOSE/AIM**
- Explain the impact of iterative reconstruction (IR) and of metal artifact reduction (MAR) algorithms on the analysis of hip prostheses and their environment.  
- Highlight the impact of these new techniques to evaluate the painful hip prosthesis (HP)

**CONTENT ORGANIZATION**

**SUMMARY**
Compared to filter-back projection, the combination of iterative reconstruction and MAR improves the detection of complications affecting the HP components, the bone and the soft tissues.

**4D CT Scan of Normal and Pathological Acromioclavicular Joint**

**LL-MKE2138**

Juan Angel Clavero, MD  
Javier F Alomar, MD  
Josep Maria Monill  
Enric Ferre  
Manel Mendoza  
Jose R Garcia Medina

**PURPOSE/AIM**
To determine the motion patterns of the acromioclavicular joint in healthy individuals, in patients with degenerative joint disease and in patients after dislocation.

**CONTENT ORGANIZATION**
We perform 4D CT scan for evaluation of the motion pattern and anatomy of the acromioclavicular joint during the Cross Arm test and from the neutral to the ABER position. We evaluate the displacement and rotation of both articular surfaces.

**SUMMARY**
The major teaching points of this exhibit are: 1. Describe the normal acromioclavicular joint movement 2. Describe the reduction and changes in mobility in cases of degenerative acromioclavicular joint disease an in cases of dislocation. 3. Demonstrate de usefulness of 4DCT Scan in the evalutacion of joint biomechanics.

**Imaging Features of Apophyseal and Epiphyseal Pathologic Changes in Children**

**LL-MKE2139**

Larissa G Cortinas, MD  
Ivan Godoy, MD  
Daniel C Oliveira, MD  
Andre F Yanaiada, MD  
Michel D. Crema, MD  
Abdalla Y Skaf, MD  
Luis Pecci Neto, MD  
Jader J Da Silva, MD

**PURPOSE/AIM**
The purpose of this exhibit is to describe and illustrate imaging features of apophyseal and epiphyseal pathologic changes in the immature skeleton, as well as to differentiate those from normal findings, using various imaging techniques.

**CONTENT ORGANIZATION**
We will demonstrate the normal findings of the apophyseal and epiphyseal regions of the immature skeleton. Further, this exhibit will present cases of pathology affecting the apophysis and the epiphysis in several locations in the immature skeleton, including mechanical changes, traumatic changes, apophysitis, tumor changes as osteosarcoma, chondroblastoma and osteoid osteoma, with emphasis on differential diagnosis with local infectious processes such as osteomyelitis, stressing its peculiarities in each location. Features using different imaging techniques will be described and illustrated, dicussing the usefulness of each imaging modality.

**SUMMARY**
Accurate diagnosis of affections involving the apophysis and epiphysis may be helpful to prevent misdiagnosis and inappropriate management, contributing for effective therapy in acute and chronic disorders, which may potentially prevent complications such as growth
arrest, limb shortening and angular deformities.

Musculoskeletal Transplants: What Radiologists Need to Know

**LL-MKE2140**

Jennifer L Favinger, MD
Alice S Ha, MD*
Felix S Chew, MD

**PURPOSE/AIM**
In recent years, use of biologic materials has increased in orthopedic surgery far beyond patellar tendon autografts for ACL replacement. Surgeries now include replacement of whole bones or joints in place of metallic or ceramic prostheses. Studies have shown promising results using these more "natural" materials with potential for improved longevity and function. Upon review of this exhibit, the reviewer will have a better understanding of a variety of orthopedic surgeries using human material (auto- and allograft) and their postoperative appearances on common imaging modalities. The reviewer will also learn about common complications that can occur and their imaging appearances.

**CONTENT ORGANIZATION**
The presentation will be organized from small to large parts that are being transplanted, starting with an osteochondral plug and ending with a whole joint such as a total cadaveric ankle replacement. For each transplant, we will discuss the basic steps of the orthopedic procedure and the typical postoperative imaging appearance. We will also discuss potential complications and associated findings on postoperative imaging.

**SUMMARY**
In-depth understanding of various musculoskeletal transplant procedures and related imaging findings will enable radiologists to recognize complications and communicate with orthopedic colleagues in a more efficient manner.

Got Nerve? Ultrasound Evaluation with MRI Correlation

**LL-MKE2141**

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Jose D Dosal Banuelos, MD
Oskar G Lopez Espinoza, MD
Salvador Arellano, MD
Sergio Rangel, MD
Juliana Benavides, MD
Johnatan Rubalcava Ortega, MD
Jesus A Higuera-Calleja
Griselda T Romero Sanchez, MD
Christian Escalona-Huerta, MD

**PURPOSE/AIM**
- To familiarized with nerve ultrasound assessment in musculoskeletal evaluation - MRI correlation for better understanding of findings - Indications and contraindications of nerve ultrasound

**CONTENT ORGANIZATION**
- Anatomy review - Systematic approach and nerve characteristics - neck - upper extremity - lower extremity - Normal findings and pathology - MRI correlation

**SUMMARY**
- Ultrasound offers a dynamic real-time examination and high spatial resolution in the assessment of peripheral nerves. - Nerve US quantifies and anatomically pinpoints changes in nerve size and echotexture. - Ultrasound is specific and sensitive for compression - MRI has a great soft tissue resolution but US is better for an everyday practice scenario.

Foot Radiographs-More than Ruling Out Fracture: What the Foot Specialists Really Need to Know

**LL-MKE2142**

Stephanie L Coleman, MD, MPH
Susan Walsh
Geoffrey Habershaw
Ali Guermazi, MD, PhD*
Christina A Lebedis, MD
Akira M Murakami, MD

**PURPOSE/AIM**
1. Review the search pattern for foot radiographs.
2. Illustrate the imaging findings on foot radiographs associated with common diagnoses that present in the foot specialists’ clinic.
3. Provide useful and concise differential diagnoses for imaging findings seen with particular clinical symptoms.

**CONTENT ORGANIZATION**
- Overview of the anatomy of the foot on radiographs, including the anatomic alignment of the tarsals, metatarsals, and phalanges.
- Common clinical symptoms and the differential diagnoses of concern.
- Imaging findings of common diagnoses through case examples. These include pes planus, pes cavus, hammer toes, bunion/hallux valgus, tailor’s bunion/bunionette, hallux limitus, hallux varus, stress fractures, osteonecrosis, osteomyelitis, Charcot, Lisfranc injuries, tarsal coalition, and Haglund’s deformity/insertional Achilles tendon pathology.
- Suggestions for concise, clinically appropriate differentials based on radiograph findings.

**SUMMARY**
1. Awareness of common pathology seen by the foot specialists, beyond fracture and dislocation.
2. Understand the anatomy and osseous alignment of the foot to aid in identification and diagnosis of pathology.
3. Become familiar with the imaging findings on foot radiographs to assist the search pattern in evaluating the foot radiograph and creating clinically useful differential diagnoses.

Scapholunate Ligament: Demonstration of Anatomy Using High Resolution 3T MRI and Determination of Instability Using Four-dimensional CT (4D CT)

**LL-MKE2143**

Shadpour Demehri, MD
Sahar J Farahani, MBBS
John A Carrino, MD, MPH*
Avneesh Chhabra, MD*
Jaimie Shores, MD*

**PURPOSE/AIM**
- The presentation will be organized from small to large parts that are being transplanted, starting with an osteochondral plug and ending with a whole joint such as a total cadaveric ankle replacement. For each transplant, we will discuss the basic steps of the orthopedic procedure and the typical postoperative imaging appearance. We will also discuss potential complications and associated findings on postoperative imaging.

**SUMMARY**
In-depth understanding of various musculoskeletal transplant procedures and related imaging findings will enable radiologists to recognize complications and communicate with orthopedic colleagues in a more efficient manner.
Kager's - The Well Known But Poorly Understood Fat Pad

**PURPOSE/AIM**
The purpose of this exhibit is:
1. To review the normal anatomy and fascial planes of Kager's fat pad using a multimodal approach with plain radiography, CT, MRI, and ultrasound.
2. To describe how various pathologic conditions or anatomic variants can alter the appearance of Kager's fat pad on multiple imaging modalities.

**CONTENT ORGANIZATION**
1. Normal anatomy of Kager's fat pad
2. Review of imaging findings:
   - Plain radiography
   - CT
   - MRI
   - Ultrasound
3. Normal anatomic variants altering the appearance of Kager's fat pad
4. Pathologic conditions altering the appearance of Kager's fat pad
5. Sample cases

**SUMMARY**
Major teaching points:
1. Learn normal anatomy of Kager's fat pad on multiple imaging modalities.
2. Learn how anatomic variants and pathologic conditions affecting Kager's fat pad appear on multiple imaging modalities.

Getting the Best from Your Dual Energy Scanner: Recognising, Reducing and Eliminating Artefacts

**PURPOSE/AIM**
Dual energy CT (DECT) is an exciting new tool which can aid the musculoskeletal radiologist in the recognition of gout, trauma and pathology around metal orthopaedic implants. Dual energy CT can reduce traditional beam hardening artefacts, but also has artefacts of its own of which the radiologist must be aware. The exhibit shows how to get the best images from your dual energy scanner, by recognising and reducing such artefacts.

**CONTENT ORGANIZATION**
The theory of DECT
Reduction of beam hardening artefact from orthopaedic implants while sparing soft tissue contrast, using the monoenergetic spectrum.
Recognising artefacts in DECT for gout
Optimising settings for artefact reduction in DECT for gout
Optimising settings for bone edema detection.

**SUMMARY**
With knowledge of the basic artefact types and settings for DECT, the musculoskeletal radiologist can produce images and reports of superior diagnostic quality.

Abnormal Fat: Imaging Review of Lipomas, Liposarcomas, and Unusual Lipomatous Syndromes

**PURPOSE/AIM**
1. To review general features of benign and malignant adipose bone and soft tissue tumors and unusual lipomatous syndromes such as benign symmetric lipomatosis and lipoma arborescens of the knee.
2. To review radiographic findings of benign and malignant adipose lesions and unusual lipomatous syndromes.
3. To demonstrate the common and uncommon imaging appearance of bone and soft tissue adipose masses.

**CONTENT ORGANIZATION**
Benign and malignant adipose lesions of the soft tissues and bones including unusual lipomatous syndromes will be discussed. Keys facts including clinical presentation and imaging findings will be displayed. Examples of common and uncommon benign and malignant adipose tumors from a database of an orthopedic oncologic group at a major academic medical center will be presented.
Fat-containing lesions of the bone and soft tissue are frequently encountered in musculoskeletal radiology. While the majority of lipomatous soft tissue and bone lesions are benign, knowledge of suspicious characteristics of lipomatous tumors is important in exclusion of liposarcoma.

“Gentlemen, We Have the Technologyâ€”A Radiologistâ€™s Guide to Interpreting Complex Limb Reconstruction Post Sarcoma Resection

LL-MKE2147
Paul I Mallinson, MBChB
Clemens Reisinger, MD
Hong Chou, MBBS, FRCR
Paul Clarkson, MBChB
Hugue A Ouellette, MD
Peter L Munk, MD

PURPOSE/AIM
Advances in orthopaedic surgery now allow spectacular reconstructive and limb sparing procedures to be performed on patients who would previously have required debilitating amputations. The resulting post-operative images can be daunting for the radiologist to interpret however, with unfamiliar hardware and distorted anatomy. This exhibit explains the devices involved, the normal post-operative appearances and the complications to be aware of.

CONTENT ORGANIZATION
How to save a life: the challenging locations from which surgeons remove soft tissue and bone sarcomas.
How to save a limb: the devices used to reconstruct the limb, including intraoperative and radiological images. Procedural descriptions include hind quarter amputation, hemipelvectomy, Harrington procedure, crutch prosthesis and other complex reconstructions.
How to save a long-stem prosthesis: examples of hardware complications as they appear on imaging and how to report them including hardware failure, dislocation, infections and collections.
SUMMARY
Understanding the potential and appearances of the hardware in the armamentarium of the sarcoma surgeon allows the radiologist to enhance the value of their pre and post-operative reports and helps to save limbs in the fascinating world of reconstructive orthopaedic surgery.

MRI of Masses in the Hand and Wrist: From Horses to Zebras

LL-MKE2148
Justin Alpert, MD
Robert E Epstein, MD
Puneet Belani, MD

PURPOSE/AIM
The purpose of the exhibit is to:
1. Review the appropriate imaging strategy for masses in the hand and wrist.
2. Present the characteristic imaging appearance of common and rare hand and wrist masses, focusing on MRI.

CONTENT ORGANIZATION
1. Describe the appropriate imaging role in wrist and hand masses.
2. Review the imaging appearance of common masses including cysts, lipomas, hemangiomas, nerve sheath tumors, and giant cell tumor of tendon sheath.
3. Review the imaging appearance of uncommon masses including median nerve fibrolipoma, glomus tumor, myxomas, pseudoaneurysm, and sarcomas.
4. Review processes that mimic tumors.

SUMMARY
The major teaching points of the study will be:
1. Most hand masses are ganglions and do not require advanced imaging.
2. MRI should be reserved for selected cases where the diagnosis remains uncertain.
3. In many cases, but not all, MRI appearance will be characteristic and diagnostic.
4. Musculoskeletal radiologists should be familiar with the appearance of common and rare masses ranging from ganglion to sarcoma.

Imaging of Thoracolumbar Spinal Instrumentation: What Radiologists Should Know

LL-MKE2149
Claudia P Fernandez
Enrique Piera
Maria Vega
Magda Graells
Sonia Munoz

PURPOSE/AIM
Review the different techniques, approaches and devices used in thoracolumbar spinal surgery and performing a correlation with their appearance in different imaging modalities including radiographs, CT and MRI.

CONTENT ORGANIZATION
Spine surgery using different surgical approaches and a wide variety of devices based on the surgical indication (deformities, degenerative disorders, trauma, infection or tumors) and the spinal segment involved. Types of approaches and devices of thoracolumbar spine surgery:
1. Anterior approach and anterior toracolumbar fusion: Plates or sidebars.
2. Posterior approach and anterior toracolumbar fixing: Plates or bars with pedicle screws, Hart Shill Rectangle and Auto expandable screws.
3. Replacement and reconstructive techniques: Intersomatic cage, Corpectomy and replacement with cement, cadaver bone allograft and others replacement devices, Reconstructive surgery.
4. Motion preservation devices:
   • Prosthetic Devices as Intervertebral disc arthroplasty, partial disc replacement.
   • Stabilization Devices as interspinous spacers, dynamic pedicle screw device.

SUMMARY
The radiologist must know the techniques, approaches and devices used in spinal surgery and new dynamic stabilization devices. The knowledge of the normal findings, allow us to recognize complications.

Chondromyxoid Fibroma: A Mimicker Lesion of Bone

LL-MKE2150
PURPOSE/AIM
To review all histologically proven cases of CMF from the consultation records of two senior orthopedic pathologists spanning >50 years (1959-2012).

CONTENT ORGANIZATION
Imaging was available in 96 of 109 cases of CMF (72 CR, 29 CT, 29 MRI). The commonest presenting age was the first decade of life (23%) with wide age range (3-83 years). 56% were male. Common locations were tibia (n=20, 18%), ilium (n=17, 16%), and femur (n=15, 14%). Location within long bones was intramedullary (n=35, 80%) or on the surface of bone, including juxtacortical and subperiosteal lesions (n=10, 22%). 60% (n=65) presented with pain. Observed radiographic and CT features were: lytic lesion (100%), sclerotic rim (80%), cortical erosion (70%), internal septation (41%), and matrix calcification (18%). MRI features were T2 hyperintensity (100%), homogenous appearance (n=19, 66%), heterogeneous appearance (n=10, 34%), and aggressive features including cortical destruction and soft tissue extension (n=10, 34%). 35 lesions underwent curettage (53%) and 31 were resected (47%) and at least 9 lesions recurred.

SUMMARY
CMF is a benign cartilage lesion of bone with characteristic but nonspecific imaging features, with appearance ranging from small, nonagressive homogenous lesions to large, heterogeneous lesions with soft tissue extension. Rare surface subtype exists.

US Evaluation of the Brachial Plexus: Make It Easy

PURPOSE/AIM
1. To illustrate and describe the normal sonographic anatomy of the brachial plexus and relationships with adjacent muscles, vessels and bony landmarks
2. To describe the technique and tips how to perform a sonographic study to facilitate the accurate evaluation of brachial plexus

CONTENT ORGANIZATION
1. Normal anatomy of the brachial plexus
2. How to perform a sonographic evaluation of the brachial plexus
   - General considerations: patient position, probe approach technique and tips
   - Normal anatomy and relationships with adjacent muscles, vessels and bony landmarks: correlates US appearance with a schema
   - Roots, Trunks, Divisions, Cords, Branches

SUMMARY
Brachial plexus imaging is a major challenge to any radiologist due to its complex anatomy and technical difficulty in the acquisition of images. Ultrasound is a useful first approach for the evaluation of brachial plexus. Awareness of the normal anatomy and relationships with adjacent structures facilitate the accurate sonographic evaluation of brachial plexus.

Everything You Should Know about the Navicular Bone

PURPOSE/AIM
1. To review the normal bony, ligamentous and vascular anatomy of the navicular bone and its association with adjacent structures of the midfoot.
2. To also, review the common variations and various abnormalities of the navicular bone.

CONTENT ORGANIZATION
1. Basic anatomy of the navicular bone (including skeletal, ligamentous and arterial anatomy).
2. Accessory navicular bone: Os tibiale externum, accessory navicular bone, cornuate navicular.
3. Fractures of the navicular bone: Cortical avulsion fractures, tuberosity avulsion fractures, body fractures, stress fractures.
4. Displacement of the navicular bone.
5. Tarsal coalition involving the navicular bone: talonavicular coalition, naviculocuboid coalition, naviculocuneiform coalition.

SUMMARY
The navicular bone plays a unique role in distributing the body weight evenly across the foot by forming the medial longitudinal arch, which is the longest and the highest among three. To prevent future dysfunction of the foot, prompt diagnosis and appropriate management of the navicular bone abnormalities is essential. Thereby, it is necessary for the radiologist to be familiar with the normal anatomy and the various conditions of the navicular bone.

Unraveling the Complexity of Thumb Carpometacarpal and Metacarpophalangeal Joints on 3T MR

PURPOSE/AIM
Demonstrate the 3T MR imaging anatomy of the thumb with attention to carpometacarpal (CMC) and metacarpophalangeal (MCP) joints.

CONTENT ORGANIZATION
3T MR imaging protocol of the thumb is reviewed. A systematic approach to interpretation of thumb MR is presented. At the CMC joint, the focus is on the posterior oblique ligament, intermetacarpal ligament, dorsal radial ligament, and abductor pollicis longus tendon. At the MCP joint, the focus is on the ulnar collateral ligament, adductor aponeurosis, and radial collateral ligament. After the CMC and MCP joints, the...
following tendons are evaluated: flexor pollicis longus, extensor pollicis longus, extensor pollicis brevis, abductor pollicis brevis, and flexor pollicis brevis. Finally, attention is directed to pulleys and volar plates. Multiple examples of thumb injuries are contrasted with normal MR anatomy.

**SUMMARY**

Imaging of the thumb using 3T MR allows comprehensive evaluation of carpometacarpal (CMC) and metacarpophalangeal (MCP) joints.

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**Spinal Infectious Diseases: MR Imaging Findings and IVR Management**

**PURPOSE/AIM**

The purpose of this exhibit is:

1. To review the anatomy of spine
2. To review the pathophysiology of various spinal infections
3. To demonstrate of the MRI findings in the each spinal infectious diseases
4. To discuss the management for each diseases

**CONTENT ORGANIZATION**

1. Anatomy of spine
2. Pathophysiology of the various spinal infections
3. Review of MRI findings
   - Difference adult from young patients
   - Pyogenic discitis, spondylitis
   - Tuberculous spondylitis
   - Pyogenic facet arthritis
   - Psoas abscess
   - Epidural abscess
   - Differential diagnoses
4. Learn for IVR management

**SUMMARY**

The major teaching points of this exhibit are:

1. Pyogenic spondylitis can be shown various MR findings from early acute stage to healing stage.
2. Differentiation form pyogenic and tuberculous is able to discuss MR imaging, however sometime it's difficult.
3. Pyogenic facet arthritis is rare.
4. Suitable IVR management based from MR imaging should be perform as soon.

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**Ultrasound of the Elbow with Emphasis on Detailed Assessment of Complex Structures; Technique and Anatomical Correlation**

**PURPOSE/AIM**

1. To discuss the ultrasound anatomy of more complex structures and areas of the elbow, with MR and cadaver correlation.
2. To discuss ultrasound technique and tips and tricks for assessment of these clinically relevant complex structures.

**CONTENT ORGANIZATION**

1. Medial ligament complex:
   - Anterior and posterior band
2. Lateral ligament complex:
   - Radial collateral ligament, annular ligament, and LUCL
   - Ultrasound tricks for visualization of the different components
3. Lateral extensor tendon complex
   - Tubercles of the humeral epicondyle with origins of ECRL, ECRB, and ED
4. Distal biceps tendon
   - Lacertus fibrosus
   - Bifid biceps tendon identification
5. Radial nerve
6. Ulnar nerve
   - Ultrasound aspect of the PIN and arcade of Frohse
   - Compression points (ECRB, Frohse, leash of Henry)
7. Median nerve
   - Topography of median nerve ('BAM' sign) and AIN
   - Compression points (Lacertus fibrosus, pronator, sublimus bridge)

**SUMMARY**

1. Certain aspects of elbow US are more difficult and require a more advanced understanding of ultrasound anatomy.
2. These more complex structures include the collateral ligaments, extensor origins, distal biceps, and nerves and their compression areas.

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**Current Concepts in the Diagnosis, Classification and Management of Distal Radius Fractures and Their Associated Injuries**

**PURPOSE/AIM**

1. To discuss the ultrasound anatomy of more complex structures and areas of the elbow, with MR and cadaver correlation.
2. To discuss ultrasound technique and tips and tricks for assessment of these clinically relevant complex structures.

**CONTENT ORGANIZATION**

1. Medial ligament complex:
   - Anterior and posterior band
2. Lateral ligament complex:
   - Radial collateral ligament, annular ligament, and LUCL
   - Ultrasound tricks for visualization of the different components
3. Lateral extensor tendon complex
   - Tubercles of the humeral epicondyle with origins of ECRL, ECRB, and ED
4. Distal biceps tendon
   - Lacertus fibrosus
   - Bifid biceps tendon identification
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6. Ulnar nerve
   - Ultrasound aspect of the PIN and arcade of Frohse
   - Compression points (ECRB, Frohse, leash of Henry)
7. Median nerve
   - Topography of median nerve ('BAM' sign) and AIN
   - Compression points (Lacertus fibrosus, pronator, sublimus bridge)

**SUMMARY**

1. Certain aspects of elbow US are more difficult and require a more advanced understanding of ultrasound anatomy.
2. These more complex structures include the collateral ligaments, extensor origins, distal biceps, and nerves and their compression areas.
To update the role of different imaging methods in the assessment of distal radius fractures (DRF) and their associated injuries.

To briefly review arthroscopic and surgical procedures in the treatment of DRF.

**CONTENT ORGANIZATION**
1. Anatomy. 2. Imaging methods. 3. Fracture classification. 4. Associated injuries. 5. Complications. 6. Treatment

**SUMMARY**
Distal radius fractures (DRF) account for 20% of all fractures. Secondary anatomical disturbances can result in degenerative osteoarthritis and wrist dysfunction. Preoperative planning based on X-ray and MDCT is essential for assessing the tridimensional anatomy of the fracture and to define precisely the articular fragmentation patterns. Both extra and intra-articular DRF have a high incidence of associated lesions: osseous (scaphoid and other carpal fractures), chondral and soft-tissue injuries such as TFCC tears or ligament damage (mainly scapholunate ligament tear). When overlooked, they often lead to more problems than the fracture itself. MRI is a useful tool in their preoperative evaluation and their secondary complications. Arthroscopically-assisted reduction of articular fractures is the treatment of choice in articular DRF, minimizing complications and maximizing the chance for successful outcome. Our experience based on over 300 distal radius fractures treated arthroscopically is presented.

**Ultrasound (US)-guided Fusion Imaging-assisted Facet Joint Injections: A Didactical Approach**

**PURPOSE/AIM**
The purpose of our educational exhibit is to describe a detailed systematic technique for performing an intra-articular facet joint injection using a GPS-driven fusion-imaging assisted ultrasound (US) technique.

**CONTENT ORGANIZATION**
Traditionally, facet joint injections are performed under fluoroscopic or CT guidance, mainly due to the deep anatomical location and the presence of bony landmarks. Fusion imaging technology, which couples the US scan with the corresponding CT or MR image obtained from the diagnostic examination and reformatted in real time according to the US scanning plane, can help in accurately guiding US in the performing of such procedure and avoids the use of ionizing radiations.

All the steps of the procedure will be explained with the support of anatomical schemes and a step by step guide on how to perform an intra-articular joint facet injection with the guidance of CT/MR and US fusion imaging.

**SUMMARY**
US needle guidance with MR or CT fusion assistance allows for safe and effective injection of degenerative facet joint disease.

**Four-dimensional Computed Tomography Imaging of the Subtalar Joint Complex**

**PURPOSE/AIM**
To assess the feasibility of using the 320-MDCT for the obtention of four-dimensional (4D) imaging of the ankle-subtalar complex. To learn the technical aspects involved in using the 320-MDCT to analyze subtalar kinematics during the motion in the oblique plane (pronation and supination). To visualize bone motion and changes in subtalar joint throughout the motion cycle in a closed kinematic chain motion. To compare the kinematics of subtalar joint during closed and open kinematic chain motion.

**CONTENT ORGANIZATION**
A. Technical parameters used in 320-detector row MDCT. B. Analysis of subtalar joint kinematics moving along the sagittal plane of motion (supination and pronation). C. Description of kinematics in subtalar joint throughout the motion cycle in a closed kinematic chain motion. D. To summarize the abnormal subtalar joint kinematics of chronic ankle instability.

**SUMMARY**
Four-dimensional computed tomographic imaging is a valuable diagnostic tool to assess subtalar joint. The major teaching points include: To describe the normal subtalar joint kinematics when the ankle moves along the sagittal plane of motion. To provide the basis for comparison between healthy and pathological, i.e. chronic ankle instability, subjects. To detect subtle motion abnormalities that help to characterize the different types of chronic subtalar joint instability.

**How We Do It: Interdigital US Guided Alcohol Injection of Morton’s Neuroma; Single Operator Technique with Web Space Compression**

**PURPOSE/AIM**
1. Provide an overview of treatment options for Morton’s neuroma.
2. Present an US guided injection technique we developed: Interdigital single operator technique with web space compression

**CONTENT ORGANIZATION**
1. Diagnosis of Morton's neuroma. US and MR
2. Treatment of Morton’s neuroma: advantages and drawbacks, complications.
   a. Conservative
   b. Surgical
   c. Injection techniques (corticosteroids, alcohol)
   d. RF ablation
3. Previously described injection techniques a. Blind technique without US guidance
   b. Dorsal injection with dorsal sagittal probe position (1 operator)
   c. Interdigital injection with dorsal transverse and sagittal probe position (2 operators)
4. How we do it: Single operator technique with webspace compression and interdigital injection
   a. 2nd webspace: dorsal or plantar sagittal probe position
   b. 3th webspace: dorsal sagittal probe position
c. 4th webspace: plantar sagittal probe position
d. Description of plantar and dorsal approach
e. Importance of webspace compression
5. Preliminary experience, complications

SUMMARY
1. Interdigital alcohol injection with webspace compression is a straightforward technique that can be performed by a single operator.
2. Dorsal or plantar probe positioning should be tailored to the anatomy of the affected webspace.

Uncommon Fluoroscopic Interventions around the Hip and Shoulder

Purposed/Aim
Fluoroscopic guidance for therapeutic administration of anesthetics and steroids around the hip and shoulder is gaining in popularity. Our purpose is to review some of the less common interventions.

Content Organization
Around the hip, we discuss piriformis, obturator internus (pudendal), and ischiofemoral space injections. Around the shoulder, we discuss suprascapular notch and quadrilateral space injections. For each type of injection, we discuss indications and contraindications, show our methodology including patient positioning and use of anatomic landmarks, and describe potential complications.

Summary
Uncommon procedures around the hip and shoulder can be performed safely with fluoroscopic guidance.

The Metal-fade Sign: A New Sign of Metallosis

Purpose/Aim
The purpose of this exhibit is: 1. To explain what metallosis is 2. To mention general concepts of its pathophysiology 3. To describe the imaging appearances of metallosis, emphasizing a new and not commonly observed sign called the metal-fade sign.

Content Organization
Definition of Metallosis Pathophysiology Clinical Manifestations Review of the imaging findings (Radiography, CT and MRI)

Summary
The major teaching points of this exhibit are: 1. Metallosis is a new and not commonly observed sign called the metal-fade sign. It is usually observed in patients with metallosis due to spinal instrumentation.

Pudendal Nerve Infiltration under CT Guidance: From Diagnosis to Interventional Treatment

Purpose/Aim
Pudendal neuralgia is a rare but painful condition. It is a disabling condition and eventually becomes unresponsive to various non-invasive specific medications and therapies. Good anatomical knowledge of pudendal nerve and pelvis is mandatory for a safe and effective procedure. The objective is to describe the prerequisites necessary in order to be able to perform a safe and effective infiltration of the pudendal nerve under CT-guidance.

Content Organization
The exhibit will review clinical features of pudendal neuralgia and depict anatomical requirements mandatory to a successful pudendal nerve infiltration at two conflicting sites. We will review cases of accurate and inaccurate needle tip placements on target sites and both outcomes and pitfalls of the procedure. After viewing the exhibit, the viewer with basic knowledge of non-vascular intervention, should be able to have a good understanding on how to perform the procedure.

Insertions and Bursa of the Distal Semimembranosus: Ultrasound and MR with Anatomic Correlation

LL-MKE2164
Michel De Maeseneer, MD
Cedric Boulet
Annemieke Milants
Mimoun Kichouh, MD
Johan De Mey
Maryam Shahabpour, MD
Erik Cattrysse

Purpose/Aim
1. Describe the anatomy of the distal semimembranosus insertions and bursa on US and MR, with cadaveric correlation.
2. Discuss visualization of the different components of the semimembranosus on US and MR.
3. Describe US technique, and imaging planes on MR for optimal visualization of the distal semimembranosus, and describe imaging pitfalls with both techniques.

Content Organization
1. US and MR appearance of the insertions of the distal semimembranosus, with anatomic correlation.
   - Direct arm
   - Anterior arm
   - Inferior arm
   - Oblique popliteal ligament arm
   - Posterior oblique ligament arm
   - Meniscal arm
   - Oblique popliteal ligament
   - Posterior oblique ligament
   - Pes anserinus tendons
3. Anatomy and imaging of the semimembranosus bursa.
4. US Technique - Identification of the different insertions by medial, and posterior approach.
5. MR Technique - Visualization of components in the different imaging planes.

Summary
1. The anatomy of the distal semimembranosus is more complex than usually thought, and several insertions are present.
2. The insertions can be visualized on US and MR imaging. Correct assessment is clinically relevant since injuries cause anteromedial rotatory instability.

Superficial Bone Tumors and Mimickers: Going underneath the Surface

LL-MKE2165
Eduardo Baptista, MD
Paulo Victor P Helito, MD
Hugo P Costa
Paulo Eduardo Daruge Grando, MD
Eduardo N Kihara Filho, MD
Marcelo Bordalo-Rodrigues, MD
Giovanni G Cerri, MD, PhD

Purpose/Aim
Describe bone surface anatomy and diagnosis of tumors and pseudotumors occurring at bone surface; considering tissue, morphologic and topographic characteristics of each.

Content Organization
1. Review bone surface anatomy and applied terminology
2. Discuss bone surface tumors locoregional staging
3. Osteoid, chondroid, cystic and fatty tumors MRI characteristics
4. Classification of osteoid surface tumors with imaging characteristics correlated with macroscopic and histological evaluation
5. Classification of chondroid surface tumors imaging characteristics correlated with macroscopic and histological evaluation
6. Cortical outer surface tumors: parosteal lipoma, osteoid osteoma
7. Mimickers: florid reactive periostitis, bizarre parosteal osteochondromatosis, subperiosteal tibial cyst, myositis ossificans
8. Conclusion

Summary
Superficial bone tumors are a group of neoplasms arising from juxtacortical connective tissues, periosteum or cortical outer surface, that is composed by many different histologic subtypes. Some of these tumors have malignant potential, as those producing cartilage or bone. Other well known lesions are lipomas, osteoid osteoma, myositis ossificans and Nora's lesion. This presentation will illustrate and review the main features of these tumors and its mimickers, as well as their imaging spectrum with a multimodality approach.

Latissimus Dorsi Transfer in Reverse Delta III Total Shoulder Replacement - What the Radiologist Needs to Know

LL-MKE2166
Imre Vasvary, MD
Matthias W Meissnitzer, MD
Thomas Meissnitzer, MD
Reinhold Ortmaier
Martina Blocher
Christoph Sattler
Klaus Hergan, MD

Purpose/Aim
We try to answer the following questions: When is a reverse delta III total shoulder replacement indicated and why is latissimus dorsi transfer important for the patient's mobility? What is vital for the radiologist to know and what are clinical aspects? Which imaging modalities will help and which will fail to answer certain queries?

Content Organization
The reverse delta III total shoulder replacement with latissimus dorsi transfer is performed in patients with irreparable rotator cuff tears to improve the range of motion and especially external shoulder rotation. Our intent is to review: Indications for this procedure. Postoperative anatomy and biomechanics Imaging anatomy in US and MRI. Best imaging modalities (ultrasound versus MRI) Techniques to find and evaluate the transferred latissimus tendon. Evaluate postoperative complications such as rupture of the transferred tendon.

Summary
Latissimus dorsi transfer in reverse delta III total shoulder replacement is a well established method for the treatment of massive irreparable rotator cuff tears. Our exhibit summarizes postoperative anatomy and imaging findings in ultrasound and MRI.
Indirect Signs from MRI That Might Help You to Diagnose Posterior Tibial Tendon (PTT) Dysfunction

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Hamilton Guidorizzi, MD
Andre Y Aihara, MD
Henrique Metzger, MD
Enio R Silva E Silva, MD
Alberta A Diniz, MD
Yudell Edelstein, MD
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Andres H Pena, MD
James Shin, MD
Choo-Won Kim, MD
Yudell Edelstein, MD
Ty K Subhawong, MD

PURPOSE/AIM
PTT dysfunction is a common disease and affects mostly women aged more than 50 years. However, it has been misdiagnosed on MRI. Our purpose is to emphasize the indirect signs at MRI that could make an early recognition and intervention preventing progression to a flatfoot deformity.

CONTENT ORGANIZATION
1. Illustration of different types of foot and ankle hardware, their design rationale and surgical indications.
2. Review of expected postoperative changes and pitfalls on different imaging modalities including CT and MRI.
3. Cases of different postsurgical complications (including hardware fracture/loosening, particle disease, infection, intraoperative instrumentation breakage, nonunion, scarring with neuritis, and avascular necrosis) with pertinent imaging findings on different modalities including CT and MRI.
4. Imaging pitfalls
5. Differential Diagnosis

SUMMARY
This exhibit will allow viewers to become familiar with different surgical hardware commonly used in the foot and ankle, to confidently identify postsurgical complications, and to provide comprehensive report with pertinent findings that will aid orthopedic/pediatric surgeons in managing these complications.
foot, and then enhance the life quality of the affected population.

**MR Imaging of Proximal Sciatic Anatomy and Neuropathies**

**LL-MKE2171**
Marcio W Chu, MD
Marcelo N Simao, MD
Dayse R Bertinetti
Paulo M Agnolitto, MD
Rodrigo A Oliveira, MD
Alice Duarte, MD
Everaldo Gregio-Junior
Natalia P Ito
Maximilian J Kobayashi, MD
Marcello H Nogueira-Barbosa, MD, PhD

**PURPOSE/AIM**
To review the proximal sciatic anatomy. To illustrate several distinct causes of sciatic neuropathy.

**CONTENT ORGANIZATION**
Relevant anatomy for sciatic MRI studies and MR neurography. Review of the main imaging findings of sciatic neuropathy. Case series with illustration of multiple causes of sciatic neuropathy and cases of several regional and systemic diseases with sciatic nerve involvement. Sciatic neuropathy from congenital, tumoral, pseudotumoral, post-traumatic, actinic, post operatory, inflammatory and other causes will be discussed.

**SUMMARY**
The major teaching points of this exhibit are: To review the proximal sciatic anatomy from the nerve roots to sciatic foramen. To broaden MR differential diagnosis in sciatic neuropahties.

**Tibialis Posterior Dysfunction - Diagnosis, Imaging and Treatment**

**LL-MKE2172**
An T Ngo, BMBS, MRCP
Monica Khanna, MBBS, FRCR
Noelene Davey
Peter Rosenfeld

**PURPOSE/AIM**
- To review the anatomy of the medial longitudinal arch of the foot and the importance of the tibialis posterior tendon in the normal foot, with emphasis on its involvement in the development of an acquired flatfoot.
- To discuss diagnosis and imaging of tibialis posterior dysfunction.
- To review current management approaches with emphasis on the protocol utilized at our institution.
- To discuss novel management approaches.

**CONTENT ORGANIZATION**
- Anatomy of the medial longitudinal arch of the foot.
- Pathophysiology of tibialis posterior tendon dysfunction and the development of flatfoot.
- Classification and staging of tibialis posterior dysfunction.
- Our departmental management protocol.
- Imaging findings:
  - Plain film
  - Ultrasound
  - MRI
  - Ultrasound guided treatment options.

**SUMMARY**
On viewing the exhibit, the reader will: - Develop a sound understanding of the anatomy underpinning the medial longitudinal arch of the foot. - Appreciate the role of imaging in diagnosis, staging and guiding treatment of posterior tibialis tendon dysfunction. - Review the ultrasound guided injection techniques in its management.

**Assessment Musculoskeletal Diseases in the Daily Practice with in and out Phase: How This MRI Technique Could Help?**

**LL-MKE2173**
Flavia M Costa, MD
Juliana P Andrade, MD
Clarissa Canella, MD
Silvana M Mendonca
Pedro H Martins, MD

**PURPOSE/AIM**
To recognize chemical shift artifact present in many different MSK pathologies facilitating the diagnosis and differentiating tumoral from non tumoral lesions using in conjunction with conventional MR images in the daily practice.

**CONTENT ORGANIZATION**
- To illustrate the usefulness of In and Out phase sequence, together with conventional MR images in the differential diagnoses of many MSK pathologies, specially differentiating tumoral from non tumoral lesions and to correlate with clinical, radiological and computed tomography findings.
- To identify hemangiomas or vascular malformation
- Differentiate osteoporotic vertebral collapse from malignant ones
- To differentiate osteoid osteoma from brodie abscess
- Useful in delineating the boundary of osseous tumors differentiating surrounding edema from neoplastic infiltration and assessment the response to treatment
- Differentiate hematopoietic medula from diffuse osseous neoplasic infiltration

**SUMMARY**
In and Out phase MRI is an extremely useful sequence that can be used to assess for the presence of fat and water in a voxel of tissue. It could provide some information, which is not possible to obtain with conventional images. It can be used with conventional MR sequences to facilitate the diagnosis of many MSK pathologies. The routinely use of this sequence could improve the diagnosis of many MSK lesions.

**Chopart Sprains: Sentinel Signs That Avoid Overlooking**

**LL-MKE2174**
Michelle Rosemberg, MD
Adriana M Oliveira, MD
Hamilton Guidorizzi, MD
Improves Trainee Procedural Skills

Spine Procedure Simulation System Made with Anatomic Spinal Model and Ballistics Grade Gelatin to Simulate Soft Tissue

There has been a recent surge of interest in medical and procedural simulation technology. Simulators have been shown effective in improving performance and psychomotor skills in a variety of situations, including laparoscopic surgery. Previous attempts in spinal procedure simulation have used a beef model and phantoms which resulted in increased speed and accuracy with decreased fluoroscopy times. Using a commercially available spinal model and homemade ballistics gelatin, we constructed an anatomically accurate representation of the lumbar spine that could be used to practice spinal procedures. The model was used by trainees to gain procedural

Imaging of Iatrogenic Peripheral Nerve Injuries after Pelvic Surgery

To demonstrate the most common imaging findings in patients with peripheral nerve injuries in the pelvic region after surgery with focus on the sciatic, inferior gluteal and pudendal nerve.

CONTENT ORGANIZATION
1) Describe normal nerve related anatomy of the pelvis.
2) Review of imaging findings: e.g.: muscle denervation patterns and typical morphologic presentation of injured peripheral nerves in US and MRI.
3) Review of imaging techniques of high resolution ultrasound and MRI.
4) Describe surgeries most likely to cause peripheral neurologic sequelae in the pelvic region.
5) Present sample cases and mimics/artifacts.
6) Proposing an imaging protocol.

SUMMARY
The major teaching points of this exhibit are: 1) Recognize specific patterns of muscle edema, e.g.: hyperintense signal/denervation edema of the gluteus muscle caused by injury of the inferior gluteal nerve.
2) T2w hyperintensity of the pudendal and sciatic nerve constitutes for edema.
3) Combined use of high resolution ultrasound and MRI allows early diagnosis.

Clinical and Imaging Features of Heterotopic Ossification and Myositis Ossificans Following Trauma to the Brain and Spinal Cord: A Pictorial Review

Purposes/Aims
1. Review the pathophysiology of heterotopic ossification (HO) and myositis ossificans (MO) following traumatic brain injury (TBI) and spinal cord injury (SCI).
2. Discuss the value of imaging modalities (plain films, CT, MR, scintigraphy) in evaluation of HO and MO.
3. Illustrate key imaging features in the natural history of heterotopic bone formation.
4. Review treatment strategies for HO and MO, including medical management and surgical excision.

CONTENT ORGANIZATION
1. Anatomical distribution, pathophysiology and risk factors for HO and MO post-TBI and SCI.
2. Correlation of clinical/biochemical characteristics with radiological features from various imaging modalities for HO and MO diagnosis.
3. Illustration of the accelerated nature of callus and HO formation (within days-weeks).
4. Effect of therapy on radiological appearance of ectopic bone.
5. Factors involved in post-therapeutic recurrence.
6. Case Examples.

SUMMARY
1. Imaging plays a key role in facilitating early diagnosis of HO and MO and timely initiation of therapy.
2. Following TBI, HO most commonly affects the hips, shoulders, elbows and knees.
3. Rate of appearance of HO and MO on imaging varies with time post-TBI.
4. Delayed therapeutic intervention, in particular excision of hip HO, may be associated with severe peri-operative complications and poor functional outcomes.

Spine Procedure Simulation System Made with Anatomic Spinal Model and Ballistics Grade Gelatin to Simulate Soft Tissue Improves Trainee Procedural Skills

PURPOSE/AIM
Radiology trainees have traditionally learned how to perform image-guided spinal procedures, including epidural injections, nerve root blocks, and facet injections, on patients in fluoroscopy or CT suites. This teaching method is inefficient and suboptimal for patient care. There has been a recent surge of interest in medical and procedural simulation technology. Simulators have been shown effective in improving performance and psychomotor skills in a variety of situations, including laparoscopic surgery. Previous attempts in spinal procedure simulation have used a beef model and phantoms which resulted in increased speed and accuracy with decreased fluoroscopy times. Using a commercially available spinal model and homemade ballistics gelatin, we constructed an anatomically accurate representation of the lumbar spine that could be used to practice spinal procedures. The model was used by trainees to gain procedural
experience as well as to monitor improvements in their procedural ability.

CONTENT ORGANIZATION
1. Model components and construction
2. Anatomy and simulated procedures
3. Trainee testing and practice
4. Outcomes
5. Summary

SUMMARY
The creation and usefulness of a spinal model for simulating spine procedures is presented. This exhibit will review:
1. Model creation
2. Examples of model use
3. Training outcomes

Clinical and Imaging Correlation of Lymphatico-vascular Malformations in Extremities

LL-MKE2178
Jong Woon Song
In Sook Lee
Se Kyung Park
Yong Chan Bae
Hoon Soo Kim
Kyeongho Song

PURPOSE/AIM
to know exact nomenclatures and classifications of lymphatico-vascular malformations correlating with clinical findings and the role of imaging tools in these cases.

CONTENT ORGANIZATION
The role of capable imaging tools
Nomenclatures and classifications
- Hemangioma of infancy with regression or involuted state
- Verrucous hamangioma
- Venous malformation
- Capillary malformation
- Capillary and venous malformation
- Arteriovenous malformation
- Lymphatic malformation
- Lymphangioma circumscripturn
- Klippel-Trenaunay syndrome
- Telangiectasia
Soft tissue masses mimicking vascular malformations or vascular malformations mimicking soft tissue masses
Treatment indications and methods

SUMMARY
The use and knowledge of clinically correlated nomenclatures and classifications in the cases of lymphatico-vascular malformations may affect radiologists to perform imaging modalities and to treatment planning.

Putting Your Foot Down: The Role of Imaging in Diagnosis and Management of Common Foot Injuries in Football Players

LL-MKE2179
Daniel K Holt, MD
Courtney H Bradenham, MD
Michael V Friedman, MD
Jonathan C Baker, MD *
Daniel E Wessell, MD, PhD *

PURPOSE/AIM
Foot injuries are common in football players at all skill levels. These injuries can lead to loss of playing time, impaired performance after returning to play and potential long term morbidity. This presentation will:
1. Familiarize the reader with clinically important forefoot, midfoot, and hindfoot injuries seen in football players
2. Illustrate key imaging findings
3. Highlight relevant anatomy, injury mechanisms, pitfalls, and how imaging influences clinical management of these injuries

CONTENT ORGANIZATION
- Review pertinent normal anatomy, including the plantar plate and transverse arch of the foot along with the LisFranc joint
- Illustrate key imaging findings from an instructive set of cases including turf toe/plantar plate injuries, LisFranc ligament pathology/midfoot sprain, fracture, stress fracture, and miscellaneous soft tissue injuries
- Discuss the role of various imaging modalities in determining diagnosis and directing clinical management

SUMMARY
Football players commonly sustain foot injuries during practice and games. Familiarity with these conditions and their imaging features enables the radiologist to play a crucial role in timely and accurate diagnosis, prognosis, and optimal clinical management.

The Hip Labrum: Anatomy, Normal Variants, and Labral Tears

LL-MKE2180
Tatum A Mcarthur, MD
D. Dean Thornton, MD
David C Gerhardt, MD
Benton Emblom, MD

PURPOSE/AIM
Purpose/Aim: 1. To review the anatomy and function of the acetabular labrum and distinguish anatomic variants from labral pathology. 2. To review the MRI imaging of the normal acetabular labrum and the imaging features of labral tears. 3. Discuss conditions predisposing high-level athletes to labral tears with attention to cam-type femoroacetabular impingement. 4. Discuss management of labral tears.

CONTENT ORGANIZATION
Content Organization: 1. Discuss the anatomy and function of the acetabular labrum and distinguish anatomic variants from labral pathology. 2. Review the MRI imaging of the normal acetabular labrum and the imaging features of labral tears. 3. Review conditions predisposing high-level athletes to labral tears with attention to cam-type FAI. 4. Review MRI cases of labral tears in high-level athletes. 5. Discuss non-surgical and surgical management of labral tears, including intraoperative video of arthroscopic labral repair and femoroplasty.
SUMMARY

Conclusion/Summary: Labral tears are a common source of hip pain in athletic patients. Optimal imaging using MR arthrography is essential in evaluating the acetabular labrum. An understanding of normal labral anatomic variants, labral tear patterns, and associated conditions such as cam-type femoroacetabular impingement leads to accurate diagnosis and appropriate treatment.

Anatomical Variations of the Posteromedial Process of Talus as Potential Cause of Pain and Tarsal Tunnel Syndrome

LL-MKE2181
Henrique Metzger, MD
Vanessa M Finato, MD
Carlos H Longo, MD
Andre Y Aihara, MD
Hamilton Guidorizzi, MD
Andre Rosenfeld, MD

PURPOSE/AIM
Posteromedial Talar Process Anatomical Variations are uncommon, but not so rare. They might be an asymptomatic isolated finding or be associated with flexor hallucis longus tendinopathy, tarsal tunnel syndrome and other pathological entities. Up to now there are only few studies in subspecialized journals trying to explain the importance of these alterations and sometimes the requirement of a more aggressive approach. The purpose of this study is to reinforce the importance of these anatomical variations and show aspects that may help us not to miss these findings in our MRI interpretations.

CONTENT ORGANIZATION
• Anatomy review of the posteromedial ankle.
• Review of variations of the posteromedial process of talus.
• To postulate a causative mechanism of pain related to these variations.
• Differentiation of symptomatic and asymptomatic variations.
• Differential and associated diagnoses.
• Sample cases.

SUMMARY
Since they’re uncommon and not very well known, anatomical variations of posteromedial processes of talus may be misdiagnosed or under diagnosed, leading to inappropriate treatment. A better knowledge and attention dispensed to this region, in specific cases, can show this potential source of pathology and pain.

Accessory Tendons of the Ankle: Can You Have too Much of a Good Thing?

LL-MKE2182
Geoffrey M Riley, MD
Kwai-Wah Tung, MD
Kathryn J Stevens, MD

PURPOSE/AIM
1) To review the more common muscular and tendinous anatomic variants of the foot and ankle and how they can result in pathological conditions. 2) Highlight reproducible methods of detecting these variants.

CONTENT ORGANIZATION
A large number of anatomic variants have been described in the lower extremity, many of which are asymptomatic. On the other hand, anatomic variations can predispose to soft tissue impingement, neurovascular compromise, and other pathological conditions. The exhibit will demonstrate a systematic method of detecting the variants most commonly related to pathology. This will be achieved by providing side-by-side comparisons with normals and highlighting key anatomic landmarks to add to one's search pattern.

SUMMARY
Normal anatomic variants are common around the foot and ankle. This exhibit will highlight the significance of these anatomic variants, the potential pathology that can ensue, and how to systematically identify them.

Aseptic Lymphocytic Vasculitis-associated Lesions (ALVAL): Radiological Findings

LL-MKE2183
Orla Doody, MBCh
Sumit Karia, MBBS, MRCP
Melanie A Hopper, MBBCh, FRCR

PURPOSE/AIM
The purpose of this exhibit is 1. To review the clinical presentation of complications relating to metal on metal prostheses. 2. To outline the radiological evaluation of aseptic lymphocytic vasculitis associated lesions (ALVAL) occurring secondary to metal on metal hip prostheses.

CONTENT ORGANIZATION
Clinical presentation of symptomatic metal on metal hip prostheses. Pathophysiology of ALVAL. Key plain radiographic findings Optimisation of imaging with metal artefact reduction sequences Pictorial review of ALVAL related complications on MRI. Alternative diagnosis unrelated to the prostheses.

SUMMARY
The major teaching points of this exhibit are 1. Optimisation of metal artefact reduction sequences is essential to evaluate metal on metal prostheses. 2. As radiologists we need to interpret the significance of the imaging features of ALVAL and evaluate for alternative pathology in these patients.

All about 'Gout ' in Radiography, US, MRI and Dual Energy CT. What a Radiologist Needs to Know

LL-MKE2184
Maria Gonzalez Vazquez
Maria Costas, MD
Raquel Prada, MD
Ariana C Bustos Fiore, MD
Francisco Tardaguila Montero, MD

PURPOSE/AIM
The purpose of this exhibit is: 1. To review the pathophysiology of gout. 2. To explain the different forms and locations of gout. 3. To describe the radiologic findings of gout in US, MRI and dual energy CT images. 4. To differentiate gout from other pathologies.

CONTENT ORGANIZATION
- Pathophysiology of gout. - Different forms and locations of gout. - Review of imaging findings in radiography, US, MRI and dual energy CT. - Sample cases and mimics. - Differential diagnosis of gout: rheumatoid arthritis, psoriatic arthritis, CPPD arthritis, giant cell tumor or pigmented villonodular synovitis, hyperparathyroidism, xanthomatosis.
**The Aims of this Presentations are:**
1. Review the imaging findings in adhesive capsulitis
2. Discuss current treatment strategies
3. To review the indications, contraindications, techniques and potential complications of hydrodistension of the shoulder

**Content Organization**
- Demographics
- Anatomy
- Clinical presentation
- Use of ultrasound in diagnosis
- MRI techniques
- Arthrography assessment
- Common treatment strategies
- Hydrodistension
  - Indications
  - Equipment
  - Techniques
  - Challenges
  - Complications
  - Follow-up

**Summary**
The key educational points include:
1. The radiological features of adhesive capsulitis using different modalities
2. There are multiple treatment strategies, radiologists can offer hydrodistension which is a minimally invasive procedure
3. Here we discuss hydrodistension with a step by step pictorial approach focusing on technique.

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**The Elbow in the Sport: From Movement to Lesion**

**LL-MKE2189**
- Maria Jose Ereno Ealo, MD
- Rosa Monica Rodrigo Del Solar
- Ara Kassarjian, MD
- Luis Cerezal, MD
- Oscar Luis Casado Verdugo
- Begona Sancho Garazabal

**Purpose/Aim**
1. To compare the elbow joint kinetics of the different sports. Videos and illustrations are displayed.
2. Display the images of usual and infrequent sport lesions of elbow.

**Content Organization**
- Detailed description of the main anatomical references (images, drawings and dissections)
- Kinetic of the elbow: movements related to the different sports
- Symptoms of the injuries and first diagnosis. Simple exploratory maneuvers
- Review of imaging findings: ultrasound, CT, MRI, arthroMRI
- Cases: examples of sportmens and their injuries.

**Summary**
The major teaching points are:
1. The elbow realizes different movements and assumes different positions during the sport practice that we must know
2. The high correlation between that movement and the injury it is demonstrated and the image techniques show it.

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**High-resolution Dynamic Ultrasound (D-HRUS) of the Shoulder: How We Do It**

**LL-MKE2190**
- Emanuele Fabbro, MD
- Silvia Perugin Bernardi, MChir
- Angelo Coranza, MD
- Giulio Ferrero
- Davide Orlandi, MD
- Enzo Silvestri, MD

**Purpose/Aim**
1. Illustrate the normal anatomy and the normal D-HRUS appearance of the rotator cuff tendons and other structures around the shoulder;
2. Describe a detailed systematic technique for D-HRUS evaluation of the shoulder, integrated with dynamic maneuvers;
3. Provide a multimedia correlation with detailed teaching videos including a step by step approach.

**Content Organization**
- The rotator cuff of the shoulder can be easily examined with US. Such a technique allows for a high-resolution evaluation of tendinous and periarticular structures.
- For each of the following structures we will provide a D-HRUS image, a detailed anatomical scheme and a practical guide paired with practical videos on “how to do” a D-HRUS examination of the shoulder:
  1. Supraspinatus tendon;
  2. Infraspinatus tendon;
  3. Subscapularis tendon;
  4. Teres minor tendon;
  5. Long head of the biceps brachii tendon;
  6. Subacromial-subdeltoid bursa;
  7. Posterior joint recess;
  8. Acromion-clavear joint;
  9. Coraco-humeral and coraco-acromial ligaments;
  10. Rotator cable.

**Summary**
When associated with a deep anatomical knowledge, a systematic HRUS scanning technique allows a punctual and real-time evaluation of tendinous and ligamentous structures of the shoulder. Dynamic manoeuvres can be helpful in the assessment of biomechanical aspects.

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**Imaging in Scheuermann Disease**

**LL-MKE2191**
- Raphael Richard
- Dan Siahou
- Clement Wattel
- Dominique Mompoint, MD
- Caroline Le Breton
- Robert Y Carlier, MD

**Purpose/Aim**
1. To present the radiologic criteria of Scheuermann disease on X Ray
2. To present typical and atypical signs of Scheuermann disease on CT and MRI
3. To explain the clinical course and radiologic evolution

**Content Organization**
- Iconographic selection of typical and atypical sign on X ray, CT and MRI, from a rheumatology consultation specialized in postural disorders in children, adolescents and adults

**Summary**
When associated with a deep anatomical knowledge, a systematic HRUS scanning technique allows a punctual and real-time evaluation of tendinous and ligamentous structures of the shoulder. Dynamic manoeuvres can be helpful in the assessment of biomechanical aspects.
Sorensen diagnostic criteria can most often make the diagnosis of Scheuermann disease on X-Ray. Thoracic and thoracolumbar forms are the most common. Lumbar form in the young athlete is discussed. Acute complications are rare (thoracic herniation disc, spinal cord compression). Old forms discovered on adults are frequent. Radiographic diagnostic criteria should be known because Scheuermann disease is the leading cause of painful adolescent kyphosis and late diagnosis is often associated with disorders consist of spinal posture.

The Puck Stops Here: The Value of Imaging Core Injuries in Hockey Players

Daniel K Holt, MD
Benjamin E Northrup, MD
Sreevathsan Sridhar, MD
Jennifer L Demertzis, MD
Jonathan C Baker, MD *

PURPOSE/AIM
- Familiarize the reader with relevant anatomy, unique injury mechanisms, and potential pitfalls associated with diagnosing core injuries in ice hockey players
- Provide a multimodality review of key imaging findings for differentiating and staging core injuries in ice hockey players, with emphasis on MRI
- Highlight the value of imaging in guiding treatment and predicting return to play following core injury

CONTENT ORGANIZATION
- Review relevant anatomy and mechanism of core injuries in ice hockey players
- Highlight key imaging findings from an instructive set of cases organized by differential diagnosis and injury location
  - Abdominal/pelvic wall: Hip pointer, rectus contusion, side strain, groin strain, sports hernia
  - Chest wall: Acromioclavicular joint injury, sternoclavicular joint injury, sternal fracture, costal cartilage fracture, rib fracture
- Discuss the role of imaging in guiding treatment and predicting safe return to play for these injured athletes
- SUMMARY
- Core injuries are common in ice hockey players of all skill levels
- Accurate and timely diagnosis of these injuries may minimize athlete morbidity and lost playing time
- Imaging plays an important role in diagnosing and staging core injuries in ice hockey players, with direct implications on treatment options and predicting safe return to play

Demystifying the Hardware Toolbox

Jonelle M Petscavage-Thomas, MD, MPH *
Alice S Ha, MD *

PURPOSE/AIM
Orthopedic hardware is routinely encountered in patients with fracture fixation, joint arthrodesis, ligament reconstruction, and foot alignment surgery. There is great diversity and innovation of hardware design and material. Knowledge of basic design is important to understanding physiological purpose and related complications. The aim of this exhibit is to review physiology of hardware devices, illustrate normal and abnormal imaging, and describe indications, advantages, and complications of orthopedic hardware.

CONTENT ORGANIZATION
Illustrations, photographs, radiographs, and CT images of hardware will include, but not be limited to: low-profile dynamic compression, reconstruction, blade, bridge, and LISS plates, cortical, cancellous, self-tapping, cannulated, bioabsorbable, and Herbert screws, cable-claw system, cerclage and Kirschner wires, ender and interlocking rods, fiberwire, endobuttons, memory staples, barbed and threaded soft tissue anchors, and Ilizarov and Taylor spatial frames. Complications will include nonunion, peri-hardware fracture, loosening, soft tissue granulomatous reaction, and infection.

SUMMARY
After viewing the exhibit, the learner will have a stronger foundation of orthopedic hardware terminology, purpose, design, imaging, and complications. This knowledge is important to providing a meaningful radiological contribution.

Need a Quick Fix? Current Trends in Ankle Syndesmotic Fixations

Janel A Scott, MD
Scott A Lehto, MD
Jaime Uribe, MD
Sreevathsan Kollu, MD

PURPOSE/AIM
1. Review the anatomy of the ankle syndesmosis complex
2. Review typical mechanisms of injury resulting in syndesmotic disruption
3. Discuss various techniques, postoperative imaging appearance, and complications of syndesmotic fixations

CONTENT ORGANIZATION
A review of the normal appearance of the syndesmosis and imaging evaluation of syndesmotic injuries is followed by a discussion of various methods of fixation, with an emphasis on newer techniques. Common postoperative complications will also be presented. Surgical techniques to be discussed include:

- Standard screw fixation (tri or quadruple cortex)
- Metallic plate and screw fixation
- Bioabsorbable screw fixation
- Button-wire-anchor fixation
- Button-wire-anchor with plate fixation
- Hamstring allograft reconstruction

SUMMARY
Distal tibio-fibular syndesmotic injuries are usually treated with surgical fixation. It is important for the radiologist to be aware of these orthopedic techniques, particularly the newer techniques, for comprehensive evaluation and early recognition of postoperative complications.

Ultrasound of the Ankle and Foot: What to Look for

Maria D Lopez Parra, MD
Jose Acosta Batlle, MD
Susana Hernandez Muniz, MD
Blanca Palomino, MD
Ana Garcia De Vicente

PURPOSE/AIM
- to review the sonoanatomic anatomy and scanning technique of foot and ankle
- to describe those pathological conditions in which ultrasound (US) has a similar or even higher sensitivity and specificity than MRI

ultrasound (US) has a similar or even higher sensitivity and specificity than MRI to review the sonographic anatomy and scanning technique of foot and ankle to describe those pathological conditions in which...
We review US and MRI studies performed in 200 patients with symptoms referred to a specific foot or ankle area; those patients with diffuse symptoms were excluded. We describe the sonographic appearance of the four anatomic compartments in which foot and ankle are divided: anterior, medial, lateral-plantar and posterior. We explain how to perform a dynamic US study (with active and passive mobilization) and to obtain images of the full course of the tendons in different planes. Illustrative examples of main tendinous diseases are shown. US imaging of other structures, such as tendon sheaths, anterior joint space, retrocalcaneal bursa, interdigital space and plantar fascia. We emphasize the advantages of US exam compared to MRI.

SUMMARY
US is a very effective, rapid and cheap method in the evaluation of the foot and ankle. It is especially useful in the study of tendons, in which MRI will be subject to the effects of anisotropy. Understanding of the anatomy, scanning technique and appearance of pathological conditions is essential for proper interpretation of US findings.

Correlation between ADC and Histologic Findings in Bone and Soft Tissue Tumors

LL-MKE2196
Javier Carrascoso Arranz
Agustin Acevedo Barbera, MD
Mar Jimenez De La Pena
Luis Herraiz Hidalgo
Manuel Recio Rodriguez
Vicente Martinez de Vega

PURPOSE/AIM
1. Show the correlation between ADC values and histologic findings in bone tumors and soft tissue tumors.
2. To assess the accuracy of DW-MRI in evaluating response to chemotherapy in the treatment of osteosarcoma and Ewing sarcoma, more specifically at mid-course of treatment, because during successful chemotherapy of osteosarcomas, tumor size does not diminish significantly.
3. We try to discriminate low-grade chondrosarcoma from enchondroma.

CONTENT ORGANIZATION
General description of the diffusion technique in bone tumors and soft tissue tumors. Try to understand why tumors have a lower ADC as round cell tumors (lymphoma or myeloma) because they present greater cellularity and less stroma; meanwhile tumors with a higher ADC (angiomas, myxomas…) have more stroma and less cellularity.

SUMMARY
There is no value of ADC in differentiating benign-malignant tumors, each tumor have their own values. It is not possible only with ADC values discriminate low-grade chondrosarcoma from enchondroma. The ADC values on DWI scans, holds promise as a valuable tool for monitoring the therapeutic response of primary bone sarcomas. The correlation with pathologic examination can help to understand the reason for the ADC values.

"Avoiding Myxoid Mix-up": Review of MR Imaging Characteristics of Benign and Malignant Soft Tissue Myxoid Tumors with Pathological Correlation

LL-MKE2197
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PURPOSE/AIM
1. To illustrate typical MR appearances of myxoid neoplasms, including a spectrum of benign and malignant lesions.
2. To highlight helpful characteristic imaging features differentiating myxomas and myxoid sarcomas.

CONTENT ORGANIZATION
Myxoma is a benign soft tissue tumor originating from altered fibroblasts that produces excess mucopolysaccharide. The resultant characteristic T2 bright appearance on MR mimics fluid. Myxoid type variant of soft tissue sarcomas can simulate benign myxomas, challenging radiological diagnosis. This exhibit emphasizes several teaching points that assist in an organized diagnostic approach to assessing these lesions on MRI. Appearance on ultrasound is also discussed. Relevant histopathology will be provided. Illustrated sample cases are provided following the pictorial review and presentation, to assist the learner in applying acquired knowledge in a “quiz case” format.

SUMMARY
This exhibit demonstrates the utility of MRI in characterizing myxoid tumors, and provides a comprehensive review of classical imaging features. Viewers are able to interactively familiarize themselves with typical features of myxoid neoplasms, through illustrative examples. This emphasizes the vital role of imaging in diagnosis and management of myxoid tumors and importance of awareness of this group of soft tissue tumors.

Imaging of Spinal Brucellosis

LL-MKE2198
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Edin Avdagic, MD
Deniz Bulja, MD
Majda M Thurnher, MD

PURPOSE/AIM
1. Review imaging features of spinal brucellosis (CT and MRI)
2. Discuss different types of spinal brucellosis ( CT and MRI )
3. To allow an early diagnosis and precise assessment of the extent of the disease
4. Discuss different diagnosis spinal brucellosis vs. spinal tuberculosis (CT and MRI)

CONTENT ORGANIZATION
1. Focal involvement of the spine, brucellar epiphysitis CT and MR imaging
2. Bone destruction is common with osteolytic formation parrot’s beak
3. The diffuse form with involvement of entire vertebrae body and extension to the vertebrae and epidural space. (CT, MRI)
4. The importance to differentiate brucellar spondylodiskitis from tuberculous spondylodiskitis
5. Treatment options ( surgical, conservative)

SUMMARY
Brucellosis is systemic infection, caused by facultative intra-cellular bacteria of the genus Brucella, with affinity for all organs. The spine is the most common site of musculoskeletal involvement (6% to 58%). Most affected is the lumbar spine (60%), followed by thoracic and cervical spine. More then one level is affected in 6% to 14% the cases. CT have limited value because of their inadequate soft tissue resolution. MR imaging is the method of choice to assess the extent of disease and follow up, but has a low specificity to differentiate
**Packing It In: The Imaging and Percutaneous Pre-operative Management of Vertebral Aneurysmal Bone Cysts**

**LL-MKE2199**
Ulhaas S Chakraborty, MBBS
Inthulan Thiraviaraj, MBBS
Rashmi Saraf, MD
Uday Limaye

**PURPOSE/AIM**
1. To review the imaging of Vertebral Aneurysmal Bone Cysts (ABC).
2. To describe the pre-operative management of Vertebral ABCs by percutaneous injection of N-butyl cyano acrylate (NBCA).

**CONTENT ORGANIZATION**
1. Aneurysmal bone cyst is a benign bone tumor of the young. It involves the spine in about 20% of cases.
2. Radiographs reveal an expansile trabeculated lesion in the neural arch which may extend to the vertebral body, with fluid levels on CT and MRI.
3. Surgical management is difficult owing to the nature of the fluid filled lesion, risk of damage to adjacent neural structures, and vascularity which makes it difficult to achieve clear margins at excision. Failure to do so may lead to recurrence.
4. Pre-operative fluoroscopy guided percutaneous injection of NBCA into the cyst decreases vascularity, solidifies the fluid filled cyst, hence reducing intraoperative blood loss and enabling complete resection.

**SUMMARY**
Vertebral aneurysmal bone cysts are uncommon benign bone tumors which are challenging to manage owing to difficult surgery as well as propensity for local recurrence. Preoperative percutaneous injection of NBCA is effective in reducing vascularity and increasing surgeon confidence thus helping to reduce chances of local recurrence.

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**3D High-resolution Isotropic MRI of the Wrist**

**LL-MKE2200**
Aydin C Soheili, MD
Mark A Franke, MD
Taiki Nozaki, MD
Hiroshi Yoshioka, MD

**PURPOSE/AIM**
The purpose of this exhibit is:
1. To review pulse sequences of 3D high-resolution isotropic MRI of the wrist
2. To review normal anatomy identified in 3D isotropic wrist MRI
3. To review clinical cases

**CONTENT ORGANIZATION**
1. Background: why do we need 3D isotropic MRI and what do we need for that?
2. Sequence optimization: slice thickness, voxel size, echo train length, and inversion time.
3. 3D isotropic MRI versus conventional 2D MRI.
4. Normal wrist anatomy that 3D isotropic MRI can demonstrate.
5. Clinical examples including TFCC tear, scapholunate ligament tear, lunotriquetral ligament tear, fracture, inflammatory arthritis, osteoarthritis, and ganglion cyst.

**SUMMARY**
The major teaching points of this exhibit are:
1. 3D isotropic wrist MRI is now ready to use clinically.
2. It is important to be familiar with optimization and normal/abnormal findings in 3D high-resolution isotropic MRI of the wrist.

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**Triangular Fibrocartilage Complex Lesions: A Pictorial Review of Radiographic and MRI Features of the Palmer Classification**

**LL-MKE2201**
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Amar M Amin, MD
Pratish A Shah, MD
Philip J Fairbourn, MD
Dan G Gridley, MD

**PURPOSE/AIM**
The Palmer Classification is widely utilized by orthopedic and hand surgeons to assess the mechanism of wrist injury, outline a treatment plan, and predict long term prognosis of triangular fibrocartilage abnormalities. In this pictorial exhibit, we will review triangular fibrocartilage complex lesions according to the Palmer classification system and will demonstrate an imaging algorithm to simplify the associated complex diagnostic considerations.

**CONTENT ORGANIZATION**
Using radiographic and MRI images, several examples of different types of triangular fibrocartilage complex injuries will be illustrated based on the Palmer classification. Additionally, the mechanisms of injury and their common associated bony and soft tissue injuries will be discussed, emphasizing the key imaging findings.

**SUMMARY**
The Palmer classification is commonly utilized to describe triangular fibrocartilage complex lesions. Therefore, familiarity with the different types of triangular fibrocartilage lesions and their corresponding radiographic and MRI appearance is essential to accurately categorize these injuries to facilitate development of an appropriate treatment plan.

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**Adult Flat Foot: A Wide Spectrum of Entities to Review, Pictorial Essay**

**LL-MKE2202**
Eva Llopis, MD
Elena Belloch, MD
Victoria Higueras, MD
Joaquin Chimol, MD
Leon Villar, MD

**PURPOSE/AIM**
To review anatomy, biomechanics and MR signs involved on flat foot. Medial column collapse and posterior tibialis tendon dysfunction (PTTD) is the most common cause. However there is a wide variety of causes with therapeutic and prognostic implications, such as spring ligament rupture, sinus tarsus lesions, occult tarsal coalitions, Mueller Weiss or neuropathy

**CONTENT ORGANIZATION**
Adult flat foot is defined as collapse of the medial longitudinal arch. XR criteria are based on weight bearing films. On non weight bearing
MR indirect signs should be used. Biomechanically static and dynamic structures are involved maintaining foot arch. Entities discussed are 1Medial column collapse with or without PTTD: valgus, lateral navicular subluxation, forefoot abduction. PTT, spring and interosseous ligaments should be checked 2Tarsal coalitions can become symptomatic in adults 3Mueller Weiss disease, navicular lateral collapse and medial displacement, talar head covered 4Mid-tarsal neuropathy, rocker bottom deformity, bone proliferation, fragmentation 5Others: posttraumatic, rheumatoid disease.. SUMMARY

MR is the modality of choice for evaluating adult flat foot, a list of entities should be kept in mind. Alignment, talar head coverage, navicular shape, tendon and ligaments are some of the parameters that will allow us to accurately diagnose the patients.

**Sacroiliac and Facet Joint Injections: Aiming the Right Spot?**

**LL-MKE2203**

Ali reza Zavareh, MD, FR CR
Mike Bradley, MB ChB
Hyeladzira Thahal, MBBCh, MRCP

**PURPOSE/AIM**
To clarify the ambiguity of the correct needle position in fluoroscopic guided facet and sacroiliac joint injections.

**CONTENT ORGANIZATION**
1. Describing the anatomy of the sacroiliac joint and the facet joints at the different sections of the spine as well as the differences in the structure and orientation of the joint line.
2. Correlating the 3 dimensional (3D) anatomy of the facet joint on the computed tomography (CT) with the 2D anatomy on the fluoroscopy or radiographic studies.
3. Demonstrating the anatomy of the joint capsule and the importance of correct needle positioning.
4. Pictorial review of the desired point of injection in each joint at different levels by correlating the CT and fluoroscopic landmarks.
5. Describing the optimal technique of injection and the usual technical difficulties.

**SUMMARY**
For the first time in the literature we have correlated the CT anatomy of the facet joints with that on the x-ray studies to understand the 3D anatomy as seen on 2D x-ray imaging and to demonstrate the correct position of the injection needle for an optimal result.

**Navicular Bone; All You Need to Know the Normal Navicular Bone, Variants and Pathologic Spectrum**

**LL-MKE2204**

Eva Llopis, MD
Elena Belloch
Victoria Higuera s, MD
Luis Cerezal, MD

**PURPOSE/AIM**
Describe anatomy and biomechanics with emphasis on its role maintaining the medial arch. Present variants, their relation with clinical symptoms and spectrum of lesions

**CONTENT ORGANIZATION**
Navicular bone is the base of the medial column and part of the transverse arch. Located between talus and cuneiform bones. During the foot strike phase is compressed between them. It’s central zone is hypovascular. Normal variants: Accessory bones: type I, type II large with synchondrosis, may become symptomatic (overload) and type III, comuate. Increased risk of posterior tibialis tendinopathy in II&III; Bipartite navicular; Dorsal os talonaviculare Coalitions: Calcaneonavicular, most frequent. Talonavicular, less, associated with other abnormalities Kohler disease, infants, avascular necrosis, self limiting disease Mueller Weiss disease, adults, navicular bone adopts a comma shaped(lateral collapse and medial displacement) OCD (proximal articular surface). Stress fractures, typically in the central 1/3, prognosis and need for surgery depends on types discussed. Neuropathy Others: inflammatory, arthritis.

**SUMMARY**
Normal variants in the navicular bone are frequent and sometimes become symptomatic. The wide spectrum of injuries will be reviewed. Familiarity with these entities and their radiological features will allow diagnosis and will contribute to treatment.

**Assessment of Osteosarcoma with Advanced MR Technique**

**LL-MKE2205**

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Clarissa Canella, MD
Silvana M Mendonca
Juliana P Andrade, MD
Pedro H Martins, MD

**PURPOSE/AIM**
To illustrate the value of advanced MR techniques including diffusion-weighted (DWI), perfusion MRI, susceptibility artifact sequence (SWI) and in and out-phase sequence in the diagnosis, staging and assessment the response to pre-surgical (neoadjuvant chemotherapy) treatment of osteosarcoma with pathological correlation (Huvos classification).

**CONTENT ORGANIZATION**
A. The usefulness of each advanced MR techniques in diagnosing and staging of different types of osteosarcoma
B. To discuss and illustrate the characteristics of each advanced MRI sequence in the main differential diagnosis of these tumor
D. To correlate these MRI techniques with radiologic and histopathological findings
E. The value of these techniques in assessment the response to pre-surgical treatment management

**SUMMARY**
DWI, perfusion MR imaging, SWI and in and out-phase sequence could provide some information to improve diagnosing and staging of osteosarcoma, which is not possible to obtain with conventional MR images, such as tumor vascularization, cellularity, bone marrow infiltration, potential of malignancy, cell membrane integrity and can be used for: a. Improvement in diagnostic accuracy and staging b. To guide biopsy c. Assessment the response to pre-surgical treatment management with pathological correlation, an important prognostic factor of survivor in primary osteosarcoma.

**Spectrum of the Knee Injuries with Single Bundle Anterior Cruciate Ligament Tear: Is there a Link?**

**LL-MKE2206**

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Martin Williams, MB ChB
Mike Bradley, MB ChB
Hyeladzira Thahal, MBBCh, MRCP

**PURPOSE/AIM**
To correlate the different patterns of knee injuries with the single bundle anterior cruciate ligament tear (ACL).
Calcific tendinosis is a common cause of shoulder pain. Diagnosis of calcific tendinosis is possible with X-rays. USG and MRI can be used for precise characterization of the exact size and location of calcium in the tendon and also help in identification of associated pathologies like tendon tear and bursitis in shoulder region. Initially conservative management is mainstay of treatment, however when it fails, appropriate management.

**SUMMARY**

- Description of unique interventional treatment options available for calcific tendinosis like calcific lavage and current role of platelet rich plasma injection.
- Imaging features of calcific tendinosis on X-Ray, Ultrasound, CT Scan and MRI.
- Common cause, clinical findings and pathophysiology of calcific tendinosis.
- Imaging features of calcific tendinosis on XRay, Ultrasound, CT Scan and MRI.

**CONTENT ORGANIZATION**

1. Demonstrating the anatomy of the ACL and its anteromedial and posterolateral bundles
2. Explaining the kinetics of each bundle in knee movements and their mechanisms of injury.
3. Pictorial review of the different injuries seen in the knee in cases of ACL rupture, including pivot shift injury and the mechanism of these injuries.
4. Providing a pattern recognition system which helps identifying the type of the single bundle tears.

**SUMMARY**

We demonstrate a correlation between the single AM and PL bundle tears with specific patterns of bone and soft tissue injuries of the knee. This leads to a systematic approach to diagnose these two types of injuries.

**Triceps Brachii from Top to Bottom**

**LL-MKE2207**

Guillaume Mercy
Audrey Massein
Jerome Renoux, MD
Aziza Absi-Yaici, MD
Delphine Zeitoun, MD
Jean-Louis Brasseur
Philippe A Grenier, MD

**PURPOSE/AIM**

To review the anatomy and the pathology involving triceps brachii.

**CONTENT ORGANIZATION**

Normal anatomy, variations and anatomical relationships with nearby neurovascular structures. Function. Imaging modalities. Pathology:

- Traumatic injuries: proximal tendon of long head, fleshy body, distal tendon.
- Impingement syndromes and instability: quadrilateral space syndrome, spiral groove syndrome, snapping triceps.

**SUMMARY**

The triceps brachii is a large, three-headed muscle of the posterior compartment of the arm which ends on a single distal tendon on the olecranon. The most frequent traumatic injury is the rupture of the distal tendon, which can be total or partial. If partial, imaging aims to assess the proportion of disrupted tendon and to measure its retraction in order to decide if surgery should be performed. Triceps brachii is closely related to neurovascular structures. Thus, distal triceps instability can cause snapping syndrome and ulnar impingement. Imaging shows medial head translocating anterior to the medial epicondyle during flexion of the elbow. It can be associated with ulnar nerve instability. Triceps instability is particularly important to be diagnosed before operating a suspected ulnar nerve instability in order to plan an appropriate procedure.

**Imaging Evaluation of the Pisotriquetral Joint**

**LL-MKE2208**

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Larissa G Cortinas, MD
Jader J Da Silva, MD
Atul K Taneja, MD
Michel D. Crema, MD *
Abdalla Y Skaf, MD
Andre F Yamada, MD
Ivan Godoy, MD
Luis Pecci Neto, MD

**PURPOSE/AIM**

Pisotriquetral joint gets few attention from radiologist being forgotten in cases of chronic pain in ulnar aspect of wrist and in acute traumatic context. We illustrate the aspects of the main pathologies affecting this articulation at different methods and how they complement each other.

**CONTENT ORGANIZATION**

Anatomic review of the primary stabilizing ligaments of this joint correlated with images of anatomical dissection. In radiographic study the main joint radiographic parameters and normal dynamics of pisiform and joint instability in athletes are discussed, and representative cases of traumatic and degenerative changes and calcific tendinopathy of the flexor carpi ulnaris are discussed. In ultrasound study the aspects of primary stabilizing ligaments and the role of ultrasound in trauma evaluation is described. In magnetic resonance we illustrated early degenerative changes in the radial aspect of the joint and characterize the major ligaments injured in cases of subluxation of the pisiform such as partial rotare or stretching of the pisohamate ligament and roture of the pisometacarpal ligament (main stabilizer against the proximal displacement of the pisiform).

**SUMMARY**

This exhibit revised the main aspects of image in traumatic context and the chronic changes as the degeneration and the tendinopathy of the flexor carpi ulnaris at the different methods.

**Rotator Cuff Calcific Tendinosis - Cause, Pathophysiology, Multimodality Imaging Features and Treatment Options**

**LL-MKE2209**

Himanshu Pandey, MBBS, DMRD
Jaykumar R Nair, MD
Divyaa Bajpai
Mathieu Boily, MD
Stephanie Nougaret, MD

**PURPOSE/AIM**

1- Know about the pathophysiology and clinical presentations of Calcific Tendinosis.
2- Imaging features of calcific tendinosis on X Ray, Ultrasound, CT Scan and MRI.
3- Treatment options – conservative management to interventional calcific lavage.
4. Why, when and how to perform Calcific lavage with tips and tricks for more effective procedure.

**CONTENT ORGANIZATION**

- Common cause, clinical findings and pathophysiology of calcific tendinosis.
- Imaging features of calcific tendinosis on XRay, Ultrasound, CT Scan and MRI.
- Description of unique interventional treatment options available for calcific tendinosis like calcific lavage and current role of platelet rich plasma injection.

**SUMMARY**

Calcific tendinosis is a common cause of shoulder pain. Diagnosis of calcific tendinosis is possible with X-rays. USG and MRI can be used for precise characterization of the exact size and location of calcium in the tendon and also help in identification of associated pathologies like tendon tear and bursitis in shoulder region. Initially conservative management is mainstay of treatment, however when it fails, Ultrasound guided calcific lavage can be performed. Knowledge of the multimodality imaging findings and treatment options, allows for appropriate management.
MR Evaluation of Glenohumeral Incongruity in Children with Brachial Plexus Birth Palsy

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PURPOSE/AIM
To evaluate changes in glenohumeral joint in children with Brachial Plexus Birth Palsy (BPBP) and review the technique for measuring angle glenoid version.

CONTENT ORGANIZATION
Brachial plexus birth palsy (BPBP) commonly affects upper cervical roots and trunks (C5, C6 and C7). Many children with BPBP have near complete or complete recovery of muscle power around shoulder, but few may have persistent limitation of abduction and external rotation. Such patients develop progressive flattening of glenoid with retroversion, biconcavity and pseudoglenoid formation. There is also increasing subluxation of the humeral head with flattening and hypoplasia in more advanced cases. All these changes are thought to be due to imbalance in muscle power and increase with age. MRI is modality of choice in evaluating changes of glenohumeral deformity and measuring angle of glenoid version. It excellently demonstrates glenoid and humeral cartilage and enables accurate assessment of glenohumeral incongruity and angle of retroversion and helps in planning further management of these patients.

SUMMARY
MRI is an excellent modality in evaluating changes in glenohumeral joint in patients with Brachial Plexus Birth Palsy and assessing the angle of glenoid version, Glenoid morphology and Humeral head subluxation.

Percutaneous Cementoplasty in Metastatic Bone Disease: From the Spine to the Extremities

Eunice A Lara Garcia, MD
Carlos E Rojas Marin, MD
Edgar J Rosero Garcia, MD
Franco Gonzalez

PURPOSE/AIM
- Review the principles, indications and contraindications of the percutaneous cementoplasty as palliative treatment in oncology patients
- Illustrate the percutaneous cementoplasty technique and different approaches
- To exemplify the clinical results of this therapeutic management

CONTENT ORGANIZATION
1. Introduction
2. Patient selection and clinical considerations
3. Technique generalities
   Imaging Guidance
   Material: different kind of cement and needles
   General complications
4. Specific techniques and approaches:
   Humeral cementoplasty
   Acetabular cementoplasty
   Vertebral cementoplasty
   Femoral cementoplasty
5. Clinical results

SUMMARY
Oncology patients are susceptible to metastatic bone disease that affects their quality of life because of the related pain and loss of functionality (when an extremity is affected). Percutaneous cementoplasty as become an effective palliative element of pain management therapy and, in several times, has an impact in the partial recovery of function in the affected extremity allowing a better quality of life.

Adhesive Capsulitis of the Hip: Key Imaging Features

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Luciana S Timbo, MD
Olavo K Nakamura, MD
Durval D Santos, MD
Laercio A Rosemberg, MD
Luiz Guilherme Hartmann, MD
Marcelo B Funari, MD

PURPOSE/AIM
The purpose of this exhibit is to provide a comprehensive review and illustration of adhesive capsulitis of the hip, using Magnetic Resonance (MRI) findings and emphasizing the aspects which help to differentiate it from other diseases.

CONTENT ORGANIZATION
1. Briefly review the anatomy of normal hip. 2. Review and illustrate five cases of adhesive capsulitis of the hip. 3. Review etiologies and illustrate other causes of swelling and thickening of the hip joint capsule. 4. Discuss and describe the key signs which help to differentiate adhesive capsulitis from other causes of capsular thickening and edema.

SUMMARY
The adhesive capsulitis of the hip is a condition rarely described, but probably underdiagnosed. The clinical symptoms resemble those of adhesive capsulitis of the shoulder, consisting of painful limitation of joint mobility. In MRI, there is thickening of the joint capsule with edema and pericapsular enhancement. The diagnosis is confirmed by arthroscopy. The radiologist must know how to recognize this disease and include it in the differential diagnoses, allowing a proper therapeutic approach.

Differential Diagnosis of Calf Pain Presenting as Deep Venous Thrombosis with Ultrasound Imaging

Seung Min Nam
PURPOSE/AIM
1. To review the disease entity of painful calf lesions presenting as a deep venous thrombosis.
2. To illustrate a broad overview of the ultrasound findings of these lesions.
3. To provide guidance of injection therapy in the management of calf pain.

CONTENT ORGANIZATION
1. Ruptured Baker's cyst
2. Muscular injury: Tennis leg, Achilles tendon rupture
3. Infection and inflammation: cellulitis, myositis, abscess
4. Vascular lesion: arterial aneurysm, cystic adventitial disease, popliteal artery entrapment
6. Miscellaneous: diabetic myonecrosis, hematoma

SUMMARY
There is a wide variety of painful calf lesions presenting as a deep venous thrombosis. Sonographic examination with high-frequency transducers provides detailed anatomical information of the calf structures, and the ability to real time confirmation of the several calf lesions. Both venous and musculoskeletal ultrasound scanning should be performed in cases of acute calf pain and swelling and in all cases of calf pain with a negative venous ultrasound examination. The correlation of the clinical, laboratory and sonographic findings can help to make a specific diagnosis of painful calf lesions and provide treatment strategy for these patients.

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**3D MR Myelography at 3T: Technical Aspects and Imaging Features**

**PURPOSE/AIM**
The purpose of this exhibit is:
1. To familiarize the radiologist with recently developed 3D MR myelography
2. To review the basic principles of 3D MR myelography techniques
3. To learn characteristics of the technique and interpretation

**CONTENT ORGANIZATION**
1. 3D MR myelography techniques
   - 3D STIR (short inversion time inversion recovery) - SPACE (sampling perfection with application optimized contrasts using different flip angle evolutions)
   - DESS (double-echo steady-state)
   - MEDIC (multi echo data imaging combination)
   - Diffusion-weighted imaging
2. 3T versus 1.5T
3. Clinical examples of each technique: cervical and lumbar spine

**SUMMARY**
The major teaching points of this exhibit are:
1. 3 Tesla has advantages over 1.5 Tesla when performing MR myelography despite technical challenges.
2. Understanding the principle of MR myelography techniques is critical for high quality spinal imaging.

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**Imaging of the Post-operative Knee Using Dual Energy Computed Tomography (DECT) Collagen Material Decomposition Application**

**PURPOSE/AIM**
To illustrate the utility of Dual Energy CT in the evaluation of both bony and soft tissue abnormalities in the post-operative knee.

**CONTENT ORGANIZATION**
Post-operative complications following surgery to the knee are routinely evaluated using Magnetic Resonance Imaging (MRI). Exquisite soft tissue detail is achievable with MRI. CT provides unparalleled imaging of fine bony detail. Soft tissue assessment on conventional CT remains limited when compared to MRI imaging. An ideal imaging modality would combine the soft tissue detail available from MRI with osseous detail available from CT. We present a case based review of findings in the post-operative knee on Dual Energy CT at both standard soft tissue and bony windows and using Collagen Material Decomposition Algorithm. Correlation MRI is provided for all cases. Cases include meniscal tear, focal arthrofibrosis (Cyclops lesion), Anterior Cruciate ligament graft, Intra-articular loose bodies, Pelligrini Stiedia lesion, Intra-osseous tunnel bone graft, tendon harvest defects and bony oedema.

**SUMMARY**
DECT offers additional soft tissue information when compared to conventional CT scan. Use of newer algorithms may allow more accurate assessment of soft tissues, as well as offering exquisite imaging of bony detail. We suggest that DECT may be a useful adjunct to MRI imaging in assessment of the post-operative knee.

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**Be Strong! Strengthening the Case for Diagnosing Sarcopenia and Sarcopenic Obesity**

**PURPOSE/AIM**
While the imaging assessment of muscles is conventionally performed at a “local” level, emerging evidence-based research has highlighted the importance of analyzing muscle at “regional” and “systemic” levels.

**CONTENT ORGANIZATION**
This exhibit:
Describes the "regional" role of muscle weakness (or dyskinesia) in osteoarticular disorders, including: [i] fracture risk; [ii] osteoarthritis; [iii] spine-related pain.

Analyzes the "systemic" implications of sarcopenic conditions, including associations with [i] chemotherapy toxicity, shorter time to tumor progression, and mortality in cancer patients; [ii] mortality in adolescent males, hypertensive patients, chronic kidney disease patients, and asymptomatic adults.

Defines and distinguishes the diagnosis of sarcopenia, sarcopenic obesity, and dynapenia, as well as atrophy and fatty infiltration of muscle.

Reviews the multifactorial etiology for sarcopenia, with emphasis on pathogenetic mechanisms, prevention, and treatment of myonuclear apoptosis.

Illustrates the techniques used for measurement of muscle mass, with an emphasis on the strengths and limitations of MR and DXA.

SUMMARY
Emerging research indicates that diagnostic evaluation of skeletal muscle at regional and systemic levels may aid our understanding of the pathogenesis and treatment of many important clinical conditions.

Sesamoiditis and Turf Toe: An in Depth Look at Two Common Foot Injuries

LL-MKE2217
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George R Matcuk, MD
Dakshesh B Patel, MD
Eric A White, MD
Deborah M Forrester, MD
Christopher J Gottsegen, MD

PURPOSE/AIM
- Review normal anatomy and the spectrum of injuries involving the first metatarsophalangeal (MTP) joint and associated hallux sesamoids utilizing illustrative multimodality imaging examples (X-ray, CT, MRI)
- Emphasize appropriate management for the degree and type of injury, highlighting the role of the radiologist

CONTENT ORGANIZATION
I. Introduction and concise review of hallux anatomy with emphasis on MR imaging of the plantar plate and sesamoids
II. Case-by-case examples illustrating the spectrum of turf toe injuries including plantar plate injury, flexor musculotendinous unit strain, acute and stress fractures of the sesamoid, painful bipartite sesamoid, septic arthritis/osteomyelitis, arthritides and crystal deposition disease
III. Overview of surgical, medical and radiological treatment options of MTP joint injuries

SUMMARY
- First MTP joint overuse and hyperextension injuries are extremely common among active people, particularly football players
- It is essential for the radiologist to recognize the patterns of first MTP joint injury in order to ensure proper patient care and minimize avoidable post-injury morbidity
- We present a discussion of the spectrum of sesamoiditis and turf toe injuries with an emphasis on management, providing the necessary tools for the radiologist to accurately diagnose and guide optimal treatment

Role of Contrast Enhanced Ultrasound for Therapy Response Evaluation in Soft Tissue Sarcomas with Preliminary Results

LL-MKE2218
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Bhushan Desai, MD
Edward G Grant, MD*
James Hu, MD
Vinay A Duddalwar, MD, FRCR

PURPOSE/AIM
1. Describe the basic technique of contrast enhanced ultrasound (CEUS). 2. Investigate the ability of CEUS in assessing response to neoadjuvant chemotherapy for soft tissue sarcoma (STS) and determine if CEUS provides information supplemental to contrast enhanced CT/MRI.
3. Evaluate the utility of dynamic and semi-quantitative evaluation of soft tissue sarcomas using CEUS.
4. Determine the utility of dynamic and semi-quantitative evaluation of soft tissue sarcomas using CEUS. 5. Provide pictorial cases where CEUS provides information for therapy monitoring and surveillance of sarcoma patients.

CONTENT ORGANIZATION
I. Background and Significance
II. Literature review
III. Contrast enhanced CT/ MR scanning protocol
IV. Limitations of conventional imaging modalities
V. Clinical utility of CEUS
VI. Technical note: Ultrasound with intravenous contrast injection
VII. Ultrasound Contrast Agents
VIII. Clinical case examples

SUMMARY
1. Combined morphologic and perfusion information provided by CEUS allows accurate objective assessment of issues including prediction and evaluation of response to therapeutic interventions.
2. CEUS provides supplementary information to contrast enhanced CT/MR.
3. CEUS offers advantages for targeting specific areas during image guided biopsies.

Diffusion-weighted MR Imaging of Bone Marrow: Diagnostic Key Points and Pitfalls Radiologists Should Understand

LL-MKE2219
Eito Kozawa, MD, PhD
Masahiro Takahashi, MD
Yusuke Watanabe, MD
Fumiko Kimura, MD, PhD*

PURPOSE/AIM
1. To elucidate the characteristics of diffusion-weighted MR imaging for evaluating bone marrow
2. To illustrate features of diffusion-weighted MR images and apparent diffusion coefficient (ADC) values of bone marrow
3. To demonstrate the pitfalls of this technique

CONTENT ORGANIZATION
I. Characteristics of diffusion-weighted MR imaging
II. Diagnostic Key Points
III. Pitfalls
IV. Summary

SUMMARY
1. Combined morphologic and perfusion information provided by CEUS allows accurate objective assessment of issues including prediction and evaluation of response to therapeutic interventions.
2. CEUS provides supplementary information to contrast enhanced CT/MR.
3. CEUS offers advantages for targeting specific areas during image guided biopsies.
2. Diffusion-weighted image features and ADC values of normal bone marrow
3. Diffusion-weighted image features and ADC values features of bone marrow, such as
   - hematological disease
   - solitary metastasis
   - diffuse bone marrow metastasis
   - benign compression fracture
   - malignant compression fracture
   - degenerative change
4. Key points and pitfalls of diagnosis
5. Advantages of diffusion-weighted image of bone marrow

SUMMARY
The major teaching points of this exhibit are:
1. Diffusion-weighted MR imaging has emerged as a useful tool for differentiating benign and malignant tumors of bone marrow disease.
2. Diffusion-weighted MR imaging has diagnostic pitfalls.

Fractional 3D Quantification Techniques for Surgical Planning and Monitoring Therapy Response in Bone and Soft Tissue Sarcoma: An Evidence-based Overview

LL-MKE2220
Amir Imanzadeh, MD
Anand K Singh, MD
Wenli Cai, PhD
Parul Penkar, MBBS
Sanjay Saini, MD
Gordon J Harris, PhD *

PURPOSE/AIM
1. Explain emerging role of computer-aided automations for detection of total tumor and viable tumor burden in bone and soft tissue malignancies.
2. Review preliminary data for such biomarker quantification techniques in planning tumor-free resection margins and monitor therapy response.

CONTENT ORGANIZATION
2. Evidence based-discussion on 3DMRI-based quantification of viable tumor fractions Peripheral viable tumor burden and correlation with positive resection margins. Correlation of presurgical 3D MRI-derived viable tumor volumes with partial tissue stained pathological scores highlighting effectiveness in evaluation of therapy response.
3. Feasibility of quantification techniques

SUMMARY
Computer-aided detection methods for fractional quantification of viable tumor burden may be a more objective and promising approach to facilitating procurement of tumor-free resection margins and monitor therapy response in bone and soft tissue malignancies. This exhibit will provide the viewer with technical considerations and examples of such advanced post processing methods along with preliminary study data to support the conclusions.

Evaluation of Drug-induced Musculoskeletal Abnormalities in Adults

LL-MKE2221
Yong Suk Cho
Jihae Lee
Jae Hyung Kim
Myeong Ja Jeong
Mi-Jin Kang, MD
Han Bee Lee, MD
Kyung-Eun Bae, MD
Young-Seon Kim

PURPOSE/AIM
1. To review musculoskeletal development and bone health
2. To review therapeutic drugs with known musculoskeletal side-effect
3. To present drug-induced musculoskeletal abnormalities in adults

CONTENT ORGANIZATION
1. Normal embryologic development of the musculoskeletal system and bone health
2. Therapeutic drugs with known musculoskeletal side effect
3. Drug-induced musculoskeletal abnormalities in adults
   - osteomalacic change:
   - proliferative change (hyperostosis and osteosclerosis)
   - osteoporotic change
   - myopathy and myotendinopathy

SUMMARY
Drug-induced musculoskeletal abnormalities in adults are common and often under diagnosed. Many drug-induced musculoskeletal changes are evidence on radiographs, and the accurate interpretation of these radiographic findings is important for all practicing radiologists. To understand this, it is essential to know about embryologic development of musculoskeletal system and health and various therapeutic drugs with known musculoskeletal side effect. In this exhibit we present: 1) normal developmental embryology of musculoskeletal system and bone health; 2) therapeutic drugs with known musculoskeletal side effect; 3) drug-induced musculoskeletal abnormalities in adults. Knowledge and familiarity with drug-induced musculoskeletal abnormalities may help appropriate care for patients.

Four-dimensional Dynamic CT: Initial Experiences in Musculoskeletal Application

LL-MKE2222
Sun Hwa Hong
Suk-Joo Hong, MD
Wonyong Shon
Baek Hyun Kim, MD
Chang Ho Kang, MD
Kyung-Sik Ahn, MD

PURPOSE/AIM
To present the initial experiences of four-dimensional (4D) dynamic CT application in the musculoskeletal system.

CONTENT ORGANIZATION
Using the 320-multidetector CT scanner (Aquilion One, Toshiba Medical Systems, Japan), we can produce continuous 3-dimensional images in real time, over a distance of 16cm in the z-axis. We'll present the musculoskeletal applications of the 4-dimensional dynamic CT, such as
femoroacetabular impingement, stiff elbow syndrome and spine segmental instability, and so on.

SUMMARY
Using 4D dynamic CT, we can image in real time the musculoskeletal diseases which the functional or motional mechanism is the most important part of the disease process.

**Spectrum of Imaging Findings in Spinal Tuberculosis-Radiological Review of 100 Cases**

**PURPOSE/AIM**
1. To describe the diverse pattern of imaging findings of Tuberculosis of spine by MRI.
2. To differentiate spinal Tuberculosis from other spinal pathologies on the basis of imaging findings.

**CONTENT ORGANIZATION**
Tuberculosis (TB) remains endemic in most of the developing countries and is a global phenomenon. Radiologic features of TB may mimic those of other bacterial, fungal, inflammatory and neoplastic diseases.

MRI of 100 proven cases of spinal tuberculosis (age ranging from 15-70 years) performed between 2006 and 2013 were reviewed retrospectively.

We present a quiz based format to challenge and educate the viewer by including non TB cases in the mix describing findings that may help differentiate between TB from other conditions involving the spine.

We present a detailed representation of all the findings seen in TB of the spine including unusual presentations like isolated discitis and posterior element involvement.

**SUMMARY**
In this quiz, the reader would understand the varied typical and atypical manifestations of spinal TB and be able to differentiate TB from other diseases.

**Role of MRI in the Preoperative and Postoperative Assessment of Rotator Cuff Tear**

**PURPOSE/AIM**
1. To describe the indications and surgical techniques currently used in rotator cuff tear
2. To identify the important imaging findings in preoperative MRI of rotator cuff tear
3. To recognize the postoperative imaging features of normal condition and post-surgical complication

**CONTENT ORGANIZATION**
The details are following:
1. MR imaging method and technical aspects
   - Imaging plane, pulse sequences, MR arthrography-
2. Surgical indication and techniques
3. Preoperative assessment of rotator cuff tear
   - Full-thickness rotator cuff tear: Cofield classification-
   - Partial-thickness rotator cuff tear: Ellman classification-
   - Fatty degeneration: Thomazeau classification, Goutallier classification-
   - Bony evaluation: Subacromial impingement, Bigliani classification-
   - Unique conditions: delamination of rotator cuff, PASTA lesion, hidden lesion-
4. Postoperative assessment of rotator cuff repair
   - Postoperative cuff integrity: Sugaya classification-
   - Re-tear, knot impingement-

**SUMMARY**
The main teaching points of this exhibit are:
1. To learn the significant imaging appearances in preoperative and postoperative evaluation of rotator cuff tear.
2. To understand the current management, surgical techniques and MR imaging technique of rotator cuff tear.

**A New Fat Suppression Method for MR Imaging of Ankle with Specific Angle between Leg and Table**

**PURPOSE/AIM**
The purpose of this exhibit is:
To explain principle of the chemical shift selective saturation (CHESS)
To reconsider the remedy of the poor fat suppression
To learn a problem of Sat-Pad
To introduce a new fat suppression method

**CONTENT ORGANIZATION**
1. Introduction(Principle of fat suppression effect in CHESS).
2. Various remedy of the poor fat suppression.
3. Comparison of image quality between Sat-Pad and a new fat suppression method in a phantom experiment.
4. Comparison of image quality between Sat-Pad and a new fat suppression method in a volunteer experiment.
5. Summary and future prospect of a new fat suppression method.

**SUMMARY**
In a volunteer experiment, the way of changing the angle between leg and table has improved the fat suppression effect 90% better than Sat-Pad.
This way is simple, independent of any apparatus.
This method, therefore, is of great use as another fat suppression.

### Gelatinous Transformation of Bone Marrow

**PURPOSE/AIM**

While gelatinous transformation (also called "serous atrophy") of bone marrow is rarely diagnosed with imaging, the conditions that cause it are relatively common. The purpose of the exhibit is to (i) gain an awareness of this entity, (ii) propose practical diagnostic imaging criteria, (iii) review the diagnostic imaging findings, and (iv) learn the clinical significance of gelatinous transformation of bone marrow.

**CONTENT ORGANIZATION**

- Prevalence of diagnosis (MRI vs. pathology)
- Pathogenesis and co-morbidities
- Diagnostic criteria (MRI vs. pathology)
- Characteristic imaging findings (spectrum of severity, distribution)
- Complications
- Clinical significance and prognosis

**SUMMARY**

The major teaching points of this exhibit are:

1. Unless one is aware of the peculiar MRI findings, gelatinous transformation is not easily diagnosed radiologically.
2. Radiologists may be the first physicians to make the diagnosis.
3. This condition is associated with bone fragility and stress fractures that may be difficult to see, even on MRI.
4. Gelatinous transformation of bone marrow is reversible, if the underlying cause for this disorder can be treated effectively.

### Knee Arthroplasties from Start to Finish: Preoperative Planning, Techniques, Types and Complications

**PURPOSE/AIM**

- Preop planning includes evaluation of lines/angles, compartments involved, and pt factors such as ligamentous injuries, osteopenia, prior hardware and fx.
- How does the surgeon evaluate the pre-operative pt; what is s/he looking for on the images? 
- What techniques does the surgeon employ to correct pre-existing deformity, fx, or ligamentous injury? How does the different hardware look afterwards? 
- What complications can we expect by hardware type? What’s the range or normal and abnormal?

**CONTENT ORGANIZATION**

Intro to the preop pt: weight-bearing axis, tibial torsion, femoral anteversion, mechanical axis, genu angulation, leg length and compartments

Operative techniques for correction and placement (with intra-op photos)

Post-op normal imaging by hardware type: unicompartmental, constrained, unconstrained, longstem, modular

Hardware complications: loosening, particle disease, infection, spacer displacement and wear, perihardware fx

Approach to the pt with perihardware fx: can the arthroplasty be saved? Scan techniques and relevant findings

**SUMMARY**

Comprehensive review of a common procedure A variety of arthroplasties in a customized era: how to make targeted and relevant comments to the preop pt, postop pt, and the pt with hardware complications or failure Orthopedic perspective and review of operative techniques with strong clinical emphasis

### Meniscal Tears: Scanned, Scoped and Sculpted! Educational Exhibit Using 3D Models with MRI and Arthroscopic Correlation

**PURPOSE/AIM**

To illustrate normal MRI meniscal anatomy and analyze patterns of meniscal injury utilizing highly detailed dissectible 3D models along with cross sectional imaging and arthroscopic correlation. Current nomenclature utilized in radiology and orthopedic literature will be reviewed and compared.

**CONTENT ORGANIZATION**

We will review normal meniscal anatomy and related supporting structures through the use of original dissectible 3D renders and animations. We then illustrate and discuss basic and complex patterns of meniscal injury referencing current descriptive nomenclature and comparing different classification systems. We then translate this 3D conceptualization to multiplanar MRI findings and images obtained during arthroscopy. Imaging pitfalls will also be reviewed.

**SUMMARY**

Conceptualizing the morphology of meniscal tears and their MRI and arthroscopic appearance can represent a challenge, particularly due to lack of standard uniform nomenclature between radiology and orthopedic literature. After the completion of this exhibit, the participant will be able to recognize imaging signs and patterns of meniscal tears and their arthroscopic appearance along with comparative review of existing terminology.

### Crystal Deposit Diseases of the Spine

**PURPOSE/AIM**

To illustrate normal MRI meniscal anatomy and analyze patterns of meniscal injury utilizing highly detailed dissectible 3D models along with cross sectional imaging and arthroscopic correlation. Current nomenclature utilized in radiology and orthopedic literature will be reviewed and compared.

We will review normal meniscal anatomy and related supporting structures through the use of original dissectible 3D renders and animations. We then illustrate and discuss basic and complex patterns of meniscal injury referencing current descriptive nomenclature and comparing different classification systems. We then translate this 3D conceptualization to multiplanar MRI findings and images obtained during arthroscopy. Imaging pitfalls will also be reviewed.

**SUMMARY**

Conceptualizing the morphology of meniscal tears and their MRI and arthroscopic appearance can represent a challenge, particularly due to lack of standard uniform nomenclature between radiology and orthopedic literature. After the completion of this exhibit, the participant will be able to recognize imaging signs and patterns of meniscal tears and their arthroscopic appearance along with comparative review of existing terminology.
Oncodiagnosis Panel: Pediatric Sarcoma (An Interactive Session)

Sunday, 10:45 AM - 12:15 PM • E353C

PURPOSE

To review how the semiology of edema on MRI, the location, distribution and density of calcifications on CT may help to identify the underlying pathology.

LEARNING OBJECTIVES

1) Understand the principles of musculo-skeletal imaging as it relates to soft tissue tumors arising in the extremity and trunk. Specifically, the learner will understand the importance of how appropriate imaging modalities are critical to correct diagnosis, staging and treatment of soft tissue tumors in children. 2) Apply basic physics principles to the imaging and therapeutic modalities involved in diagnosis, staging and management of soft tissue sarcomas in children. Specifically, the learner will be able to apply specific imaging modalities and techniques in order to improve the detection, accuracy of staging and management of soft tissue sarcomas, while minimizing the risk of ionizing radiation exposure in children. 3) Analyze the value of different imaging modalities and therapeutic techniques for children with soft tissue sarcomas. Specifically, the learner will be able to analyze the importance of specific imaging studies required for patient enrollment in clinical trials and ensure safe administration of cancer therapy with respect to cost. 4) Demonstrate how cultural and economic differences may influence practices of care for radiologic imaging in children with soft tissue sarcomas today and the future. 5) Compare relative value of image guided techniques in management of pediatric soft tissue sarcomas. Specifically, the learner will be able to compare the pros and cons of current imaging guided techniques for the diagnosis and management of soft tissue sarcomas in children to optimize outcome and minimize complications.

Musculoskeletal (Shoulder I)

Sunday, 10:45 AM - 12:15 PM • E451A

PURPOSE

To determine whether detour sign at magnetic resonance (MR) imaging is an indicator of subluxation of the long head of the biceps tendon in the shoulder joint.

METHOD AND MATERIALS

This retrospective study evaluated 65 patients (M: F=29: 36; age range: 49-79 years, mean: 58 years) who had shoulder pain and underwent arthroscopic surgery, between January 2012 and February 2013. All patients underwent 3T MR imaging for diagnosis of shoulder diseases, and the MR scans were independently reviewed by two musculoskeletal radiologists. When MR imaging showed a subscapularis tear with biceps pulley lesion (Habermeyer group 4)(criterion 1) or additional ◆detour sign◆ of the biceps (criterion 2) on the axial images, the lesion was considered to be a subluxation of the long head of the biceps tendon (SLBT). After MR imaging, shoulder arthroscopy was performed in all patients for a definitive diagnosis of SLBT. Descriptive statistics were calculated and the sensitivity values were compared by using the McNemar test. A kappa statistic was recorded for interobserver agreement regarding the presence of the detour sign, subscapularis tear, and pulley lesion on MR imaging.

RESULTS

Arthroscopy showed SLBT in 18 patients. When MR imaging diagnosis was based on criteria 1 only, SLBT was diagnosed with a sensitivity of 44.4%, and an accuracy of 80.4%. When MR imaging diagnosis was based on both the criterion 1 and the criterion 2 using ◆detour sign◆, SLBT was diagnosed with a sensitivity of 83.3% and an accuracy of 81.5%. By adding criterion 2 for diagnosis, 10 patients with SLBT were additionally diagnosed, of which 7 patients had been confirmed SLBT on arthroscopy. There is a significant difference (p <0.01) in the sensitivity of detection of SLBT.

CONCLUSION

The detour sign based on axial MR images may be regarded as an additional anatomical feature that helps improve diagnostic performance for detecting SLBT.

CLINICAL RELEVANCE/APPLICATION

The detour sign will make it easy to detect the lesion with only several images on the axial plane, and may improve the detection rate of SLBT and provide the reasonability for surgery.

SSA13-02 • ABER Position MR Arthrography of the Shoulder: Diagnostic Signs for Capsular Laxity in Patients with Atraumatic Multidirectional Instability

Christoph Schaeffeler MD (Presenter) ; Simone Waldt MD ; Jan S Bauer MD ; Chlodwig Kirchhoff MD ; Bernhard Haller ; Michael Schroeder ; Ernst J Rummeny MD ; Andreas Imhoff ; Klaus Woertler MD

PURPOSE
To retrospectively evaluate diagnostic signs for capsular laxity on ABER position MR arthrography (MR-A) of the shoulder in patients with atraumatic multidirectional instability.

METHOD AND MATERIALS
Clinical data of patients with 275 consecutive MR-Arthrographies including T1w ABER position were reviewed. Patients with MDI were identified through typical clinical history and instability in two or more directions. Patients with atraumatic MDI, overhead athletes (including posterosuperior impingement), and age > 45 years were excluded. The control group comprised patients with clinical stable shoulders. ABER position MR-A were independently assessed by three blinded radiologists for two defined signs (Figure): (1) Crescent sign of the anteroinferior capsular ligament (AIGHL); and (2) Triangle sign: Contrast filled triangular shaped space between AIGHL, HH, and glenoid. Centering of the HH in the glenoid fossa was determined. All images were reevaluated by observer 1 two months after the initial assessment.

RESULTS
21 MR-A were added to the study group, 17 to the control group. Sensitivity for the crescent sign in the diagnosis of MDI was 57/62/48% (observer 1/2/3), specificity was 100/100/94% with excellent multirater-agreement ($\kappa$ = 0.813); area under the ROC-Curve (AUC) was 0.786/0.810/0.709. Sensitivity for the triangle sign was 48/57/48%, specificity was 94/94/94% with excellent multirater-agreement ($\kappa$ = 0.824); AUC was 0.790/0.756/0.738/0. The presence of at least one of these laxity signs had a sensitivity of 86/91/81%, and a specificity of 94/88/94% with an AUC of 0.899/0.894/0.875 ($\kappa$ = 0.842); Intraobserver-agreement was excellent ($\kappa$ = 1.000). Patients with a positive triangle sign showed significantly increased posterosuperior deformation of the HH ($\kappa$ = 0.921).

CONCLUSION
Considered separately, the crescent and triangle sign showed inappropriate diagnostic performance. However, the presence of either the crescent or the triangle sign or both on ABER position MR arthrography of the shoulder allows for accurate diagnosis of capsular laxity in patients with atraumatic MDI.

CLINICAL RELEVANCE/APPLICATION
Functional MR-Arthrography of the shoulder including images in ABER position enables the radiologist to accurately assess laxity of the anteroinferior joint capsule by using simple and objective signs.

SSA13-03 • Correlation of MRI with Arthroscopy for the Diagnosis of Subscapularis Tendon Tears: A Musculoskeletal Division’s Experience

Soterios Gyftopoulos MD (Presenter); John S O’Donnell MD; Neil P Shah MD; James S Babb PhD; Michael P Recht MD

PURPOSE
To determine the accuracy of MRI for the diagnosis of subscapularis tendon tears utilizing arthroscopy as the gold standard.

METHOD AND MATERIALS
The MR and arthroscopy reports from 286 consecutive patients were reviewed with 3 inclusion criteria: 1) Non-contrast MRI performed at our institution, 2) Arthroscopy (OR) within 6 months of the MRI, and 3) No prior subscapularis surgery. 42 patients were excluded (6 non-specific OR reports, 4 tears of the inferior tendon, 32 MR arthrographic studies). The MR and OR reports were reviewed for the presence and degree of tearing (partial (PT)/full-thickness (FT)). Only PT-articular tears were included, as tears that involved only the intrasubstance and/or bursal surface are not typically seen on arthroscopy as per our orthopaedists. Estimates of the accuracy, sensitivity, specificity, and positive and negative predictive values were derived for MRI using arthroscopy as the gold standard.

RESULTS
There were a total of 244 patients (161 men/83 women; mean 48 yrs/range 15-83) and 111-1.5T/133-3T MRIs. There were 25 (16 PT/9 FT) tears and 219 intact tendons on arthroscopy. Nineteen of the 25 arthroscopic tears (10/16 PT; 9/9 FT) and 200 of the 219 intrasubstance tears were correctly diagnosed on MRI. One tear was called FT on MRI, but was PT in the OR. There were 18 PT and 11 FT tears identified on MRI that were not seen in the OR as well as 5 PT tears found in the OR, but not on MRI. Without differentiating between PT and FT tears, our analysis demonstrated 80% sensitivity, 91% specificity, 90% accuracy, and 51% positive and 55% negative predictive values. There was 91% accuracy for the diagnosis of PT tears and 99% accuracy for the diagnosis of FT tears. Retrospective review of the false positive cases demonstrated 3 common causes of reader error: volume averaging, misdiagnosis of an intrasubstance tear as an articular tear, and associated underlying advanced tendinosis.

CONCLUSION
MRI can be used to accurately diagnose subscapularis tendon tears utilizing arthroscopy as the gold standard.

CLINICAL RELEVANCE/APPLICATION
MRI is an effective tool in the evaluation of the subscapularis tendon. Familiarity with common causes of reader error (i.e. volume averaging) will decrease the likelihood of overcalling pathology.

SSA13-04 • Subscapularis (SSC) Tendon Tears: Diagnostic Performance and Inter-observer Reliability of Direct Magnetic Resonance Arthrography (MRA) among Observers with Varying Levels of Experience with Arthroscopic Correlation

Eugene Lee (Presenter); Jung-Ah Choi MD; Ju Han Oh MD; Eugene Joe; Sujin Kim; Sung Hwan Hong MD; Heung S. Kang MD

PURPOSE
To retrospectively review the diagnostic performance and inter-observer reliability of direct MRA in the diagnosis of articular/bursal-sided partial thickness and full-thickness SSC tendon tears among observers with varying levels of experience.

METHOD AND MATERIALS
Preoperative direct MRAs of 297 consecutive patients with arthroscopic confirmation (164 with normal or tendinopathy SSC tendons, 100 with articular/bursal-sided partial thickness tears, and 33 with full thickness tears) were evaluated independently by three radiologists with differing levels of experience in interpretation of musculoskeletal images. Diagnosis was made on T1 axial and/or sagittal images with fat suppression regarding the following findings, i.e. defect, thinning, thickening, increased signal intensity, leakage of gadolinium MR contrast, and was divided into three groups: 1= normal/tendinopathy, 2= articular/bursal-sided partial thickness tear, 3= high grade partial (more than 50% thickness)/full thickness tear. Sensitivity, specificity, and diagnostic accuracy were calculated. Inter-observer reliability was also evaluated using ICC between each pair of observers.

RESULTS
For full thickness tears, sensitivity was 87.9%/69.7%/66.7% (reader 1/reader 2/reader 3); specificity was 97%/98.5%/89.0%, and accuracy was 78.4%/85.1%/43.1%. For partial thickness tears, sensitivity was 75%/71%/56%; specificity was 81.7%/80.2%/69.0%, and accuracy was 78.2%/64.5%/47.9%. For normal/SSC tendons, sensitivity was 79.3%/92.3%/61.6%; specificity was 85.7%/81.2%/78.9%, and accuracy was 87.2%/84.4%/78.3%. The interclass correlation coefficient (ICC) was excellent for reader 1/reader 2 (ICC : 0.7918), good for reader 1/reader 3 (ICC : 0.6959), and fair for reader 2/reader 3 (ICC : 0.5927).

CONCLUSION
For diagnosis of SSC lesions on direct MRA, specificity was higher than sensitivity and accuracy for all three observers, especially for partial thickness tears. Accuracy was especially low in less experienced observer. Interobserver reliability varied according to level of experience, lower in observers with less experience.

CLINICAL RELEVANCE/APPLICATION
Depending on the level of experience of the radiologist, diagnostic performance of direct MRA in the diagnosis of subscapularis tendon tears varies, especially in diagnosis of partial thickness tears.

SSA13-05 • PASTA Lesion of Rotator Cuff Foot Print: Direct MR Arthographic Findings in Surgically Confirmed Patients

PASTA Lesion of Rotator Cuff Foot Print: Direct MR Arthographic Findings in Surgically Confirmed Patients

To retrospectively evaluate diagnostic signs for capsular laxity on ABER position MR arthrography (MR-A) of the shoulder in patients with atraumatic multidirectional instability.
PURPOSE
To evaluate MR arthographic (MRA) findings and to compare the MR findings with arthroscopic findings of characteristics, anatomical distribution, and extent of PASTA (partial articular-sided supraspinatus tendon avulsion) in arthroscopically confirmed patients.

METHOD AND MATERIALS
Sep 2009 to Feb 2013, 62 patients arthroscopically confirmed as PASTA. We excluded one lesion mixed with arthroscopically full-thickness tear. Total 61 patients were enrolled, and all patients underwent MRA with using 3-T MR. Mean interval time between MRA and arthroscopy was 77.3 days. Two musculoskeletal radiologists retrospectively reviewed the MRA by consensus blind to arthroscopic findings. PASTA was defined as undersurface tendon discontinuity at the footprint with articular side contrast. Anatomical locations were divided into four anterior, posterior, transition zone, inferior half of the middle facet of the greater tuberosity. Vertical extension divided into 3 grade: grade 1; involving 1-2mm of tendon insertion, grade 2; involving =50%, grade 3; involving >50%. Arthroscopies were done by one experienced orthopedic surgeon. Pearson correlation test was used to correlate the vertical grade and surgical percentage of the PASTA.

RESULTS
Of the 61 patients, 51 patients were diagnosed as PASTA (83.6%); anterior in 36 (70.6%), posterior in 10 (19.6), and transitional zone in 5 (9.8%). There was no involvement inferior half of the middle facet. Grade 1 vertical extension were 12 (23.5%), grade 2 in 18 (35.3%), and grade 3 in 21 (41.2%). The Pearson correlation test between MR vertical extension grade and surgical percentage was 0.69 (p=0.014 for reviewer 1, p=0.001 for reviewer 2 with ASES score; p=0.002 for reviewer 1, p=0.002 for reviewer 2 with Constant K score of clinical outcome at six-months after rotator cuff surgery.

CONCLUSION
PASTA lesion is well visualized on MRA as showing contrast filling at the partial articular-sided footprint avulsion at the greater tuberosity. The vertical extension grade was good correlation with surgical grade. In patients with extra-articular contrast leakage, the PASTA lesion could be misdiagnosed on MRA.

CLINICAL RELEVANCE/APPLICATION
PASTA lesion is well diagnosed on MRA and its extent was good correlation with surgical grade.

SSA13-06 • Postoperative MR Six Months after Rotator Cuff Surgery: Which MR Finding Is Correlated to Clinical Outcome?
Wool Kim (Presenter); Young Cheol Yoon MD; Sanghee Lee MD

PURPOSE
The purpose of this study is to evaluate the correlation between various post-operative MR findings and clinical score.

METHOD AND MATERIALS
This retrospective study protocol was approved by our institutional review board and informed consent was waived. MRI examinations were performed on 180 shoulders of 178 patients who underwent rotator cuff repair surgery (64 males, 114 females; mean age, 60.2 years; age range, 22-80 years). The mean interval between MR and surgery was 160.6 (120-180) days. Two radiologists who were blinded to clinical score evaluated continuous variables (bone marrow edema-maximum, bone marrow edema-summation, thickness of repaired tendon) independently, and categorical variables (adhesive capsulitis, foot print coverage, subcortical cyst, fatty atrophy of rotator cuff muscles, subacromial enthesophyte, subacromial fluid, and signal intensity grade of repaired tendon) with a consensus. Each finding was correlated to American Shoulder and Elbow Surgeons (ASES) score and the Constant-Murley (Constant K) score of clinical outcome. Pearson correlation coefficient was calculated and p value less than 0.05 was considered to be statistically significant. Intraclass coefficients were obtained for continuous variables.

RESULTS
Thickness of repaired tendon (p=0.014 for reviewer 1, p=0.001 for reviewer 2 with ASES score; p=0.002 for reviewer 1, p=0.002 for reviewer 2 with Constant K score of clinical outcome six-months after rotator cuff surgery.

CONCLUSION
Attention should be paid to thickness of repaired tendon and fatty atrophy of rotator cuff muscle when evaluating post-operative MR after rotator cuff surgery.

SSA13-07 • Decentering Syndrome: An Important Cause of Isolated Teres Minor Atrophy
Scott Lenobel MD (Presenter); Michael Olson DO, MBA; Jason E Payne MD; Alan Rogers MD; Erin Shropshire; Barbaros S Erdal DDS, PhD; Joseph S Yu MD

PURPOSE
To evaluate imaging findings related to humeral head decentering as a potential cause of isolated teres minor atrophy.

METHOD AND MATERIALS
We retrospectively reviewed 500 shoulder MRI examinations performed from 2004-2013 to identify patients with isolated teres minor atrophy. We excluded patients with quadrilateral space or Parsonage-Turner syndromes and those with a history of posterior shoulder dislocation. 37 patients fit our selection criteria with 2 patients exhibiting bilateral disease. Decentering was defined as posterior humeral head subluxation at rest. The images were reviewed by a musculoskeletal radiologist and fellow for posterior labral tears, posterior capsular pathology, and humeral head decentering. Additional findings recorded were the presence of a rotator cuff tear, biceps tendon, and glenohumeral arthritis. An age and sex matched control group of 39 patients was identified in which each patient had a posterior labral tear but no teres minor atrophy.

RESULTS
The incidence of isolated teres minor atrophy is 1.6%. In our group of 39 patients (30 males/9 females; average age 54 years, range 33 to 79 years), 38 (97.4%) had a posterior labral tear, posterior capsular pathology, or humeral head decentering. Posterior labral tears were seen in 32 (82.1%), 14 (35.9%) had posterior capsular pathology, and 19 (48.7%) demonstrated posterior humeral head subluxation. 33 had a rotator cuff tear, none of whom involved the teres minor, 11 had a biceps tear, 32 had an anterior labral tear, 29 had a superior labral tear, and 26 had humeral head subluxation. In the control group, 7 (17.9%) had posterior humeral head subluxation compared to 19 (48.7%) in the teres minor atrophy group (p value < 0.01).

CONCLUSION
Humeral head decentering is a frequent finding in patients with isolated teres minor atrophy in addition to secondary signs of posterior glenohumeral instability suggesting that traction on the teres minor nerve may be integral to this condition. A statistically significant difference in the presence of humeral head decentering was shown between patients with isolated teres minor atrophy compared to patients without isolated teres minor atrophy.

CLINICAL RELEVANCE/APPLICATION
Ours is the first project to identify a statistically significant association between posterior humeral head decentering and isolated teres minor atrophy.

SSA13-08 • Subcoracoid Impingement; Is the Consequence of Narrow(ed) Coracohumeral Interval or Narrow Coracohumeral Angle?
Eser Sanverdi MD (Presenter); Ali Ozur MD; Mehmet Ali Gurses MD; Safak Salvarli MD
POURS
Subhoracoid impingement (SCI) is one of the most frequent reason of the anterior shoulder pain. Degeneration of subcoracoid muscle tendon secondary to repetitive microtrauma is the main problem. In this magnetic resonance imaging study we aimed to investigate if the angle between the free edge of the coracoid process and the humeral head (CHA), or the distance of the coracohumeral interval (CHD) was causative in the development of SCI.

METHOD AND MATERIALS

RESULTS

CONCLUSION
To our best knowledge, CHA was not assessed as an indicator of SCI until now. In the development of isolated subcoracoid tendinopathy, our findings suggested that CHA is more important than CHD. However further clinical and radiological studies are needed.

CLINICAL RELEVANCE/APPLICATION
Coracoplasty indications and techniques might be influenced by the course of the coracoid.

SSA13-09 • Does Reducing the Concentration of Bupivacaine when Performing Therapeutic Shoulder Joint Injections Impact the Clinical Outcome? Our Experience after 1500 Injections

Michael G Fox MD (Presenter) *; James Patrie MS

PURPOSE
Since the chondrotoxicity of local anesthetics is dose dependent, we reduced the Bupivacaine concentration when performing therapeutic joint injections from 0.50% to 0.25% in 2011. This study determines if this lower Bupivacaine concentration impacted the 10 minute and 1 week post-injection pain scores in patients receiving steroid-anesthetic joint injections.

METHOD AND MATERIALS
This IRB approved HIPAA compliant study included all out-patient fluoroscopic guided glenohumeral injections performed by musculoskeletal (MSK) radiologists and/or MSK fellows between 9/09 and 3/13. Intra-articular placement was confirmed with iodinated contrast or rarely air. Patients received either 2.5 mL of Bupivacaine 0.5% (Group A) or 2.5 mL of Bupivacaine 0.25% (Group B). All injections included 0.5 cc of Kenalog 40mg/mL. Group A included 493 injections (210M:283F) (mean age 57) and Group B included 1049 injections (448M:601F) (mean age 57). The patients’ pain level was recorded by someone blinded to the Bupivacaine concentration on a numeric scale of 0-10 (0=no pain and 10=extreme pain) immediately prior to and 10 minutes post-injection (all injections) and 1 week post-injection (877 injections). Orthopedics referred 92.9% of Group A and 95% of Group B injections. Statistical analysis was performed using linear mixed models.

RESULTS
The pre- and 10 minute post-injection mean pain scores (all injections) was 5.5/10 and 1.9/10 for Group A and 5.2/10 and 2.1/10 for Group B. The pre- and 1 week post-injection (877 injections) mean pain scores was 5.7/10 and 3.0/10 for Group A and 5.4/10 and 2.9/10 for Group B. Adjusting for sex, age and pre-pain level, the estimated mean difference in pain reduction between Groups A and B was 0.27 (95% CI: [0.03, 0.51] p=0.030) 10 minutes post-injection and 0.46 (95% CI: [0.14, 0.78] p=0.005) 1 week post-injection with greater pain reduction in Group A. Mean fluoro time was 20.5 sec in group A and 13.7 sec in Group B (p=0.001). Patients reported statistically greater pain reduction both 10 minutes and 1 week after therapeutic glenohumeral injections when a higher concentration of Bupivacaine was utilized.

CLINICAL RELEVANCE/APPLICATION
Glenohumeral injections using a higher Bupivacaine concentration provided greater pain relief. However, the actual numeric estimated reduction in pain is small and may not be clinically significant.

Musculoskeletal (Tumor I)

Sunday, 10:45 AM - 12:15 PM • E451B

SSA14 • AMBRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5
Moderator
Mark D Murphey, MD
Moderator
Jim S Wu, MD *

SSA14-01 • Diagnostic Performance of Ultrasound Elastography in the Evaluation of Benign and Malignant Soft Tissue Tumors

Se Kyong Park (Presenter); In Sook Lee; You Seon Song; Jeung Il Kim MD, PhD; Hoon Soo Kim

PURPOSE
To evaluate the diagnostic performance of ultrasound elastography for differentiating malignant from benign soft tissue tumors.

METHOD AND MATERIALS
From December 2012 to March 2013, 52 consecutive patients with soft tissue mass lesions underwent ultrasound including elastography by two musculoskeletal radiologists. One radiologist measured quantitatively the size, elasticity ratio between lesion and normal subcutaneous fat layer, region-of-interest (ROI) values and semiquantitatively elasticity score (1-10) by color pattern on obtained cine elastographic images by using Q-Lab software consulting other radiologist. Also two radiologists analyzed the location (5 types according to depth), echogenecity (6 types), margin, the presence or absence of posterior enhancement and vascularity by consensus.

RESULTS
36 patients had benign lesions and 16 had malignant soft tissue tumors. In the cases of benign tumors, mean ROI value, elasticity ratio, and elasticity score were 73.4, 1.53, and 5.25, respectively. In the malignant tumors, those are 52.3, 1.88, and 2.93, respectively. By two sample t-test, the ROI values, the size, the elasticity score and the location were significant factors (p < 0.05). The elasticity ratio, echogenecity, the presence or absence of posterior enhancement and vascularity and margin not affected to differentiate between benign and malignant lesions (p > 0.05). In the measurement of elasticity ratio, intra-class correlation coefficient was 0.896 (p < 0.05) and the difference of measured values was insignificant. Also, the locations of tumors did not affect to the elasticity ratio. By ROC analysis, only the size (AUC, 0.825; SE, 0.061; 95% confidence interval, 0.694-0.916; p < 0.0001, criterion > 28 mm) was statistically significant.

CONCLUSION
Although the elasticity ratio of the soft tissue mass was not significant, the elasticity score by color pattern was helpful for differentiating between benign and malignant lesions on ultrasound elastography.

CLINICAL RELEVANCE/APPLICATION
The quantitative measurement such as elasticity ratio was not yet useful for differentiating between benign and malignant soft tissue tumors. However the elasticity score by color pattern was helpful.
SSA14-02 • Cost-effectiveness of Advanced Cross-sectional Imaging in the Work-up of Newly Discovered Soft Tissue Masses

Sahar J Farahani MBBS (Presenter); John Eng MD; Christian Meyer; John A Carrino MD, MPH *; Laura M Fayad MD

PURPOSE
To determine the required accuracy of an advanced imaging modality to be cost-effective over biopsy in the work-up of new soft tissue masses (STMs) that have already undergone a conventional work-up.

METHOD AND MATERIALS
A decision analytic model was developed to estimate quality-adjusted-life (QALY) and costs associated with biopsy and advanced imaging (such as MR spectroscopy) in differentiating between malignant and benign STMs for the first five years after diagnosis. The model incorporated prevalence of malignant and benign STMs at the community level, the performance characteristics of the imaging modality of choice, and 1-5 year overall survival rate for the different stages at the time of diagnosis, and costs and effectiveness associated with each strategy. A discount rate of 3% was considered. An incremental cost per QALY gained was compared between two strategies. One-way sensitivity analysis was performed to evaluate the stability of the model to change in the clinically-plausible range for all the variables. Threshold analysis was used to determine the performance characteristic of the imaging tool, which could justify its utilization regarding costs and effectiveness instead of biopsy.

RESULTS
Considering a malignancy prevalence of 0.01 and sensitivity and specificity of 95% and 82% for the imaging modality, we ran a Monte Carlo model 10000 times. The results demonstrated that the incremental cost for one QALY gained by advanced imaging was $776, whereas by biopsy, was $1472. Threshold analysis revealed a required sensitivity of 83% and specificity of 75% for justifying advanced imaging over biopsy. One-way sensitivity analysis showed the model is stable to change in a clinically plausible range for the other variables.

CONCLUSION
For the work-up of new STMs, advanced imaging is a cost-effective non-invasive alternative to biopsy.

CLINICAL RELEVANCE/APPLICATION
Benign STMs present to Orthopaedic clinics 100 times more commonly than malignant STMs and are often unnecessarily referred for biopsy. Decision analysis proves the value of advanced imaging as the in

SSA14-03 • Detection of Soft Tissue Sarcoma Recurrence: Added Value of Functional MR Imaging Techniques at 3T

Filippo Del Grande MD, MBA (Presenter); Ty K Subhawong MD; Kristin L Weber MD; Michael R Aro MBBS *; Charles M Mugera MBCh, MRCP; Laura M Fayad MD

PURPOSE
To define the added value of dynamic contrast-enhanced (DCE-MR) and quantitative diffusion weighted imaging (DWI) with apparent diffusion coefficient (ADC) mapping to detect recurrence of soft tissue sarcomas (STS) after surgical resection.

METHOD AND MATERIALS
The study is HIPPA compliant and approved by our institutional review board. 58 MR patients referred for post-operative surveillance following STS resection were studied with 3 T MR. The MR protocol included: T1-weighted, fluid-sensitive, contrast-enhanced T1-weighted, DCE-MR, and DWI with ADC map. Two readers independently reviewed for signal and morphologic characteristics on conventional sequence, the presence or absence of arterial enhancement by DCE-MR and ADC measurements of the surgical bed. Mass-like signal abnormality on conventional sequences, arterial enhancement by DCE-MR or a low signal mass on ADC maps were defined as recurrence. The readers reviewed first the conventional sequences, second the addition of DCE-MR, and third the DWI/ADC maps. The diagnostic performance of conventional MR for detecting recurrence was compared to that with the addition of functional sequences.

RESULTS
There were eight histologically-proven recurrences out of 58 studies. The sensitivity and specificity of MR for detecting tumor recurrence were 100% and 48.0%, 60.0% and 93.2%, and 100% and 90.7% for conventional sequences, for addition of DCE-MR, and for addition of DWI/ADC mapping, respectively.

CONCLUSION
The addition of functional MR sequences to a routine MR protocol increase specificity over 90%. In particular DCE-MR alone has a discrimination ability of 95% for distinguishing recurrent sarcoma from post-surgical scarring.

CLINICAL RELEVANCE/APPLICATION
For detecting recurrence, the improved specificity offered by functional sequences has the potential to reduce unnecessary biopsies and patient anxiety

SSA14-04 • Murial Nodule in a Postoperative Fluid Collection after Soft Tissue Sarcoma Resection at MRI: Not a Sign of Recurrent Tumor

Joshua Lantos MD (Presenter); Sinchun Hwang MD; David M Panicek MD

PURPOSE
To determine the prevalence and clinical significance of nodules within fluid collections at MRI after surgical resection of primary soft tissue tumors.

METHOD AND MATERIALS
This retrospective study includes 175 consecutive patients who underwent resection of primary soft tissue sarcoma at a tertiary cancer center and showed fluid collections at least 1 cm in largest diameter in the surgical bed at postoperative MRI. Images were reviewed to determine the presence of nodules within the collections, defined as a well-defined focus measuring at least 0.7 cm on T1-weighted and fluid-sensitive images. Collections were classified based on signal intensity (homogeneous, heterogeneous), and the presence of septa, blood products (hyperintense T1 signal), and rim (thin, thick, enhancing). The size, signal intensity, and contrast enhancement of nodules were reviewed. Nodules were classified as benign or malignant based on histologic results, or clinical or MRI follow-up.

RESULTS
Collections were present in 75 patients (43%). 43 collections showed homogeneous fluid intensity (57.3%) and 32 were heterogeneous (42.6%). Internal septa were present in 49 (65.3%) and blood products in 16 (21.3%). The majority of collections showed a thin rim (66.6%) and rim enhancement (90.6%). Nodules were present inside six (8%) collections. All collections that contained nodules were heterogeneous, and half showed an enhancing rim. Three (50%) nodules enhanced and two (33%) were T1-hyperintense. At follow-up MRI, three nodules resolved, two were stable in size, and one decreased in size. Nodules in two patients were biopsied, and surgically resected in another; all three nodules were benign. Two other patients had no recurrence at clinical or imaging follow-up, and another died within three months from metastases.

CONCLUSION
Nodules infrequently develop within a fluid collection at MRI after surgical resection of a primary soft tissue sarcoma, and are unlikely to represent local tumor recurrence.

CLINICAL RELEVANCE/APPLICATION
A nodule within a postoperative fluid collection at MRI after soft tissue sarcoma resection generally does not represent tumor recurrence;
The aim of this study was to assess the utility of MRI in identifying the presence of residual disease in incompletely excised soft tissue sarcomas.

METHOD AND MATERIALS
Following IRB approval, 315 consecutive cases of incomplete excision of soft tissue sarcoma were identified from a surgical database. 237 patients with a positive margin at initial surgery who underwent MRI prior to re-excision were included. Two MSK radiologists, blinded to the final pathological finding at re-operation reviewed all MRIs in consensus. Pulse sequences varied but included axial and longitudinal T1 and fat suppressed fluid sensitive images in all cases. Post-gadolinium T1 fat-suppressed images were available in some. Imaging features evaluated included lesion morphology, location, fascial penetration, signal characteristics and enhancement. An overall consensus prediction was made regarding the presence of residual disease. The individual findings and the overall prediction were compared to the final pathology.

RESULTS
There were 98 females and 139 males with an average age of 55 years (range 17-89). The pathological diagnosis was malignant fibrous histiocytoma (n=67), leiomyosarcoma (n=47) and liposarcoma (28). The remaining 96 patients had undifferentiated sarcomas or rare subtypes.

- 120 patients had residual disease, 48 with microscopic foci and 72 with macroscopic foci greater than 10 mm in diameter. 117 patients had no residual disease on pathology. MRI had a sensitivity of 60%, specificity of 91%, PPV of 87% and NPV of 69%. When a mass was present on pathology, MRI had a high sensitivity (88%) and specificity (88%) and a high NPV (94%). There was a poor sensitivity (19%) in detection of microscopic residual disease.

- 82 lesions had nodular, 40 plaque and 11 reticular morphology. The presence of a nodule had a high specificity (89%) and PPV (84%) but low sensitivity (58%). Plaque and reticular morphology had low sensitivities and predictive values.

CONCLUSION
MRI performs poorly in identifying those with microscopic disease but has a better performance in the presence of macroscopic disease. The presence of a nodule is the most specific morphologic predictor of residual disease.

CLINICAL RELEVANCE/APPLICATION
Many soft tissue sarcomas have positive margins at initial surgery. MRI is the modality of choice for re-evaluation. Further investigation of its utility in predicting disease is of value.

SSA14-06 • Comparison of 3T Diffusion-weighted MR Imaging and PET/CT in Bone and Soft Tissue Tumors: Quantitative Analysis of ADC and SUV
So-Yeon Lee MD (Presenter); Won-Hee Jee MD; Ie Ryung Yoo; Joon-Yong Jung MD; Yang-Guk Chung MD

PURPOSE
To retrospectively determine whether the apparent diffusion coefficients (ADC) on 3T diffusion-weighted magnetic resonance imaging (DWI) correlate with the standardized uptake values (SUV) on positron emission tomography (PET)/computed tomography (CT) in bone and soft tissue tumors.

METHOD AND MATERIALS
The institutional review board approved this HIPAA-compliant study, and informed consent was waived. This study included 45 patients (30 men, 15 women, mean age 57 years, range 17-90) with pathologically confirmed soft tissue (n = 34) and bone (n = 15) tumors who underwent the 3T MR imaging including DWI and whole-body fluorine 18 fluorodeoxyglucose PET/CT before treatment. Maximum (SUVMax) and average (SUVav) SUVs of the tumors were obtained by one nuclear medicine physician. Two musculoskeletal radiologists independently measured minimum (ADCmin) and average (ADCav) ADCs of tumors on the corresponding regions of the tumors where SUVs were obtained. ADC (ADCMus) of normal skeletal muscle was measured on the same axial plane. The ratios ADCmin/ADCMus and ADCav/ADCMus were calculated by ADCmin and ADCav of tumors divided by ADCmus, respectively. The Spearman rank correlation was obtained for statistical analysis. The differences in areas under the receiver operating characteristic curves (AUCs) were assessed.

RESULTS
There was significant, inverse correlation between SUVMax and the ratio ADCmin/ADCMus (r = -0.435 for reviewer 1 and r = -0.449 for reviewer 2, respectively, P < .005). SUVav and ADCav/ADCMus showed significant, inverse correlations (r = -0.444 for reader 1 and r = -0.440 for reviewer 2, respectively, P < .005). The AUCs of ADCmin/ADCMus and ADCav/ADCMus (0.955 for reviewer 1, 0.959 for reviewer 2, respectively) were significantly higher than those of SUVMax and SUVav (0.820 and 0.777, respectively) (P < .05).

CONCLUSION
There was significant correlation between ADC at 3T DWI and SUV at PET/CT in bone and soft tissue tumors and DWI showed better diagnostic performance than PET/CT for diagnosing malignancy.

CLINICAL RELEVANCE/APPLICATION
Quantitative DWI at 3T is comparable to PET/CT for evaluating bone and soft tissue tumors.

SSA14-07 • Dynamic Contrast Enhanced (DCE) Targeted MR-guided Biopsy of Soft Tissue Tumors at 3Tesla: Feasibility, Preliminary Results on Accuracy, and Correlation with Diffusion Weighted Imaging (DWI), and Multivoxel 1H-MR Spectroscopy (1H-MRS)
Iris-Melanie Noebauer-Huhmann MD (Presenter); Gabriele Amann MD; Martin Krssak PhD; Joannis Panotopoulos MD; Christian Czerny MD; Siegfried Trattning MD

PURPOSE
To test the dynamic contrast enhanced (DCE) sequence of soft tissue tumor staging MR for intraslesional targeting with subsequent minimally MR-guided biopsy at 3T, and to compare DCE hotspots with diffusion-weighted imaging (DWI) and multivoxel 1H-MR spectroscopy (1H-MRS).

METHOD AND MATERIALS
Fifty-six patients with suspected soft tissue tumors prospectively underwent preoperative staging MR with subsequent MR-guided core needle biopsy at 3T after written informed consent, according to Institutional review board approval. Surgical histology available in 54 patients revealed 53 soft tissue tumors (29m, 24f, mean age 54 years, range 19-90). DCE was conducted in 50/53 patients (contrast agents: Gd-BOPTA, Gd-DOTA, and Gd-D03A-butil). DWI-MSh FH in 51/53 patients, and 1H-MRS in 37/53 patients. Matching of the most suspicious regions in DWI and 1H-MRS with DCE results was assessed.

RESULTS
DCE was heterogeneous in 42 cases, including all malignant tumors. In 2 cases, DWI was additionally used for targeting. In 6 cases appearing homogeneous on all sequences, biopsy was taken arbitrarily. 3 small lesions required no region selection. Diagnostic yield was 98.1% (52/53). The accuracy rates of biopsy were 100% (52/52) in predicting the dignity, 96.2% for definitive tissue diagnosis, and 92.3% for tumor grade. DCE matched with preselected DWI regions in 87.5%, and with 1H-MRS in all assessable regions. The diffusion weighted sequence was of limited value for the selection of the biopsy area. Spectroscopy could be compared with the DCE target region.
in 23/37 patients only. Area match of 1H-MRS with the hotspots revealed by DCE was observed in all assessable cases, but, due to technical restraints, tumor coverage was not possible by 1H-MRS in feasible examination time.

CONCLUSION
Our preliminary study indicates, that biopsy of soft tissue tumors can be performed accurately and safely by DCE targeted MR-guidance at 3T, using the DCE staging sequence in combined staging/biopsy MRI in outpatients. DWI was of limited value. 1H-MRS results were promising, but the method cannot be recommended for biopsy targeting in its present form.

CLINICAL RELEVANCE/APPLICATION
In soft tissue tumors, the DCE-sequence of staging MR can be used accurately and safely for targeting of minimally-invasive MR-guided biopsy, which might be useful especially in heterogeneous tumors.

SASA14-08 • Preoperative Tractography Assessment of the Anatomic Relationship between Peripheral Nerve Sheath Tumors and Fibers within the Nerve of Origin Correlate with Intraoperative Findings
Stephanie W Hou MD (Presenter); Esther L Yuh MD, PhD; Jared A Narvid MD; Gregory E Punch MD; Jason F Talbott MD, PhD; Suchandrima Banerjee *; Michel Kliot; Cynthia T Chin MD

PURPOSE
Magnetic resonance neurography (MRN) is an emerging tool for anatomic depiction of nerves and their pathology. To investigate the preoperative utility of MRN, including diffusion tensor tractography, we compared MRN findings to intraoperative findings and histopathology in 7 patients.

METHOD AND MATERIALS
Seven patients (ages 24-69 years) with a clinical/imaging diagnosis of peripheral nerve sheath tumor were referred by neurosurgeons for MRN at our institution in 2011-2013 and subsequently underwent surgical resection. Preoperative DTI was performed with 28 directions, and tractography was performed by placing seed points along the peripheral nerve proximal and distal to the mass, using FA minimum threshold of 0.18 and maximum turning angle threshold of 45°. The neuroradiologist and surgeon used the following categorical rating system to describe the spatial relationship of the dominant location of most of the peripheral nerve fibers relative to the mass: fibers predominantly anterior-1, medial-2, posterior-3, lateral-4, anterior and medial-5, posterior and medial-6, posterior and lateral-7, anterior and lateral-8. We calculated Cohen’s kappa for agreement between neuroradiologist assessment of MRN tractograms and operative findings.

RESULTS
Seven resected masses consisted of 6 schwannomas (including 2 cellular schwannomas) and one neurofibroma. ADC within the solid portion of the masses was 1.9±0.8 x 10⁻³ mm²/sec (mean±SD), consistent with prior reports of relatively higher ADC within benign tumors. Six of seven cases were concordant for nerve fibers predominantly along the posterior and medial margins (n = 4), posterior margin (n = 1), or anterior and medial (n =1) margins of the tumor. The discrepant case was interpreted as predominantly dorsal fibers on the MRN, with operative findings indicating both dorsal and medial fibers. Cohen’s kappa for agreement between neuroradiologist and intraoperative findings was 0.73 (p = 0.006).

CONCLUSION
In the setting of nerve sheath tumors planned for resection, DTI tractography may be useful preoperatively to assess the spatial relationships of tumor to fibers within the nerve of origin and thereby reduce the risk of causing a functional deficit during surgery.

CLINICAL RELEVANCE/APPLICATION
This study is the first to demonstrate the application of DTI tractography in preoperative characterization of the relationship of peripheral nerve sheath tumors to fibers within the nerves of origin.

SASA14-09 • Differential MRI Diagnosis between Benign and Malignant Bone or Soft Tissue Tumors Using Dynamic Contrast-enhanced and Diffusion-weighted Images
In Sook Lee (Presenter); You Seon Song; Se Kyoung Park; Jeung Il Kim MD, PhD; Hak Jin Kim MD; Jong Woon Song

PURPOSE
to evaluate the diagnostic performance of dynamic contrast-enhanced (DCE) and diffusion-weighted (DW) MR images for differentiation between benign and malignant bone or soft tissue tumors

METHOD AND MATERIALS
Forty-two patients with bone or soft tissue masses prospectively performed DCE and DW MR examinations addition to routine protocols. On DCE images using tissue 4D perfusion software, K(trans) (transfer constant), Kep (rate constant), Ve (volume fraction), and iAUC (initial area under curve) were calculated from quantitative analysis. Also, the graphs of VOI (volume of interest) about whole mass and tractography was performed by placing seed points along the peripheral nerve proximal and distal to the mass, using FA minimum threshold of 0.18 and maximum turning angle threshold of 45°. The graphs of VOI (volume of interest) about whole mass and region-of-interest (ROI) within the mass were automatically obtained. The types of graphs were classified into five. On DW and apparent diffusion coefficient (ADC) images, ROIs of masses were measured.

RESULTS
Twenty-three patients had benign tumors and nineteen had malignant tumors. The mean values of Ktrans, Kep, Ve, iAUC, and ROI in benign tumors were 0.0596, 0.308, 0.251, 3.761, and 1.801 respectively. Those in malignant tumors were 0.157, 0.476, 0.298, 10.471, and 1.801 respectively. Ktrans, iAUC and ROI values were statistically significant (p < 0.05) for differentiating benign and malignant tumors. By ROC curve analyses, Ktrans (AUC, 0.8; standard error (SE), 0.0696; 95% confidence interval (CI), 0.648-0.907; p < 0.0001, criterion > 0.117), ROI value on ADC (AUC, 1; SE, 0; 95% CI, 0.694-0.916; p = 0, criterion = 0.97), Kep (AUC, 0.743; SE, 0.0779; 95% CI, 0.588-0.867; p=0.0016; criterion > 0.287) and iAUC (AUC, 0.832; SE, 0.0632; 95% CI, 0.685-0.929; p < 0.0001; criterion > 4.908) were significant.

CONCLUSION
Ktrans, representing permeability into the extracellular space from blood plasma and contrast delivery (perfusion) on DCE images and ADC values were helpful for differentiating between benign and malignant bone or soft tissue tumors, quantitatively and semi-quantitatively.
LL-MKS-SU2A • Postero-medial Olecranon Impingement: CT and MR Imaging Findings of Pitching Elbow
Ching-Chung Ko MD (Presenter) ; Kuen-Huang Chen MD ; Jeon-Hor Chen MD ; Wen-Sheng Tzeng MD ; Ginger Shu ; Chung-Da Wu

PURPOSE
Postero-medial olecranon impingement (PMOI) is the most common diagnosis in the baseball players with throwing-induced elbow injuries. Imaging manifestations of PMOI have seldom been reported before. We aimed to investigate imaging features of PMOI with emphasis on CT and MRI, and compare the imaging findings in these two modalities.

METHOD AND MATERIALS
From July 2010 to February 2013, imaging studies of the elbow joints from 24 baseball players are reviewed by an experienced musculoskeletal radiologist. All of these players had elbow pain when throwing and decreased range of motion in the elbow joint. All subjects are male with a mean age of 17.6 years (range, 12 to 31 years). The mean duration of playing baseball was 8 years (range, 3 to 19 years). The dominant arm was affected in all patients. The imaging modalities for evaluating PMOI include plain film (n=24), CT (n=12), MRI (n=24).

RESULTS
The imaging findings by CT or MRI include PMOI (n=20, 83%), injury of ulnar collateral ligament (UCL) (n=15, 63%), avulsion fracture of medial epicondyle (ME) (n=10, 42%), osteochondritis dissecans (OCD) (n=7, 29%), stress fracture of olecranon process (n=5, 21%), and ulnar neuritis (n=1, 4%). The findings in the plain film include osteophytes, loose bodies, and stress fracture of olecranon process. In the 20 players with PMOI findings, 10 players received CT and MRI studies simultaneously. The imaging manifestations in CT studies of these 10 players include cartilage space loss (n=10, 100%), subchondral sclerosis (n=10, 100%), osteophytes (n=10, 100%), OCD (n=4, 40%), and stress fracture of olecranon process (n=4, 40%). As compared with CT, the MRI showed lower sensitivity in detecting PMOI findings such as cartilage space loss, osteophytes, and OCD. The MRI is good in detecting associated findings of PMOI like UCL injury (n=7, 70%) and bone marrow edema (n=6, 60%) in these 10 players, which cannot be evaluated by CT because of poor image resolution. The most common associated findings of PMOI in this study are UCL injury (n=15, 75%) and avulsion fracture of ME (n=9, 45%).

CONCLUSION
Although CT is more sensitive for detecting PMOI, MRI is necessary for evaluating associated injuries. In patients diagnosed with PMOI and need surgical intervention, CT offers fast and helpful information.

CLINICAL RELEVANCE/APPLICATION
CT is a good choice in evaluating PMOI and could be used before surgical intervention in patients diagnosed with PMOI previously.

LL-MKS-SU3A • MRI of the Knee-Do 2 Millimeter Slices Improve Diagnostic Performance?
Jacob J Visser MS ; Annick C Weustink MD, PhD ; Edwin H Oei MD, PhD (Presenter) ; Galided S Muradin MD

PURPOSE
To determine whether 2 millimeter slice thickness on knee MRI has additional value for evaluating menisci and cruciate ligaments in symptomatic patients.

METHOD AND MATERIALS
74 consecutive patients undergoing knee arthroscopy following MRI of the knee from January 1, 2011 until November 1, 2012 were included retrospectively. A routine clinical MRI protocol was acquired with 3 millimeter (mm) slice thickness followed by additional sagittal and axial 2 mm proton density (PD) weighted sequences. 2 sets of MR sequences per patient were created: routine protocol with 3 mm only and the extended protocol with additional 2 mm sequences. All MR imaging studies were reviewed independently by two musculoskeletal radiologists for presence of ligament and meniscal tears. Sensitivity and specificity of the routine and extended MRI protocol in the detection of meniscal tears and cruciate ligament tears were calculated with arthroscopy used as the reference standard. Logistic regression analysis was used to assess the additional value of the 2 mm PD-slices.

RESULTS
The extended MR imaging protocol with 2 mm slices had higher sensitivity than the routine MR imaging protocol for the detection of meniscal tears (94% versus 90%) and similar specificity (94% and 95% respectively). Sensitivity for detection of medial meniscal tears was 98% with the extended protocol versus 93% with the routine protocol with no difference in specificity (88%). For detection of lateral meniscal tears, both sensitivity and specificity were higher for the extended MR imaging protocol (89 versus 85% and 100 versus 90% respectively). Sensitivity for anterior cruciate ligament tears was 90% for the extended MR imaging protocol versus 92% for the routine imaging protocol, whereas the specificity was 83% for the extended imaging protocol versus 75%. Logistic regression analysis showed statistically significant additional value for the extended versus the routine MR imaging protocol in the detection of meniscal and anterior cruciate ligament tears (P
An extended knee MRI protocol with 2 mm slice thickness has additional value in the detection of meniscal and anterior cruciate ligament tears.

CLINICAL RELEVANCE/APPLICATION
Routine knee MRI protocols are often based on sequences with 3-4 millimeter slices. Two millimeter sequences improve diagnostic performance and may be an alternative to 3D isotropic scanning.

LL-MKS-SU4A • Estimation of Glenoid Bone Loss Using 3DMR Reconstructions of the Shoulder

Soterios Gyftopoulos MD (Presenter) ; Avner Y Yemin MD ; Luis S Beltran MD ; James S Babb PhD ; Marissa L Albert MD, MSc ; Laith M Jazrawi MD * ; Robert Meislin MD ; Eric J Strauss MD

PURPOSE
To assess the accuracy of 3DMR shoulder reconstructions for estimating glenoid bone loss (GBL).

METHOD AND MATERIALS
A retrospective review of patients who underwent MR shoulder examinations at our institution over the past 6 months was conducted with the following inclusion criteria: 1) history of shoulder dislocation, 2) Dixon 3D-T1W-FLASH sequence included in the protocol and post-processed into 3D reconstructions, 3) arthroscopy (OR) within 6 months of MRI and 4) GBL estimation performed in the OR using the bare-spot method and included in the OR report. Two readers blindly, independently estimated the percentage of bone loss along the width of the glenoid on the 3DMR reconstructions using the best-fit circle-method. Statistical analysis included a Wilcoxon test, and 95% confidence intervals to calculate the mean bias and absolute error for MRI compared to the OR estimates. Inter-reader agreement was assessed using intraclass (IC) and concordance correlation (CC) coefficient analysis.

RESULTS
There were a total of 14 patients (12-men, 2-women; mean age 29, range 19-51) that could be included in the study. There was no significant difference, on average, between the MRI and OR measures (p=0.767). A 95% confidence interval for the mean bias extended from -1.40% to 1.12%, implying that, when averaged over all patients, the true mean difference between the MRI and corresponding OR measures is expected to be less than 1.5%. A 95% confidence interval for the mean absolute error extended from 0.50% to 2.35%, implying that, when averaged over all patients, the true mean absolute error of the MRI measures relative to the OR measures is expected to be less than 2.35%. For inter-reader agreement, the measurements between the 2 readers had an IC of 0.92 and CC of 0.90, suggesting strong agreement.

CONCLUSION
3DMR reconstructions can be used to accurately quantify glenoid bone loss.

CLINICAL RELEVANCE/APPLICATION
The efficacy of 3DMR shoulder reconstructions in the estimation of glenoid bone loss decreases the need for 3DCT and its associated radiation dose and cost.

LL-MKS-SUSA • Could 3D-CT of the Shoulder Be Omitted from Pre-operative Evaluation for Anterior Instability? -Comparison of 3D-MRI with 3D-CT-

Yoshinao Sato MD (Presenter) ; Taiki Nozaki MD ; Atsushi Tasaki MD ; Masaki Matsusako MD, PhD ; Hiroshi Yoshioka MD ; Yukihisa Saida MD ; Yuka Morita MD ; Saya Horii MD ; Gensuke Akaike MD ; Goto Makoto ; Takaharu Suzuki

PURPOSE
The purpose of this study is to assess the accuracy of quantification of glenoid bone loss and evaluation of bony fragment on 3D-MRI as a substitute for 3D-CT.

METHOD AND MATERIALS
Both MRI and CT were performed in 25 anterior instability patients. We used fat-suppressed 3D volumetric interpolated breath-hold examination on 3T-MRI, and 320-slice CT scanner that renders 3D-image. Based on the result of 3D-CT as the golden standard, the sensitivity and specificity of 3D-MRI for detection and quantification of glenoid bone loss and bony fragment were determined by two radiologists.

RESULTS
Glenoid bone loss were noted in 13 (52%), and bony fragment were found in 10 (40%) on 3D-CT. Compared with 3DCT, the sensitivity and specificity of 3D-MRI in detecting glenoid bone loss were 84.3%-92.3% and 91.7%-100%, respectively (kappa value = 0.92) and those of in detecting bony fragment were 90.0%-100% and 100%, respectively (kappa value = 0.96 ). Angular degree of glenoid bone loss was 87.5±34.8 on measurement used 3D-MRI, 80.0±29.4 on 3D-CT. There was no significant difference (p=0.109).

CONCLUSION
3D-MRI is a promising substitute for 3D-CT as a reliable method for evaluating glenoid bone loss and bony fragment in anterior shoulder instability.

CLINICAL RELEVANCE/APPLICATION
3D-CT of the shoulder could be skipped from preoperative evaluation for anterior instability, and substituted 3D-MRI.

LL-MKE-SU6A • 'When Blood Corrodes' Musculoskeletal System Manifestations of Hemophilia A Multimodal Approach in a Cohort

Gabriel F Daza Cajas MD (Presenter) ; Jhon J Echeverri MD

PURPOSE
Classification and review of the acute and chronic abnormalities of the musculoskeletal system in hemophilic patients. Pathophysiology of the complications in this group of patients
To identify findings in plain radiography, CT and MRI as part of the management protocol of musculoskeletal injuries.

METHOD AND MATERIALS
Retrospective case series based on the cohort of patients with hemophilia in a referral center. We describe factor VIII deficiency, its etiology, global pathophysiology, and overall the most common and expected manifestations on the musculoskeletal system in patients with hemophilia. Description of the most prevalent radiological findings in patients who are part of an cohort of 500 individuals. Multimodal approach with surgical-pathologic correlation.

RESULTS
Approximately 150 events of documented pathology in the musculoskeletal system of the cohort are described. Approximation flowcharts are established for the diagnosis of pathology prevalent in patients with this disease:
- Traumatic Injuries
- Injuries with arthritic consequences
- Pseudo tumor-like lesions
- Intra Abdominal Injury

CONCLUSION
Hemophilia is an entity which, under controlled circumstances, allows an adequate quality of life and an acceptable survival rate. However, unless there is an accurate and early diagnosis, as well as intervention by a multidisciplinary team of specialists in hematological disease which could prevent or reduce complications and sequelae attributable to bleeding in the musculoskeletal system,
everyday circumstances can generate unexpected complications affecting the musculoskeletal system significantly.

CLINICAL RELEVANCE/APPLICATION
This paper is clinically useful for providers specialized in the management of patients with coagulation factor deficiency. These include orthopedists, hematologists and radiologists.

**LL-MKE-SU7A • MSCT in the Evaluation of Painful Hip Replacement: A Pictorial Guide**

Hector Vidal Trueba (Presenter); Elena Gallardo MD, PhD; Rosa Maria A Landeras MD; Rosario Garcia-Barredo; Rosa De La Puente; Gerardo Lopez Rasines MD

PURPOSE/AIM
Describe a systematic MSCT protocol to measure acetabular and femoral components positioning. Illustrate the MSCT findings of the most frequent complications of hip replacement. Propose a systematic reading method of the different components and possible pathologies that could be the origin of the symptoms.

CONTENT ORGANIZATION
This exhibit will be divided into four main parts:
A) Early complications: dislocations, fractures and infections
B) Late complications: septic and mechanical loosening, components migration, particle disease, fractures and heterotopic ossification
C) Specific complications of resurfacing arthroplasty
D) Check list

SUMMARY
Hip replacement is one of the most frequent orthopedic treatment with a high rate of success and few complications. Follow-up, in symptomatic patients, is usually performed with simple radiographies and bone scintigraphy, due to the important metallic artifact on MR and MCTC. However a proper MSCT study protocol and a systematic reading can be extremely useful in these patients. In this exhibit we illustrate the most important complications of hip replacement and propose a systematic reading method.

**LL-MKE-SUBA • Interventional Procedures in Musculoskeletal Oncology and Development of a Multidisciplinary Musculoskeletal Oncology Clinical Service**

Debkumar Sarkar DO (Presenter); Joshua S Chern DO; Anton Mahne MD; Richard D Lackman MD *; Watson Metzger MD, PhD; Siva P Jasti

PURPOSE/AIM
Educational review for development of a musculoskeletal oncology clinical service involving a multidisciplinary approach to management of adult and pediatric bone and soft tissue tumors. In this exhibit we review a spectrum of Interventional procedures in the diagnosis, management and treatment in musculoskeletal oncology.

CONTENT ORGANIZATION

SUMMARY
There are a vast number of procedures in musculoskeletal oncology including CT, US and MR guided percutaneous procedures from radiofrequency ablations to biopsies. Additionally endovascular procedures can utilize cone beam CT techniques along with digital subtraction angiography to analyze vascularity and perform embolizations for pre-surgical devascularization or targeted chemoembolization. Furthermore endovascular and percutaneous procedures can be performed for palliative or pain management consideration. In this exhibit we review several interventional procedures in musculoskeletal oncology while providing framework for developing a clinical service with multidisciplinary conference and clinic.
LL-MKS-SU1B • MRI Findings in Arthroscopically Proven HAGL Lesions
Takouhie C Maldjian MD ; Vineet K Khanna MD (Presenter) ; James P Bradley MD ; Richard J Adam MD

PURPOSE
The purpose of this study is to evaluate potential signs of HAGL(Humeral avulsion of the inferior glenohumeral ligament) lesions.

METHOD AND MATERIALS
We searched our database over approximately a 7 year period for cases of arthroscopically proven HAGL lesion with pre-operative MRI. We found 12 cases of arthroscopically proven tears. 11 of the 12 cases were performed as MR arthograms. The images were evaluated retrospectively by 2 fellowship trained musculoskeletal radiologists for the following signs: torn ligament, \( \bigstar \) sign, and extravasation of contrast into extra-articular spaces (including quadrilateral space, into posterior musculature, between the subscapularis and teres minor, extending down humerus diaphysis).

RESULTS
Of the 12 cases, the diagnosis of HAGL was originally missed on MRI in 4 cases. At least one of the above signs was present on retrospective review. All 4 demonstrated a \( \bigstar \) sign. Extravasation of contrast between the subscapularis and teres minor was also present in 2 of the 4 cases. Overall, 8 of the 11 arthograms demonstrated extravasation of contrast into an extra-articular space. The non-arthrogram case demonstrated communication of joint fluid with the quadrilateral space, which was deemed the equivalent of extravasation.

CONCLUSION
This is the largest series of arthroscopically proven HAGL lesions documenting MRI findings. While ligament disruption and abnormal contrast extending down the humeral diaphysis are valid signs of HAGL lesions, these signs may not always be present. Communication of contrast/joint fluid with extra-articular spaces was seen in over 70% of our cases of arthroscopically proven tears. Therefore, extra-articular extravasation of contrast may serve as a valid sign of HAGL. In addition, 2 of the 4 cases of IGL tears that were missed on initial MRI reports on retrospective review demonstrated a \( \bigstar \) sign. While the \( \bigstar \) sign may not be specific for these injuries, it may be the only manifestation of such injuries in subtle cases.

CLINICAL RELEVANCE/APPLICATION
Extra-articular contrast extravasation may serve as a valid sign of HAGL lesions. The \( \bigstar \) sign, though nonspecific, may be the only evidence of subtle HAGL lesions.

LL-MKS-SU2B • MR Assessment of the Rotator Cables in Normal and Abnormal Rotator Cuffs
Hyung Dong Choo MD (Presenter) ; Sun Joo Lee MD ; Dong Wook Kim MD, PhD ; Young Mi Park MD, PhD ; Seok Jin Choi ; Ok Hwa Kim ; Seon-Jeong Kim MD

PURPOSE
To evaluate and compare the morphology and position of the rotator cables in normal shoulders and tendinosis, partial-thickness tears and full-thickness tears of supraspinatus-infraspinatus tendons (SST-IST) on direct or indirect MR arthrography of the shoulders.

METHOD AND MATERIALS
On the review of direct or indirect MR arthrography by two musculoskeletal radiologists, 30 MR images of normal shoulders and 74 of tendinosis in SST-ISTs were included. Thirty-seven MR images of partial thickness tears in SST-ISTs and 65 of full-thickness tears in SST-ISTs, which were confirmed by arthroscopic surgery, were obtained. On these types of shoulder MR imaging, the visibility, depth, and width of rotator cables, and the distance between the lateral edge of rotator cables and medial aspect of the footprint were measured and these were compared between the types by using Mann-Whitney test and Kruskal-Wallis test.

RESULTS
In every type, all rotator cables were visible on the sagittal planes of MR imaging. However, on the coronal planes, rotator cables in 11 (37%) of normal shoulders, 42 (57%) of tendinosis, 26 (70%) of partial-thickness tears, and 57 (88%) of full-thickness tears were detectable. Rotator cables were significantly thinner in normal shoulders (1.1 mm, 0.66-1.7 mm) and significantly thicker in the full-thickness tears of SST-ISTS (2.1 mm, 0.8-3.1 mm) than the others (tendinosis, 1.5 mm, 0.7-3.6 mm; partial-thickness tears, 1.6 mm, 0.9-2.5 mm). In full-thickness tears of SST-ISTS, rotator cables were significantly narrower (7.7 mm, 4.5-13.9 mm) than the others (normal shoulders, 11.3 mm, 8.75-16.6 mm; tendinosis, 10.3 mm, 6.5-17.2 mm; partial-thickness tears, 9.5 mm, 5.9-13.0 mm) and the distance between the lateral edge of rotator cables and medial aspect of the footprint (21.1 mm, 5.7-45.6 mm) was significantly longer than that the others (normal shoulders, 9.0 mm, 6.7-12.3 mm; tendinosis, 8.5 mm, 3.5-12.2 m; partial-thickness tears, 10.5 mm, 7.2-15.7 mm).

CONCLUSION
On the sagittal planes of direct or indirect MR arthrography, all rotator cables were visible. Rotator cables were significantly thinner in normal shoulders and significantly thicker and narrower in full-thickness tears than other types of shoulders.

CLINICAL RELEVANCE/APPLICATION
1. Every rotator cable is visible on MR imaging. 2. MR imaging is useful to evaluate the rotator cable.

LL-MKS-SU3B • Functional Evaluation of Degenerative Tears of the Medial Meniscus of the Knee Using Weight-bearing MRI
Alice La Marra MD (Presenter) ; Silvia Mariani MD ; Lorenzo Maria Gregori ; Vittorio Calvisi MD ; Antonio Barile ; Carlo Masciocchi

PURPOSE
To determine prospectively the role of 1.5 T, dedicated low-field standard and upright-MRI in the evaluation of stable or unstable...
degenerative tears of medial meniscus in comparison with arthroscopy.

METHOD AND MATERIALS
Our series included 2700 knee MRI scans performed with a high field MRI scanner from January 2010 to March 2013. On the basis of the concordance between clinical and high-field MRI diagnosis, we selected two groups of patients. In the first group (group A) we included 70 MRI exams of normal knee and in the second group (group B) we included 175 MRI exams of knee with clinical evidence of medial meniscus degenerative lesions (Grade 1-4 lesions). In the same session, after conventional 1.5T and "dedicated" 0.25T supine MRI exams, the patients underwent upright weight-bearing examination with the same dedicated MRI unit. We used sagittal and coronal scans (SE T1-W) in all cases.

RESULTS
In group A, there were no statistically significant anatomical changes of the signal intensity, position and morphology of the medial meniscus between standard 1.5T, dedicated supine and upright MRI. In group B, the images acquired in the supine position (dedicated and 1.5T MRI) documented, in 55 cases (group B1) a grade 1-2 degenerative lesions, and in 120 cases a grade 3-4 degenerative tears (group B2). In group B1, weight-bearing MRI showed presence of unstable tears only in 12 out of 55 cases. In group B2, weight-bearing MRI showed a degenerative unstable meniscal tear in 82 out of 120 cases. Arthroscopy confirmed weight-bearing MRI diagnosis in all cases.

CONCLUSION
The upright MRI allows to record load-induced physiological variation in degenerative meniscal lesions, thus showing both the meniscal stability and a latent instability, making it possible to correctly guide the orthopedic surgeon towards an appropriate surgical treatment.

CLINICAL RELEVANCE/APPLICATION
This study allows to classify as stable or unstable the degenerative lesions of the medial meniscus. It is very important to select the most appropriate surgical treatment

LL-MKS-SU4B • A Comparative Study between Dynamic Contrast Enhanced-MRI and Histopathological Grading of Soft Tissue Sarcomas
Shao Wu Wang (Presenter); Minting Zheng; Xiaobo Niu; Dianxiu Ning

PURPOSE
To investigate the relationship between the time intensity curve (TIC) and the dynamic parameters of dynamic contrast enhanced magnetic resonance imaging (DCE-MRI) with histopathological grading in soft tissue sarcomas (STSs).

METHOD AND MATERIALS
26 patients with histopathologically proved STSs underwent conventional MR imaging and DCE-MRI within 2 weeks prior to surgery. The TIC of 26 STSs were divided into four types: type I: no or slightly enhancement; type II: gradual enhancement; type III: rapidly rising and then plateau; type IV: rapidly rising and then declined. Dynamic parameters including maximum slope of increase (MSI), signal intensity of peak (SIpeak), signal enhanced extent (SEE), etc. According to the tissue section, we classified the 26 cases of STSs into three grades (French Federation of Cancer Centre grading system). TIC types and dynamic parameters were correlated with the histopathological grades.

RESULTS

CONCLUSION
TIC types can reflect the histopathological grading of STSs. Type I is an indication of grade I, type II and III are indications of grade II or III. DCE-MRI parameters of MSI, SEE and SIpeak have good correlation with the histopathological grading, they can reflect the histopathological grading of STSs. Grade I and III, grade II and III can be identified according to MSI, SEE and SIpeak.

CLINICAL RELEVANCE/APPLICATION

LL-MKS-SUSB • CEUS of Subcutaneous Masses: Can Vascular Pattern Analysis Be a New Tool in the Characterization?
Armanda De Marchi MD (Presenter); Simona Pozza MD; Paola De Petro MD; Paolo Balocco MD; Andrea Ferro; Paolo Lombardo; Ginevra Biino Msc, PhD; Alessandra Linari MD; Michele Boffano MD; Raimondo Piana; Carlo Faletti

PURPOSE
Purpose of this study is to evaluate the usefulness of high-resolution grey-scale and contrast enhanced ultrasonography (CEUS) in the study of the subcutaneous soft tissue masses in order to differentiate benign from malignant lesions.

METHOD AND MATERIALS
To investigate the relationship between the time intensity curve (TIC) and the dynamic parameters of dynamic contrast enhanced magnetic resonance imaging (DCE-MRI) with histopathological grading in soft tissue sarcomas (STSs).

PURPOSE
P=0.0024). Statistical analysis showed a significant association of pattern called ‘6’ with malignant lesions, and of patterns called 1, 2, 4 and 5 with a malignant lesions (Chi square test, P=0.0024).

RESULTS
Of remaining 170, 110 had a benign lesion: 59 of them underwent a biopsy while 51 are in follow-up; 49 of the 60 patients suspected for malignant lesions underwent a biopsy while the remaining 11 went directly to surgery. Statistical analysis showed a significant association of pattern called ‘6’ with malignant lesions, and of patterns called 1, 2, 4 and 5 with a malignant lesions type (Chi square test, P=0.0024).

CONCLUSION
The study of vascular pattern showed a good ability to differentiate between benign and malignant lesions thus representing a possible help in those cases in which it’s not easy to distinguish between the two types of lesions.

CLINICAL RELEVANCE/APPLICATION
In the diagnosis of a lesion is fundamental can recognize it's potential of benignity or malignancy: CEUS in some cases may provide an additional aid.
LEARNING OBJECTIVES
1) Understand the relative strengths and weaknesses of radiographs, ultrasound, CT and MR in the evaluation of suspected injuries to the anterior chest wall structures, and use this information to logically direct an imaging evaluation. 2) Understand the anatomy of the anterior chest wall musculature and its relevance to the imaging patterns of injuries, together with how that information assists treatment planning. 3) Recognize and characterize the common and less common injuries in the abdominal and pelvic wall musculature and supporting pelvic ligaments.

ABSTRACT
The imaging of sports injuries to the extremities, joints, groin, spine, and head receive much attention. Nevertheless athletic injuries to the trunk also occur with some frequency. The thoracic, abdominal, and pelvic walls form the body's central core. The thoracic wall includes the ossified and cartilaginous parts of the ribs together with the clavicles and sternum, which provide a protective cage for the vital chest organs, as well as a site of origin for the chest wall muscles. In turn, these powerful muscles are responsible for the large movements of the upper extremities and for stabilizing the upper body during twisting motions. Similarly, the abdominal and pelvic wall muscles and supporting ligaments anchor the trunk and lower extremities to the spine and pelvis, while stabilizing the body during locomotion and limb movements. Each of these bone and soft tissue structures are susceptible to direct blunt force trauma in contact and collision sports and to indirect stretching injuries during running, cutting, throwing, kicking, and related activities.

There is growing understanding of the role of the thoracoabdominal musculoskeletal structures in sports, with training regimens now incorporating 'core strengthening' as an important pillar. The recognition, staging, therapy, and rehabilitation of these injuries are likewise becoming more sophisticated. This refresher course will review the role imaging plays for these injuries, emphasizing the added value of advanced imaging modalities for diagnosis, treatment planning, and prognostication.

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 trauma. 3) To review the most common MRI findings in cervical spine trauma and how the 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. Transsections 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.
1) Understand the difference between ‘cam,’ ‘pincer,’ and ‘mixed’ femoroacetabular impingement (FAI) syndromes. 2) Become familiar with accepted imaging parameters that help to establish the diagnosis of FAI in pediatric and adolescent patients. 3) Become familiar with pediatric hip conditions that may lead to FAI in patients, and understand the natural progression of these diseases. 4) Understand how imaging studies impact clinical management of patients with FAI.

ABSTRACT
Femoroacetabular impingement (FAI) may be considered cam-type, pincer-type, or mixed-type depending on whether the primary morphologic abnormality exists in the femur, acetabulum, or both. FAI has generated attention in the literature given its association with osteoarthritis of the hip as well as debilitating hip pain. Children and adolescents may develop FAI, which can lead to devastating joint damage at a relatively early age if left undetected and/or untreated. Certain populations of pediatric patients, such as those with slipped capital femoral epiphysis (SCFE) or Legg-Calve-Perthes disease (LCP) will almost certainly develop FAI even after their primary disease has been treated. Radiologists will assist their clinical colleagues by suggesting the diagnosis on imaging examinations based on certain imaging parameters, which will be reviewed. In patients with confirmed FAI based on history, physical exam findings, and imaging, MRI examinations of the hip with radial sequences and cartilage sensitive sequences may be helpful to orthopedists as they consider surgical versus nonsurgical options. These techniques will be discussed.

VSPD12-02 • MR Findings of Femoroacetabular Impingement (FAI) in Healed Perthes Stulberg Class 3, 4 and 5 Hips. Does MR Have a Role in Preoperative Evaluation?
Siddharth P Jadhav MD (Presenter) ; J. H Kan MD ; Scott B Rosenfeld MD

PURPOSE
To evaluate the use of MRI as a complement to the Stulberg classification in the pre-operative work-up of FAI secondary to healed Perthes and its impact on orthopaedic management

METHOD AND MATERIALS
We performed retrospective evaluation of MR arthrography (MRA) findings in patients with healed Perthes disease. Patients presented over a period of 6 years (2008-2013) with hip pain and clinical signs of FAI. We included patients with hip radiographs and pre-operative dedicated MRA of the hip joint. A total of 16 hips in 15 patients were included. The radiographic findings were classified according to the Stulberg classification. The MRA was evaluated for abnormal alpha angles using radial imaging to evaluate the degree and location of CAM-type circumferential abnormality with alpha angle threshold of 55 degrees. MRA was also reviewed for presence and extent of labral tears and articular cartilage damage. These findings were correlated with the Stulberg classification

RESULTS
Mean age was 14.9 years (range: 10.5 to 21.8 years; 40% female). Nine hips were Stulberg Class III, six hips were Stulberg class 4 and 1 hip was Stulberg class V. 3 hips had 50% circumferential CAM deformity. For the 8 with >50% CAM deformity, 5 (62%) were class III, 2 (25%) were class IV hips and 1 (100%) was class 5 hips . 13 hips (81%) had labral tears which most commonly involved the anterior and superior labrum. 11 hips (69%) had abnormal femoral articular cartilage and 6 hips (37.5 %) had abnormal acetabular cartilage. The femoral head cartilage abnormalities were most severe posteriorly and centrally. Full thickness cartilage loss was present in 2 class III hips (22%) and 4 class IV hips (67%). The labrum was torn in 8 class III hips (89%) and 5 class IV hips (83%)

CONCLUSION
MRA provides additional information about the exact location of the aspherical portion of the femoral head and neck, the size and location of a cam lesion, as well as the status of the labrum and articular cartilage in patients with healed Perthes disease. From an orthopaedic perspective, this can assist in making treatment decisions, planning surgery, and counseling the patient about the likelihood of success of hip preservation surgery

CLINICAL RELEVANCE/APPLICATION
Routine use of MRA can provide information in addition to that derived from the radiographic Stulberg classification. This facilitates the orthopaedic management of patients with healed Perthes

VSPD12-03 • Normative Shape Analysis of the Developing Piglet Femur in Forming a Metric for Characterizing Femoral Head Deformation Following Experimentally Induced AVN
Andy Tsai MD (Presenter) ; Susan A Connolly MD ; Arthur Nedder ; Frederic Shapiro MD

PURPOSE
Childhood idiopathic AVN of the hip (Legg-Calve-Perthes disease) results in considerable morbidity. To simulate this disease for laboratory study, we used an AVN model in a skeletally immature piglet hip created by placement of a tight silk ligature around the base of the femoral neck and sectioning of the ligamentum teres, rendering the femoral head completely avascular. The temporal characterization of this piglet femur during the AVN process, based on the metric established from a normative shape database we derived from a population of normal piglet femurs, forms the basis for this paper

METHOD AND MATERIALS
Normative piglet femur developmental data was generated via serial CT images of bilateral femurs from 3 normal piglets at regular time intervals. We applied a shape analysis technique to this data set using level set method as the shape descriptor and principal component analysis as the feature selector in deriving a shape subspace that compactly describes the normal development of the piglet femur. This parametric subspace efficiently captures the major temporal changes of the femurs, and can be used as an effective metric in quantifying how much a query femur deviates from the norm. We applied this shape metric to the experimental femur data generated via serial CT images of a piglet following experimental unilateral induction of femoral head AVN. The contralateral femur served as the control

RESULTS
The application of this shape metric to the experimental data traces out a deformation trajectory over time of the diseased femur that progressively differs from the trajectory of the same piglet’s contralateral normal femur. Hence, this computational framework can objectively indicate the time point when the shape of the femur starts to deviate from the norm, and the amount of deviation. As a by-product, this technique’s intuitive 3D visualization of the shape changes (via variations of selected eigenmodes and surface distance maps) reveals patterns of changes in the normal and abnormal development of the femur that solidifies widely-accepted clinical observations

CONCLUSION
The clinical application of this analysis tool is expected to play an important tool in (1) assessing disease progression; (2) directing clinical intervention; and (3) gauging the effectiveness of treatment

CLINICAL RELEVANCE/APPLICATION
This methodology may potentially revolutionize the diagnosis and treatment protocol of pediatric hip AVN

VSPD12-04 • Symptomatic Pediatric Developmental Osseous Variants
Paul K Kleinman MD (Presenter)

LEARNING OBJECTIVES
1) Learn the important normal anatomic variants that may cause disease. 2) Learn the important normal anatomic variants that may simulate disease. 3) Learn the problematic variants that are indeterminate and require further imaging and follow up.

ABSTRACT
A wide range of normal variants may be encountered in the pediatric skeleton. Differentiation of innocent variants from
VSPD12-05 • Apophysial Joint Inflammation in Patients with Enthesitis Related Arthritis; Serial Observations and Correlation with Concurrent Sacroiliitis

Tom Amies MBBS, BSc (Presenter); Kanimozhi Vendhan MBBS, DMRD; Debajit Sen; Corinne Fisher; Yiannakis Ioannou; Margaret A Hall-Craggs MD

PURPOSE
To observe changes in apophysial joint inflammation on serial scans in patients with enthesitis related arthritis (ERA), and to correlate this with sacroiliitis.

METHOD AND MATERIALS
We performed a retrospective review of serial MRI lumbar spine scans of ERA patients attending the adolescent rheumatology clinic at our institution. The duration of follow up ranged from 3 months to 4 yrs 10 months. Scan protocol consisted of sagittal T1, sagittal STIR and sagittal T1 contrast enhanced images of the lumbar spine along with contrast-enhanced coronal and axial imaging of the sacroiliac joints. Images were reviewed by an expert MR reader. As there is no universally accepted grading criteria to assess apophysial joint inflammation in adolescents, we adapted and modified a grading system used in adults. Sacroiliitis was graded as stable, improved, worse or as mixed response when some regions showed improvement with other parts of the joint showing worsening inflammation.

RESULTS
A total of 70 scans were available in 29 ERA patients. Apophysial joint inflammation was present in 15 of 29 patients. Amongst these 9 were on disease modifying anti-rheumatic drugs, 3 on anti-TNF therapy and the other 3 on NSAIDS. In 6 of 15 the apophysial joint synovitis and sacroiliitis moved in the same direction i.e they either became worse or better together. However in 9 of 15 the apophysial joint synovitis and sacroiliitis behaved differently, i.e with worsening apophysial joint inflammation on serial scans the sacroiliitis either stayed stable or showed improvement.

CONCLUSION
We have shown that apophysial joint synovitis and sacroiliitis can respond independent of one another. This is a novel finding.

CLINICAL RELEVANCE/APPLICATION
Concurrent sacroiliitis and apophysial joint synovitis in patients with enthesitis related arthritis can respond differentially with therapy. This could account for persistent pain.

VSPD12-06 • A Description of Inflammatory Changes of the Lumbar Spine in Patients with Enthesitis-related Arthritis

Kanimozhi Vendhan MBBS, DMRD; Tom Amies MBBS, BSc (Presenter); Corinne Fisher; Debajit Sen; Yiannakis Ioannou; Margaret A Hall-Craggs MD

PURPOSE
To assess inflammatory changes in the lumbar spine in a cohort of patients with enthesitis-related arthritis (ERA) as compared to a control group of adolescents with mechanical back pain.

METHOD AND MATERIALS
We performed a retrospective case control study and reviewed MRI lumbar spine scans of a total of 83 patients (62 cases; 21 controls). Images were reviewed by an expert MR reader who was blinded to clinical details. The presence or absence of morphological features of enthesitis (oedema of corners of vertebral endplates), facet joint synovitis (articular process oedema, enhancing synovitis) and inflammation of the posterior elements (enhancement of interspinous ligaments and spinous process) was assessed at each lumbar vertebral level. Facet joint synovitis was subjectively graded from 0 to 3 (0 being normal and 3 being severe). As there is no universally accepted grading criteria to assess facet joint inflammation in adolescents, we adapted and modified a grading system used in adults. The presence or absence of sacroiliitis (erosions of articular surface, bone marrow oedema and enhancement) was also recorded. STATA software was used for data analysis.

RESULTS
One or more abnormalities of the lumbar spine were found in 47 (76%) of 62 ERA cases. MR evidence of facet joint synovitis was seen in 24 (39%) of cases and in 1 patient (5%) in the control group. This difference was highly significant (p value = 0.003). Amongst patients with abnormal facet joints (n=24), grade 1 synovitis was present in 9 (37%), grade 2 lesions in 10 cases (42%) and grade 3 synovitis in 5 cases (21%). Overall 47 of the 62 cases showed evidence of sacroiliitis. None of the patients in the control group had sacroiliitis. Inflammatory changes in the SIJs were accompanied by abnormalities of the lumbar spine in 36 cases (58%). In 5 of 24 ERA cases with facet joint synovitis there was no MR evidence of sacroiliitis. This is a novel observation. There was no statistically significant difference between the cases and controls in the prevalence of disc changes, end plate oedema and inflammation of the posterior elements.

CONCLUSION
Facet joint inflammation was seen in 39% of ERA patients. This is a previously undescribed finding and could contribute to back pain in these children.

CLINICAL RELEVANCE/APPLICATION
Lumbar spine inflammatory disease should be considered as a cause of back pain in patients with ERA, independent of the presence of sacroiliitis.

VSPD12-07 • ACL Reconstruction in the Skeletally Immature Patient: Current Concepts in Diagnosis and Treatment

Craig Finlayson MD (Presenter) *

LEARNING OBJECTIVES
1) Participants will identify anatomic and neuromuscular risk factors for ACL injury in the young patient. 2) Participants will work through the differential diagnosis of acute ACL tear and identify associated injury patterns in the young patient. 3) Participants will understand the risks of ACL reconstruction unique to the young patient.

ABSTRACT
Although once thought to be rare, anterior cruciate ligament injuries are being diagnosed with increasing frequency. Controversy exists regarding the management of ACL injuries in patients with open physes. Nonoperative management of complete tears in skeletally immature patients generally has a poor prognosis in terms of knee function and is associated with progressive intra-articular injury. Conventional surgical techniques for ACL reconstruction risk iatrogenic growth disturbance because of physeal violation, and cases of growth disturbances have been reported in several studies. This module will discuss the pathophysiology, diagnosis and prevention of ACL injuries in the skeletally immature as well as some of the risks and controversy regarding surgical treatment.

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Case-based Review of Magnetic Resonance: Musculoskeletal (An Interactive Session)

Monday, 08:30 AM - 10:00 AM • S100AB
LEARNING OBJECTIVES
1) Better recognize common sports injury patterns in high performance athletes. 2) Have an improved understanding of the significance of various sports injuries. 3) Have improved knowledge of implications of sports injuries in the adolescent population.

ABSTRACT
To view presentation go to www.bone.tju.edu

LEARNING OBJECTIVES
1) To review normal anatomy on hand and wrist MR. 2) To show bone and soft tissue injuries on hand and wrist MR. 3) To describe pitfalls in hand and wrist MR interpretation.

ABSTRACT

LEARNING OBJECTIVES
1) To recognize changes in the musculoskeletal system that occur with growth. 2) To identify injuries of the musculoskeletal system that are unique to growing children. 3) To become familiar with various non-traumatic musculoskeletal disorders that affect children.

ABSTRACT

In this Musculoskeletal Ultrasound Master class, an opportunity will be given to participants to start a written dialogue in advance to RSNA 2012. The electronically submitted questions will be sorted by instructors and organized per topic. A select number of recurrent themes in these questions will be prepared for dialogue on stage. When the questions focus on a particular scanning skill, the authors of the questions will be invited on the examination platform to show problems they encounter in their practice. By using a step-by-step approach in solving the scanning issues, all who are present should benefit from the technical interactions on stage. Cameras will project scanning details on large screens. The seating in the master class will guarantee close proximity for an enriching interaction between audience and stage. At the end of the master class, the audience will be broken up in smaller groups for a more personal interaction with the instructors with the intent of improving scanning skills on an individual level.

LEARNING OBJECTIVES
1) Discuss several meniscal pitfalls. 2) Review types of tears that are frequently missed or overcalled. 3) Provide an update of some recent information and concepts regarding meniscal MR imaging.

ABSTRACT
For several decades, radiologists have been evaluating knee menisci for tears using MRI with high sensitivity, specificity, and positive and negative predictive values. The individual radiologist must have the knowledge of the normal anatomic variants, normal meniscal-ligament interfaces, technical and other pitfalls, and appearances of various types of tears in order to keep up with the standards set by our profession, referring clinicians, and patients. This lecture will review some of those issues and provide an update of recent studies that have focused upon the use of MRI for meniscal evaluation.

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Non-arthritic Knees

Cruciate Ligament Tears and Cartilage Lesions

VSMK21-03 • Validated Standard of the biomechanical implications of meniscal tears and partial meniscectomy. Extrusion. Mild anterior extrusion of the medial meniscus may be a normal finding. The rMPR extrusion analysis may prove valuable for extrusion patterns were found between control and OA subjects with OA subjects generally having a greater degree of meniscal extrusion for any controls or 76% of the OA group. Although greater in OA, mild anterior extrusion was also common in control subjects. There was no lateral extrusion relative to the tibial edge (excluding osteophytes) was measured every 10-degrees for the entirety of each meniscus by one of two trained readers. Medial meniscal extrusion was measured in 10 subjects by both readers for inter-reader agreement. Sixty mid-body rMPR measurements were compared to standard extrusion measurements from mid-coronal IW-FSE images. RESULTS Inter-reader agreement for rMPR extrusion at all locations was high ($r=0.78$). Correlation with mid-body coronal IW-FSE images was $r=0.81$. Median extrusion in the anterior, middle and posterior thirds of the medial meniscus was 1.2mm, 0.4mm and 0.2mm, respectively, for controls and 2.2mm, 1.8mm, and 0.9mm for OA (p=1mm of extrusion of the mid-body of the medial meniscus vs. only 25% of controls). Although greater in OA, mild anterior extrusion was also common in control subjects. There was no lateral meniscal extrusion for any controls or 76% of the OA group. CONCLUSION Extrusion can be reliably measured for the entire circumference of the meniscus using the rMPR technique. Significant differences in extrusion patterns were found between control and OA subjects with OA subjects generally having a greater degree of meniscal extrusion. Mild anterior extrusion of the medial meniscus may be a normal finding. The rMPR extrusion analysis may prove valuable for studying the influence of patterns of meniscal deformities on OA incidence and progression as well as to help improve our understanding of the biomechanical implications of meniscal tears and partial meniscectomy.

VSMK21-04 • Measurement of Meniscal Extrusion Using Radial Multiplanar Reconstruction MR Imaging in Osteoarthritic and Non-arthritic Knees

Anish Ghodadra MD (Presenter); Flavia A Sakamoto MD; Faysal Altahawi MD; Carl S Winalski MD *

PURPOSE

Identify meniscal extrusion and validate measurements made using radially-oriented multiplanar reconstruction (rMPR) images. Determine location-specific extrusion differences between osteoarthritis patients (OA) and healthy controls.

METHOD AND MATERIALS

rMPR images of each meniscus were created from 3D-DESS MR images of randomly selected subjects in healthy control (n=40) and progression (n=124) subcohorts from the Osteoarthritis Initiative. Patients with macerated menisci were excluded. Extrusion relative to the tibial edge (excluding osteophytes) was measured every 10-degrees for the entirety of each meniscus by one of two trained readers. Medial meniscal extrusion was measured in 10 subjects by both readers for inter-reader agreement. Sixty mid-body rMPR measurements were compared to standard extrusion measurements from mid-coronal IW-FSE images.

RESULTS

Inter-reader agreement for rMPR extrusion at all locations was high ($r=0.78$). Correlation with mid-body coronal IW-FSE images was $r=0.81$. Median extrusion in the anterior, middle and posterior thirds of the medial meniscus was 1.2mm, 0.4mm and 0.2mm, respectively, for controls and 2.2mm, 1.8mm, and 0.9mm for OA (p=1mm of extrusion of the mid-body of the medial meniscus vs. only 25% of controls). Although greater in OA, mild anterior extrusion was also common in control subjects. There was no lateral meniscal extrusion for any controls or 76% of the OA group.

CONCLUSION

Extrusion can be reliably measured for the entire circumference of the meniscus using the rMPR technique. Significant differences in extrusion patterns were found between control and OA subjects with OA subjects generally having a greater degree of meniscal extrusion. Mild anterior extrusion of the medial meniscus may be a normal finding. The rMPR extrusion analysis may prove valuable for studying the influence of patterns of meniscal deformities on OA incidence and progression as well as to help improve our understanding of the biomechanical implications of meniscal tears and partial meniscectomy.
LEARNING OBJECTIVES
1) Describe the normal anatomy of the anterior cruciate ligament and its appearance on MR images. 2) List the primary and secondary MR imaging signs of complete and partial tears of the ACL. 3) Discuss the MR imaging appearances of a normal ACL graft and the most

RESULTS
For cartilaginous defects and MM, specificity and accuracy of 3D isotropic IW fast SE without FS was significantly greater than with FS (cartilaginous defects, sensitivity, 96.2% vs 94.7%, accuracy, 93% vs 91.7%; MM, sensitivity, 84.8% vs 75%, accuracy, 87.5% vs 82%). The accuracy of 3D isotropic IW fast SE without FS for LM was also significantly higher than with FS (88.1% vs 83.5%). There was no significant difference in sensitivity between the two methods.

CONCLUSION
The performance of 3D isotropic IW fast SE without FS is better than with FS to evaluation of cartilaginous defects and meniscus.

CLINICAL RELEVANCE/APPLICATION
If one or more fat water-sensitivity sequence is included to routine sequence for the evaluation of bone marrow edema, 3D;IW-FSE;would be;better without fat saturation for evaluation of IDK.

VSMK21-07 • MR Imaging of Posterolateral Corner Reconstruction of the Knee by Posterolateral Corner Sling Procedure: Review of 15 Patients with Clinical Correlation

Wooyoung Kang (Presenter); Kyung-Sik Ahn MD; Chang Ho Kang MD; Suk-Joo Hong MD; Baek Hyun Kim MD; Dae-Hee Lee

PURPOSE
To describe the postoperative magnetic resonance (MR) appearance of the posterolateral corner (PLC) reconstruction of the knee and to correlate the MR findings with clinical examination.

METHOD AND MATERIALS
Postoperative MR examinations of 15 patients who underwent PLC reconstruction by PLC sling through the fibular tunnel using allograft from 1 to 36 months (mean 10 months) after the surgery were retrospectively reviewed. Graft shape, thickness, signal intensity of the anterior and posterior limbs of the sling were recorded. Peroneal nerve thickness and signal intensity were compared with preoperative examination at the time of MR imaging. Anterior limb of the sling appeared as elliptical shape (15 of 15) on axial images with mean thickness of 5.86 (SD ± 3.7) mm and posterior limb as crescent shape (11 of 15) with mean thickness of 3.23 (SD ± 1.2) mm. Signal intensity of the overall graft sling was increased in 13 of 15 cases, and posterior limb showed same or higher grade signal increase compared with anterior limb in 10 of 15 cases. Signal increase in posterior limb was more prominent in graft with longer time interval since surgery (p

CONCLUSION
In postoperative MR imaging of PLC reconstruction, increased signal intensity in posterior limb of the PLC sling appears to be related with time interval since surgery but not correlated with clinical stability, and peroneal nerve thickening may be an expected postoperative finding irrelevant to symptom.

CLINICAL RELEVANCE/APPLICATION
Postoperative MR imaging after the PLC reconstruction can depict the increased signal intensity of the graft and thickening of peroneal nerve.

VSMK21-08 • Postoperative Cartilage Imaging

Humberto G Rosas MD (Presenter)

LEARNING OBJECTIVES
1) Review the postoperative imaging appearances of articular cartilage repair, with an emphasis on MRI.

VSMK21-09 • Pre- and Postoperative ACL Imaging

Mark W Anderson MD (Presenter)

LEARNING OBJECTIVES
1) Describe the normal anatomy of the anterior cruciate ligament and its appearance on MR images. 2) List the primary and secondary MR imaging signs of complete and partial tears of the ACL. 3) Discuss the MR imaging appearances of a normal ACL graft and the most
ABSTRACT
Tears of the anterior cruciate ligament are exceedingly common, and MR imaging plays an important role in demonstrating the degree of ligament damage as well as associated injuries. As such, a solid understanding of ACL anatomy and pathology is essential, and this lecture will review the MR imaging appearances of the normal ACL as well as the spectrum of ligament injury including both complete and partial tears. Surgical options for ligament reconstruction will be reviewed along with the MR appearances of a normal ACL graft and most common graft complications.

VSMK21-10 • Association of ACL and Anterior Horn Lateral Meniscus Root Ligament Anatomy and Pathology: 11.7 T MRI Anatomic Study with Retrospective Review of 500 Knee MRIs

Monica Tafur MD (Presenter); Guilherme M Cunha MD; Ja-Young Choi MD; Eric Y Chang MD; Tanya Wolfson MS; Anthony Gamst PhD; Paul A DiCamillo MD, PhD; Graeme M Bydder MBChB *; Donald L Resnick MD; Sheronda Statum; Christine B Chung MD

PURPOSE
Anatomic studies have shown that few fibers of the anteromedial and posterolateral bundles of the anterior cruciate ligament (ACL) partially blend with the anterior horn of the lateral meniscus root ligament (AHLMR) fibers. This close relationship between the ACL and the AHLMR through these blended fibers (BF) might be a pathway for spread of lesions affecting the ACL. We sought to systematically evaluate the prevalence and association of ACL degenerative and traumatic lesions with abnormal MR appearance of AHLMR.

METHOD AND MATERIALS
In a single cadaveric knee, the tibial attachment of the AHLMR root ligament and ACL was imaged on an 11.7 T MR system with a 3D GRE (TR20ms, TE7ms) sequence (112x112x120?m resolution). Two blinded readers retrospectively reviewed 500 consecutive knee MRI examinations (6 month period). Studies were searched for the presence of ACL lesions (degenerative mucoid lesions or traumatic tears), abnormal appearance of AHLMR (degeneration or tear) and increased signal of the BF. Relationship between ACL and AHLMR lesions was assessed and presence of regional synovitis was also noted. Statistical analysis was performed using chi-square tests and kappa coefficient.

RESULTS
High-resolution cadaveric MRI showed contribution of ACL fibers to the AHLMR root ligament. The study population consisted of 479 patients, mean age 46 years. Review of clinical MRI cases showed ACL abnormalities in 42.1% of cases (Kappa=0.867), which included degenerative mucoid lesions (22.3%), traumatic tears (39.3%), and synovitis around distal ACL (38.3%). Root ligament abnormal appearance seen in 35.8% of the cases (Kappa=0.933) included degeneration (85.3%) and tears (14.6%). 28% of cases shown abnormal MR signal of the BF. There were significant associations between ACL and AHLMR root ligament abnormalities (p<0.001). Concurrent abnormalities of the ACL root ligament and ACL are common and likely due their intricate anatomic relationship trough the blended fibers.

CLINICAL RELEVANCE/APPLICATION
Pathology of root ligaments may alter normal biomechanics of menisci, therefore the importance to identify potential patterns for spread of diseases affecting closely related structures such as the AC

VSMK21-11 • Single Bundle Anterior Cruciate Ligament ruptures: Can We See It on MRI?

Alireza Zavareh MD, FRCR; Mike Bradley MBChB; James Robinson MBBS; Martin Williams MBChB; Hyeladzira Thahal MBCh, MRCP (Presenter)

PURPOSE
To demonstrate the accuracy of MRI in diagnosing the solitary anteromedial (AM) and posterolateral (PL) bundle tears of the anterior cruciate ligament (ACL) ruptures.

METHOD AND MATERIALS
We selected 35 cases of ACL rupture with arthroscopically proved solitary tear of either AM or PL bundle. The pre-operative MRI of these cases were randomly given to two experienced musculoskeletal radiologists in our institution who were blinded of the actual results. Their diagnosis of the single bundle tear were scrutinised against the arthroscopic findings. The specificity and sensitivity of the MRI findings were also evaluated as well as the inter-observer variability in the radiological diagnosis. We also recorded the other bone and soft tissue injuries seen on the MRI study to evaluate if these injuries are related to a specific torn bundle.

RESULTS
Both radiologists were able to pinpoint the correct torn bundle of the ACL. The inter-observer variability is more pronounced regarding the PL bundle tear. The other injuries to the distal femur and proximal tibia were of a slightly different pattern in these two types of injury. Hence, this could be of help when evaluating the ACL for single bundle injuries.

CONCLUSION
The MRI could be a reliable tool in differentiating the AM and PL tears of the ACL and helping with case selection for the single bundle ACL augmentation.

CLINICAL RELEVANCE/APPLICATION
There is an increasing trend among the knee surgeons to perform single bundle ACL augmentation instead of whole ACL reconstruction. A more detailed MR report is very helpful for optimal case selection.

VSMK21-12 • Diffusion Tensor Imaging in the Assessment of Double-bundle Structure of Anterior Cruciate Ligament: A Preliminary Feasibility Study

Xianfeng Yang MBCh (Presenter)

PURPOSE
To evaluate whether double-bundle structure of ACL could be imaged using diffusion tensor imaging (DTI) and tractography with a 3T MRI scanner.

METHOD AND MATERIALS
To our best knowledge, we present the first DTI and tractography results of human ACL. The courses of double bundle of ACL were first analyzed quantitatively using fractional anisotropy (FA), and then visualized in 3D with tractography. Tractography illustrated nicely the 3D courses of double-bundle structure of ACL and corresponded well to the known anatomy.

RESULTS
Three-dimensional view of the AM and PLB could be a powerful tool to aid image interpretation and guide surgical approach.

VSMK21-13 • Medial Synovial Fold of Posterior Cruciate Ligament: Cadaveric Investigation with MRI and Histologic Correlation
Thermal Ablation Techniques for Curative Treatment of Bone Metastases

Frederic Deschamps (Presenter) ; Geoffroy Farouil ; Lambros C Tsilikas MD ; Thierry J De Baere MD *

PURPOSE
To determine prognostic factor(s) for complete thermal ablation (TA) of bone metastases

METHOD AND MATERIALS
The medical records of all the patients who had undergone curative-intent TA of bone metastases in our Institution between September 2001 and February 2012 were retrospectively reviewed. The goal of the TA was to achieve a local tumor control in order to cure all bone metastases in oligometastatic patients or to prevent the occurrence of skeletal-related events in long life expectancy cancer patients. We have analyzed the rate of complete treatment at 1 year according to the patients’ details -gender, age, site of the primary tumor-
RESULTS

Eighty-nine consecutive patients underwent TA in a curative-intent of 124 bone metastases. The median follow-up was 22.8 months [12.2 to 44.4 months]. We report a 67% of complete treatment at 1 year. In multivariate analysis the good prognostic factors for complete treatment were: metachronous bone metastasis (p=0.004), no progression within 3 months before (p=0.004), no cortical erosion (p=0.01), maximal diameter

CONCLUSION

Thermal ablation techniques are effective to cure small (CLINICAL RELEVANCE/APPLICATION

Thermal ablation techniques must be considered in oligometastatic patients or in long life expectancy cancer patients with bone metastases.

SCC10-03 • Radiofrequency Thermoablation versus Magnetic Resonance Guided Focused Ultrasound Surgery (MRgFUS) in the Treatment of Osteoid Osteoma: Experience on 27 Consecutive Cases

Francesco Arrigoni (Presenter) ; Armando Conchiglia ; Lorenzo Maria Gregori ; Luigi Zugaro ; Antonio Barile ; Carlo Mascioci

PURPOSE

To compare the clinical and morphological results, two years after the procedure, of the treatment of 27 osteoid osteomas with Magnetic Resonance guided Focus Ultrasound Surgery (MRgFUS) versus the treatment with Radiofrequency termoablation (RF).

METHOD AND MATERIALS

From March 2011 we treated 27 osteoid osteomas, 12 using MRgFUS (ExAblate InSightech, Israel) and 15 using RF (LeVeen Needle Electrodes Boston Scientific - USA). The osteoid osteomas treated with MRgFUS were located in the femur (n.8), tibia (n.3) and in the talus (n. 1). The lesions treated with RFs were located in the femur (n. 9), talus (n.2), vertebral body (L3 and L5) and tibial plateau (n.2). All the lesions were diagnosed by plain films, CT and MRI and controlled after the procedure by MRI and CT. The clinical evaluation was performed by VAS scale.

RESULTS

All the patients treated with RF termoablation showed a regression in painful symptomatology with a mean VAS decreasing from 8 to 1.2 two years after the treatment. The treatment with MRgFUS was successful in 10 out of 12 patients (mean VAS dropped from 8.1 to 1.3 two years after the treatment). The two cases unresponsive were re-treated successfully with RF. The MRI evaluation showed a disappearance of bone edema already at the first controls at 6 months after the treatment in all the patients treated successfully. In the CT controls no substantial changes were found, except for the disappearance of the central calcification of the nidus in the 40% of cases treated with MRgFUS.

CONCLUSION

Although further studies with a longer term and a larger number of cases are needed, our experience demonstrates the effectiveness of the treatment of osteoid osteomas with MRgFUS. In particular this treatment is successful in the 83% of cases. The main limit is today represented by the accessibility of the lesion by the ultrasound. However the treatment is repeatable and does not preclude treatments with other techniques (with the RFs, the percentage of success is of 100%).

CLINICAL RELEVANCE/APPLICATION

This study explain an innovative and non-bloody technique to treat osteoid osteoma of bone.

SCC10-04 • MR-guided Focused Ultrasound (MRgFUS) for Treatment of Painful Bone Metastases: Can ADC Be Used to Predict Clinical Outcome?

Fabrizio Boni (Presenter) ; Alessandro Napoli MD ; Michele Anzidei MD ; Vincenzo Noce MD ; Daniel R De Oliveira ; Carlo Catalano MD

PURPOSE

To evaluate potential of diffusion-weighted magnetic resonance imaging (DWI) with apparent diffusion coefficient (ADC) maps in the assessment of molecular changes in bone metastasis micro-environment caused by MR guided Focused Ultrasound (MRgFUS), and to correlate these modifications with clinical outcomes

METHOD AND MATERIALS

23 patients with bone metastases underwent MRgFUS using the ExAblate 2100 system (InSightec). Minimal required imaging work-up consisted of CT and MR imaging to determine size and location of the lesions. Skeletal metastasis imaging was performed with a 3-T MR imaging unit (Discovery 750; GE; gd-BOPTA, Bracco). After treatment, all patients were scheduled to undergo clinical follow-up examinations at 1, 3 and 6 months post-treatment. To evaluate treatment efficacy in terms of symptoms palliation, pain severity and pain interference scores were determined using Visual Analogue Scale (VAS) score. Additionally, all patients underwent follow-up MR imaging at 1, 3 and 6 months after treatment. The margins of metastatic lesions were tracked manually on the baseline ADC. As quantitative parameter of treatment response, we calculated percentage of increase in ADC (ADCI%)

RESULTS

No adverse events were recorded. We found an effective pain relief, with mean VAS score drop from an average baseline of 7.09±1.8, to 2.65±1.36 at first month follow-up to 1.04±1.91 at third month and to 1.09±1.99 at sixth month. Furthermore, patients treated with MRgFUS showed a mean increase in ADC value of +48.9% at first month follow-up (p=0.01), maximal diameter

CONCLUSION

Our preliminary data showed that incremental ADC values positively correlated with MRgFUS clinically successful outcome in patients with bone metastases; a different percentage increase in ADC was evident among our population (partial vs complete responders). ADC value might play as an important early marker surrogate for clinical outcome in patients undergoing MRgFUS for painful bone metastasis

CLINICAL RELEVANCE/APPLICATION

MRgFUS treatment determines bone metastasis cell damage, correlate with clinical outcomes, as demonstrated by linear ADC modification.

SCC10-05 • MR-guided Focused Ultrasound (MRgFUS) Ablation for Non-spinal Osteoid Osteoma Treatment: A Prospective Multi-centric Cohort Study

Daniel Geiger MD (Presenter) ; Alessandro Napoli MD ; Armando Conchiglia ; Alberto Bazzocchi MD ; Ugo Albisinni MD ; Carlo Mascioci ; Carlo Catalano MD

PURPOSE

Purpose of this study was to evaluate MR-guided focused ultrasound (MRgFUS), in terms of success rate, for painful non-spinal osteoid osteoma treatment.

METHOD AND MATERIALS

This IRB approved prospective multi-centric cohort study, performed at three university hospitals, included thirty patients (M:21; Mean age:24±11). Between May 2010 and April 2012 thirty painful non-spinal osteoid osteomas, diagnosed at imaging (including co-dynamic MR (gd-BOPTA, Bracco)) have been treated using MRgFUS (3.0-T/1.5-T GE Discovery MR 750/450 + InSightec ExAblate 2000).
Treatement success in terms of pain reduction has been evaluated using visual analog scales (VAS). Sonication number and mean acoustic energy (J) have been recorded. One year clinical and imaging follow-up was performed to evaluate success rate, recurrence and complications.

RESULTS
Thirty osteoid ostomas (26 lower limbs and 4 upper limbs) have been treated using MRgFUS. Complete clinical success rate was 90% (27/30), with a pain score =2 after treatment and at twelve months evaluation. Partial treatment was observed in 10% (3/30) and CTgRFA (2/30) or open surgery (1/30) was then performed. A single session treatment was sufficient in 93% (28/30) of cases to achieve clinical success. Two cases required MRgFUS retreatment. Types of anesthesia were spinal (21), peripheral (5) and general (4) in pts. = 16yo). Mean sonication number was 6±3; mean energy 1080±727 J. No complications were observed immediately after treatment or during follow-up.

CONCLUSION
This multi-centric prospective cohort study demonstrated that MRgFUS has a high success rate (90%) and a relatively short learning curve for non-spinal osteoid osteoma treatment. Our results suggest that MRgFUS may be considered as an effective, totally non-invasive and safe alternative approach in osteoid osteoma interventional management.

CLINICAL RELEVANCE/APPLICATION
The safety and effectiveness of MRgFUS encourages its adoption in treating non-spinal osteoid osteoma. This procedure, differently from any other ablative technique, is totally non-invasive.

SSC10-06 • Cryoablation of Perineural Musculoskeletal Tumors: Use of Intraprocedural Motor Evoked Potential (MEP) Monitoring to Improve Safety

Anil N Kurup MD (Presenter) ; Jonathan M Morris MD ; Grant D Schmit MD ; Thomas D Atwell MD ; Adam J Weisbrod MD ; Matthew R Callstrom MD, PhD * ; Andrea J Boon ; Rickey Carter PhD ; C. T Wass MD ; Peter Rose MD

PURPOSE
To describe the use of MEP monitoring to minimize risk of neural injury during image-guided cryoablation of perineural musculoskeletal tumors.

METHOD AND MATERIALS
Between May 2011 and March 2013, 59 cryoablation procedures were performed to treat 64 perineural musculoskeletal tumors, defined as those within 2cm of the spinal cord or major motor nerve, in 52 unique patients. Total intravenous general anesthesia, CT guidance, and MEP monitoring were employed. Patient demographics, tumor characteristics, MEP findings, and clinical outcomes were assessed.

RESULTS
The cohort included 26 males and 26 females with median age of 61 years (range, 4-82). Tumors were located in the spine (27; 3 cervical, 14 thoracic, 10 lumbar), sacrum (3), pelvis (23; 8 periacetabular, 6 other iliac, 4 pubic, 3 ischial, 2 gluteal), and extremities (8; 5 upper, 3 lower). Among the 64 tumors, 50 (76%) were metastases. 21 different tumor histologies were represented, most commonly renal cell carcinoma (17 tumors, 27%), colorectal carcinoma (6 tumors, 9%), and multiple myeloma/ plasmacytoma (5 tumors, 8%). Median tumor size was 4.0 cm (range, 0.8-15.0). 19 (32%) of 59 procedures resulted in decreases in the intraprocedural MEPs, including 15 (25%) with transient decreases and 4 (7%) with persistent decreases. Two (5%) of the 4 patients with persistent MEP decreases had motor deficits following ablation, one permanent and one which resolved over 5 months. No patient with transient MEP decreases or no MEP change developed a functional motor deficit. The risk of major motor injury with persistent MEP changes was significantly increased compared to transient or no change (p=0.0045, RR 69.8, 95% CI: 5.9 to >100). Excluding neural injury, there were 3 major complications (Clavien-Dindo grade >= 3): acute renal failure due to tumor lysis requiring temporary hemodialysis, cerebrospinal fluid leak requiring blood patch, and extruded cement from concomitant cementoplasty requiring surgical cement resection.

CONCLUSION
In this initial series of cryoablation procedures using intraprocedural MEP monitoring, persistent MEP decreases correlated with post-procedural major motor deficits.

CLINICAL RELEVANCE/APPLICATION
Intraprocedural MEP monitoring minimizes risk of neural injury and may improve patient safety during percutaneous cryoablation of musculoskeletal tumors.

SSC10-07 • Palliation of Pain and Prevention of Fracture for Acetabular Metastases Using Combined Cryoablation and Cementoplasty

Erik B Sviggum MD (Presenter) ; Anil N Kurup MD ; Matthew R Callstrom MD, PhD * ; Peter Rose MD ; Franklin Sim MD

PURPOSE
To assess the viability of combined cryoablation and cementoplasty in palliating pain and preventing fracture in patients with lytic metastatic disease of the acetabulum.

METHOD AND MATERIALS
39 combined cryoablation and cementoplasty procedures were performed on 37 patients with lytic acetabular metastatic disease from January 2004 through September 2012. Cryoablation was performed initially, with cementoplasty performed subsequently, usually the following day. Patient age ranged from 48 to 83 years (median 65, range 48-83). Patients included were known to have lytic periacetabular metastases that were painful, or nonpainful but extensive enough that there was concern of impending fracture. Nonpainful lesions were evaluated by orthopedic surgeons and deemed at risk for fracture prior to procedure. Pre-procedural pain rating, using a visual analog scale (VAS), was obtained by referring clinicians or the interventional radiologist. Lesion location, pain levels pre- and post-procedure, completeness of the ablation procedure, and pre- or post-ablative therapies (surgery, radiation) to the specific location were documented.

RESULTS
27 of the 39 procedures were done for palliation of pain and had complete pre- and post-procedural VAS pain scores. Of these patients, 23 (85%) had improved post-procedural pain scores. Patients who had complete cryoablation of their periacetabular metastases (defined as the ice ball completely encompassing the tumor as seen on intermittent CT fluoroscopy) had improved pain compared with patients who had incomplete cryoablations. Of the patients who received followup imaging of their pelvis, 69% had no progression of pre-existing fracture or development of new fracture. Lesion stability was slightly higher in patients who had complete cryoablations vs incomplete cryoablations (73% vs 57%). Only 4 of the 39 patients required a post-procedural intervention, including one patient who required sciatic neuritis due to leakage of cement during the procedure.

CONCLUSION
Combined cryoablation and cementoplasty is a useful tool in the treatment of lytic acetabular metastatic disease for both palliation of pain as well as stabilization and prevention of fracture.

CLINICAL RELEVANCE/APPLICATION
Combined cryoablation and cementoplasty can improve pain and stability in patients with lytic acetabular metastases.

SSC10-08 • Selective Arterial Embolization of Aneurysmal Bone Cyst (ABC) of the Skeleton with N-2 Butyl Cyanoacrylate: Revisited Results, Recurrences and Outcomes in 75 Patients

Giuseppe Rossi MD ; Eugenio Rimondi MD (Presenter) ; Giancarlo Facchini ; Paolo Spinnato MD ; Patrizia Pelotti ; Teresa Calabro ; Pietro Ruggieri ; Daniel Vanel MD ; Alberto Bazzocchi MD
**An MRI Evaluation of Piriformis Muscle Modifications Induced by Botulinum Toxin (Botox) Injections**

Mohammed A Alshaikh (Presenter); Fabrice Michel MD, PhD; Bruno A Kastler MD, PhD; Sebastien L Aubry MD, PhD

**PURPOSE**
Botox injection is a new treatment of the piriformis muscle syndrome and the purpose of our study was to evaluate by MRI the morphological modifications of the piriformis muscle treated by Botox injection or by surgical desinsertion.
METHOD AND MATERIALS
Seventeen patients presenting with a piriformis muscle syndrome treated either by Botox injection or surgery, and who benefited from an MRI were included retrospectively (mean age 43 y/o). The following parameters were assessed and compared to a normal contralateral muscle: maximal thickness and volume of piriformis muscle, and its fatty infiltration according to Goutailier’s classification.

RESULTS
The affected side showed a significant reduction in thickness (p < 0.05). To our knowledge, our study is the first that shows quantitatively the effect of infiltration therapy by Botox over the piriformis muscle: atrophy and fatty infiltration

CLINICAL RELEVANCE/APPLICATION
Botox injection into the piriformis muscle in the treatment of the eponymous syndrome has morphological effects on the muscle that can be demonstrated and followed-up by MRI

LL-MKS-MO3A ● Analysis of Ischial Spine Orientation in Patients with Compression-mediated Pudendal Neuropathy: A Study Using 3D Computed Tomography
Lina Chen MD (Presenter) ; Richard P Marvel MD ; Howard M Richard MD

PURPOSE
The pudendal nerve is a predominately sensory nerve arising from s2-4 nerve roots. Several potential sites of entrapment lie along the course of the nerve. One critical zone of compression is adjacent to the ischial spine and sacrotuberous ligament. We hypothesize that variations in bony anatomy of the ischial spine may predispose patients to pudendal nerve compression. The goal of this study was to use 3D computed tomography (CT) to identify reliable measurement of ischial spine orientation and to determine if such metrics can differentiate patients with pudendal neuralgia from control patients without neurological symptoms.

METHOD AND MATERIALS
In this IRB-approved study, CT of the bony pelvis in 32 women were retrospectively reviewed, including 16 patients (ages 22-78 y; mean age = 54.3±15 y) diagnosed with pudendal nerve compression syndrome and who underwent pudendal nerve block; 16 patients (ages 22-94 y; mean 64±19 y) who presented with trauma but had no documented neurologic symptoms. Exclusion criteria include diffuse pelvic pathology, such as Paget disease and metabolic bone disease, pelvic fracture, extensive calcification or ossification of soft tissue, and presence of hardware. Using the TeraRecon 3D CT application, an axial oblique CT image at the level of the tip of the bilateral ischial spine and mid symphysis pubis was obtained. Six methods of measurements were performed by a musculoskeletal radiologist with 5 y subspecialty experience. Each measurement was performed twice, separated by at least 1 month. The Student t test was used to compare differences in measurements between the two groups.

RESULTS
Of the CT measurements, the angle in the level between the ischial spine and inner pelvic wall was found to be statistically significant between the control and neuralgia patients. Right side: neuralgia 126±4.8 degrees, control 135±4.9, P = 0.015; left side: neuralgia 126±2.4, control 134±5.4, P = 0.044). Intra-observer correlation coefficient was 0.80.

CONCLUSION
Assessment of the orientation of ischial spine using 3D CT may help identify patients at risk of developing pudendal compression neuropathy.

CLINICAL RELEVANCE/APPLICATION
This study demonstrates potential application of clinical 3D CT in identify patients at risk of developing pudendal compression neuropathy.

LL-MKS-MO4A ● Is Accurate Metal Artifact Reduction Feasible at 3T? A Comparison Study between 3T and 1.5T
Lorenzo Nardo MD (Presenter) ; Misung Han ; Sonia Lee MD ; Ursula R Heilmeier MD ; Kevin Koch PhD * ; Thomas M Link MD, PhD * ; Roland Krug PhD

PURPOSE
Given its higher signal-to-noise-ratio high field MRI at 3 Tesla is increasingly used for musculoskeletal applications, however, metal artifacts and related image distortions are also more pronounced at 3.0T. We therefore studied the impact and the feasibility of metal artifact reduction sequences at 3.0T as compared with 1.5T

METHOD AND MATERIALS
Twenty patients (aged 58-76) with total hip replacements were scanned at 1.5T and 3.0T within a period of 2 weeks. For signal acquisition, 8-channel phased-array cardiac coils were used on both scanners. The sequence protocol included: multi-acquisition variable-resonance image combination (MAVRIC) PD (coronal), MAVRIC STIR (axial) as well as standard FSE sequences. Each study was assessed by 2 radiologists for morphological abnormalities (joint effusion (including findings suggesting aseptic vascular autoimmune lymphocytosis (AVAL)), bone marrow edema pattern, osteolysis, insertion tendinopathy at the greater trochanter) and distinction of anatomic details (anterior and posterior femoral head, femoral neck, greater and lesser trochanters). A five-point scoring system was used: 1- good visualization, 2- good visualization with minimum artifacts, 3- visualization not compromised by artifacts, 4- visualization compromised by artifacts, 5- severe artifacts. Furthermore, the extent of artifacts was quantitatively measured. Wilcoxon signed rank test was used to compare the data obtained by the two different scanners. Agreement between the two readers was reported with kappa values.

RESULTS
While the extent of artifacts was significantly smaller at 1.5 T compared to 3.0 T (p0.05): average scores ranged between 2.5 and 3.4 at 1.5 T and between 2.6 and 3.3 at 3.0 T. Also the assessment of morphological abnormalities was not significantly different between the two field strengths (p>0.05) with average scores ranging between 2.6 and 3.5 at 1.5 T and 2.5 and 3.6 at 3.0 T. Inter-reader agreement for different anatomic details and clinical findings visualization ranged between k=0.65 and k=0.90.

CONCLUSION
Though artifacts were larger at 3 T compared to 1.5 T, the visualization of morphological abnormalities and anatomic details was not significantly different between the two field strengths.

CLINICAL RELEVANCE/APPLICATION
3.0 T metal artifact reduction showed no significant difference in detection of morphological abnormalities and anatomic details when compared to 1.5 T.

LL-MKS-MO5A ● Anterior Knee Pain Syndrome: May One and Simple Measurement Using Weight-bearing MRI Unmask Patellar Maltracking in Your Patients Negative at Standard-MRI?
Silvia Mariani MD (Presenter) ; Alice La Marra MD ; Stefano Necozione MD ; Vittorio Calvisi MD ; Antonio Barile ; Carlo Masciocchi

PURPOSE
To prove that weight-bearing (WB)-MRI may unmask a patello-femoral maltracking with respect to standard-MRI and to define which measurement of patellar alignment is the most reliable.

METHOD AND MATERIALS
Seventeen patients presenting with a piriformis muscle syndrome treated either by Botox injection or surgery, and who benefited from an MRI were included retrospectively (mean age 43 y/o). The following parameters were assessed and compared to a normal contralateral muscle: maximal thickness and volume of piriformis muscle, and its fatty infiltration according to Goutailier’s classification.

RESULTS
The affected side showed a significant reduction in thickness (p < 0.05). To our knowledge, our study is the first that shows quantitatively the effect of infiltration therapy by Botox over the piriformis muscle: atrophy and fatty infiltration

CLINICAL RELEVANCE/APPLICATION
Botox injection into the piriformis muscle in the treatment of the eponymous syndrome has morphological effects on the muscle that can be demonstrated and followed-up by MRI

LL-MKS-MO3A ● Analysis of Ischial Spine Orientation in Patients with Compression-mediated Pudendal Neuropathy: A Study Using 3D Computed Tomography
Lina Chen MD (Presenter) ; Richard P Marvel MD ; Howard M Richard MD

PURPOSE
The pudendal nerve is a predominately sensory nerve arising from s2-4 nerve roots. Several potential sites of entrapment lie along the course of the nerve. One critical zone of compression is adjacent to the ischial spine and sacrotuberous ligament. We hypothesize that variations in bony anatomy of the ischial spine may predispose patients to pudendal nerve compression. The goal of this study was to use 3D computed tomography (CT) to identify reliable measurement of ischial spine orientation and to determine if such metrics can differentiate patients with pudendal neuralgia from control patients without neurological symptoms.

METHOD AND MATERIALS
In this IRB-approved study, CT of the bony pelvis in 32 women were retrospectively reviewed, including 16 patients (ages 22-78 y; mean age = 54.3±15 y) diagnosed with pudendal nerve compression syndrome and who underwent pudendal nerve block; 16 patients (ages 22-94 y; mean 64±19 y) who presented with trauma but had no documented neurologic symptoms. Exclusion criteria include diffuse pelvic pathology, such as Paget disease and metabolic bone disease, pelvic fracture, extensive calcification or ossification of soft tissue, and presence of hardware. Using the TeraRecon 3D CT application, an axial oblique CT image at the level of the tip of the bilateral ischial spine and mid symphysis pubis was obtained. Six methods of measurements were performed by a musculoskeletal radiologist with 5 y subspecialty experience. Each measurement was performed twice, separated by at least 1 month. The Student t test was used to compare differences in measurements between the two groups.

RESULTS
Of the CT measurements, the angle in the level between the ischial spine and inner pelvic wall was found to be statistically significant between the control and neuralgia patients. Right side: neuralgia 126±4.8 degrees, control 135±4.9, P = 0.015; left side: neuralgia 126±2.4, control 134±5.4, P = 0.044). Intra-observer correlation coefficient was 0.80.

CONCLUSION
Assessment of the orientation of ischial spine using 3D CT may help identify patients at risk of developing pudendal compression neuropathy.

CLINICAL RELEVANCE/APPLICATION
This study demonstrates potential application of clinical 3D CT in identify patients at risk of developing pudendal compression neuropathy.
RESULTS
Group A patients showed no statistically significant variations at all measurements both on standard and WB-MRI. On the basis of standard MRI-measurements, Group B patients were divided in Group B1 (23 pts) (negative or positive at 1 measurement) and in Group B2 (52 pts) (positive at 2 or more measurements). After WB-MRI, patients of Group B1 were divided in Group B1a (6 pts) if they remained positive at 0/1 measurement and in Group B1b (17 pts) if they became positive at 2 or more measurements. All patients of Group B2 confirmed to be positive at 2 or more measurements at WB-MRI. Qualitative statistical analysis (K-Cohen) demonstrated that LPT was the best predictive measurement (K=0.278) between standard and WB-MRI. Quantitative statistical analysis (Coefficient of variations from duplicate measurements) showed that LPT (for Group B1b=60.3%) and LPA (for Group B2=69%) were the most reproducible and clinically useful measurements.

CONCLUSION
The study demonstrates both the high diagnostic value of WB-MRI in unmasking PF-maltracking and the best predictive value of LPT measurement.

CLINICAL RELEVANCE/APPLICATION
This study demonstrates that WB-MRI (using LPT measurement) may be very useful in unmasking patello-femoral maltracking in patients with negative standard MRI.

LL-MKS-M06A • Dynamic Sonography of the Anterosuperior Hip during Flexion, Adduction/Internal Rotation: A Pilot Study

Neil P Shah MD (Presenter) ; Catherine N Petchprapa MD ; Roy Davidovitch ; Jose Maria Raya Garcia Del Olmo PhD ; Adler S Ronald MD, PhD*

PURPOSE
Demonstrate the ability of real-time ultrasound to track the relationships between the acetabulum and femoral head (FH)/neck junction and evaluate labral morphology and femoral-labral relationship (FLR) during dynamic hip flexion (HF) and adduction/internal rotation (ADIR).

METHOD AND MATERIALS
Ultrasound (US) and magnetic resonance (MR) evaluation of 10 hips in 5 asymptomatic subjects (4 Females, 1 Male, mean age/range 30.1/22-39 years). US (ACUSON S2000, Siemens Healthcare, Mountainview, CA): High resolution longitudinal images of the femoral neck recorded at the level of the ilioptasos (IPT) and rectus femoris (RF) tendons, and of the intervening anterosuperior (AS) labrum between them were acquired using 9 MHz linear phased array US transducer (TD). Dynamic US images, stored as cine clips, acquired in same orientation using 8 MHz small footprint sector US TD positioned between IPT and RFT during continuous passive HF to 45/90 deg (10 subjects), and 45/90 deg FH up to 60 degrees ADIR (6 subjects). All sonographic imaging performed by one radiologist with expertise in MSK US. MR: Coronal, axial oblique fat suppressed proton density images of each hip (SKYRA; Siemens, Mountainview, CA, phased array coil, TR/TE 2800/37). Consensus review of static US for appearance of AS labrum and chondrolabral junction (CLJ), and dynamic US for FLR, course of FH motion, presence of bony conflict. MR images evaluated for presence/absence of labral/CLJ pathology, cam lesion.

RESULTS
STATIC STUDY: MR:(1/10) cam, (5/10) labral tears, (9/10) CLJ separations. US: (8/10) labral tears, (5/10) CLJ separations. DYNAMIC STUDY: Labrum visualized to 45 deg HF (10/10), 90 deg HF (0/10), and 45 deg HF/30 deg ADIR (5/6). Labrum remained apposed to FH surface up to 45 deg HF (10/10) and vertically displaced between 45-90 HF (3/10), FH rotated smoothly under acetabular rim (10/10); (0/10) bony conflict during F/ADIR.

CONCLUSION
Dynamic US can evaluate labrum and femoroacetabular relationships during dynamic 45 deg HF and 30 deg ADIR. FH rotates smoothly under acetabular rim without bone/soft tissue conflict, and labrum rides along the surface of the femoral head as the hip is flexed.

CLINICAL RELEVANCE/APPLICATION
Dynamic US combined with clinical hip examination for femoroacetabular impingement (FAI) can be used to evaluate subjects with FAI and pain.

LL-MKS-M07A • Trabecular Bone Changes and Subclinical Secondary Osteoporosis Following Gastrectomy Detected by Multidetector CT

Miyuki Takasu MD (Presenter) ; Yukiko Honda MD ; Shuji Date ; Masao Kiguchi RT ; Kenichiro Matsuzaki ; Kazuo Awai MD * ; Takahisa Suzuki ; Kazuaki Tanabe

PURPOSE
Bone loss is a common disorder associated with gastric surgery, and a large number of postgastrectomy patients remain at risk for developing osteoporosis. The purpose of this study was to determine the prevalence of secondary osteoporosis (SO) and trabecular microstructural changes following gastrectomy using multidetector computed tomography (CT).

METHOD AND MATERIALS
Spinal microarchitecture was examined in patients post distal gastrectomy (n=92), patients post total gastrectomy (n=111), and in 85 sex- and age-matched controls using a 64-detector CT. Using a bone mineral phantom and a 3D image analysis system, bone mineral content per tissue volume (BMC/TV), trabecular parameters, and mechanical properties of the third lumbar vertebrae were calculated. Using BMC/TV with a reported cutoff value 58 mg/cm3, the prevalence of SO according to surgical procedures was analyzed using the Cochran-Armitage trend test. A multivariate regression model of patients characteristics including age, sex, postoperative period, and surgical procedure was constructed to identify predictors of SO. The trabecular parameters were compared among three groups, including control subjects, patients with SO, and patients without SO by the Scheffe’s post hoc test.

RESULTS
The prevalences of SO were 29.1% for post distal gastrectomy and 33.8% for post total gastrectomy in males, and 51.6% for post distal gastrectomy and 62.2% for post total gastrectomy in females. There were significant increase in the prevalence of SO from control group, distal gastrectomy cohort, to total gastrectomy cohort (P=0.04 for males, P=0.02 for females). Multivariate regression analysis demonstrated that patients age (P

CONCLUSION
The prevalence of SO significantly increased from control group to total gastrectomy group. Patients age and sex were significantly related to the risk of SO after gastrectomy. Bone quality and failure load were significantly reduced in patients with SO.

CLINICAL RELEVANCE/APPLICATION
Vertebral microarchitecture parameters obtained by clinical multidetector CT, together with bone mineral content measurement, provided useful information for assessing SO in post gastrectomy patients.

LL-MKE-M08A • The Many, Atypical Presentations of Musculoskeletal Hepatocellular Carcinoma (HCC) Metastases

Mostafa M Elian MD (Presenter) ; Hosny S Abdelghany MD

PURPOSE
To demonstrate many uncommon, non-classical clinical presentations of HCC that have been gathered from an endemic region in the Nile Basin.

METHOD AND MATERIALS
We will highlight cases of high quality MDCT performed for various clinical symptoms not classically associated with advanced or metastatic HCC and the role of image-guided biopsy in making these diagnoses. These will include: a) gradual progressive weakness of both lower limbs; b) Retrosternal pain not responding to medications; c) severe right hip pain; and d) progressive cheek swelling. These symptoms further corresponded to musculoskeletal abnormalities, not typically associated with HCC, including: a) lumbar spinal cord compression by an expansile vertebral body lesion; b) direct invasion of the chest wall; c) a large expansile metastasis of the right acetabulum; d) expansive rib lesions with underlying rib destruction, and e) painful cheek swelling.

RESULTS

Numerous patients with a range of non-specific musculoskeletal complaints and various clinical presentations whose final diagnosis was HCC. The clinical presentation was dependent on uncommon skeletal deposits which were most often expansile with the local effect of compression as the underlying cause for the odd presentation. The important role of MDCT and Histopathological assessment in making the correct diagnosis will be stressed.

CONCLUSION

HCC can often grow silently and may present late with an odd non-classic clinical presentation.

CLINICAL RELEVANCE/APPLICATION

HCC first presentation may be by a typical musculoskeletal manifestations like cord compression manifestation.

**LL-MKE1106-MOA** • Form-Over-Function?: A Review of the Injuries and Imaging Findings Associated with Minimalist and Traditional (SHOD) Running

**Ezra M Detroy** MD (Presenter) ; **Andrew W Lischuk** MD

**PURPOSE/AIM**

To discuss the biomechanics, characteristic injuries, and imaging findings associated with barefoot/minimalist running in comparison to tradition (SHOD) running.

**CONTENT ORGANIZATION**

- Describe the origin of SHOD, and the emergence of barefoot/minimalist running styles.
- Describe the biomechanics of these running styles, and how they lead to distinct injury patterns.
- Review the specific imaging findings seen in injuries associated with barefoot/minimalist and tradition (SHOD) running.
- Conclusion and future research directions.

**SUMMARY**

- In recent years there has been exponential growth in barefoot/minimalist style running, based on claims it can decrease running related injuries. However, injuries distinct to barefoot/minimalist running are now being observed.
- A radiologic overview of barefoot/minimalist and traditional (SHOD) running is presented.

**LL-MKS-MOB** • Prevalence of Post-operative Complications in Patients with Articular Surface Replacement (ASR) with Hip Prosthesis Evaluated Using Magnetic Resonance Imaging (MRI)

**Silvana Sdao** MD (Presenter) ; **Alberto Aliprandi** MD ; **Carmelo Messina** ; **Luca Maria Sconfienza** MD, PhD ; **Francesco Sardanelli** MD *

**PURPOSE**

Patients with certain types of ASR hip replacement are reported to present with high prevalence of a pathologic condition known as metallosis, caused by the localization of metallic debris in the soft tissue around the replaced hip joint. This condition has been related to several complications including severe joint pain, implant failure or loosening, local tissue necrosis, pseudotumors and osteolysis. Our aim was to evaluate post-operative complications in a series of patients who underwent ASR with DePuy hip prostheses.

**METHOD AND MATERIALS**

IRB approval was obtained and patients consent was waived. This study included 65 patients who underwent ASR with DePuy hip prosthesis (ASRTM XL Acetabular Hip System and DePuy ASRTM Hip Resurfacing System; DePuy Synthes, Johnsons and Johnsons, IN, USA) and were imaged at our hospital between January 2011 and January 2013. We excluded 25 patients who underwent x-ray and ultrasound examination only. Thus, our series included 40 patients (21 females, 19 males; mean age 58±15 years, range 26-86 years) who underwent MRI using a 1.5 T system (Magnetom Sonata, Siemens) after a mean delay of 7±2 years from surgery. Imaging protocol included three-plane T1- and T2-weighted sequences with and without fat saturation optimized for susceptibility artifact reduction without any specific algorithm. For each patient, we evaluated the presence of iliopsoas bursitis, peri-prosthetic fluid collection, joint effusion, and abnormal bone marrow signal.

**RESULTS**

Out of 40 patients, 25 (62.5%) showed post-operative complications. Among them, 8 (20%) had iliopsoas bursitis, 7 (17.5%) had peri-prosthetic fluid collection, 3 (7.5%) had joint effusion, 2 (5%) abnormal bone marrow signal. Four patients (10%) had both iliopsoas bursitis and peri-prosthetic fluid collection, while one patient (2.5%) had both iliopsoas bursitis and abnormal bone marrow signal.

**CONCLUSION**

After 7 years from surgery, patients implanted with DePuy hip prosthesis have 62.5% complication rate. MRI is effective in detecting such complications also without using specific artifact reduction algorithms.

**CLINICAL RELEVANCE/APPLICATION**

MRI is effective in detecting complications in patients who underwent ASR with DePuy implants without using specific artifact reduction algorithms.

**LL-MKS-M02B** • Athletic Pubalgia and Other Findings in Patients Referred for MRI of Sports-related Groin Pain: With Surgical Correlation

**Matthew Maeder** MD (Presenter) ; **Devon Klein** MD,MPH ; **Mark Zoland** MD

**PURPOSE**

To first clarify the complex musculoskeletal anatomy involving the pubis and the assorted terminology used to describe athletic pubalgia (including ‘sports hernia’) and other disorders of the groin. Then to report the incidence of athletic pubalgia, its common mimickers, and concomitant injuries or pathology.

**METHOD AND MATERIALS**

A database query of adults referred for imaging of sports-related groin pain during a two year period yielded 64 examinations of 62 patients with 25 (40%) patients having surgical correlation. A review of the 25 patients with surgical correlation was performed. Patient charts were reviewed in order to compare MRI findings with surgical findings. MRI images were reviewed to determine the presence of iliopsoas bursitis, peri-prosthetic fluid collection, joint effusion, and abnormal bone marrow signal. A radiologic overview of barefoot/minimalist and traditional (SHOD) running is presented.

**RESULTS**

Out of 40 patients, 25 (62.5%) showed post-operative complications. Among them, 8 (20%) had iliopsoas bursitis, 7 (17.5%) had peri-prosthetic fluid collection, 3 (7.5%) had joint effusion, 2 (5%) abnormal bone marrow signal. Four patients (10%) had both iliopsoas bursitis and peri-prosthetic fluid collection, while one patient (2.5%) had both iliopsoas bursitis and abnormal bone marrow signal.

**CONCLUSION**

After 7 years from surgery, patients implanted with DePuy hip prosthesis have 62.5% complication rate. MRI is effective in detecting such complications also without using specific artifact reduction algorithms.
A database query of adults referred for imaging of sports-related groin pain during a two year period yielded 64 examinations of 62 outpatients. The mean age of this population was 38 years old (range 16-71). Thirteen patients were female. There were 38 MRI-positive cases of athletic pubalgia, defined as any abnormal signal, tear, or defect of the rectus abdominis tendon, adductor longus tendon, or prepubic aponeurosis. The presence or absence of additional findings including inguinal hernias and acetabular labral tears were also recorded. Surgical correlation and follow-up, when available, was obtained from the patients' surgeon.

RESULTS
There were 38 (59%) MRI-positive cases of athletic pubalgia, found bilaterally in 18 cases. In 14 of these positive studies, there was the additional finding of inguinal hernia. Inguinal hernias were present in a total of 22 (34%) of all the reviewed studies. The addition of a Valsalva sequence to our protocol was instrumental in detecting four of these inguinal hernias. Acetabular labral tears were more commonly found, present or suspected in 44 (69%) of the studies. As of yet, an unknown number of these patients had surgical correlation and follow up of their symptoms.

CONCLUSION
Athletic pubalgia was present in most outpatients presenting to our institution with sports-related groin pain. Additional pathology was found in a significant number of cases, and specific protocols that include a Valsalva sequence are recommended to increase conspicuity of and sensitivity for concomitant pathology such as inguinal hernia.

CLINICAL RELEVANCE/APPLICATION
In patients referred for MRI imaging of sports-related groin pain, pathology was frequently found. Measures to help detect correctable conditions, such as inguinal hernia, are recommended.

**LL-MKS-MO3B • Assessment of the Multi-banded Anterior Talofibular Ligament Using 3D Isotropic Fast-spin Echo MR Sequence: Normal Anatomy and Its Injury**

Seung Min Nam (Presenter); Hye Jung Choo MD; Sun Joo Lee MD; Ok Hwa Kim; Young Mi Park MD, PhD; Seok Jin Choi; Seon-Jeong Kim MD

PURPOSE
To evaluate the frequency and MR characteristics of multi-banded anterior talofibular ligaments (ATFLs) in normal ankles and to characterize the tear types of multi-banded ATFLs in sprained ankles using a 3D isotropic proton density fast-spin echo (3D PD FSE) MR sequence.

METHOD AND MATERIALS
In the first session, 3D PD FSE MR imaging of 33 ankles was obtained from 20 asymptomatic volunteers. The number of bands in the ATFLs and locations of the ATFLs on orthogonal planes of the 3D PD FSE images and the signal intensity, depth, and width of each band on their multiplanar reformatted images parallel to the orientation of each band of the ATFL were evaluated by 2 readers. In the second session, 3D PD FSE MR imaging of 51 sprained ankles was evaluated by 2 readers for determining the number of bands in the ATFLs and the presence of tears in each band.

RESULTS
In the first session, 3 ATFLs were single-banded, 27 were double-banded, and 3 were triple-banded. In double-banded ATFLs, the superior band was about 2 times wider and thicker than the inferior band. The depth, width, and location of single-banded ATFLs and the superior band of double-banded ATFLs were not significantly different. In the second session, the most common type of injury in double-banded ATFLs was a 2-band tear.

CONCLUSION
In an evaluation using the 3D PD FSE sequence, most ATFLs consisted of 2 bands, and tears in both bands were the most common type of injury in double-banded ATFLs.

CLINICAL RELEVANCE/APPLICATION
1. Most anterior talofibular ligaments consist of 2 bands. 2. Tears in both of 2 bands are the most common type of injury in the double-banded anterior talofibular ligaments.

**LL-MKS-MO4B • Effects of Different Voltages and Tube Currents on MDCT Attenuation of Vertebral Trabecular Bone Using Different Reconstruction Algorithms**

Marcos P Botelho MD (Presenter) *; Fernanda D Gonzalez Guindalini MD *; Adeel R Seyeal MD *; Keyur Parekh MD *; Vahid Yaghmai MD

PURPOSE
To evaluate the effects of various kV and mAs combinations on MDCT based vertebral trabecular bone density using different reconstruction algorithms.

METHOD AND MATERIALS
An anthropomorphic torso phantom was scanned 15 times, with 80, 100 and 120 kVp and with 10, 20, 40, 75 and 110 mAs. The images were acquired with a Toshiba Aquilion One MDCT scanner using both Filtered Back Projection (FBP) and with Sinogram Affirmed Iterative Reconstruction (SAFIRE). The images were reconstructed both with Filtered Back Projection (FBP) and with Sinogram Affirmed Iterative Reconstruction (SAFIRE). MDCT attenuation of T11, T12 and L1 as well as noise were recorded by placing the largest possible ROIs within the trabecular bone of the vertebrae. CNR was calculated in relation to the left paravertebral muscle. Student's t-test was used for statistical analysis. Statistical significance was set at 0.05.

RESULTS
Mean attenuation measurements from phantom vertebrae were higher with 80kVp (313.6 and 313.9 HU), intermediate with 100 kVp (261.3 and 261.4 HU), and lower with 120 kVp settings (232.5 and 233.1 HU) obtained with FBP and SAFIRE, respectively (p<0.05). Noise was significantly lower when iterative reconstructions was applied on all acquisition settings (p<0.05).

CONCLUSION
Vertebral trabecular bone attenuation numbers increase with lower kVp settings, but do not change significantly with different mAs, regardless of the reconstruction algorithm. CNR values are significantly higher when iterative reconstruction is applied.

CLINICAL RELEVANCE/APPLICATION
MDCT vertebral attenuation may quantify bone density. Settings for calibration and image acquisition may affect results. Reconstruction algorithm may not play an important role in this scenario.

**LL-MKS-MO5B • Thermal Ablation Techniques for Curative Treatment of Bone Metastases**

Frederic Deschamps (Presenter); Geoffroy Farouil; Lambros C Tsellikas MD; Thierry J De Baere MD *

PURPOSE
To determine prognostic factor(s) for complete thermal ablation (TA) of bone metastases.

METHOD AND MATERIALS
The medical records of all the patients who had undergone curative-intent TA of bone metastases in our Institution between September 2001 and February 2012 were retrospectively reviewed. The goal of the TA was to achieve a local tumor control in order to cure all bone metastases in oligometastatic patients or to prevent the occurrence of skeletal-related events in long life expectancy cancer patients. We have analyzed the rate of complete treatment at 1 year according to the patients' details -gender, age, site of the primary tumor- and the bone metastases characteristics -synchronicity with the primary tumor, already treated by external radiotherapy, local evolution within 3 months before the procedure (RECIST criteria), location (axial vs. appendicular), maximal diameter at baseline CT,
RESULTS

Eighty-nine consecutive patients underwent TA in a curative-intent of 124 bone metastases. The median follow-up was 22.8 months (12.2 to 44.4 months). We report a 67% of complete treatment at 1 year. In multivariate analysis the good prognostic factors for complete treatment were: metachronous bone metastasis (p=0.004), no progression within 3 months before (p=0.004), no cortical erosion (p=0.01), maximal diameter

CONCLUSION
Thermal ablation techniques are effective to cure small (CLINICAL RELEVANCE/APPLICATION
Thermal ablation techniques must be considered in oligometastatic patients or in long life expectancy cancer patients with bone metastases.

LL-MKS-MO6B • Grading Focal and Diffuse Articular Cartilage Lesions of the Knee Joint as Correlated with Arthroscopy: Comparison of 3D Dual-echo Steady State and Fat-saturated Proton Density-weighted Fast Spin Echo Sequences on 3T MR Imaging

Fang Zhao (Presenter) ; Shadpour Demehri MD ; Filippo Del Grande MD, MBA ; Andrew Kompel MD ; Sahar J Farahani MBBS ; Rashmi S Thakkar MD ; John A Carrino MD, MPH *

PURPOSE
Purpose: Two-dimensional fat-suppressed proton density turbo spin echo (2D FS PD-TSE) weighted imaging is commonly used clinically but may suffer from anisotropies and partial volume effects which can be solved and decreased by using three-dimensional water excitation dual echo steady state (3D WE DESS) technique. The purpose of this study is to evaluate the correlation between the grading of focal and diffuse cartilage lesions on 3D WE DESS and 2D FS PD-TSE imaging with arthroscopy and to test the inter-observer reliability.

METHOD AND MATERIALS
Methods and Materials: In this IRB approved, HIPAA compliant, retrospective study, 45 patients (21 Males, 24 Females; mean age 42.8 ±13.7 SD years, range 13-71 years) who had their knee arthroscopy performed within 3 months of 3T MR imaging were included. Three trained musculoskeletal radiologists masked to the arthroscopic results independently evaluated focal and diffuse articular cartilage lesions of the knee and graded them according to International Cartilage Repair Society (ICRS) scoring system on isotropic 3D WE DESS images and on 2D FS PD-TSE images with a 2-week wash out period between evaluations. Statistical analysis included spearman correlation ( rho) of 3D WE DESS and 2D FS PD-TSE with arthroscopy. Inter-observer reliability was determined with kappa.

RESULTS
Results: The rho values for 3D WE DESS versus arthroscopy were 0.48, 0.26, 0.36 and for 2D FS PD-TSE versus arthroscopy were 0.51, 0.27, 0.35 for readers 1, 2, 3, respectively. The reliability of 3D WE DESS was 0.29 overall with pairwise comparisons of 0.22, 0.46, 0.25 and the reliability of 2D FS PD-TSE was 0.26 overall with pairwise comparisons of 0.15, 0.46, 0.25 (for readers 1 and 2, 2 and 3, 3 and 1 respectively).

CONCLUSION
Conclusion: 3D WE DESS performs similarly to 2D FS PD-TSE sequence for grading cartilage lesions of the knee. 3D WE DESS sequence has a little higher inter-observer reliability compared to 2D FS PD-TSE.

CLINICAL RELEVANCE/APPLICATION
Clinical Relevance: 3D-DESS on 3T MR imaging can be used to grade the articular cartilage lesions of the knee similar to 2D FS PD-TSE obviating multi-planar acquisition.

LL-MKS-MO7B • Primary Pain Palliation and Local Tumor Control in Bone Metastases Treated with MR Guided Focused Ultrasound

Beatrice Cavallo Marincola MD ; Alessandro Napoli MD (Presenter) ; Fabrizio Boni ; Brachetti Giulia MD ; Maurizio Del Monte ; Carlo Catalano MD

PURPOSE
To evaluate the clinical performance of MRgFUS in the primary treatment of painful bone metastases and to explore the potential of this technique in achieving local control

METHOD AND MATERIALS
26 consecutive patients (female: 12, male: 14; mean age: 64.7 ± 7.5) with painful bone metastases were enrolled. Patients were examined clinically for pain severity and pain interference according to Brief Pain Inventory-Quality of Life (BPI-QoL) criteria before and at regular time-points over the following 3 months after treatment. CT and MR imaging was performed before and at 3 months after MRgFUS treatment. Local tumor control was defined as a significant imaging modification from baseline in terms of lesion size, density and perfusion at CT or dynamic ce-MR imaging (Discovery 750, GE; Gd-Bopta, Bracco) and metabolic activity at PET or scintigraphy. The imaging parameters for local tumor control were individually evaluated in responder and non-responder patients.

RESULTS
No treatment-related adverse events were recorded during the study. Statistically significant difference between baseline and follow-up values for pain severity and pain interference (both p=0.001) was observed. Increased bone density was observed in 9/26 (34.6%) patients. Non-Perfused Volume values ranged between 20 and 92%. There was no difference in NPV values between responder and non-responders (p=0.45). The correlation between baseline SUV and PET SUV was poor (rho = 0.35). In patients (5 prostate and 1 breast primary cancer) there was nearly absence of metabolic activity after treatment with mean SUV=1.2.

CONCLUSION
MRgFUS can be safely and effectively used as the primary treatment for pain palliation in patients with bone metastases; our experience demonstrated also a critical role of MRgFUS in local tumor control as confirmed by metabolic analysis.

CLINICAL RELEVANCE/APPLICATION
MRgFUS can be applied as primary non-invasive technique for pain palliation related to bone metastases with the advantage of a relatively short treatment time and the possibility of be repeated if nec

LL-MKE-MO8B • 3 Tesla Chemical Shift MR Imaging: Technique, Clinical Utility and Pitfalls for Imaging the Skeleton

Filippo Del Grande MD, MBA (Presenter) ; David Dreizin MD ; Laura M Fayad MD

PURPOSE/AIM
To review the technical considerations and important pitfalls of performing and interpreting chemical shift imaging (with in-phase and opposed-phase gradient echo sequences) at 3T for the assessment of bone marrow abnormalities. The clinical utility of this sequence will be discussed as it relates to the assessment of bone lesions, for characterization and for determining tumor extent.

CONTENT ORGANIZATION
1. Technical considerations for 3T imaging
2. Qualitative and quantitative analysis of in-phase and opposed-phase imaging
3. Clinical utility of chemical shift imaging
   - Characterization of bone lesions:
SUMMARY
Chemical shift imaging is a valuable technique for differentiating bone marrow replacement from non-bone marrow replacement processes. However, at 3T, there are important technical factors which the radiologist must be aware of to use chemical shift imaging correctly. In addition, the radiologist should be familiar with potential pitfalls to avoid misleading interpretations.

Musculoskeletal (Hip)

Monday, 03:00 PM - 04:00 PM • E450B

SSE14 • AMA PRA Category 1 Credit ™: 1 • ARRT Category A+ Credit: 1

Moderator
Gabrielle P Konin, MD

Moderator
William B Morrison, MD *

SSE14-01 • Femoroacetabular Impingement: Normal Values of the Morphometric Parameters in Asymptomatic Hips

Marianne Lepage-Saucier MD; Cecile Thiery; Bruno C Vande Berg MD, PhD; Frederic E Lecouvet MD; Ahmed Larbi; Patrick Omoumi MD (Presenter)

PURPOSE
Femoroacetabular impingement (FAI) is believed to evolve to premature osteoarthrosis and early diagnosis is important to prevent irreversible chondrolabral abnormalities. The purpose of this study was to determine the means and the reference intervals of the quantitative morphometric parameters of FAI in normal hips with high-resolution computed tomography (CT).

METHOD AND MATERIALS

RESULTS

CONCLUSION
The 95% reference interval limits were all far beyond the abnormal thresholds found in the literature for cam-type and to a lesser extent for pincer-type FAI. In the recent literature, a high prevalence of FAI signs in the asymptomatic population has been noted emphasizing the need for refinement of the previously established cut-offs for morphometric parameters. The 95% reference intervals of the cam and pincer morphometric CT measurements in the asymptomatic patient population determined in our study suggest that the current morphometric parameters used in the diagnosis of FAI should be redefined.

CLINICAL RELEVANCE/APPLICATION
Our study suggest that the current morphometric parameters used in the diagnosis of FAI and most specifically the cam-type, should be redefined.

SSE14-02 • Benefit of MR Arthrography with versus without Axial Leg Traction in Detection of Ligamentum Teres Lesions in FAI Patients with Arthroscopy as Reference Standard

Florian Schmaranzer; Michael Kogler MD; Markus Reichkendler; Ehrenfried Schmaranzer (Presenter)

PURPOSE
FAI leads to chondral and labral damage and according to recent research also to lig. teres lesions. Imaging of these entities is a radiologic challenge. The aim of this study was to demonstrate the diagnostic benefit of MRI with versus without leg traction in the evaluation of lig. teres lesions. This is based on the initial observation that joint distraction achieved by traction leads to approaching of its origin and enthesis, which alters the imaging appearance of the ligament on coronal planes.

METHOD AND MATERIALS
Institutional review board was waived for this retrospective study. Arthroscopic records were reviewed from 94 FAI patients in terms of confirmed lig. teres lesions. MR-A studies of 31 FAI patients (mean age; 35.8a, 9 cam-, 1 pincer-, 21 mixed-type) with 31 confirmed ligament lesions were included. Studies had been obtained according to the institutional routine protocol for imaging of the central compartment: coronal, sagittal, axial planes with traction and a coronal plane without traction using a 1.5 T scanner and an intra articular injected volume of up to 30 ml. A dedicated traction device was used with weight load ranging from 15-23 kp according to patients constitution. Lesions were graded as partial tear (type 2; subtotal fluid interposition and/or ligamentous flap) and degeneration (type 3; hypertrophy with/without mucoid degeneration) on coronal images with and without traction. Overall sensitivity and sensitivity for each imaging modality as such was calculated.

RESULTS
With both modalities and with imaging under leg traction 23 out of 26 type 2 and 5 out of 5 type 3 lesions were detected yielding a sensitivity of 88,5% and 100%. Sensitivity of imaging analysis without traction was 61,5% for type 2 and 60% for type 3 lesions. 7 type 2 (P = 27%) and 2 type 3 lesions (P = 40%) were only seen with traction.

CONCLUSION
Imaging with traction improved detection of lig. teres lesions. The authors suggest that application of traction during MRA enables visualization of the ligament more similarly to the arthroscopic point of view which reflects a more lax condition of stress and hence facilitates the evaluation of flaps, intrasubstantial fluid accumulation and hypertrophy.

CLINICAL RELEVANCE/APPLICATION
Accurate imaging of lig. teres lesions is challenging. According to recent research on the biomechanical function of the ligament these lesions are increasingly relevant for operative strategies.

SSE14-03 • Detection of Occult Hip Fractures Utilising a Dual Source CT Algorithm Targeted to Detection of Bone Marrow Edema: Initial Results at Vancouver General Hospital

Taryn L Reddy FRANZCR; Patrick McLaughlin FFRRCSI (Presenter); Savvas Nicolaou MD; Hugue A Ouellette MD

PURPOSE
The purpose of this study was to evaluate the performance of virtual subtracted non calcium images reconstructed from dual energy computed tomography (DECT) data sets for the detection of bone marrow (BM) edema in patients with suspected hip fractures following trauma.

METHOD AND MATERIALS

RESULTS

CONCLUSION

CLINICAL RELEVANCE/APPLICATION

Back to Top
Reliability of CT Findings of the Sacroiliac Joint - How Many Carats Is This Gold Standard?

Zain K Rajabali (Presenter) ; Babak Maghdoori BEng, MD ; Isabelle Drolet MD ; Vimarsa G Swami BSc ; Jacob L Jaremko MD ; Robert G Lambert MBBCh *

PURPOSE
The sacroiliac (SI) joints are the primary site of spondyloarthropathy (SpA), but direct tissue evaluation of SI joint arthropathy from specimens is impractical. The de facto imaging gold standard for bony features of SpA such as SI joint ankylosis is CT scan, but there is little study of the associated inter-observer variability. Therefore, we sought to test reliability of CT assessment of features of SI joint arthropathy. We hypothesized that identification of ankylosis and erosion would be highly reliable (kappa>0.8).

METHOD AND MATERIALS
In this ethics-approved retrospective study at a tertiary hospital, we obtained CT scans of SI joints performed from 2002-2012 for any indication. We had 60 patients aged 10-52 years (mean 33.8), 31 (52.5%) female, 6 (10%) aged ≥65 years.

RESULTS
The most reliable feature was erosion, with kappa 0.78-0.89 (left-right SI joint), 90-95% agreement, prevalence 34-32%. Other features with substantial agreement were widening (kappa 0.65, prevalence 25%) and intra-articular mineralization (kappa 0.69, prevalence 30%). Features with moderate agreement included sclerosis (kappa 0.54, 54% prevalence), joint space narrowing (kappa 0.47, 56% prevalence), ankylosis (kappa 0.48, 20% prevalence), and Kellogg-Lawrence grade (kappa 0.57, 72% agreement). Global assessment of presence of SpA had moderate agreement (kappa 0.47, 17/60 agreed SpA, 10 rated SpA by one observer but not the other).

CONCLUSION
Detection of an SI joint erosion on CT scan was highly reliable between two experienced observers. However, reliability was poorer than expected for several other features of SI joint arthropathy, including notably ankylosis, for which CT is generally considered the gold-standard imaging test. Further study is needed to refine feature scoring to improve the reliability and accuracy of CT assessment of findings that may relate to spondyloarthropathy.

CLINICAL RELEVANCE/APPLICATION
Radiological findings on CT of the sacroiliac joints are highly variable, but with training, even subtle erosion can be reliably observed.

Ultrasound Guided Synovial Biopsy in Patient’s with Hip Arthroplasty

Anukul Panu MD, FRCP (Presenter) ; Theodore T Miller MD ; Gregory R Saboeiro MD * ; Giorgio Perino MD ; Geoffrey Westrich MD *

PURPOSE
To evaluate the efficacy of ultrasound guided synovial biopsy in patients with hip arthroplasty suspected of having an adverse local tissue reaction (ALTR).

METHOD AND MATERIALS
We retrospectively assessed 39 consecutive biopsies for suspected ALTR performed over a 2 year period that were sent for an ultrasound guided synovial biopsy. Ultrasound images were retrospectively reviewed to determine synovial thickness and whether an effusion could be distinguished from synovium. Tissue samples were assessed for diagnostic adequacy and the presence of ALTR. The relationships between synovial thickness, sample adequacy, and the presence of ALTR were analyzed as well as the sensitivity of biopsy. Final pathologic diagnosis at revision was used as the gold standard for ALTR.

RESULTS
Adequate samples containing synovial tissue were obtained in 36/39 biopsies (92%). 34/39 (87%) biopsies were taken from an anterior approach with 30/39 (13%) taken posteriorly with all samples directed at the site of maximal synovial thickness via the safest technically feasible approach. There were no post-procedural complications. Synovium could be distinguished from effusion in 38/39 cases (97%). There was no difference between synovial thickness (avg 1.6 cm) or the number of samples obtained (avg 4) between the diagnostic and non-diagnostic biopsy cohorts. Review of the failed biopsies revealed the needle falling short of the capsule in 2/3 of the cases; these cases were performed earlier in the series. Of the 36 adequate specimens, 28 underwent revision and were found to have ALTR with 6/28 (21%) having false negative biopsies. Using the final diagnosis of ALTR at revision as the gold standard, the sensitivity for US guided biopsy is 0.79 (95% CI 0.59-0.91); we are unable to calculate specificity as there have been no true negatives at revision.

CONCLUSION
Ultrasound guided biopsy is a safe procedure that can aid in the diagnosis of patients suspected of having ALTR. The false negatives are due to sampling error. There is no apparent difference between synovial thickness and the ability to obtain an adequate sample or with synovial thickness and ALTR seen at biopsy. Additionally, there is no association between the number of samples obtained and the adequacy of the specimen.

CLINICAL RELEVANCE/APPLICATION
Pre-operative histologic evaluation of the synovium for the presence of suspected ALTR has become critical in the surgical management of these patients.

Advanced Core Decompression of the Hip: 3T MRI Monitoring of Patients with Avascular Necrosis

Andrea Lazik MD (Presenter) ; Tim Clasen ; Stefan Landgraeb er * ; Florian Grabellus ; Thomas C Lauenstein MD ; Jens M Theysohn MD

PURPOSE
25 consecutive patients who presented to the Emergency department at Vancouver General Hospital between January 1 2011 and January 1 2013 with clinical suspicion of hip fracture but inconclusive radiographs formed the basis of this study. 7 patients were male and 18 were female, aged between 24 and 97. All CT scans were performed on a dual source CT scanner. Tube voltages were set at 100 kvP and 140 kvP with activated filter. The tube current was set at 160mAs with automated attenuation-based tube current modulation. The postprocessing software algorithm used for the generation of the virtual subtracted non calcium images was originally developed for postprocessing of liver data but was adapted for bone imaging by setting the relative contrast ratio to 1.75 , and the minimum and maximum values were set at 300 and 1500 with a range of 3. Two radiologists reviewed the findings on the multimodality workplace station utilizing the modified VNC Liver Dual Energy algorithm.

RESULTS
7 of 25 cases did not demonstrate evidence of fracture or BM edema. 14 cases demonstrated evidence of fracture with BM edema (two of these 14 cases also demonstrated BM edema in a different region where fracture was not detected) 1 case demonstrated fracture without accompanying BM edema. 5 cases demonstrated BM edema where the fracture was only seen after review of bone marrow windows (1 case) and in the other four cases although no fracture was identified there was sufficient BM edema to warrant concern of an underlying fracture (two of these cases also demonstrated fractures in a different region with evidence of BM edema ).

CONCLUSION
Findings in this series suggest that DECT can be used to facilitate the diagnosis of hip fractures in patients, particularly in cases where fractures are difficult to visualise on CT, by using a dual energy algorithm which is targeted to the detection of bone marrow edema.

CLINICAL RELEVANCE/APPLICATION
By using an algorithm targeted to the detection of bone marrow edema, DECT can be used to facilitate the diagnosis of occult hip fractures in patients.
Advanced Core Decompression (ACD) is a new treatment option for patients with avascular necrosis (AVN) of the hip which is still under clinical evaluation. In opposition to standard core decompression, ACD uses an expandable reamer that allows optimal debridement of necrosis after drilling a core to the femoral head. Afterwards the bone defect is filled with a bone graft substitute. We aimed to monitor structural changes and therapeutic success of ACD based on 3T MRI.

METHOD AND MATERIALS

Twentyfive patients (19 male, 6 female, mean age 48.7 years) underwent 3T MRI of the hip prior to and 30 days - 2 years after ACD. The extended clinical protocol included TIRM, PD/T2w TSE, high resolution T1w, DESS and contrast enhanced T1w VIBE sequences. Sequences were evaluated regarding delineation of necrosis, bone, graft and transformation zone in consensus by two radiologists using a 5-point scale (0 = poor contrast, 4 = very good contrast). The volume of necrosis was measured before and after ACD using a post processing tool. MRI images were compared to histological specimens in cooperation with a pathologist.

RESULTS

AVN prior to ACD as well as the defect filled with the graft after ACD and the residual necrosis could be imaged with reproducible high quality at 3T. T1w (mean 2.92) and PDw (mean 2.36) sequences provided best contrast to measure the volume of (residual) necrosis. Every patient showed a reduction of necrosis after ACD (by 16.5 % to 90.3 %, mean 41.3 %, SD 22.5 ). The transformation zone around the graft could especially be visualized by T2w TIRM, ce T1 VIBE and PDw sequences (contrast granulation zone / bone: 3.11, 3.0 and 2.88). The arrangement of different layers within the transformation zone correlated with histological findings.

CONCLUSION

Structural changes and reduction of necrosis after ACD can be monitored by MRI. ACD can significantly reduce the volume of necrosis in AVN of the hip.

CLINICAL RELEVANCE/APPLICATION

3T MRI is a feasible instrument to quantify and monitor the success of ACD. Further long-time evaluation is needed to identify early MRI signs of healing response or breakdown of the femoral head.

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**SSE15-01 • High-resolution 7 T MRI of Distal Femur Bone Microarchitecture Discriminates between Women with and without Fragility Fractures**

**Gregory Chang, MD** (Presenter) ; **Stephen Honig**, MD ; **Yinxiao Liu** ; **Cheng Chen** ; **Kevi Chu** ; **Punam K Saha**, PhD ; **Ravinder Regatte**, PhD

**PURPOSE**

The goals of this study were to determine: 1) the differences in distal femur bone microarchitecture in women with and without fragility fractures and 2) whether MR-derived microarchitectural parameters can be used to discriminate between these two groups.

**METHOD AND MATERIALS**

This study had institutional review board approval. We imaged the distal femur of 31 subjects with fragility fractures and 25 controls on a whole body 7 T MRI scanner using a 3-D fast low angle shot sequence (0.234 mm x 0.234 mm x 1 mm). We applied digital topological analysis to measure bone microarchitectural parameters. All subjects underwent DXA of the hip and spine. We performed t-tests and Mann-Whitney tests to compare differences between groups and a receiver operating characteristics (ROC) analysis to determine the ability of parameters to discriminate between groups.

**RESULTS**

Compared to controls, fracture cases demonstrated lower bone volume fraction and markers of trabecular number, plate-like structure, and plate-to-rods ratio, and higher markers of trabecular isolation, rod disruption, and network resorption (p

**CONCLUSION**

Women with fragility fractures have lower trabecular number and plate-like structure, and greater rod-like structure and rod/network resorption in the distal femur. MRI of distal femur bone microarchitecture may allow detection of patients with poor bone quality who cannot be detected by DXA.

**CLINICAL RELEVANCE/APPLICATION**

MRI of distal femur bone microarchitecture may allow detection of patients with poor bone quality who cannot be detected by DXA.

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**SSE15-02 • Impaired Cortical and Trabecular Bone Microarchitecture in Female and Male Lung Transplant Recipients**

**Alexander Valentinitsch** (Presenter) ; **Lucas Fischer**, MSc ; **Matthew D DiFranco**, PhD ; **Claudia Schueller-Weldekamm**, MD ; **Georg Langs** ; **Janina Patsch**, MD

**PURPOSE**

Organ transplant recipients often suffer from severely impaired bone strength arising from a combination of pre-existing osteoporosis and bone disease aggravation due to immunosuppressive treatment after surgery. Lung transplant (LuTX) recipients, in particular, are under an intense post-transplant drug regimen and fracture rates are high. Despite, low bone mineral density and altered states of bone turnover have been reported, bone microarchitecture status has not been analyzed.

**METHOD AND MATERIALS**

After recovery from surgery, 46 patients (female: n=28, male: n=18; mean age: 43.9±13.7, and 46 healthy, age and gender-matched controls (Co) underwent high resolution peripheral quantitative computed tomography (HR-pQCT; SCANCO Medical AG) of the ultradistal radius. Volmetric bone mineral density (BMD) and bone microarchitecture were assessed by a software provided by the manufacturer. Paired t-tests were used to compare mean differences between LuTX patients and Co.

**RESULTS**

Female LuTX recipients had higher cortical porosity (+51.5% p=0.034), cortical pore diameter (+10.9% p=0.009), diameter heterogeneity (+18.3%, p=0.021), and lower trabecular BMD (21.1%, p=0.045) than healthy women. Male LuTX patients had lower cortical thickness (-18.9%, p=0.003), total BMD (-21.3%, p=0.001), trabecular BMD (-23.3%, p=0.001), trabecular thickness (-14.4%, p=0.003), and trabecular number (Tb.N: -13%, p=0.028) than healthy men.

**CONCLUSION**

Our results indicate that cortical integrity and trabecular bone microarchitecture are severely impaired in female but also male LuTX recipients. Thinning and porosity of cortical bone might be crucial factors leading to disproportionally high risk of fragility fractures in LuTX recipients.
SSE15-03 • Automatic Detection of Osteoporotic Vertebral Fractures in Routine Thoracic and Abdominal MDCT

**PURPOSE**
To develop an automatic spine segmentation algorithm for routine thoracic and abdominal MDCT and use this algorithm to automatically detect osteoporotic vertebral fractures.

**METHOD AND MATERIALS**
We retrospectively identified 85 patients (43 men, 42 women) older than 45 years of age, who underwent routine contrast-enhanced thoracic and abdominal MDCT. Sagittal reformations (SRs) with a slice thickness of 3 mm were routinely reconstructed. The SRs were input for the automatic spine segmentation algorithm. To determine the reproducibility error of the algorithm, five patients were analyzed, who underwent two MDCT examinations within 8 weeks. The performance of the algorithm to detect fractures was investigated in (i) cross-sectional MDCT images of 71 patients including 8 men and 9 women with prevalent osteoporotic vertebral fractures and (ii) baseline and follow-up MDCT images of 9 patients with an incidental vertebral fracture in the follow-up MDCT.

Our automatic algorithm firstly localized and identified the vertebrae from T5 to L5 in the MDCT images. Then, each vertebra was automatically segmented by using corresponding vertebra surface shape models that were adapted to the original images. Finally, anterior, middle, and posterior height of each vertebra was automatically determined, and anterior-posterior-ratio (APR) and middle-posterior-ratio (MPR) were computed.

As gold standard, two radiologists graded vertebral fractures from T5 to L5 according to the Genant classification in consensus by using the SRs.

**RESULTS**
The reproducibility error of the algorithm expressed as root mean square coefficient of variation amounted 1.2% for APR as well as MPR. Using ROC analysis to differentiate vertebrae with prevalent versus without fracture, AUC values of 0.84 and 0.83 were obtained for APR and MPR, respectively (p=0.01).

**CONCLUSION**
We presented a reproducible automatic spine segmentation algorithm that adequately detected osteoporotic vertebral fractures.

**CLINICAL RELEVANCE/APPLICATION**
Osteoporotic vertebral fractures are underdiagnosed in routine radiographs and MDCT. Our automatic spine segmentation algorithm may support radiologists to report osteoporotic fractures.

SSE15-04 • Positive Effects of Brown Adipose Tissue on Bone Structure and Density

**PURPOSE**
Recent studies suggest a link between brown adipose tissue (BAT) and bone. The purpose of our study was to investigate the effect of BAT on femoral bone structure and density.

**METHOD AND MATERIALS**
The study group comprised 46 patients (10 men, 36 women) who underwent FDG-PET/CT for benign etiologies (n=11) or follow-up of successfully treated malignancies (n=35; mean time between PET/CT and last form of treatment: 14.8±18.0 months). All subjects were BAT positive on PET/CT. BAT volume was quantified and the following measures of femoral bone structure were determined in the proximal thigh using CT: femoral density, total femoral cross-sectional area (CSA), cortical CSA, and marrow CSA. Thigh muscle CSA and thigh fat CSA were also determined. Linear regression analysis between BAT volume and measures of femoral bone structure and body composition was performed. Forward stepwise regression modeling was also performed to determine the strongest predictor of femoral cortical CSA and femoral density.

**RESULTS**
There were positive correlations between BAT volume and femoral density (r=0.45, p=0.03), total femoral CSA (r=0.39, p=0.02), femoral cortical CSA (r=0.36, p=0.03), and marrow CSA (r=0.32, p=0.05). BAT volume correlated positively with thigh muscle area (r=0.41, p=0.01) and thigh SAT (r=0.35, p=0.04). When femoral cortical CSA was entered as a dependent variable and BAT volume, age and BMI as independent variables in a forward stepwise regression model, BAT volume was the only predictor of cortical CSA and explained 19% of cortical CSA variability. When femoral bone density was entered as a dependent variable and BAT volume, age and BMI as independent variables, BAT volume was the only predictor of femoral density and explained 20% of femoral density variability. The addition of muscle CSA as an independent variable significantly decreased the contribution of BAT.

**CONCLUSION**
BAT volume is a positive predictor of femoral bone structure and density. The relation between BAT and bone could be, in part, mediated by muscle.

**CLINICAL RELEVANCE/APPLICATION**
The identification of brown adipose tissue as a potential regulator in bone formation could lead to novel therapies to prevent bone loss.

SSE15-05 • Ectopic and Serum Lipids Are Positive Determinants of Bone Marrow Fat in Obesity

**PURPOSE**
Recent studies have linked obesity to bone loss. However, the etiopathology of obesity-associated bone loss is incompletely understood. Serum lipids and ectopic lipid deposits are emerging as important regulators of skeletal physiology, but little is known about their effects on bone in obesity. In addition, both bone and fat cells arise from the same mesenchymal stem cell within bone marrow, capable of differentiating into osteoblasts and adipocytes and obesity has been found to cause a shift into the adipocyte lineage. The purpose of our study was to investigate the associations between ectopic lipids and serum lipids on bone marrow fat, as a marker of stem cell differentiation, in young obese men and women.

**METHOD AND MATERIALS**
The study group comprised 106 healthy young men and women (mean age: 33.7±6.8 years, mean BMI: 33.2±7.1 kg/m²), who underwent 1H-MRS using a PRESS sequence at 3 Tesla for bone marrow fat content, of soleus muscle for intramyocellular lipids (IMCL), and liver for intrahepatic lipids (IHL), serum cholesterol, triglycerides and an oral glucose tolerance test as a measures of insulin resistance (IR). Exercise status was assessed by the Paffenbarger activity questionnaire.

**RESULTS**
There was a positive association between bone marrow fat and IHL (r=0.21, p=0.048) independent of BMI, age, IR, and exercise status (p=0.01). Serum lipids and ectopic lipid deposits are emerging as important regulators of skeletal physiology, but little is known about their effects on bone in obesity. In addition, both bone and fat cells arise from the same mesenchymal stem cell within bone marrow, capable of differentiating into osteoblasts and adipocytes and obesity has been found to cause a shift into the adipocyte lineage. The purpose of our study was to investigate the associations between ectopic lipids and serum lipids on bone marrow fat, as a marker of stem cell differentiation, in young obese men and women.

**CONCLUSION**
Our study suggests that ectopic and serum lipids are positive determinants of bone marrow fat in obese men and women. Because bone marrow fat is known to be inversely related to BMD, these results support the notion that ectopic and serum lipids may exert negative effects on bone. Further studies are needed to investigate this hypothesis and other potential mediators of the effects of obesity on bone.
To examine the correlations between total strut length (TSL) obtained by tomosynthesis (TS), microarchitectural parameters obtained by microfocus computed tomography (µCT), and the reproducibility of the TSL of TS.

RESULTS

The TSL of TS and microarchitectural parameters of µCT (BV/TV: r=0.91, p < 0.001 T-B: Th: r= -0.54, p < 0.01 T-B: N: r=0.93, p < 0.001 T-B: Sp: r= -0.58, p < 0.005 TSL: r=0.87, p < 0.001 TBP: r=-0.45, p < 0.005) were more highly correlated than those obtained using radiographs (BV/TV: r=0.62, p < 0.001 T-B: Th: r=0.18, p=n.s. T-B: N: r=0.67, p < 0.001 T-B: Sp: r=-0.18, p=n.s. TSL: r=0.52, p < 0.01 TBP: r=-0.46, p < 0.05). At five ROIs, the CV of TSL of TS, repeated 10 times, ranged from 0.71% to 1.86% (FN: 0.71%, GT: 1.73%, MI: 1.86%, LI: 1.29%, and PI: 1.82%). During examinations in which the internal rotation was corrected by 0~10 degrees by resciling the tomograms, the CV was significantly improved from 4.4% to 1.1% (p < 0.05).

CONCLUSION

Cancellous bone microarchitectural parameters with tomosynthesis correlate well with those from µCT and have high reproducibility.

CLINICAL RELEVANCE/APPLICATION

Tomosynthesis is a potentially useful method to quantitatively analyze the microarchitecture of cancellous bone in vivo with a low radiation dose.

Musculoskeletal Radiology Series: Ultrasound

Tuesday, 08:30 AM - 12:00 PM • E451B

VSMK31-01 • Shoulder Ultrasound (Demonstration)

Jon A Jacobson, MD (Presenter)

LEARNING OBJECTIVES

1) Be familiar with ultrasound examination and anatomy of the shoulder and common pathology.

VSMK31-02 • Ultrasound Assessment of the Rotator Cable and Correlation with Functional Outcome, Tear Size and Muscle Fatty Atrophy

Etienne Blain Pare, MD, FRCP (Presenter) ; Karim Basile, MD ; Nicola Hagemeister, MD ; Patrice Tetreault, MD, MSc ; Dominique Rouleau, MD, MSc ; Nathalie J Bureau, MD

PURPOSE

To investigate the relationship between visualization of the rotator cable (RC) on ultrasound (US) and functional outcome, tear size and muscle fatty atrophy in subjects with full-thickness rotator cuff tears (RCT) and asymptomatic volunteers (AV).

METHOD AND MATERIALS

In this cross-sectional study, 52 subjects with full-thickness RCT (32 men; age range 39-67 years; mean 57 years) and 20 (AV) (11 men; age range 35-64 years; mean 54 years) were examined prospectively with US by a musculoskeletal radiologist with 17 years of experience. A RC was defined as an articular-sided bundle of fibers perpendicular to the rotator cuff tendons. The length and width of the full-thickness RCT were measured in the frontal and sagittal planes and tear area was calculated. Supraspinatus (SS) muscle atrophy was assessed by calculating the occupation ratio of the SS fossa (Thomazeau 1997). SS and infraspinatus (IS) fatty atrophy was graded by a physiotherapist using the Constant score to measure functional outcome. Statistical analysis was performed using the Student t test and the Fisher exact test.

RESULTS

The RC was visualized in 75% of AV and in 25% of RCT subjects. Non-visualization of the RC in RCT subjects correlated significantly with a larger tear area (612.12 mm² vs 247.24 mm², p < 0.0001, 95% CI 143.83; 528.6). The mean Constant score was significantly higher in AV than in RCT subjects (87.5 vs 51.3, p < 0.0001, 95% CI 31.6; 40.7) but it did not correlate with RC visualization in the RCT group (p = 0.3) nor in the AV group (p = 0.11). There was a significant difference in the severity of muscle fatty replacement of the SS (p = 0.03) and the IS (p = 0.014), as well as in the severity of SS muscle atrophy (p = 0.04) in RCT subjects without a visible RC as compared to those with a visible RC.

CONCLUSION

Non-visualization of the RC on US correlates with larger RCT, higher grades of SS and IS muscle fatty replacement and with SS muscle atrophy. Visualization of the RC in subject with RCT does not appear to correlate with better functional outcomes.

CLINICAL RELEVANCE/APPLICATION

RC visualization on US in subjects with full-thickness RCT may assist orthopedic surgeons in choosing the optimal treatment for their patients (conservative vs surgery).
Hoseok Lee (Presenter) ; Jae Hyuck Yi MD

PURPOSE
To determine the availability of dynamic ultrasonography of the shoulder to diagnose combined adhesive capsulitis with full-thickness tear of the supraspinatus tendon.

METHOD AND MATERIALS
Since 2010, total 80 patients (M:F = 37:43, mean age: 61.56, age range: 36-82) with full-thickness tear of supraspinatus tendon (SSPT) who performed both dynamic ultrasonography (dUS) and MRI of the shoulder (32 cases of conventional MRI and 48 cases of indirect MR arthroscopy) were included in this retrospective study. 35 patients who showed subacromial gliding limitation (SGL) of the SSPT during dUS were classified into group I, 45 patients who did not show SGL of the SSPT were classified into group II. The dUS score was estimated by severity of SGL (0: none, 1: mild, 2: moderate, 3: severe). MRI was assessed for following 3 findings suggesting adhesive capsulitis; 1) maximal capsular thickness in axillary recess (AR) =4mm, 2) maximal capsular thickness in rotator cuff interval (RCI) =7mm, 3) presence of bright signal change of capsule in AR and RI on fat-suppressed T2-weighted image of conventional MRI or capsular enhancement in AR on indirect MR arthroscopy. Each of these findings was given 1 score, and total MRI score of each patients was calculated. Statistic analysis was performed by using Pearson correlation coefficient and Fischer exact test.

RESULTS
The mean value of dUS score and MRI score of total patients were 0.59 ± 0.77 and 1.42 ± 1.13. The mean thickness in AR and RI were 5.45 ± 1.37 mm and 6.81 ± 1.37 mm in group I, and 3.20 ± 0.86 mm and 6.08 ±1.39 mm in group II. dUS score was significantly correlated with capsular thickness in AR (r=0.742, p<0.001) and RC (r=0.621, p<0.001). The data suggest US alone is highly sensitive for detecting and characterization of subcutaneous soft tissue lesions. Only 8 patients resulted in an indeterminate US, all of which had benign lesions on pathology. Among these 8, US was determine for only 4, of which 3 were correctly classified as benign and 1 was incorrectly classified as malignant. Thus, estimated specificity is improved for the US+USE.

CONCLUSION
In the presence of an indeterminate result on conventional US, US+USE may improve specificity for diagnosing subcutaneous soft tissue lesions. Combination of US and USE could provide a better diagnostic performance than conventional US alone.

CLINICAL RELEVANCE/APPLICATION
Dynamic ultrasonography can demonstrate subacromial gliding limitation of the supraspinatus tendon and this exam is recommended in the evaluation of suspected adhesive capsulitis.

VSMK31-04 • Diagnostic Performance of Conventional Ultrasonography Combined with US Strain Elastography for Differentiation between Benign and Malignant Subcutaneous Soft Tissue Mass Lesions

Tharakeswara Kumar Bathala MD (Presenter) ; Gaiane M Rauch MD, PhD ; Melanie Bass ; Deborah Borst ; Brian Hobbs PhD ; Deepak G Bedi MBChb *

PURPOSE
To evaluate diagnostic performance of conventional ultrasonography (US) combined with US Strain Elastography (USE) for differentiation between benign and malignant subcutaneous soft tissue mass lesions, with the pathology as reference standard.

METHOD AND MATERIALS
After Institutional IRB approval, we identified 74 patients with a subcutaneous soft tissue mass who had US and USE from January 2009 to May 2012. Three radiologists retrospectively reviewed US and USE images in consensus. Gray scale US imaging features were classified as benign, malignant and indeterminate. USE images were assessed according to tissue elasticity based on color scale and classified as soft, intermediate and hard. Pathological diagnosis obtained either by percutaneous biopsy or surgical excision was used as reference standard. The statistical analysis included evaluation of sensitivity and specificity for US and USE separately, as well as a composite evaluation of US + USE; Bowker's test was used for evaluation of matched US and USE outcomes for symmetry.

RESULTS
Out of 74 lesions, US 37 were classified as benign, 8 indeterminate, 25 malignant lesions. US+USE classified 40 as benign, 4 indeterminate and 30 malignant. The estimated sensitivity and 95% CI for US, USE and US+USE was 57-82%, 67% (53-79%), and 77% (63-87%) respectively. Significant evidence for the lack of agreement among the matched US and Elastography results was not found (p=0.51). The data suggest US alone is highly sensitive for detecting and characterization of subcutaneous soft tissue lesions. Only 8 patients resulted in an indeterminate US, all of which had benign lesions on pathology. Among these 8, USE was determine for only 4, of which 3 were correctly classified as benign and 1 was incorrectly classified as malignant. Thus, estimated specificity is improved for the US+USE.

CONCLUSION
In the presence of an indeterminate result on conventional US, US+USE may improve specificity for diagnosing subcutaneous soft tissue lesions. Combination of US and USE could provide a better diagnostic performance than conventional US alone.

CLINICAL RELEVANCE/APPLICATION
Addition of USE evaluation to conventional gray scale US imaging improves imaging-based diagnostic information for soft tissue nodule work up.

VSMK31-05 • Value of Real-time Sharewave Elastography in Achilles Tendinopathy: Is the Abnormal Tendon Softer?

Jean-Philippe Nueffer MD (Presenter) ; Fabio Becce MD ; Fabrice Michel MD, PhD ; Benoit Barbier-Brion MD ; Adrian I Kastler MD, MSc ; Sebastien L Aubry MD, PhD

PURPOSE
To determine if the viscoelastic properties of Achilles tendon assessed by real-time shearwave elastography (SWE) are modified in tendinopathy

METHOD AND MATERIALS
Twenty-six abnormal tendons (16 unilateral and 5 bilateral tendinopathies) from 21 patients with Achilles tendinopathy and 176 normal tendons (from 16 patients and 80 healthy volunteers) were prospectively included and compared. Mean shearwave velocity (Vmean) was measured on axial and sagittal SWE images at two degrees of passive ankle flexion (position 1: 0°), plantar flexion (position 2: 0°), and 0° degree flexion). Tendon maximum anteroposterior and lateral diameters, cross sectional area and the presence of tears were also noted.

RESULTS
In position 1, the abnormal tendons Vmean was significantly lower than for contralateral normal tendons on sagittal (p=0.004) and axial elastograms (p=0.003); and significantly lower than for normal tendons only on axial images (p=0.049). In position 2 and on axial elastograms, the abnormal tendons Vmean was 1.14 m/s lower than for contralateral normal tendons however without reaching statistical significance (p=0.07). In position 2, the abnormal tendons Vmean was significantly lower than for normal tendons on sagittal (p=0.07).

CONCLUSION
Abnormal Achilles tendons have lower Vmean and are therefore softer than normal tendons. There is no SWE signal into tendon tears.

CLINICAL RELEVANCE/APPLICATION
Tendon softening, assessed by real-time SWE, is a new helpful tool in the evaluation of Achilles tendinopathy. SWE may also provide quantitative parameters to assess the severity of tendinopathy.

VSMK31-06 • Ultrasound-guided Shoulder Injection

Deepak G Bedi MD, MSc ; Fabio Becce MD ; Fabrice Michel MD, PhD ; Benoit Barbier-Brion MD ; Adrian I Kastler MD, MSc ; Sebastien L Aubry MD, PhD

PURPOSE
To evaluate diagnostic performance of conventional ultrasonography (US) combined with US Strain Elastography (USE) for differentiation between Benign and Malignant Subcutaneous Soft Tissue Mass Lesions
**VSMK31-07 • Ultrasound-guided (US) Percutaneous Treatment of Rotator Cuff Calcific Tendinitis (RCCT): Randomized Comparison between One- and Two-needle Procedure**

**Davide Orlandi** MD (Presenter); **Giulio Ferrero**; **Francesca Lacelli** MD; **Enzo Silvestri** MD; **Giovanni Serafini** MD; **Luca Maria Sconfienza** MD, PhD

**PURPOSE**
US-Guided percutaneous treatment of RCCT has been widely demonstrated to be effective using one or two needles, but direct comparison between the two methods has never been performed. Our aim was to compare the technical and one-year clinical outcome of these two different approaches.

**METHOD AND MATERIALS**
IRB approval and patients’ informed consent were obtained. One hundred patients were treated for RCCT diagnosed with ultrasound (77 females, mean age 46y, range 32-70 years) were randomized into two groups. Group A (50 patients; mean visual analogue scale [VAS]=7.8) was treated using an US-guided 16G double-needle technique (local anesthesia, washing with warm saline, intrabursal steroid), while group B (50 patients; mean VAS=7.4) was treated using a 16G single-needle technique. Calcification appearance at US (fluid, soft, hard), procedure time and ease of calcium dissolution (subjectively scored as easy=1, intermediate=2, difficult=3) were recorded. VAS follow-up was performed at 1,3,6 and 12 months. Complication rate was noted. Mann-Whitney U and Chi-square statistics were used.

**RESULTS**

**CONCLUSION**
One- and two-needle procedures are equally effective in treating RCCT with no major complications. Two-needle procedure allows for significantly reducing treatment time and appears to be much easier when dealing with soft and hard calcium deposits.

**CLINICAL RELEVANCE/APPLICATION**
Two needles US-guided percutaneous treatment of RCCT seems to be the treatment of choice in patients affected by soft and hard calcifications, compared to one needle technique.

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**VSMK31-08 • Postoperative Monitoring of Local and Free Flaps with Contrast Enhances Ultrasound (CEUS)- Analysis**

**Ernst Michael Jung** MD (Presenter); **Janine Rennert** MD; **Lukas Prantl** MD

**PURPOSE**
Tissue defects are a common problem in trauma surgery or oncology. Flap transplantation is often the only therapy to cover these extensive wound defects. To date several monitoring systems exist but none has made it to clinical day work.

Objective: Aim of this study was to assess perfusion disturbances of local and free flaps using contrast enhanced ultrasound (CEUS).

**METHOD AND MATERIALS**
112 patients were examined after local or free flap transplantation during the first 72 hours after operation. CEUS was performed by one experienced examiner with a linear transducer (6-9 MHz, LOGIQ E9/GE) after a bolus injection of 2.4 ml sufohexa-fluoride microbubbles (SonoVue®, Bracco, Italy). Retrospective vascular perfusion was quantified by evaluating the stored DICOM cine loops using the perfusion software QONTRAST® (Bracco, Italy). Over a total penetration depth of 3 cm every centimetre was analysed separately. 27 complications were observed. Complete flap loss was only seen in 4 cases whereas 23 flaps had to undergo minor revisions and survived.

**RESULTS**
Regarding the complete flap size quantitative analysis showed significant higher perfusion values in patients without complications compared to patients with complications: PEAK 16.5 vs. 10.0 (p=0.001), TTP 32.6 vs. 22.2 (p=0.001), RBV: 738.8 vs. 246.2 (p=0.001).

**CONCLUSION**
CEUS was capable of detecting vascular disturbances after flap transplantation. TTP, RBV and MTT seem to be the most accurately parameters and are very unsusceptible to malfunction during measurement.

**CLINICAL RELEVANCE/APPLICATION**
CEUS offers an excellent imaging method to detect early reduction of the tissue transplants microvascularization also if MRI is not available or not realizalbe.

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**VSMK31-09 • The Effects of US-guided Injection of Platelet-rich-Plasma (PRP) on the Degenerative Disease of the Achilles and Patellar Tendon in Athletes**

**Alice La Marra** MD (Presenter); **Lorenzo Maria Gregori**; **Silvia Mariani** MD; **Luigi Zugaro**; **Antonio Barile**; **Carlo Masciocchi**

**PURPOSE**
To evaluate and show the result of injection with Platelet Rich Plasma (PRP) of tendinosis of Achilles and Patellar tendon in athletes.

**METHOD AND MATERIALS**
In the last three years we evaluated 50 athletes with degenerative tendinosis of Achilles tendon and 30 athletes with degenerative tendinosis of patellar tendon. All the patients were first evaluated through diagnostic testing (MRI and US guided) and then through clinical observations (VAS for pain and VISA-A and VISA-P for functionality). The patients underwent a cycle of platelet rich plasma US-guided infiltrations every 21 days for a total of three treatments. Another MRI was performed 30 days and one year after the last infiltration.

**RESULTS**
In the patients with tendinosis of Achilles tendon we have found an improved overall by 80% (VAS) and 53%(VISA-A). Relatively to the patellar tendon, the VAS value is increased by 75% (VAS) and 50% (VISA P). We observed partial or complete morphological recovery and normalization of MRI signal in 90%. We observed a reduction of sectional area in the Achilles tendon in 39/50 cases and in the patellar tendon in 18/30 cases. Eight patients with tendinosis of Achilles tendon presented an area increased by 15%. The mean VAS at one year of treatment improved in all cases overall by 70%.

**CONCLUSION**
Our study showed that in patients who underwent PRP treatments there was an improvement of the functionality, a decrease in pain and a normalization of the signal intensity seen on MRI. Therefore, our experience proves that PRP infiltration may be a good therapeutic alternative for the treatment of Achilles and patellar tendinopathy in athletes.

**CLINICAL RELEVANCE/APPLICATION**
The US-guided PRP treatment in case of degenerative tendon diseases may increase Achille’s and Patellar tendons functionality and reduce recovery times in athletes.
The RCL and UCL of the wrist are true ligaments that can be well seen on HRUS.

**VSMK31-11 • High-resolution Ultrasonography of the Dorsal and Palmar Extrinsic Wrist Ligaments in Correlation with 3T Magnetic Resonance Imaging in 40 Normal Volunteers and 10 Cadaver Specimens with Surgical Correlation**

Miha S Taljanovic MD (Presenter); Dean Holden MD, FRCP; Elizabeth A Krupinski PhD; Joseph E Sheppard MD

**PURPOSE**
To confirm that high-resolution ultrasonography (HRUS) has comparable results with 3T Magnetic Resonance Imaging (MRI) in visualization of the extrinsic wrist ligaments.

**METHOD AND MATERIALS**
HRUS and 3T MRI of the extrinsic wrist ligaments were performed on 10 fresh frozen cadaveric wrist specimens and on 40 wrists in normal volunteers. Dorsal radiocarpal-DRCL, dorsal intercarpal-DICL and dorsal ulnotriquetral-DULT, radioscaphocapitate-RSCL, long radiolunate-LRL, short radiolunate-SRL, radioscapholunate-RSLL, palmal unlnunate-PULL, palmal ulnotriquetral-PUTL, ulnocapitate-UCL, and palmar scaphotriquetral-PSTL ligaments were evaluated. The ligaments were graded by two examiners in consensus, using the following grading system: Grade 1- ligament completely seen, Grade 2- ligament partially seen (< 100 % but > 50% of the ligament clearly seen) and Grade 3- ligament not seen (< 50% of the ligament clearly seen). Visibility on US and 3T MRI was compared using the following grading system: A- ligament equally well seen on US and MRI, B- ligament better seen on MRI, and C- ligament better seen on US. All cadaveric wrists were dissected by an orthopaedic hand surgeon. The results for each of the ligaments were shown in percentages. Differences between the distributions of percentages were tested for significance using the X2 test.

**RESULTS**
None of the examined 550 ligaments received grade A++. For MRI there was a significant difference in visualization of the ligaments (X2 = 143.04, p < 0.0001) with DULT, RSCL and UCL receiving significantly more scores of Grade 2+ than the other ligaments. For US, there was a significant difference in visualization of the ligaments (X2 = 143.83, p < 0.0001) with DULT, PUTL, and PSTL receiving significantly more scores of Grade 2+ than the other ligaments. There was a significant difference (X2 = 335.72, p < 0.0001) with DULT, PUTL, and PSTL receiving significantly more ++B scores than the other ligaments and the other 8 ligaments receiving more ++C scores. On surgical dissections in 10 cadavers all dorsal and palmar extrinsic wrist ligaments were intact.

**CONCLUSION**
HRUS enables satisfactory visualization of the extrinsic wrist ligaments with results that are at least comparable to 3T MRI.

**CLINICAL RELEVANCE/APPLICATION**
High-resolution ultrasonography enables good visualization of the extrinsic wrist ligaments and can be utilized in evaluation of these structures in routine clinical practice and sports medicine.
VSMK31-14 • Prognosis Value of Ultrasonographic Assessment in Muscle Strain Injuries: Longitudinal Study of a 70 Elite Athletes Cohort

Jerome Renoux MD (Presenter); Jean-Louis Brasseur; Philippe Thelen; Christian Dibie

PURPOSE
To evaluate prognosis value of ultrasonography performed in the first days of muscle strain injuries.

METHOD AND MATERIALS:
A prospective cohort study was lead between 2010 and 2012 in the French National Sport Institute. Ultrasonographic assessment of muscle strain lesions was performed between the 2nd and the 8th day. Return to play (total or best clinical recovery) was evaluated with a benefit of a six months hindsight. Correlation between ultrasonographic signs and clinical prognosis was statistically evaluated. Echographic signs included the local semiology (Rodineau and Durey's 5 grades classification system was used), lesion size, lesion type (myofascial vs. pure fascial), and location of the lesion (muscular group, centromuscular vs. perimuscular, proximal vs. distal). Echographic and clinical follow-up were performed until return to play.

RESULTS
70 patients were recruited. 67% of the lesions were located at the lower limbs, 20% at the upper limbs and 13% at the abdominal or thoracic walls. Mean delay between trauma and ultrasonography was 4,5 days. 3 percents were grade 0 injuries, 33% grade 1, 42% of grade 2, 20% of grade 3 and 2% of grade 4. Return to play time differed between the 5 grades of injuries (respectively 1,2±0,8; 3,1±1,2; 4,8±1,6; 8,5±3,8; 18 ± 10 weeks; p = 0.03). Myofascial lesions were correlated with a better lay-off time compared to pure fascial lesions (4,7 vs. 5,8 weeks; p = 0.02). Proximal lesions had a poorer prognosis compared to distal lesions (5,2 vs. 3,9 weeks; p = 0.009). Recurrence occurred in 16%.

CONCLUSION
Ultrasonography has a good prognosis value for muscle strain lesions. For this purpose, ultrasonography has to describe precisely the grade, the lesion type and its precise location.

CLINICAL RELEVANCE/APPLICATION
Ultrasonography can help clinicians to determine prognosis of muscle strain lesions. It helps to distinguish two types of lesions (pure fascial and myofascial) with different treatments.

VSMK31-15 • Interesting Musculoskeletal Ultrasound Cases

Jon A Jacobson MD (Presenter) *

LEARNING OBJECTIVES
1) Be familiar with important topics in musculoskeletal ultrasound.

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PRESS RELEASE

PURPOSE:

The purpose of this article is to present a variety of interesting musculoskeletal ultrasound cases that have been observed in clinical practice. These cases provide valuable insights into the diagnostic capabilities of musculoskeletal ultrasound in different clinical settings.

METHOD AND MATERIALS:

This review article is based on a selection of cases from the authors' clinical experience, focusing on the diagnostic utility of musculoskeletal ultrasound in various patient presentations. The cases are presented in an organized manner, allowing readers to quickly identify the key features and potential implications of each case.

RESULTS:

The article showcases a diverse range of musculoskeletal ultrasound cases, including images and clinical scenarios that demonstrate the versatility of the technique. Each case is illustrated with high-quality ultrasound images, accompanied by relevant clinical details and discussion points.

CONCLUSION:

Musculoskeletal ultrasound is a valuable diagnostic tool that can aid in the accurate and timely diagnosis of musculoskeletal conditions. The cases presented in this article emphasize the importance of maintaining a broad diagnostic repertoire and highlight the role of ultrasound in the management of musculoskeletal disorders.

CLINICAL RELEVANCE:

These cases serve as an educational resource for clinicians to enhance their understanding of musculoskeletal ultrasound and to improve patient care through the accurate diagnosis and management of musculoskeletal conditions.
To compare the accuracy and the radiation dose of bone biopsies performed either under conventional computed tomography guidance (CT-guidance) or under fluoroscopic guidance using a flat-panel cone CT with real-time 3D image fusion software (FP-CBCT-guidance).

METHOD AND MATERIALS
Institutional review board approval was obtained. Sixty-eight consecutive patients with bone tumor were prospectively included. The biopsies were scheduled under CT-guidance or under FP-CBCT-guidance according to operating room's availability without any preference. We prospectively compared the 2 guidance modalities for the feasibility, technical success, accuracy (distance between target and needle tip), pure time from initial to final setup (acquisitions) and pathological success (biopsy contributive for pathological diagnosis). Patients and physicians radiation doses were also compared using dedicated dosimeters. Statistical significance was evaluated using two-tailed parametric and non-parametric t-tests.

RESULTS
Thirty-four patients underwent bone biopsies under CT-guidance and 34 under FP-CBCT-guidance. All biopsies were feasible and technically successful, with both guidance modalities. There was no significant difference for puncture time (34.4 min and 34.3 min respectively; p = 0.51) and pathological results (86% and 88% of success respectively: p = 0.98). Precision was significantly better using FP-CBCT-guidance (2.3 mm and 2.1 mm respectively: p<0.001). Patients and operators radiation doses were significantly lower under FP-CBCT-guidance: patient's peak skin dose was 57 mSv +/- 44.6 versus 169 mSv +/- 146.3 (p<0.05).

CONCLUSION
FP-CBCT-guidance for bone biopsy is accurate and reduces patient and operator's radiation doses, compared to CT-guidance.

CLINICAL RELEVANCE/APPLICATION
Flat panel-CBCT-guidance can be considered for bone biopsies, allowing a significant radiation dose reduction for the patient and the operator without decrease of accuracy or puncture time extension.

SSG10-03 • Vertebral Biopsy in Patients with Suspected Osteomyelitis: Does It Change Management?

Minzhi Xing (Presenter) ; Elizabeth I Parker ; Michael R Terk

PURPOSE
To determine if vertebral biopsy affects clinical decision-making in patients with suspected osteomyelitis and diskitis

METHOD AND MATERIALS
Forty-seven (n=47) consecutive patients (mean age 67.4 years, 41.7% male) with suspected vertebral osteomyelitis and diskitis who underwent CT-guided vertebral biopsy over a 5-year period (2008-2012) at a single institution were included. A retrospective chart review was performed to determine biopsy results, immune status, antibiotic status at time of biopsy, blood culture positivity (defined as ≥2 cultures positive) and results of other fluid cultures (abscess drainage, urine). A change in management was defined as commencement of an antibiotic regimen or a change from pre-biopsy antibiotic regimen following biopsy results.

RESULTS
The cohort comprised patients with suspected osteomyelitis and diskitis who underwent biopsy of the lumbar (33, 70.2%), thoracic (13, 27.7%) and cervical (1, 0.02%) vertebrae. 23 patients (48.9%) were receiving empiric treatment or antibiotics for co-morbid disease (HIV, TB) at the time of biopsy. Adequate pre-biopsy blood cultures were obtained for 37 patients (78.7%), of which 4 were culture positive and would not have required biopsy for diagnosis. Vertebral biopsy was positive in 13 (27.7%) and negative in 34 (72.3%) patients. A change in management based on overall biopsy results occurred in 7 patients (14.8%). Of the patients with positive biopsy results, there was no change in management in 7 patients, who were continued on pre-biopsy antibiotic regimens. Of the patients with negative biopsy results, there was no change in management in 33 patients: 16 continued on the same pre-biopsy antibiotic regimen with a clinical diagnosis of osteomyelitis, and in 17 patients the decision to stop antibiotics, or an alternative diagnosis, was made before biopsy results were obtained and thus not influenced by biopsy results.

CONCLUSION
In this study, only 14.8% of vertebral biopsies provided positive histological confirmation of osteomyelitis and changed management. In the majority of patients with suspected osteomyelitis undergoing vertebral biopsy, there was little evidence that clinical decision-making with respect to antibiotic regimen was influenced by biopsy results.

CLINICAL RELEVANCE/APPLICATION
Vertebral biopsy in the setting of suspected osteomyelitis does not lead to a change in antibiotic management in the majority of patients.

SSG10-04 • CT-based Finite Element Modeling and Microstructural Analysis Detect Reduced Bone Mineral Content and Bone Strength in the Spine after CT Fluoroscopy-guided Interventional Procedures

Miyuki Takasu (Presenter) ; Yuko Nakamura ; Daisuke Komoto ; Masaki Ishikawa ; Masao Kiguchi ; Kazuo Awai ; Chihiro Tani

PURPOSE
The long-term bone toxicity associated with CT fluoroscopy-guided interventional angiography has received little attention. The purpose of this study was to determine the prevalence of secondary osteoporosis (SO) and trabecular microstructural changes after CT fluoroscopy-guided transarterial chemoembolization (TACE) for hepatocellular carcinoma.

METHOD AND MATERIALS
Spinal microarchitecture was examined by 64-detector CT in 53 patients who underwent TACE and 85 sex- and age-matched controls. Each patient's cumulative radiation exposure due to CT fluoroscopy was determined by summing the skin dose recorded by dosimeters placed on the examination table. Patients who had received medications that contribute to the risk of osteoporosis were excluded. Using a 3D image analysis system and finite element modeling (FEM), the bone mineral content per tissue volume (BMC/TV), trabecular parameters, and mechanical properties of the third lumbar vertebrae were calculated. Using BMC/TV with a reported cutoff value 58 mg/cm3, the prevalence of SO was analyzed with the chi square test. A multivariate regression model of patients' characteristics including age, stat, cumulative radiation dose, and dose per procedure was constructed to identify predictors for SO. The trabecular parameters were compared among three groups, including controls, patients with SO, and patients without SO, by Scheffe post hoc test.

RESULTS
The prevalence of SO were 42.5% in males and 50.0% in females; it was higher in males than in the controls (P=0.04). By multivariate regression analysis, age was a significant contributor to SO (P=0.004). The microstructural and mechanical properties were significantly lower in patients with SO than in the controls and the elastic modulus obtained by CT/FEM was significantly lower in patients without SO than the controls (P=0.03).

CONCLUSION
The prevalence of SO was significantly higher in male patients than the controls. The bone quality and failure load were significantly reduced in patients with SO and the elastic modulus was significantly lower in patients without SO than in the controls.

CLINICAL RELEVANCE/APPLICATION
Multidetector CT detected an increased risk of SO after CT fluoroscopy-guided TACE. CT/FEM can alert to trabecular changes before the clinical manifestation of SO.

SSG10-05 • Anterior Endplate Cement Extravasation Following Vertebroplasty or Kyphoplasty Is Associated with Increased Odds of Adjacent Level Fracture in Osteoporotic Patients
Lumbar Disk Herniation: Effects on Disk Size and Lumbar Radiculopathy in 371 Patients

SSG10-08 •

Patients with herniated disc experienced better pain relief than those with neural foraminal stenosis. We recommend median approach for CLINICAL RELEVANCE/APPLICATION predictor of CIESI was the cause of the radiculopathy, and patients with herniated disc experienced better pain relief than those with general, CIESIs were effective in 144 of 212 patients (67.9%) at short-term follow-up. Patients with herniated discs had significantly better results than patients with neural foraminal stenosis (81.7% vs 57.1%) (P = 0.05). There was no significant difference between median and paramedian approach for the effect of CIESI. The most important outcome predictor of CIESI had no significant difference in the clinical outcome between median (66.3%) and paramedian (69.1%) approach (P>0.05). In general, CIESIs were effective in 144 of 212 patients (67.9%) at short-term follow-up. Patients with herniated discs had significantly better results than patients with neural foraminal stenosis (81.7% vs 57.1%) (P<0.05).

CONCLUSION

There was no significant difference between median and paramedian approach for the effect of CIESI. The most important outcome predictor of CIESI was the cause of the radiculopathy, and patients with herniated disc experienced better pain relief than those with neural foraminal stenosis. We recommend median approach for CIESI rather than paramedian approach that is more challenging.

SSG10-06 • CT-assisted Pedicle Screw Placement after CT-controlled, Presurgical Guide Wire Implantation in Pelvic Fractures

Katrin Eichler MD (Presenter) ; Stefan Zangos MD ; Thomas J Vogl MD, PhD ; Martin G Mack MD

PURPOSE

The aim of this study was to evaluate the feasibility and accuracy of CT-assisted percutaneous placement of iliosacral screws over guide wires in patients with unstable pelvic fractures.

METHOD AND MATERIALS

39 patients (17 women, 22 men; mean age: 49.38 years, range: 16-84 years) with unstable traumatic pelvic fractures were treated with percutaneous screw placement after CT-controlled presurgical guide wire implantation to prevent surgical complications regarding the presacral venous plexus and the sacral nerve root. The patients were placed in prone or supine position on the CT table and general anesthesia was induced. For planning a CT with a collimation of 4x2. 5 mm or 64x 0. 625 mm (120 KV, 80 mAs) was performed. Based on this scan skin entry points were marked. Then thread Kirschner guide wires with a diameter of 2.5 mm were introduced percutaneously under CT control. After verification of the position of the Kirschner guidewires the distance for the correct placement of the 7 mm-screws was measured, which were then introduced over the guide wire in the operation unit or immadetly in the CT intervention room through a small skin incision.

RESULTS

In all cases the guide wires were successfully placed without complications. A total of 101 wires (47 on the right side and 54 on the left side) were introduced. All wires were correctly positioned in the first or second sacral vertebrae. In two patients with sacralized lumbar vertebrae one an additional wire was also positioned in L5. In all cases, the screws were placed over the wires without ventral or dorsal perforation of the sacrum and affection of the nerve roots. None of the patients showed radiologic or clinical evidence of instability of the sacroiliac joint or screw migration. The mean clinical and radiologic follow-up period was 16 months (range: 3-24).

CONCLUSION

CT-controlled fixation of unstable pelvic fractures is a safe and feasible method that is able to minimize the complications of surgical treatment.

CLINICAL RELEVANCE/APPLICATION

Application of this data will allow a more sophisticated intra-procedural fracture risk assessment following cement leakage.

SSG10-07 • Cervical Interlaminar Epidural Steroid Injection for Cervical Radiculopathy: Median versus Paramedian Approach

Ji Young Yoon MD (Presenter) ; Jong Won Kwon MD

PURPOSE

To compare the clinical effect of the cervical interlaminar epidural steroid injection (CIESI) for radiculopathy using the median and paramedian approach and to evaluate the prognostic factors of CIESI in general.

METHOD AND MATERIALS

We retrospectively analyzed 212 patients from February 2009 to December 2012 who initially underwent CIESI for cervical unilateral radiculopathy. Inclusion criteria were the availability of a cross-sectional image, such as a CT scan or an MR image, and a follow-up record after injection. We excluded patients with bilateral cervical radiculopathy and axial cervical pain. Short-term clinical outcomes were evaluated at the first follow-up after the administration of CIESI. The outcome was classified as effective or ineffective. Fisher's exact test was used to analyze the difference of outcome according to the approach of the spinal needle and distribution of contrast media. Other possible outcome predictors, such as age, gender, duration of radiculopathy (more or less than 6 months), cause of radiculopathy (primary or secondary), were recorded. Outcomes included presence of adjacent level fracture (ALF), location of cement extravasation (anterior, middle, or posterior third of the vertebral body), and extent of extravasation (percentage of the intervertebral disc height occupied by the bolus). An ALF was defined as a fracture which was: 1) in an unrepaired vertebra; 2) adjacent to a repaired level and 3) not due to trauma or pathology. Separate generalized linear models were fit to assess the association between the odds of ALF and the extent and location of extravasation, while controlling for correlation between levels within a patient. Logistic regression models were fit to examine the association between patient demographics and the odds of at least one ALF.

RESULTS

After exclusions, 98 levels in 52 patients remained. ALF occurred in 20 levels within 14 patients. For levels with adjacent level fracture (ALF), extravasation occurred in 9 levels, with 6 anterior, 3 middle, and no posterior leaks. For levels without ALF, extravasation was seen in 11 levels, with 2 anterior, 6 middle, and 3 posterior leaks. The odds of ALF in a given patient were 5.9 times higher (95% CI: 1.6 to 21.2, P=0.008) with extravasation when compared to no leakage. The odds of ALF in a given patient were 22.6 times higher (95% CI: 3.0 to 170.9, P=0.003) with anterior extravasation when compared to no leakage. Leakage in the middle or posterior two thirds of the vertebra (P=0.30) and extent of extravasation (P=0.024) were not associated with ALF. No associations were observed between ALF and patient demographics.

CONCLUSION

Cement endplate extravasation in general and anterior extravasation in particular have high association with adjacent level fracture after vertebroplasty and kyphoplasty in patients with osteoporosis.

CLINICAL RELEVANCE/APPLICATION

Application of this data will allow a more sophisticated intra-procedural fracture risk assessment following cement leakage.

SSG10-08 • Long-term Results of Combined Intradiscal and Periganglionic Injection of Medical Ozone for the Treatment of Lumbar Disk Herniation: Effects on Disk Size and Lumbar Radiculopathy in 371 Patients

Jong Won Kwon MD

PURPOSE

To determine if the location and extent of endplate cement extravasation is associated with adjacent level fracture (ALF) in osteoporotic patients after vertebroplasty or kyphoplasty.

METHOD AND MATERIALS

156 vertebroplasty levels in 80 patients were retrospectively reviewed. Data were obtained from a single center between 2008 and 2012. For each patient, demographics including age, gender, T-score, body mass index, and osteoporosis type (primary or secondary) were recorded. Outcomes included presence of adjacent level fracture (ALF), location of cement extravasation (anterior, middle, or posterior third of the vertebral body), and extent of extravasation (percentage of the intervertebral disc height occupied by the bolus). An ALF was defined as a fracture which was: 1) in an unrepaired vertebra; 2) adjacent to a repaired level and 3) not due to trauma or pathology. Separate generalized linear models were fit to assess the association between the odds of ALF and the extent and location of extravasation, while controlling for correlation between levels within a patient. Logistic regression models were fit to examine the association between patient demographics and the odds of at least one ALF.
WB-MRI had higher sensitivity, specificity, positive, negative predictive value and accuracy than BS in detection of metastatic deposits at are 93.5%, 100%, 100%, 97.2% and 98% respectively however for bone scan are 57.6%, 95.7%, 98.8%, 83.4% and 86.1% respectively.

**RESULTS**

Recovery (FSE-IR) and T1-Weighted Fast Spine Echo (T1w-FSE) sequences.

**METHOD AND MATERIALS**

23 patients with pathologically proven primary malignant tumors were referred from different medical, surgical, oncology and nuclear medicine departments, and suspected or known skeletal metastatic disease. The patients were subjected to both Whole-Body MRI and Technetium Methylene Diphosphonate bone scintigraphy (BS). WB-MRI was mainly obtained using 4 contiguous coronal stations for body coverage using the body coil, and 2 contiguous sagittal stations for the spine with the CTL Coil, using both Fast Spin Echo Inversion Recovery (FSE-IR) and T1-Weighted Fast Spine Echo (T1w-FSE) sequences.

**RESULTS**

15 out of 23 cases had skeletal metastases, while 8 cases were free from metastases. When using data analysis based on region by region comparison the over all sensitivity , positive predictive value ,specificity, negative predictive value and accuracy for whole body MRI are 93.5%,100%,100%,97.2% and 98% respectively however for bone scan are 57.6%,95.7%,98.8%,83.4% and 86.1% respectively.
WB-MRI had higher sensitivity, specificity, positive, negative predictive value and accuracy than BS in detection of metastatic deposits at lumber, dorsal, cervical, sacral spine, pelvis and both extremities. WB-MRI was slightly better at the sternum. BS was better than WB-MRI in detecting metastatic deposits at the ribs, while both modalities were equal at the skull and shoulder.

Whole body MRI detected 35 tumor non related extraskeletal lesions.

CONCLUSION
WB-MRI is a powerful and effective tools that showed higher sensitivity, specificity and accuracy than BS in various types of primary tumors and in various situations including solitary metastatic focus, diffuse extensive metastases and skeletal metastases from a second primary, not to mention its uniqueness in staging of malignancies during pregnancy.

CLINICAL RELEVANCE/APPLICATION
WB-MRI is a powerful and effective tools that showed higher sensitivity, specificity and accuracy than BS in various metastatic skeletal neoplastic diseases.

**LL-MKS-TU2A • The Malignant Bone Tumor Margin on PROPELLER DWI: Correlation with Pathology**

Zeng Jie Wu MBA (Presenter)

PURPOSE
To explore the accuracy of PROPELLER diffusion-weighted imaging (DWI) and apparent diffusion coefficient (ADC) value in estimating the extent of malignant bone tumor.

METHOD AND MATERIALS

RESULTS

CONCLUSION
The ADC value of PROPELLER DWI varies significantly among viable tumor, tumor necrosis, peritumoral edema and normal muscle tissue. The PROPELLER DWI has the highest sensitivity and specificity for displaying the malignant bone tumor margin compared with conventional MRI sequences.

CLINICAL RELEVANCE/APPLICATION
The PROPELLER DWI displays tumor margin more objectively and accurately compared with conventional MRI sequences and it can be used for guiding clinical operation to avoid overestimation and underestimation.

**LL-MKS-TU3A • Material Decomposition from Spectral CT in Differentiation of Osteogenic Bone Metastases and Bone Islands**

Yue Dong (Presenter) ; Shaowei Zheng ; Bing Wang ; Ruxin Wang ; Lifei Sun

PURPOSE
To quantitatively evaluate the feasibility of material decomposition (MD) for the differential diagnosis of osteogenic bone metastases and bone islands in patients with bronchogenic carcinoma.

METHOD AND MATERIALS

RESULTS

The fat (bone) and water (bone) concentrations of osteogenic bone metastases (201.17±243.43mg/cm³, 223.28±270.25mg/cm³) were significantly higher than that of bone islands (-41.89±294.94mg/cm³, -46.57±327.45 mg/cm³), (p3, 1208.07±380.82mg/cm³) were significantly lower than that of bone islands (1574.91±436.86 mg/cm³, 1579.68±469.80 mg/cm³) ( p

CONCLUSION
There is significant difference of MD quantification between osteogenic bone metastases and bone islands using spectral imaging, which is reliable for differential diagnosis.

CLINICAL RELEVANCE/APPLICATION
Material decomposition technique is reliable for differential diagnosis of osteogenic bone metastases and bone islands.

**LL-MKS-TU4A • Diagnosis of Rotator Cuff and SLAP Tears with 3T MR Arthrography: Saline Arthrography Compared to Conventional Gadolinium Arthrography**

Chang Woo Chun MD (Presenter) ; Won−Hee Jee MD ; Joon−Yong Jung MD ; So−Yeon Lee MD ; Won Sun Hong ; Yang Soo Kim

PURPOSE
To retrospectively compare the reliability and accuracy of saline versus gadolinium shoulder magnetic resonance (MR) arthrography in the diagnosis of rotator cuff and superior labral anterior posterior (SLAP) tears at 3T shoulder MR imaging.

METHOD AND MATERIALS

RESULTS

CONCLUSION
With posterior approach, saline shoulder MRA is comparable with gadolinium MRA for detecting rotator cuff and SLAP tears at 3T.

CLINICAL RELEVANCE/APPLICATION
Diagnostic performance of posterior approach saline MR arthrography of the shoulder is comparable with conventional gadolinium MR arthrography regarding rotator cuff and SLAP tears at 3T.

**LL-MKS-TUSA • Real-time MR-guided Cervical Periradicular Injection Therapy Using an Open 1.0 Tesla MRI System - An Outcome Study**

Martin H Maurer MD (Presenter) ; Tony Hartwig ; Diane M Renz MD ; Nils F Schreiter ; Bernd K Hamm MD * ; Florian Streitparth

PURPOSE
To evaluate the accuracy, safety and efficacy of MR-guided cervical nerve root injection therapy using an open 1.0 Tesla MRI system.

METHOD AND MATERIALS

RESULTS

All procedures were technically successful and there were no major complications. The mean baseline VAS-score was 7.42. We found a statistically significant decrease in mean VAS-scores (P < 0.001) 1 week (3.86±1.53) after intervention and in the follow-up interval after 1 (3.21±2.19), 3 (2.58±2.54) and 6 months (2.76±2.63). At 6 months, 14.3% of the patients reported a complete remission of radicular
CONCLUSION
MR fluoroscopy-guided periradicular injection therapy of the cervical spine is an accurate, safe and efficient treatment option for cervical radicular pain.

CLINICAL RELEVANCE/APPLICATION
The MR-guided technique may be a promising alternative to fluoroscopy- or CT-guided infiltrations at the cervical spine, especially in young patients and in a serial therapeutic regimen.

LL-MKS-TUGA • Fibrocartilage of the Temporomandibular Joint Disc - A Feasibility Study Using Delayed Gadolinium-enhanced MRI
Elisabeth Schoenbauer MD (Presenter); Elisabeth Pittschieler DMD; Pavol Szomolanyi PhD; Martina Schmid-Schwab MD, DMD; Monika Egerbacher; Siegfried Trattnig MD
PURPOSE
The amount of glycosaminoglycans (GAG) in cartilage tissue of temporomandibular joint (TMJ) plays an important role in its functionality. The purpose of this study was: 1) to test the feasibility of delayed Gadolinium-Enhanced Magnetic Resonance Imaging of Cartilage (dGEMRIC) at 3T in the temporomandibular joint disc; 2) to determine the optimal delay of the articular cartilage measurement in the TMJ disc after i.v. contrast agent (CA) administration; and 3) to compare the regional intradiscal T1 relaxation time differences with histology.

METHOD AND MATERIALS
MRI of the right and left TMJ of six asymptomatic volunteers (mean age 24.83±2.99 years; BMI<25) was performed at 3T using a dedicated 8-channel coil. Inversion recovery (IR) was performed pre-contrast and at 30, 60, and 120 min. after i.v. post-CA administration of 0.2 mmol/kg of Gd-diethylenetriamine pentaacetic acid (Gd-DTPA)²-. In addition, 3D dual flip-angle gradient-echo (3D-GRE) sequences were performed pre- and every 10 minutes up to 130 minutes post-contrast agent administration using (Gd-DTPA)²-. Pairwise tests were used to assess differences between pre- and post-contrast T1 values.

RESULTS
The IR sequence showed a statistically significant drop (p<0.001) in T1 values after i.v. CA administration in the articular disc of the TMJ. The 3D-GRE T1 confirmed these results (p<0.001), providing higher temporal resolution due to the shorter measurement time. T1 values for the TMJ discs were T1(Gd)=341.4±17.3 ms with 2D IR and 470.9±65.4 ms with 3D-GRE 90 minutes after CA administration. The mean T1(Gd) drop of 50% was reached 60–70 minutes after bolus injection in the case of 3D-GRE measurement, and 60 minutes in the case of IR. The regional distribution of T1(Gd) values showed similarities to histological GAG-specific staining techniques in TMJ disc.

CONCLUSION
T1(Gd) maps calculated from dGEMRIC data are feasible for the in vivo assessment of the fibrocartilage disc of the TMJ. The recommended diagnostic window for dGEMRIC in the TMJ after i.v. CA administration is from 60 to 120 minutes. Differences in absolute T1(Gd) values between IR and 3D-GRE are caused by the known sensitivity of 3D-GRE to the imperfection of the excitation profile of the coil.

CLINICAL RELEVANCE/APPLICATION
Our results suggest that dGEMRIC of TMJ is feasible and represent different measurable biochemical parameter, which may help in diagnostics of early stage of TMJ disorders.

LL-MKE-TU8A • In Vivo Magnetic Resonance Imaging of the Skin
Rachid Kechidi MD; Bruno A Kastler MD; Philippe Humbert PhD; Sebastien L Aubry MD, PhD (Presenter)
PURPOSE/AIM
The purpose of this exhibit are: 1) To remind technical aspect of MRI of the skin. 2) To describe the normal features of the skin. 3) To discuss challenges in diagnosis of skin disorders. 4) To present the principal applications of MRI for the in vivo characterisation of the biochemical properties of the skin.

CONTENT ORGANIZATION

SUMMARY
MRI of the skin is a recent imaging technique that has several advantages over other non-invasive imaging techniques of the skin. MRI is a non-radiating imaging modality, that is also reproducible and non-operator dependent. Because of its wider field of view than ultrasound, its spatial resolution under 100 μm and its excellent contrast, MRI allows high quality imaging of every skin layers. In addition to morphological analysis, it is also able to study some physical and biochemical properties of the skin.

Musculoskeletal - Tuesday Posters and Exhibits (12:45pm - 1:15pm)
Tuesday, 12:45 PM - 01:15 PM • Lakeside Learning Center
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RESULTS
There were 33 benign (21 biopsy-proven (16 schwannomas, 3 neurofibromas, 2 ganglioneuromas), 12 presumed benign PNSTs by follow-up) and 10 malignant PNSTs. For differentiating benign and malignant PNSTs, the AUCs for anatomic MRI sequences were 0.77 and 0.80 for reader-1 and reader-2, respectively. With the addition of DWI/ADC mapping, the AUCs were 0.79 (p = 0.8) and 0.76 (p = 0.6), respectively. With the addition of both functional and metabolic data (MRS), the AUCs increased to 0.85 (p = 0.12) and 0.86 (p = 0.05), for reader-1 and reader-2, respectively.

CONCLUSION
While functional MRI with DWI/ADC mapping offers no added value for differentiating benign and malignant PNSTs, the presence of detectable metabolic markers of malignancy provided by MRS may improve accuracy for differentiating benign and malignant PNSTs.

CLINICAL RELEVANCE/APPLICATION
Determination of malignancy in PNSTs may be improved by MRS, especially in patients with NF-1 who are at risk for developing malignancy from numerous benign PNSTs.

LL-MKS-TU2B ● Does the Radiological Skeletal Survey Still Have a Place in the Staging of Multiple Myeloma?

Surekha N Reddy MBChB, MRCS (Presenter); Fergus Perks MBChB; Simon H Jackson MBChB

PURPOSE
To determine if the radiological skeletal survey (SS) remains an adequate imaging technique for the evaluation of patients with multiple myeloma (MM) in an era where magnetic resonance imaging (MRI) is being increasingly used for initial staging.

METHOD AND MATERIALS
All skeletal surveys performed regionally during a 3 year period (January 2009 to December 2011) were reviewed. Additional imaging (MR / CT) performed within 12 months of the SS mainly for alternate purposes were also evaluated. A retrospective review of prospectively collected clinical data was then performed for correlation.

RESULTS
419 SS were requested and 358 were performed for possible MM. 203 of 358 patients (56.7%); median age 72 years; were diagnosed with MM on clinical parameters and 69 patients with monoclonal gamopathy of undetermined significance (MGUS). 47% (96 of 203) SS were positive in patients with MM and in 7% of those with MGUS. Positive SS findings in those with MM were confirmed with further imaging in 72% (50 of 96). 51% of negative SS were also confirmed with further imaging. 7.9% (16 of 203) MM patients with negative SS were found to have cortical bone and bone marrow changes on further imaging (median period of 3 months; range 2 weeks to 7 months). 11 patients without MM were reported as having a positive SS. In this study the sensitivity and specificity of SS in MM was 85.7% and 87.9% respectively with a positive predictive value of 89.7% and a negative predictive value of 83.3%.

CONCLUSION
Skeletal survey remains a useful imaging modality for initial staging in MM. Replacing SS with MR in countries where MR resources are more limited would not necessarily be of benefit. Due to the older population and high mortality rate the radiation doses associated with SS are of less clinical concern.

CLINICAL RELEVANCE/APPLICATION
The skeletal survey is a useful imaging modality for the initial staging of multiple myeloma, particularly in countries where MR resources are limited.

LL-MKS-TU3B ● Role of MRI on Spread Route of Metastasis in the Spine of Lung Cancer

Qiang Ma (Presenter); Wen He; Daqing Ma MD; Erhu Jin MD

PURPOSE
To study whether the pattern of metastasis distribution in the spine of lung cancer and other kind of tumors is different and evaluate the role of MRI on metastasis in the spine.

METHOD AND MATERIALS
50 patients, who had biopsy-proven primary tumors and MRI examination of the spine entered the study, and 10 age-matched healthy controls entered the study. Each vertebral body was divided into 2 parts (27 cells) in the midsagittal view as central and peripheral regions was calculated.

RESULTS
Positive SS findings in those with MM were confirmed with further imaging in 72% (50 of 96). 51% of SS were found to have cortical bone and bone marrow changes on further imaging (median period of 3 months; range 2 weeks to 7 months). 11 patients without MM were reported as having a positive SS. In this study the sensitivity and specificity of SS in MM was 85.7% and 87.9% respectively with a positive predictive value of 89.7% and a negative predictive value of 83.3%.

CONCLUSION
Skeletal survey remains a useful imaging modality for initial staging in MM. Replacing SS with MR in countries where MR resources are more limited would not necessarily be of benefit. Due to the older population and high mortality rate the radiation doses associated with SS are of less clinical concern.

CLINICAL RELEVANCE/APPLICATION
The skeletal survey is a useful imaging modality for the initial staging of multiple myeloma, particularly in countries where MR resources are limited.
RESULTS
The average T1 value was $1052\pm 56$ms and $689\pm 76$ms at pre- and post- contrast injection, respectively. The average contrast in cartilage was $0.11\pm 0.03$mm. The average GAG concentration was $47.4\pm 19.7$mm and MTR$_{asym}(1$ppm$)$ was $2.4\pm 1.5\%$. The GAG concentrations and MTR$_{asym}(1$ppm$)$ values have a good correlation ($r=0.86$) (Fig. 1a). Data was separated into two groups with GAG concentrations higher and lower than $40$mm/kg. For the group with low GAG concentration, the fit line is almost flat. For the group with high GAG concentration, the MTR$_{asym}(1$ppm$)$ increases linearly with the GAG concentration with a good correlation ($r=0.88$) (Fig. 1b).

CONCLUSION
gagCEST MRI was shown to correlate well with dGEMRIC at higher GAG concentration cartilage. However, at lower GAG concentration level, gagCEST becomes less sensitive and dGEMRIC has better sensitivity in differentiating various GAG levels.

CLINICAL RELEVANCE/APPLICATION
gagCEST MRI can be a quantitative imaging technique to distinguish GAG contrast between healthy people and OA patients and help in clinical therapy assessment.

LL-MKS-TUSB ● Postoperative Monitoring of Local and Free Flaps with Contrast Enhances Ultrasound (CEUS)- Analysis
Ernst Michael Jung MD (Presenter) ; Janine Rennert MD ; Lukas Prantl MD

PURPOSE
Tissue defects are a common problem in trauma surgery or oncology. Flap transplantation is often the only therapy to cover these extensive wound defects. To date several monitoring systems exist but none has made it to clinical day work.

AIM: Objective: Aim of this study was to assess perfusion disturbances of local and free flaps using contrast enhanced ultrasound (CEUS).

METHOD AND MATERIALS
112 patients were examined after local or free flap transplantation during the first 72 hours after operation. CEUS was performed by one experienced examiner with a linear transducer (6-9 MHz, LOGIQ E9/GE) after a bolus injection of 2.4 ml sufohexa-fluoride microbubbles (SonoVue®, Bracco, Italy). Retrospective vascular perfusion was quantified by evaluating the stored DICOM cine loops using the perfusion software QONTRAST® (Bracco, Italy). Over a total penetration depth of 3 cm every centimetre was analysed separately. 27 complications were observed. Complete flap loss was only seen in 4 cases whereas 23 flaps had to undergo minor revisions and survived.

RESULTS
Regarding the complete flap size quantitative analysis showed significant higher perfusion values in patients without complications compared to patients with complications: PEAK 16.5 vs. 10.0 (p=0.001), TTP 32.6 vs. 22.2 (p=0.001), RBV: 738.8 vs. 246.2 (p=0.001).

CONCLUSION
CEUS was capable of detecting vascular disturbances after flap transplantation. TTP, RBV and MTT seem to be the most accurately parameters and are very susceptible to malfunction during measurement.

CLINICAL RELEVANCE/APPLICATION
CEUS offers an excellent imaging method to detect early reduction of the tissue transplants microvascularization also if MRI is not available or not realizable.

LL-MKS-TUG6 ● 3 Tesla MRI Imaging of the Shoulder in Asymptomatic Major League Baseball Pitcher Drafts
Filippo Del Grande MD, MBA (Presenter) ; Michael R Aro MBBS * ; John Willikens ; Avneesh Chhabra MD * ; John A Carrino MD, MPH *

PURPOSE
To describe the 3 Tesla MRI imaging features of the shoulder in asymptomatic professional baseball pitcher draft picks.

METHOD AND MATERIALS
In this IRB approved HIPAA compliant study, retrospective evaluation was performed of 21 shoulder MR imaging exams in male professional baseball player draft picks (mean age 23 years $\pm$SD 4.9). Image acquisition was with a 3 Tesla MR imager using an 8-channel phased array coil employing high resolution intermediately weighted and T2-weighted pulse sequences (with and without fat suppression). An experienced musculoskeletal radiologist reviewed the images. Analysis consisted of descriptive statistics of the qualitative and quantitative imaging features observed.

RESULTS
Rotator cuff tendinopathy was present in 33% involving supraspinatus (7/21), in 66% involving infraspinatus (14/21) and in 14% involving subscapularis (3/21); 33% (7/21) had partial articular sided tears of the supraspinatus typically measuring less than 1cm. The labrum showed postero-superior labral degeneration in 81% (17/21) and labral tears in 38% (8/21); 6 were posterior and 2 were anterior involving subscapularis (3/21); 33% (7/21) had partial articular sided tears of the supraspinatus typically measuring less than 1cm. Rotator cuff tendinopathy was present in 33% involving supraspinatus (7/21), in 66% involving infraspinatus (14/21) and in 14% involving subscapularis (3/21); 33% (7/21) had partial articular sided tears of the supraspinatus typically measuring less than 1cm. The labrum showed postero-superior labral degeneration in 81% (17/21) and labral tears in 38% (8/21); 6 were posterior and 2 were anterior involving subscapularis (3/21); 33% (7/21) had partial articular sided tears of the supraspinatus typically measuring less than 1cm. The labrum showed postero-superior labral degeneration in 81% (17/21) and labral tears in 38% (8/21); 6 were posterior and 2 were anterior involving subscapularis (3/21); 33% (7/21) had partial articular sided tears of the supraspinatus typically measuring less than 1cm. The labrum showed postero-superior labral degeneration in 81% (17/21) and labral tears in 38% (8/21); 6 were posterior and 2 were anterior involving subscapularis (3/21); 33% (7/21) had partial articular sided tears of the supraspinatus typically measuring less than 1cm. The labrum showed postero-superior labral degeneration in 81% (17/21) and labral tears in 38% (8/21); 6 were posterior and 2 were anterior involving subscapularis (3/21); 33% (7/21) had partial articular sided tears of the supraspinatus typically measuring less than 1cm. The labrum showed postero-superior labral degeneration in 81% (17/21) and labral tears in 38% (8/21); 6 were posterior and 2 were anterior involving subscapularis (3/21); 33% (7/21) had partial articular sided tears of the supraspinatus typically measuring less than 1cm.

CONCLUSION
On 3T MRI imaging, baseball pitcher draft picks present with a high prevalence of rotator cuff, labrum and osseous abnormalities.

CLINICAL RELEVANCE/APPLICATION
The high prevalence of shoulder MR imaging abnormalities of baseball pitchers may require refinement of the usual positivity criteria for interpreting examinations of symptomatic pitchers.

LL-MKS-TU7B ● Yield of CT Guided Joint Synovium/Capsule Biopsy Following Dry Aspiration for the Diagnosis of Infection
Ambrose J Huang MD (Presenter) ; Frank J Simeone MD ; Connie Y Chang MD ; Susan V Kattapuram MD

PURPOSE
To determine the yield of CT guided joint synovium/capsule biopsy following a dry aspiration for diagnosing infection.

METHOD AND MATERIALS
From 10/1/2010-9/30/2012, 11 patients underwent CT guided core biopsy of the joint synovium/capsule for further evaluation following a dry aspiration. There were 8 total hip arthroplasties, 1 hip status post total hip arthroplasty removal, 1 total knee arthroplasty, and 1 native knee. A spring-loaded biopsy needle was used in all cases, and core samples were submitted to Microbiology for analysis and compared to clinical follow-up data. Patients were considered to be infected clinically if a) definitive cultures obtained at follow-up surgery were positive for infection, or b) additional clinical evidence strongly supported the diagnosis of infection and the patient was treated with a course of antibiotics. Sensitivity, specificity, positive predictive value, and negative predictive value of synovium/capsule biopsy compared to clinical follow-up were calculated.

RESULTS
In 3/11 cases, the Microbiology results were positive for infection (1 Peptostreptococcus micros, 1 coagulase negative Staphylococcus, and 1 Staphylococcus lugudensis). The coagulase negative Staphylococcus case was felt to represent a contaminant since only one colony could be recovered, and definitive cultures obtained during subsequent total hip arthroplasty revision and additional clinical findings were negative for infection (false positive). The patient with Staphylococcus micros was treated with vancomycin and cefepime (true positive). The patient with Staphylococcus lugudensis underwent total hip arthroplasty revision, and definitive cultures
acquired at surgery also revealed Staphylococcus lugdunensis (true positive). One patient with a negative biopsy underwent total knee arthroplasty removal, and definitive cultures acquired at surgery revealed Staphylococcus aureus, for which treatment with linezolid was begun (false negative). The sensitivity, specificity, positive predictive value, and negative predictive value of synovial/capsular biopsy compared to clinical follow up were 67%, 88%, 67%, and 88%, respectively.

CONCLUSION
CT guided joint synovium/capsule biopsy may be of benefit in diagnosing infection when conventional joint aspiration yields no fluid.

CLINICAL RELEVANCE/APPLICATION
CT guided joint synovium/capsule biopsy may be of benefit in diagnosing infection when conventional joint aspiration yields no fluid.

LL-MKE1107•TUB • A Multimodality Imaging Overview of Acute Syndesmotic Ankle Injury in Soccer Players

Nabil Jomaah MD (Presenter); Cristiano Eirale; Pieter D’hooghe MD; Frank W Roemer MD *; Michel D. Crema MD *; Emad Almusa DO

PURPOSE/AIM
To provide a pictorial overview of the ankle syndesmotic injury in soccer players with multimodality imaging including radiography, ultrasound and MRI.

CONTENT ORGANIZATION
Describe the normal anatomy of the syndesmosis. Recognize pitfalls and normal variants of the anterior and posterior syndesmotic ligaments. Present the biomechanical background of syndesmotic injury. Illustrate the imaging findings of ankle syndesmotic injury and associated findings.

SUMMARY
Syndesmotic injuries are the second most common ankle injury after lateral ligament injury and are encountered in 10% to 20% of all ankle sprains. Isolated syndesmosis injuries are often diagnosed as lateral ankle sprains however; they are more disabling than lateral ankle sprains and need a longer recovery period for athletes. Syndesmotic injury may not be routinely recognized on radiographs, but additional radiography under stress may reveal an unstable grade III syndesmosis sprain with surgical implication. Ultrasound can consistently depict anterior inferior tibiofibular ligament disruption; however it is less reliable in the assessment of the interosseous and the posterior inferior tibiofibular ligaments. MR imaging is highly accurate for the diagnosis of tibiofibular syndesmotic injuries and in characterizing associated pathology.

LL-MKE1107-TUB • Ultrasound Visualization of Plantar Plate Injury

Michael E Stone MD (Presenter); Marnix T Van Holsbeeck MD *; Deepa Bhatt DPM; Joshua Rhodenizer DPM

PURPOSE/AIM
The purpose of this exhibit is:
1. To review the anatomy of the lesser MTP joint.
2. To review the clinical significance of plantar plate injury.
3. To discuss the ultrasound appearance of plantar plate tear.
4. To discuss the utility of ultrasound as a primary method of diagnosing plantar plate tear.

CONTENT ORGANIZATION
1. Anatomy of the lesser MTP joint
2. Clinical significance of plantar plate injury
3. Ultrasound findings in plantar plate tear and correlation with cadaver dissection.
4. Diagnostic utility of ultrasound in comparison to MRI
5. Sample Cases
6. Future Directions

SUMMARY
The main teaching points of this exhibit are:
1. The plantar plate is a fibrocartilage structure supporting the lesser MTP joints.
2. Injury to the plantar plate is a common cause of persistent pain and digital deformity
3. Plantar plate tear typically appears as a hypoechoic or heterogeneous defect in the homogenous substance of the plate.
4. Ultrasound is a sensitive modality of diagnosing plantar plate injury.

Musculoskeletal (Shoulder II)

Tuesday, 03:00 PM - 04:00 PM • E451A

SSJ16 • AM A PRA Category 1 Credit ™:1 • ARRT Category A+ Credit:1

Moderator
William E Palmer , MD
Moderator
Soterios Gyftopoulos , MD

SSJ16-01 • MR Arthrography (MRA) of the Shoulder: Does Approach Really Impact Diagnostic Accuracy and Confidence?

Avner Y Yemin MD (Presenter); Ronald S Adler MD, PhD; Jenny T Bencardino MD; Soterios Gyftopoulos MD; John S O'Donnell MD; Neil P Shah MD; James S Babb PhD; Tyson Martin

PURPOSE
To determine whether needle approach has clinically relevant impact on diagnostic accuracy and confidence of shoulder MRA.

METHOD AND MATERIALS
A retrospective database search for consecutive shoulder MRAs with surgical correlation within 6 months was performed in a year timeframe. Exclusion criteria included prior surgery and technically limited study. The study group was categorized into two subgroups (anterior and posterior approach) based on needle technique. The MRAs were de-identified and randomized. Four musculoskeletal radiologists measured the following variables independently and blinded to needle approach: capsular distension, extravasation, SLAP, Bankart/variant, reversed Bankart/variant, and SGHL/MGHL/IGHLs tears. For each variable the diagnostic confidence was graded from 0 to 5. Sensitivity, specificity, accuracy, NPV and PPV were calculated for each diagnosis as well as kappa coefficients for inter-observer agreement, logistic regression for correlated data and exact Wilcoxon signed rank tests.

RESULTS
31 MRAs were included, 14 were performed using anterior approach (F:2 ; M:13 ; mean age 33.1 (range:15-59), 17 were performed using a posterior approach (F:1; M:16 ; mean age 37.7 (range: 21-62). In the anterior approach group, Ss/Sp/accuracy/NPV/PPV (%) were as follows: SLAP 54.5/78.0/73.6; Bankart/variant 75/80.6/78.6/85.3/68.2. In the posterior approach group, Ss/Sp/accuracy/NPV/PPV (%) were as follows: SLAP 60.7/80.0/72.1/74.4/68 and Bankart/variant 100/63.5/72.1/100/45.7. When...
Comparing anterior (A) to posterior (P) approach in regards to specificity for detection (A%/P%/P-value) of IGHL tear: 73.2/82.8/0.346; MGHL tear 89.3/85.3/0.527; SGHL tear 85.7/88.2/0.618; Reverse Bankart 83.9/77.9/0.588. Inter-reader agreement in terms of detection was moderate for the anterior approach (Kappa: 0.4 - 0.6) and moderate to substantial for the posterior approach (Kappa: 0.4 - 0.7). There was no statistically significant difference for reader confidence scores.

CONCLUSION
Our findings demonstrate a statistically significant improvement in NPV for evaluation of Bankart lesions and SLAP tears using a posterior approach and moderate agreement (kappa>0.4) for both approaches in terms of the detection of any one attribute.

CLINICAL RELEVANCE/APPLICATION
Posterior needle approach for MRA of the shoulder has a greater negative predictive value for both Bankart lesions and SLAP tears when compared to an anterior approach.

SSJ16-02 • Indirect Shoulder MRI Arthrography: A Novel Technique for Young Patients
Azam A Eghbal MD (Presenter) ; Kerwin Jones MD

PURPOSE
The purpose of this study is to compare the sensitivity of indirect magnetic resonance imaging arthrography (I-MRI) for detecting shoulder labral pathology in patients less than 21 years of age to direct MR arthrography replacement (D-MRI). The significance of the study is that shoulder I-MRI may be a reasonable and less invasive alternative to direct magnetic resonance arthrography in this population.

METHOD AND MATERIALS
A retrospective review identified 68 cases of indirect shoulder arthrography performed over a two-year period at a single pediatric institution, 37 of which had subsequent shoulder arthroscopic findings available for review. The I-MRI reports were compared to the operative images for the presence or absence of labral pathology by an independent pediatric orthopedic surgeon. An independent pediatric radiologist on staff provided the MRI reports. Labral pathology was defined as a labral tear or fraying. All MRI images were also reviewed by a second pediatric radiologist for labral pathology without knowledge of surgical findings. Descriptive statistics were used to analyze data.

RESULTS
Of the 37 cases included in the study, the I-MRI reports correctly identified the presence or absence of labral pathology found during surgery in 32 cases. Compared to arthroscopic findings, the sensitivity of I-MRI for detecting labral pathology in young patients was 94%, with a positive predictive value of 90% and a 6% false negative percentage. The sensitivity for the second pediatric radiologist was 100%, with a positive predictive value of 94%, and a 0% false negative percentage.

CONCLUSION
Direct shoulder arthrography is currently as the gold standard imaging technique in the diagnosis of labral pathology. However, indirect shoulder arthrography is a less invasive alternative, which is extremely helpful in the young population. In this series, the sensitivity of I-MRI for detecting labral pathology was 94%, which is comparable to the historical range reported for D-MRI of 88-96%. It appears that I-MRI may be a reasonable and less invasive alternative to D-MRI in young patients.

CLINICAL RELEVANCE/APPLICATION
Indirect shoulder arthrography is a less invasive alternative to Direct shoulder arthrography with comparable sensitivity.

SSJ16-03 • Usefulness of Pre and Post MR Arthrogram Imaging of the Shoulder in Detection of Unstable Labral Tears
Thomas H Magee MD (Presenter)

PURPOSE
Shoulder surgeons commonly intervene on unstable labral tears (those tears that displace with patient movement). Surgeons can detect unstable tears at surgery. It is difficult to be certain a tear is unstable on a static MR image. We report the benefit of pre and post arthrogram MR imaging in detection of unstable labral tears.

METHOD AND MATERIALS
One hundred fifty consecutive conventional shoulder MR and MR arthrogram exams performed on the same patients were reviewed retrospectively by consensus reading of two musculoskeletal radiologists. Both conventional MR and MR arthrogram exams were performed on each patient on the same day. Labral tears were assessed. It was also determined if there was any difference in position of the labral tear comparing pre and post arthographic images. All patients went on to arthroscopy.

RESULTS
Of these one hundred fifty patients, ninety -four had SLAP (superior labral anterior to posterior) tears, fifty three had posterior labral tears and forty two had anterior labral tears on MR exam. All one hundred fifty patients went on to arthroscopy. All lesions described on MR were described on arthroscopy. Twenty three SLAP tears, sixteen posterior labral tears and seventeen anterior labral tears demonstrated a change in the position of the labral tear on pre versus post arthographic images. All of these labral tears were considered unstable by the surgeon and all of these patients had surgical tacking performed.

There were five SLAP tears, three anterior labral tears and four posterior labral tears seen on arthroscopy not seen on MR or MR arthrogram examination.

CONCLUSION
In this study, pre and post arthrogram MR imaging of the shoulder was useful in demonstrating unstable labral tears in twenty three patients with SLAP tears, sixteen patients with posterior labral tears and seventeen patients with anterior labral tears. This information was useful in surgical planning.

CLINICAL RELEVANCE/APPLICATION
Pre and post arthrogram MR imaging of the shoulder is useful in demonstrating unstable labral tears. This information is useful in pre surgical planning.

SSJ16-04 • Postoperative CT Arthrographic Features of Superior Labral Anterior-to-Posterior Lesions: Correlation with Functional and Clinical Outcome
Bohwa Choi (Presenter) ; Na Ra Kim MD ; Sung Gyu Moon MD ; Jin-Young Park MD

PURPOSE
To assess the presence of a superior labral cleft on postoperative CT arthrography after superior labral anterior to posterior lesion (SLAP) repair and to evaluate whether such superior labral clefs are correlated to functional and clinical outcome.

METHOD AND MATERIALS
Forty six patients (37 men, nine women; mean age, 35 years) were included and underwent CT arthrography of the shoulder after arthroscopic SLAP repair. Two musculoskeletal radiologists reviewed CT arthrographic images for the presence and size of a superior labral cleft defined as a detectable contrast material-filled focal discontinuity of the labrum within anchor fixation sites of the glenoid on an oblique coronal image. The extent, direction of curvature, and marginal irregularity of a superior labral cleft were assessed on axial, oblique coronal and oblique sagittal CT arthrographic images. The functional and clinical outcome was evaluated by using the American Shoulder and Elbow Surgeons (ASES) scoring. The mean time interval between surgery and postoperative CT arthrography was 16.9 months (range, 7 to 63 months).
RESULTS
The superior labral cleft was found in 52% (24 of 46). The mean width and depth of the superior labral cleft were 2.0mm ± 1.1 and 2.8mm ± 0.9. When present, the superior labral cleft extended posterior to the biceps anchor in 62.5% (15 of 24), was curved medially in 91.7% (22 of 24), and had a smooth margin 79.2% (19 of 24). No significant association was seen between the presence, width and depth of a superior labral cleft, and ASES score (P = .569, .633 and .067, respectively). The superior labral clefts were seen more commonly in long time interval between surgery and postoperative CT arthography (P = .018).

CONCLUSION
Shallow superior labral clefts can be frequently seen after arthroscopic SLAP repair at long-term follow-up. The presence of superior labral clefts do not necessarily correlate with functional and clinical outcome after SLAP repair.

CLINICAL RELEVANCE/APPLICATION
Shallow superior labral clefts can be frequently seen after SLAP repair. The presence of superior labral clefts do not necessarily correlate with functional and clinical outcome after SLAP repair.

SSJ16-05 • Novel CT Metal Artifact Reduction Prototype for Evaluation of Shoulder Arthroplasties

Naveen Subhas MD (Presenter) *; Sahar Shiraj MD; Andrew Primak PhD *; Joshua M Polster MD; Andreas Krauss PhD *; Jean P Schils MD; Joseph Iannotti *

PURPOSE
Iterative metal artifact reduction (IMAR) is a new sinogram inpainting technique to reduce CT metal artifact which adds high frequency data to improve visualization close to metal edges. Our purpose was to compare the image quality and accuracy of attenuation values near hardware of IMAR and standard filtered back projection (FBP) in patients with shoulder arthroplasties (SA).

METHOD AND MATERIALS
8 patients (6 male, avg age 60) with 9 SAs were scanned on a FLASH CT (Siemens) with a standard protocol (140 kVp, 300 eff mAs, 0.6mm slice thickness, ef pitch 0.35-0.8). Images were reconstructed on a standalone workstation with a smooth kernel (B30) and 0.6mm slice thickness. 3 IMAR reconstructions with different amounts of high frequency data: IMAR (least), IMAR1.5 (more), IMAR2.5 (most) and FBP were ranked for image quality by 5 readers in a side by side comparison from best=1 to worst=4 for bone, soft tissue, metal-bone interface and overall quality. Accuracy of attenuation near hardware was quantified as the absolute difference (AD) between avg HU within a region of interest (ROI) near hardware and for an ROI containing similar tissues on a slice without hardware.

RESULTS
IMAR1.5 was ranked best for humeral cortex (avg 1.4), glenoid trabeculae (avg 1.36) and glenoid cortex (avg 1.4). IMAR2.5 was ranked best for humeral trabeculae (avg 1.2). IMAR was ranked the best for deltoid muscle (avg 1.2). IMAR1.5 and 2.5 were ranked best for metal-bone interface (avg 1.3). FBP was ranked worst for all structures (avg 3.38 -3.49). All readers ranked IMAR1.5 and 2.5 over FBP (p < .001). IMAR, especially with added high frequency data, had superior image quality and more accurate attenuation values near hardware than standard FBP in patients with shoulder arthroplasties.

CONCLUSION
IMAR is a promising new CT technique to reduce metal artifact that is fully automatic and computationally inexpensive and has the potential to replace standard FBP in patients with hardware.

SSJ16-06 • CT Metal Artifact Reduction in Internally Fixed Proximal Humeral Shaft Fractures: Comparison between Monoenergetic Extrapolation of Dual Energy and Iterative Artifact Reduction Algorithms

Sebastian Winklofer MD (Presenter); Fabian Morsbach; Emanuel Benninger MD; Stefan Rahm MD; Steffen Ross MD; Bernhard Jost MD; Christian Spross MD; Paul Stolzmann MD; Michael J Thali MD; Hatem Alkadhi MD; Roman Guggenberger

PURPOSE
To assess the value of monoenergetic extrapolations from dual-energy computed tomography (DECT) and standard filtered back projections (FBP) from single-energy computed tomography (SECT) compared to a new iterative frequency split-normalized (IFS) metal artifact reconstruction (MAR) algorithm for artifact reduction in internally fixed humeral fractures.

METHOD AND MATERIALS
In this cadaveric study, artifacts in seven internally fixeded human proximal humeral fractures of five subjects were examined with SECT and DECT. Postprocessing included routinely used FBP algorithm, a new IFS-MAR algorithm, and monoenergetic extrapolation of DECT images. Image analysis included quantitative assessment of image artifacts (HU measurements) as well as evaluation of image quality and osteosynthesis material and visualization of screw position in FBP, IFS-MAR, and DECT using a five-point Likert scale.

RESULTS
HU values of streak artifacts were significantly (P < .05) different between FBP (115.7±222.4) and IFS-MAR (68.7±106.3), and between FBP and monoenergetic DECT (10.1±146.1). Between IFS-MAR and DECT no significant differences were detected (P = .30). Artifact scores improved significantly from FBP (3.9) to IFS-MAR (2.0; P < .001) and DECT (2.6; P < .05), whereas no significant differences were seen between IFS-MAR and DECT (P = .10). Visualization scores of osteosynthesis material differed significantly (P < .05) between FBP (2.9) and IFS-MAR (2.3) and between IFS-MAR and DECT (1.4). Screw position of 57/57 screws was identically rated in FBP and IFS-MAR, but different between IFS-MAR and DECT in 11 cases, with a subjectively better visualization in DECT.

CONCLUSION
IFS-MAR algorithm in SECT as well as monoenergetic extrapolations from DECT allow for an improved image quality, a reduction of artifacts and better assessment of screw-position compared to standard FBP in SECT.

CLINICAL RELEVANCE/APPLICATION
Both, dual-energy CT and a newly applied iterative frequency split-normalized metal artifact reconstruction algorithm for CT are promising techniques for metal artifact reduction in internally fixeded fractures.
H Tao (Presenter) ; Zhan Wang ; Shuang Chen MD

PURPOSE
To quantitatively evaluate the MRI appearances of repair tissue (RT) after microfracture treatment for osteochondritis dissecans (OCD) models compared to joint debridement and investigate the correlation with histological examination.

METHOD AND MATERIALS
The animal experiment was approved by the Animal Care and Use Committee of our college. Twenty-seven OCD models in rabbit knee joints were assigned into 2 groups, 18 for microfracture group and 9 for joint debridement. At 3, 5, 7 weeks post-op respectively, a third of each group would take MRI scan mainly including 3D double echo steady state sequence (3D-DESS) and multi-echo spin-echo technique (T2-mapping). Operation sites were removed to make H-E, Masson and Safranin-O staining sections. MR images were used to quantitatively calculate the thickness index and T2 value index of RT. The histological performances were semi-quantitatively evaluated by using the general and standardized scoring system. Comparisons were made with respect to MRI and histological findings between two groups at each time point. Effects of two groups were evaluated longitudinally by comparing the results at three time points. Statistical analysis was performed by unpaired Student t tests and the one-way ANOVA, with significance defined as P < .05.

RESULTS
The thickness index and semi-quantitative histological scores of RT in two groups were increasing gradually post-op, while T2 value index was decreasing. At 3 weeks, the T2 value index of microfracture group was lower than that of joint debridement (P= .000). But at 5 weeks and 7 weeks, it was higher than joint debridement (P=.032 and .013). For microfracture group, the RT was mainly composed of hyaline-like cartilage tissue, with more production of type II collagen, glycosaminoglycan (GAG), and well-organized collagen fibrils. However, for joint debridement, RT was mainly composed of fibrous and scar tissue.

CONCLUSION
The study revealed the correlation between MRI and histological performance, which indicated the potential value of using MRI 3D-DESS and T2-mapping as a noninvasive tool to evaluate the process of cartilage repair.

CLINICAL RELEVANCE/APPLICATION
MR 3D-DESS and T2-mapping which can reflect information about thickness and biochemical properties of RT provides a noninvasive and effective tool to evaluate RT condition after microfracture for OCD.

SSJ17-02 ♦ In Vitro Comparative Study of T2 and T2* Mappings of Human Articular Cartilage Using 3-Tesla Magnetic Resonance Imaging: MRI-histologic Correlation after Total Knee Arthroplasty

Tayhee Kim (Presenter) ; Kyu-Sung Kwack MD, PhD ; Hakil Kim ; Xuanan Cui

PURPOSE
Even though many different authors have reported usefulness of T2 and T2* mappings for articular cartilage evaluation, there has been no coherent consensus about the correlation between T2 value, T2* value and histologic grade. The aim of this study was to investigate the correlation between these parameters and to show the diagnostic performance of T2 and T2* mappings in various histological grades of naturally degenerated human articular cartilage.

METHOD AND MATERIALS
Fourteen osteochondral specimens from 13 patients who underwent total knee arthroplasty were examined using a 3T MRI with standard turbo spin echo pulse sequence for T2 mapping and fast field echo pulse sequence for T2* mapping. Eight to ten regions of interest (ROIs) were positioned within articular cartilage of each lateral tibial condyles. A total of 134 ROIs were analyzed. Two readers in consensus assessed the degree of cartilage damage in HandE and Masson’s trichrome stained histological slides with the David-Vaudey grade. Histological assessment was undertaken in all ROIs to correlate the observations of T2 and T2* mappings. Correlation analysis was performed.

RESULTS
The mean relaxation values for tibial cartilage were 56.6 ± 14.1 ms for T2 and 24.2 ± 14.3 ms for T2*. The mean difference between T2 and T2* values was 31 ± 20.5 ms. Pearson correlation analysis proved a positive correlation between T2 values and histologic grade (correlation coefficient = 0.386, p<0.05). As previously reported in other studies, T2 mapping is well correlated to histological degeneration of the cartilage and may be good biomarker for osteoarthritis in human articular cartilage. Although T2* value had been known to be decreased with increasing cartilage degeneration, T2* value didn’t show statistical significant correlation in this study. Therefore, T2* mapping may not be appropriate for initial diagnosis of cartilage degeneration.

CONCLUSION
T2 mapping is superior to T2* mapping for the evaluation of human articular cartilage degeneration. T2* mapping may not be appropriate for initial diagnosis of cartilage degeneration.

SSJ17-03 ♦ Assessment of Morphology, gagCEST and T2 Mapping in Cartilage Repair Tissue after Chondrosphere-based Autologous Chondrocyte Transplantation

Benjamin Schmitt (Presenter) * ; Ferzan Suezer * ; Patrik Zamecnik MD ; Marco Essig MD * ; Siegfried Trattnig MD ; Rainer Siebold

PURPOSE
To compare results from morphological imaging, glycosaminoglycan-dependent chemical exchange saturation transfer (gagCEST) imaging and T2 mapping in a population of 30 patients after a novel chondrosphere-based autologous chondrocyte transplantation in the knee at 3 Tesla.

METHOD AND MATERIALS
Morphological MRI, T2 mapping and gagCEST imaging were performed on a clinical 3T MR scanner. Scan time for 3D gagCEST of one knee was 12:48 min with a saturation module optimized by simulation of Bloch equations, and T2 mapping was performed with a multi-echo spin echo approach. Results from gagCEST and T2 mapping in repair tissue were compared with results from native cartilage in the corresponding area of the contralateral knee as an unbiased reference. Due to regional variations in biological composition of cartilage, results from repair tissue grouped for trochlea, femoral condyles and patella were compared in groups with the native references. Differences between lesions and references were statistically analysed. Morphological scoring was done with the MOCART score.

RESULTS
Morphological imaging showed a total failure of implants in only 3 cases (MOCART=0). The remaining cases largely presented with morphologically intact transplants, which is also supported by a high median MOCART score of 65 points (interquartile range=15 points). Regarding the entire population, neither gagCEST nor T2 mapping revealed any significant differences between cartilage transplants and reference cartilage in the contralateral knee. Nevertheless, few individual cases showed clear differences between transplant and reference. Analysis of relationships between T2 values and gagCEST signal intensities showed no significant correlation (P=0.536).

CONCLUSION
The high morphologic integrity of the transplants together with no significant differences between transplants and reference cartilage in the biochemical imaging techniques suggests a high quality of the transplants. Furthermore our study indicates that using the contralateral knee as a reference to assess outcomes of repair tissue is a key element to avoid a bias compared with using a potentially biochemically different native part of cartilage from the same knee.
SSJ17-04 • The Effect of Initial Methotrexate Therapy on Cartilage Composition in Early Rheumatoid Arthritis: Follow-up with Biochemical MRI of Finger Cartilage

Falk R Miese MD (Presenter) ; Benedikt Ostendorf ; Hans-Joerg Wittsack PhD ; Christoph Schleich ; Christoph Nowak ; Gerald Antoch MD

PURPOSE
To test for initial status and subsequent recovery of cartilage glycosaminoglycane content in metacarpophalangeal joints (MCP) in patients with early rheumatoid arthritis (eRA) undergoing Methotrexate (MTX) therapy with delayed Gd(DTPA)2- enhanced MRI of the cartilage (dGEMRIC).

METHOD AND MATERIALS
MCP II and III in 19 patients with eRA and 13 healthy volunteers and were examined (eRA patients: 13 females, six males, mean age 51 years, range 25-69; eRA 6 months follow-up patients: 7 females, one male, mean age 48 years, range 33-68; healthy volunteers: ten females, three males, mean age 51 years, range 25-66). dGEMRIC was acquired using the variable flip angle techique (VFA). dGEMRIC index was measured in phalangeal and metacarpal cartilage with manually drawn region-of-interest evaluation. Cartilage thickness was determined as a conventional measure of cartilage integrity. Statistical analysis used non-parametric Mann-Whitney-U-Test to test for significant differences between the groups. Remission was assessed using DAS 28 and CRP.

RESULTS
dGEMRIC index was significantly decreased in eRA patients compared to healthy subjects (healthy volunteers: MCP II 488 ms ± 90 ms, MCP III 523 ms ± 100 ms; eRA patients: MCP II 414 ms ± 119 ms (p

CONCLUSION
In therapy naive early RA, there was a decrease in cartilage glycosaminoglycane content in metacarpophalangeal joints. Glycosaminoglycane as assessed with dGEMRIC of normal appearing finger cartilage did not significantly improve after MTX therapy despite clinical remission. dGEMRIC may be a possible tool for studies on cartilage protection in RA therapy.

CLINICAL RELEVANCE/APPLICATION
Our data do not indicate that MTX may protect cartilage despite remission.

SSJ17-05 • Aiming for a Shorter MR Screening Protocol of the Hand in Early Arthritis: Is there Additional Value of Gadolinium?

Wouter Stomp MD (Presenter) ; Annemarie Krabben ; Desiree M Van Der Heijde MD, PhD ; Tom W Huizinga ; Johan L Bloem MD, PhD ; Annette Van Der Helm-Van Mil ; Monique Reijnierse MD

PURPOSE
Gadolinium contrast enhanced MRI images are used to assess synovitis and tenosynovitis in arthritis. We compared wrist synovitis and tenosynovitis on MRI images without gadolinium (Gd-) with gadolinium-enhanced MRI (Gd+) as the reference method to determine whether contrast administration can be omitted.

METHOD AND MATERIALS
MRI imaging of the wrist was performed in 93 early arthritis patients on a 1.5 Tesla extremity MRI. Sequences included coronal T1, coronal fat-suppressed T2 and post-gadolinium coronal and axial T1 with fat suppression. Additionally a transversal T2-weighted sequence was added to facilitate evaluation. All datasets were scored twice by 2 experienced readers, once using only unenhanced images, and another time using the complete image sets, according the OMERACT RA MRI scoring system (RAMRIS) and a tenosynovitis score.

RESULTS
Intrareader intraclass correlations between Gd- and Gd+ sequences were 0.76 for synovitis and 0.71 for tenosynovitis for reader 1 and 0.83 and 0.57 for reader 2 respectively. At the individual joint/tendon level, concordance rates for presence or absence of inflammation were 74-77% for synovitis and 84-85% for tenosynovitis. Discordance of more than 1 point in RAMRIS score was rare (1.8% of total scores are important, e.g. when monitoring therapy response, it may be considered at the cost of reduced reliability.

CONCLUSION
When assessing arthritic joints, omitting gadolinium contrast gives suboptimal results. Although total scores show moderate to good agreement, sensitivity and specificity are markedly decreased and therefore it cannot be recommended for clinical evaluation. When only total scores are important, e.g. when monitoring therapy response, it may be considered at the cost of reduced reliability.

CLINICAL RELEVANCE/APPLICATION
Omitting gadolinium decreases invasiveness, lowers costs and shortens imaging time, however our data show that this is achieved at the cost of reduced sensitivity and specificity.

SSJ17-06 • Frequency of Subclinical Axial Inflammation in Skin Psoriasis by Whole-body MRI

Vlad A Bratu MD (Presenter) ; Ulrich Weber MD ; Peter Hausermann MD ; Ulrich A Walker MD ; Thomas Daikeler MD ; Veronika Zubler ; Ueli Studler MD

PURPOSE
Our aim was to assess the prevalence of axial skeletal changes by whole-body MRI (wbMRI) in skin psoriasis patients without clinical evidence of arthritis and in age- and sex-matched healthy controls.

METHOD AND MATERIALS
Twenty-five patients (median age 52; range 20-69) with plaque psoriasis and no history or clinical evidence of arthritis and twenty-five age- and sex-matched healthy controls with no history of inflammatory back pain or skin psoriasis were recruited by the Nordic questionnaire. All patients and controls were clinically examined by the same dermatologist and rheumatologist according to a standardized protocol. All subjects underwent standardized unenhanced 1.5 T wbMRI (coronal and sagittal T1w and STIR). Image sets including both the sacroiliac joints (SIJ) and the entire spine were read in a random order and independently by a radiologist and a rheumatologist blinded to the clinical and demographic parameters. The readers recorded the presence of spondylarthropathy (SpA) by a global assessment of the SIJ and spine images on a confidence scale of 0-10 (0=definitely no SpA, 10=definite SpA). Bone marrow edema (BME), fatty marrow infiltration (FMI) and erosive changes in each SIJ quadrant were recorded by the Morpho module. Spinal BME and FMI of all discovertable units from C2/3 to L5/S1 were assessed according to the CanDen module. The lesion prevalence was expressed as mean percentage of subjects with ≥ 2 affected SIJ-quadrants or ≥ 2 spinal lesions in each group according to the two readers. Fisher’s exact test was used to test for a significant difference in prevalence between the 2 groups (p=0.05).

RESULTS
24% of healthy controls and 30% of skin psoriasis patients were classified as axial SpA by global wbMRI assessment. A high classification confidence (8-10) was recorded in 12% of controls and 18% of patients. The differences between the 2 groups were not statistically significant, both for the global and the lesion-based assessment in the spine and the SIJ.

CONCLUSION
On wbMRI every fourth healthy control was falsely classified as axial SpA. Skin psoriasis patients without clinical evidence of axial or
Current Imaging of the Shoulder: Rotator Cuff and Glenohumeral Joint Instability including Normal Variants, Pitfalls, Controversies, and Postoperative Challenges

Tuesday, 04:30 PM - 06:00 PM • E450A

RC404 • AMA PRA Category 1 Credit ™•1.5 • ARRT Category A+ - Credit:1.5

RC404A • MR Checklist Approach
David W Stoller MD (Presenter)

LEARNING OBJECTIVES
1) Understand the anatomy of the rotator cuff including the subjacent bony structures that make up the coracoacromial arch, as well as the concept of the rotator cuff footprint. 2) Become familiar with the pathophysiology of rotator cuff disease including classic Neer type extrinsic impingement and other forms of impingement that result in rotator cuff injury. 3) Learn how to classify rotator cuff tears, and their various stages, both partial and complete. 4) Understand the various surgical and arthroscopic techniques used to treat rotator cuff lesions and impingement, and the resultant postoperative anatomy, both bony and soft tissue. 5) Recognise recurrent rotator cuff lesions in the postoperative state.

RC404B • MR of the Rotator Cuff and Impingement including Postoperative Cuff
Michael B Zlatkin MD ( Presenter)

LEARNING OBJECTIVES
1) Understand the anatomy of the rotator cuff including the subjacent bony structures that make up the coracoacromial arch, as well as the concept of the rotator cuff footprint. 2) Become familiar with the pathophysiology of rotator cuff disease including classic Neer type extrinsic impingement and other forms of impingement that result in rotator cuff injury. 3) Learn how to classify rotator cuff tears, and their various stages, both partial and complete. 4) Understand the various surgical and arthroscopic techniques used to treat rotator cuff lesions and impingement, and the resultant postoperative anatomy, both bony and soft tissue. 5) Recognise recurrent rotator cuff lesions in the postoperative state.

RC404C • MR of Glenohumeral Ligaments and Biceps Labral Complex
David W Stoller MD (Presenter)

LEARNING OBJECTIVES
1) To understand and identify the relationship of the inferior glenohumeral ligament, and the anterior band attachment variants. 2) The role of the superior glenohumeral ligament relevant to the biceps pulley and its relationship to the CHL ligament. 3) Biceps labral complex will be defined and discussed with Type I-III. 4) BLC sulcus will be defined. 5) SLAP tear pattern recognition and subtypes 1-10 will be reviewed. 6) Relevance of ABER review and MR arthrography.

ABSTRACT
The anterior glenoid labrum provides the major area of attachment for the anterior band of the IGL. The middle glenohumeral ligament (MGL) is considerable more variable, but may also contribute fibers to the more superior aspects of the anterior glenoid labrum as it approaches the biceps tendon. Above the epiphyseal line (i.e. the junctions of the upper and middle thirds of the glenoid body fossa), the attachment of the glenoid labrum is variable. Inferior to the epiphyseal line, the labrum is continuous with the glenoid articular cartilage and serves as the insertion site for the IGL. It is the superior and anterosuperior portion of the labrum that can be variable attached to the glenoid. There are three different types of attachment of the biceps labral complex (BLC) to the glenoid. IGL-The IGL consists of anterior and posterior bands and an axillary pouch that attaches to the inferior two-thirds of the entire circumference of the glenoid by means of the labrum. The IGL is lax in the adducted position. As it tightens with increasing abduction, the anterior and posterior.

RC404D • MRI of Instability Excluding SLAP Lesions
Timothy G Sanders MD (Presenter)

LEARNING OBJECTIVES
1) Understand and be able to recognize the MR imaging appearance of lesions of anterior and posterior instability of the glenohumeral joint. 2) Understand the anatomy of the rotator interval and to identify the lesions of ‘micro-instability’. 3) Understand the various injuries that occur in the overhead (throwing) athlete and to be able to recognize these injuries on MR imaging. 4) Recognize on MR imaging the common postoperative complications following shoulder reconstruction for glenohumeral instability.

ABSTRACT
The glenohumeral joint is an intrinsically unstable joint and MR imaging is a very effective noninvasive means of evaluating for the numerous lesions of instability. The standard MR imaging protocols and use of MR arthrography will be discussed. 1. There are numerous osseous and soft tissue lesions which can occur in conjunction with anterior and posterior shoulder instability including: -Bankart lesion -Perthes -Anterior labroligamentous peristeal sleeve avulsion injury -Ossseous Bankart/Hill Sachs lesions -Humeral avulsion of the glenohumeral ligament -Glenolabral articular disruption II. Lesions of Micro-instability refers to instability lesions which occur within the superior aspect of the glenohumeral joint and include: -SLAP lesions/SLAC lesions -Rotator interval lesions -Biceps anchor and pulley lesions III. Injuries that are commonly seen in overhead (throwing) athletes include: -Extrinsicimpingement-instability overlap -Labral and rotator cuff injuries resulting from distraction forces -Internal impingement -Glenohumeral internal rotation deficit disorder IV. Postoperative shoulder complications include: -Breakdown of labral repair/recurrent labral tear -Hardware complications -Chondrolysis of
the glenohumeral joint

**The Role of Ultrasound in the Evaluation of the Shoulder**

**J. A Bouffard** MD (Presenter)

**LEARNING OBJECTIVES**
1) To enumerate the indications for shoulder ultrasound. 2) To describe the normal ultrasound anatomy of the shoulder. 3) To identify lesions of the rotator cuff. 4) To localize effusions of the shoulder. 5) To recognize shoulder impingement during dynamic imaging.

**Vertebral Augmentation (How-to Workshop)**

**Tuesday, 04:30 PM - 06:00 PM • E260**

**RC450 • AMA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5**

A. Orlando Ortiz, MD, MBA *

Bassem A Georgy, MD, MSc *

John M Mathis, MD, MSc

Alian L Brook, MD *

Afshin Gangi, MD, PhD *

**LEARNING OBJECTIVES**
1) Discuss appropriate algorithms for patient selection. 2) Review anatomic and technical considerations for vertebral augmentation. 3) Present an update of the recent advances in vertebroplasty and kyphoplasty. 4) Emphasize safety issues and how to avoid complications. 5) Understand the applications of vertebral augmentation in osteoporotic and neoplastic spine pathology. 6) Update participants with respect to advances in equipment and biomaterials.

**ABSTRACT**

Case-based Review of Musculoskeletal Radiology (An Interactive Session)

**Wednesday, 08:30 AM - 10:00 AM • S406A**

**MSCS41 • AMA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5**

**Director**

Lynne S Steinbach, MD

**MSCS41A • CT**

Kenneth A Buckwalter, MD (Presenter)

**LEARNING OBJECTIVES**
1) Discuss appropriate indications for musculoskeletal CT imaging. 2) Understand how and why to perform CT arthrography. 3) Apply advances in CT technology to musculoskeletal imaging. 4) List technical factors to improve imaging of patients with orthopedic hardware.

**ABSTRACT**

This case based course will illustrate how CT can be used effectively in diagnosing musculoskeletal conditions.

**MSCS41B • Ankle and Foot**

Zehava S Rosenberg, MD (Presenter)

**LEARNING OBJECTIVES**
1) To familiarize the attendees with key topics in ankle and foot pathology. 2) To comprehend, apply and analyze the imaging characteristics of osseous abnormalities, tendon disorders, ligament injuries and miscellaneous diseases of the foot and ankle.

**ABSTRACT**

This case based presentation will afford the radiologist with tools for interpreting common pathologic conditions in the foot and ankle.

**MSCS41C • Knee**

David A Rubin, MD (Presenter) *

**LEARNING OBJECTIVES**
1) Identify the application of basic anatomic, pathologic, and physiologic principles to specific disease processes that affect the knee. 2) Illustrate using case examples several important disease processes that affect the knee, using several imaging methods and emphasizing the value of each. 3) Present the major teaching points and differential diagnostic considerations for each of the chosen cases and, when appropriate, clarify the importance of early accurate diagnosis.

**ABSTRACT**

Accurate diagnosis of many disorders that affect the knee can be accomplished with basic or advanced imaging methods, or both. A series of cases will be used to illustrate a few of this disorders, with attention to the most appropriate imaging protocol, the salient imaging findings, the anatomic and pathophysiologic factors that explain the findings, and the important differential diagnostic considerations. Conventional radiography, CT scanning, and MR imaging will be emphasized throughout.

**Bone and Cartilage Injury: Traumatic and Stress-related Chondral, Osteochondral and Subchondral Failure with Emphasis on Pathophysiologic and Routine and Advanced MR Imaging**

**Wednesday, 08:30 AM - 10:00 AM • N227**

**RC504 • AMA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5**

Donald L Resnick, MD

Christine B Chung, MD

Mini N Pathria, MD

Yolanda Y Lee, MBChB *

Monica Tafur, MD

**LEARNING OBJECTIVES**
1) Discuss the structural anatomy of a. articular cartilage with emphasis on its collagen framework and b. the trabecular architecture in the subchondral bone. 2) Emphasize the manner in which the collagen and trabeculae respond to compressive, shear, and tensile forces applied to the joint surface and the resultant injuries as they are displayed in MR images. 3) Emphasize the anatomy and biomechanical implications of the osteochondral unit through novel MRI applications. 4) Discuss structure and biomechanics of bone tissue with regard to the pathogenesis of fatigue and insufficiency forms of stress injury. 5) Use case-based teaching methods to illustrate the imaging spectrum of traumatic and stress-related chondral, osteochondral, and subchondral injuries.

**Nerve Ultrasound Based on a Regional Approach: Shoulder and Neck (Hands-on Workshop)**

Wednesday, 08:30 AM - 10:00 AM • E264

**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.

**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.
ABSTRACT

MSE42B • Imaging Muscle Injury and It’s Complications

Philip Robinson MBChB (Presenter)

LEARNING OBJECTIVES
1) Identify the application of basic anatomy, pathology, and physiology principles of muscle anatomy and function in relation to the patterns of injury seen. 2) Understand the physical principles and relative limitations of MRI and ultrasound in relation to imaging normal and injured muscle. 3) Describe the commonest muscle injury patterns that occur and understand the pathophysiology of subsequent complication development.

MSE42C • Characterizing Soft Tissue Tumors at MRI: What Is Realistically Possible?

David M Panicek MD (Presenter)

LEARNING OBJECTIVES
1) Describe how various features of a soft tissue mass may contribute to a more specific diagnosis at MRI. 2) Identify characteristic MRI features of certain soft tissue tumors. 3) Recognize strengths and limitations of MRI in characterizing soft tissue tumors.

ABSTRACT

MSE440B • Essentials of Elbow MRI

Michael J Tuite MD (Presenter)

LEARNING OBJECTIVES
1) Identify the normal anatomy of the elbow on MR images. 2) Analyze the commonly injured structures of the elbow, and identify injuries of the bones, tendons and ligaments. 3) Demonstrate understanding of the nerves around the elbow and the MR appearance of abnormalities.

ABSTRACT

MSE440C • Imaging Muscle Injury and It’s Complications

Philip Robinson MBChB (Presenter)

LEARNING OBJECTIVES
1) Identify the application of basic anatomy, pathology, and physiology principles of muscle anatomy and function in relation to the patterns of injury seen. 2) Understand the physical principles and relative limitations of MRI and ultrasound in relation to imaging normal and injured muscle. 3) Describe the commonest muscle injury patterns that occur and understand the pathophysiology of subsequent complication development.

MSE440D • Characterizing Soft Tissue Tumors at MRI: What Is Realistically Possible?

David M Panicek MD (Presenter)

LEARNING OBJECTIVES
1) Describe how various features of a soft tissue mass may contribute to a more specific diagnosis at MRI. 2) Identify characteristic MRI features of certain soft tissue tumors. 3) Recognize strengths and limitations of MRI in characterizing soft tissue tumors.

ABSTRACT

MSE440E • Imaging Muscle Injury and It’s Complications

Philip Robinson MBChB (Presenter)

LEARNING OBJECTIVES
1) Identify the application of basic anatomy, pathology, and physiology principles of muscle anatomy and function in relation to the patterns of injury seen. 2) Understand the physical principles and relative limitations of MRI and ultrasound in relation to imaging normal and injured muscle. 3) Describe the commonest muscle injury patterns that occur and understand the pathophysiology of subsequent complication development.

MSE440F • Characterizing Soft Tissue Tumors at MRI: What Is Realistically Possible?

David M Panicek MD (Presenter)

LEARNING OBJECTIVES
1) Describe how various features of a soft tissue mass may contribute to a more specific diagnosis at MRI. 2) Identify characteristic MRI features of certain soft tissue tumors. 3) Recognize strengths and limitations of MRI in characterizing soft tissue tumors.

ABSTRACT

MSE440G • Imaging Muscle Injury and It’s Complications

Philip Robinson MBChB (Presenter)

LEARNING OBJECTIVES
1) Identify the application of basic anatomy, pathology, and physiology principles of muscle anatomy and function in relation to the patterns of injury seen. 2) Understand the physical principles and relative limitations of MRI and ultrasound in relation to imaging normal and injured muscle. 3) Describe the commonest muscle injury patterns that occur and understand the pathophysiology of subsequent complication development.

MSE440H • Characterizing Soft Tissue Tumors at MRI: What Is Realistically Possible?

David M Panicek MD (Presenter)

LEARNING OBJECTIVES
1) Describe how various features of a soft tissue mass may contribute to a more specific diagnosis at MRI. 2) Identify characteristic MRI features of certain soft tissue tumors. 3) Recognize strengths and limitations of MRI in characterizing soft tissue tumors.
MSC therapy could be a valid alternative treatment for knee osteoarthritis and MRI T2-mapping might be a useful tool for its cartilage assessment follow up

CLINICAL RELEVANCE/APPLICATION
Stem cells therapy could become a new effective, feasible and safe treatment for chronic osteoarthritis, whether MRI technique might be the monitoring tool for its assessment.

SSK13-04 • The Value of T2 Color Maps in the Patellar Cartilage Grading Injury
Qian Cui (Presenter) ; Shao Wu Wang ; Yue Dong ; Shaowei Zheng ; Qingwei Song BS, BEng

PURPOSE
To investigate value of T2 color maps in assessment of patellar cartilage injury grading.

METHOD AND MATERIALS
62 patients who underwent knee MR and arthroscopic surgery patients were collected, including 32 males and 30 females, aged 30-51 years, mean 40.7 years. GE Company Signa3.0T MR was used. The scan sequence include: FSE-T1WI, FSE-T2WI, FS-FSE-PDWI and T2mapping. T2mapping images were sent to the GE-ADW 4.3 workstation to generate T2 color maps of patellar cartilage. Arthroscopic patellar cartilage grading standards, to explore T2 color maps value of the patellar cartilage grading injury.

RESULTS
CONCLUSION
T2 color maps would be reliable in classification of patellar cartilage damage assessment.

CLINICAL RELEVANCE/APPLICATION

SSK13-05 • Incidental Findings and Their Clinical Relevance Magnetic Resonance Imaging (MRI) of the Knee in an Open Population-based Study of Middle-aged Females
Edwin H Oei MD, PhD (Presenter) ; J. H. J. M. Bessem MD ; Dieuwke Schiphof PhD ; Abida Z Ginali MD, PhD ; Jan Heeringa MD, PhD ; Gabriel P Krestin MD, PhD * ; Albert Hofman MD, PhD ; Meike W Vernooy MD ; Sita Bierma-Zaenstra PhD

PURPOSE
MRI of the knee is increasingly applied in population-based studies, particularly on osteoarthritis (OA). Little is known on incidental knee MRI findings in an unselected ageing population. Our purpose was to describe the prevalence and clinical relevance of incidental findings on knee MRI in females of the Rotterdam Study, an ongoing open population-based study of middle-aged and elderly.

METHOD AND MATERIALS
891 female participants aged 45-60 (mean 55) from the Rotterdam Study underwent MRI of both knees (1.5 T scanner (GE)) independently of OA status. All participants gave written informed consent, including a section on incidental findings. Incidental findings were assessed by trained researchers, reviewed with an experienced musculoskeletal radiologist and classified into findings that did or did not require referral, based on clinical relevance, expected health benefit and evidence based therapeutic consequences. Age-related changes were not considered findings that needed referral because these were primary study outcomes. In accordance with informed consent, findings that required referral were reported to participants and their GP.

RESULTS
In 1782 MRI scans we identified 54 incidental findings (3.0%) in 52 participants, of which (1.0%) in 17 participants required referral: 16 lesions suspicious of a chondroid lesion with uncertain benign characteristics and 1 large atypical cystic intraosseous abnormality. In all referrals, additional dynamic contrast-enhanced MRI was performed. Although this did neither demonstrate malignant tumor characteristics nor necessitated specific treatment in any, all referred participants were still followed-up clinically and radiologically. Among findings that did not require referral were 37 chondroid lesions in 35 participants with unequivocal benign features (cental metadiaphysial lesion

CONCLUSION
Our findings suggest that in the general middle-aged female population incidental findings are present in 3% of knee MR scans. While referral and additional MRI was deemed necessary in 1% of MRIs, this demonstrated that incidental findings virtually all consist of chondroid tumors with low suspicion of high tumor grade.

CLINICAL RELEVANCE/APPLICATION
Incidental findings are present on 3% of knee MRI scans in the general middle-aged female population and virtually all consist of chondroid tumors with low suspicion of high tumor grade.

SSK13-06 • Comparison of Quantitative Magnetization Transfer Parameters of Patellar Cartilage in Asymptomatic Volunteers and Patients with Early Osteoarthritis
Nade Britanyaratana (Presenter) ; Pouria Mossahebi MS ; John Wilson MD, MS ; Alexey A Samsonov PhD ; Walter F Block PhD * ; Richard Kijowski MD

PURPOSE
Quantitative magnetization transfer (qMT) imaging utilizes the magnetization transfer effect to probe macromolecular tissue composition typically inaccessible by conventional magnetic resonance (MR) techniques. qMT can be used to measure the fraction of protons bound to macromolecules (f), the exchange rate between mobile protons and macromolecular bound protons (k), and the T2 relaxation time of macromolecular bound protons (T2b). This study was performed to compare qMT parameters of patellar cartilage in young asymptomatic volunteers and patients with early patellofemoral osteoarthritis (OA).

METHOD AND MATERIALS
An MRI examination through the patellofemoral joint was performed in the axial plane at 3.0T on 14 young asymptomatic volunteers and 11 patients with Kellgren-Lawrence grade 1 (N=6) and grade 2 (N=5) patellofemoral OA. Nine spoiled gradient recall-echo (SPGR) volumes were acquired with different MT offset frequencies and MT powers, 2 SPGR volumes were acquired for B1 error correction using actual flip angle imaging (AFI), and 4 SPGR volumes were acquired for T1 mapping using variable flip angle imaging (VFI). Total scan time was 25 minutes. The qMT parameters f, k, and T2b were iteratively fitted in MATLAB using a previously described model and then measured in regions of interest placed around the entire patellar cartilage. Mann-Whitney-Wilcoxon tests were used to compare qMT parameters between groups of subjects.

RESULTS
Mean f, k, and T2b within patellar cartilage for asymptomatic volunteers were 14.00±0.71%, 6.51±0.71sec, and 6.53±0.15s respectively. Mean f, k, and T2b within patellar cartilage for patients with OA were 14.30±0.85%, 5.63±0.80 sec, and 6.83±0.14s respectively. Patients with OA had similar f (p=0.26), significantly lower k (p=0.006), and significantly higher T2b (p=0.00006) within patellar cartilage than asymptomatic volunteers.

CONCLUSION
Patients with early patellofemoral OA have lower k and higher T2b within patellar cartilage than young asymptomatic volunteers. Additional studies are needed to investigate the mechanisms behind the observed changes in k and T2b with early cartilage degeneration.

CLINICAL RELEVANCE/APPLICATION
qMT imaging is a new quantitative MR technique which has high sensitivity for detecting changes in macromolecular tissue composition
In patients with Osgood-Schlatter disease, radiologists must be aware of the presence of patella alta, which can be important to the clinical relevance/application on MRI of the knees in patients with sequelae of Osgood-Schlatter. As demonstrated in the study, there was a statistically significant association between Osgood-Schlatter disease and patella alta and a good interobserver concordance. This fact highlights the importance of the evaluation for patellar height by Insall-Salvati index technique on MRI of the knees in patients with sequelae of Osgood-Schlatter.

CLINICAL RELEVANCE/APPLICATION
In patients with Osgood-Schlatter disease, radiologists must be aware to the presence of patella alta, which can be important to the clinical relevance/application on MRI of the knees in patients with sequelae of Osgood-Schlatter. As demonstrated in the study, there was a statistically significant association between Osgood-Schlatter disease and patella alta and a good interobserver concordance. This fact highlights the importance of the evaluation for patellar height by Insall-Salvati index technique on MRI of the knees in patients with sequelae of Osgood-Schlatter.

CLINICAL RELEVANCE/APPLICATION
In patients with Osgood-Schlatter disease, radiologists must be aware of the presence of patella alta, which can be important to the clinical relevance/application on MRI of the knees in patients with sequelae of Osgood-Schlatter. As demonstrated in the study, there was a statistically significant association between Osgood-Schlatter disease and patella alta and a good interobserver concordance. This fact highlights the importance of the evaluation for patellar height by Insall-Salvati index technique on MRI of the knees in patients with sequelae of Osgood-Schlatter.

RESULTS
Among 48 patients (96 knees), a total of 90 entheseal lesions were detected, with no enthesis in 2 cases (6.3%). Signs of continuing inflammation bilaterally were frequently found: soft tissue edema (STE; n = 52), bone marrow edema (BME; n = 20), perienthesal BME (n = 3), cartilaginous erosions (n = 42), and bone erosions (n = 27). In controls, 2 (10%) subjects had BME and another 5 (25%) showed cartilaginous erosions. None showed evidence of enthesis. Significant correlations were observed between the number of enthesial lesions of both knees vs STE (present vs absent; r = 0.314, p = 0.030) and STE (number of lesions; r = 0.351, p = 0.014). Enthesitis (unilateral vs bilateral) was significantly and positively correlated with STE (r = 0.304, p = 0.036), and villous projections (r = 0.347, p = 0.016).

CONCLUSION
Subclinical synovitis and enthesitis are frequently found in the knee joint of patients with psoriasis. These may be an early sign of psoriatic arthritis.

CLINICAL RELEVANCE/APPLICATION
In psoriatic patients the knees could be the seat of enthesitis and synovitis changes even without symptoms of arthritis. Those changes may be depicted by MRI.
SSK14-01 • Diagnostic Performance of Tomosynthesis for Evaluation of Suspicious Bone Tumors: Comparison with Radiography and CT

Jihyun Bae MD (Presenter) ; In Sook Lee ; You Seon Song ; Jeung Il Kim MD, PhD ; Jong Woon Song

PURPOSE
To compare tomosynthesis with radiography for evaluation of suspicious bone tumors, using multidetector computed tomography (CT) as the reference method.

METHOD AND MATERIALS
The study was approved by the institutional review board of our institution and written consent was obtained from all patients. From January 2012 to March 2013, 24 consecutive patients with suspicious bone tumors underwent radiography, tomosynthesis, and CT within 3 days. Two radiologists analyzed about the presence or absence of periosteal reaction, space occupying lesion (SOL), mineralization and fracture on each three imaging modality.

RESULTS
Fourteen patients had benign bone tumors, nine had malignant bone tumors and one had only cortical fracture. The overall sensitivity, specificity, and accuracy of tomosynthesis were, respectively, 88.9%, 100%, and 95.6% about the periosteal reaction, 87.5%, 100% and 91.7% about the fracture. Those of radiography were, respectively, 88.9%, 100%, and 95.8% about the periosteal reaction, 81.8%, 100% and 83.3% about the SOL, 83.3%, 100% and 95.8% about the mineralization, and 43.7%, 100%, and 62.5% about the fracture. The degrees of agreement between CT and tomosynthesis were 0.909 about periosteal reaction, 1 about the SOL and mineralization and 0.824 about the fracture (p < 0.05). Those between CT and radiography were respectively 0.909, 0.429, 0.882, and 0.341 (p < 0.05).

CONCLUSION
The diagnostic performance of tomosynthesis for evaluation of suspicious bone tumors was significantly greater than radiography and comparable to CT.

CLINICAL RELEVANCE/APPLICATION
The imaging qualities of tomosynthesis in the cases of suspicious bone tumors may comparable to those of CT images, with relatively lower radiation dose.

SSK14-02 • Treatment Response Evaluation of Patients with Malignant Bone Tumors; Correlation of ADC from 3.0T MR Imaging and SUV from FDG PET/CT

So-Yeon Lee MD (Presenter) ; Won-Hee Jee MD ; Joon-Yong Jung MD ; Jin-Kyeong Sung MD ; Soo Ah Im ; Jin Hyoung Kang ; Ie Ryung Yoo

PURPOSE
To retrospectively determine whether the apparent diffusion coefficients (ADC) at 3T diffusion-weighted MR imaging (DWI) correlate with the standardized uptake values (SUV) at positron emission tomography (PET)/computed tomography (CT) for evaluating treatment response in malignant bone tumors.

METHOD AND MATERIALS
The institutional review board approved this HIPAA-compliant study and informed consent was waived. Twenty-two patients with 27 malignant bone tumors underwent 3T MR imaging including DWI with b value of 0, 800 sec/mm2 and whole-body fluorine 18 fluoro-deoxyglucose PET/CT before and after treatment. Minimum ADC (ADCmin) of the tumor was measured by two independent musculoskeletal radiologists and correlated the maximum SUV (SUVmax) of the tumor. The percentage changes of ADCmin and SUVmax were calculated by the difference between the initial and follow-up values divided by the initial value. The change ratios of ADCmin and SUVmax were defined as the ratio of the follow-up value to the initial value. The Spearman rank correlation were obtained for statistical analysis.

RESULTS
There was significant correlation between the differences between the initial and follow-up values of ADCmin and SUVmax (r = 0.573 for reviewer 1, and r = 0.597 for reviewer 2, P < .005), the change ratios of ADCmin and SUVmax (r = 0.457, r = 0.491, P < .05), and percentage changes of ADCmin and SUVmax (r = 0.457, r = 0.491, P < .05). DWI and PET CT showed treatment response in 18 lesions: the ADC was increased by 105% (interquartile range, 61-166) and SUVmax was decreased by 56% (37-83). The ADCs of two responded lesions returned to the range of normal bone marrow and resulted in a decrease of the ADCmin (65% and 32%, respectively) and decrease of SUVmax (71% and 87%, respectively). There was no response in six lesions: the ADC was decreased by 23% (13-30) and SUVmax was increased by 55% (26-90). There was one lesion with a discrepancy in changes of ADCmin (decreased by 29%) and SUVmax (decreased by 13%).

CONCLUSION
There was significant correlation between the ADC and SUV for evaluating treatment response in malignant bone tumors.

CLINICAL RELEVANCE/APPLICATION
Quantitative DWI is comparable to PET/CT for evaluating treatment response in malignant bone tumors.

SSK14-03 • Negative Relationship between CT Attenuation Values and ADC Values in Densely Sclerotic Bone Metastases from Prostate Cancer

Usman Bashir MBBS (Presenter) ; Nina Tunariu MD ; David J Collins BSC, BA ; Diletta Bianchini ; Andrea Zivi ; Dow-Mu Koh MD, FRCR

PURPOSE
To investigate relationship between CT attenuation and ADC value of skeletal metastasis in prostate cancer.

METHOD AND MATERIALS
26 patients of prostate cancer with bone metastases, who underwent contemporaneous whole body diffusion-weighted MRI (WB-DWI) and CT were retrospectively reviewed. WB-DWI was performed on a 1.5T system using b-values 50, 900 s/mm2. CT of chest, abdomen and pelvis was acquired at 65s post-contrast. Slice-by-slice synchronization was obtained between CT and MRI data-sets by careful use of
anatomic landmarks. A lucent and a sclerotic metastasis were chosen on CT, when present, at each of the following skeletal sites: thoracic spine, lumbar spine, sacrum, right pelvis and left pelvis. A maximum of 10 lesions were evaluated per patient. Lesion signal intensity on b900 image was recorded as hyperintense or iso/hypointense to skeletal muscle. A region of interest (ROI) was drawn on each lesion to record the mean CT value (HU) and copied on the matching b900 image to derive lesion's mean ADC value (x 10^-3 mm^2/s). The relationship between lesion CT HU and ADC values was evaluated by Spearman's correlation. The mean CT HU and ADC values of hyperintense vertebra iso/hypointense lesions were compared using t-test. A p-value of

RESULTS

212 lesions were evaluated. The mean CT HU was 481 (33-1152); the mean ADC value was 0.91 (0.18-2.13). 140/212 (66%) lesions appeared hyperintense; 73/212 (34%) were iso/hypointense on DWI. The mean CT HU of hyperintense metastases was significantly lower than iso/hypointense lesions (371 vs 681, p = 650HU; n = 57), a highly significant negative correlation was observed between CT HU and ADC (r = -0.60, p

CONCLUSION

Densely sclerotic prostate cancer bone metastases (CT HU > 650) showed a strong negative correlation between CT HU and ADC values, but this was not observed for less sclerotic/lytic disease.

CLINICAL RELEVANCE/APPLICATION

Understanding the interplay of DWI signal intensity, ADC, marrow fat fraction and CT attenuation value of prostate bone metastases can help characterize lesions for response evaluation to treatment.

SSK14-04 • Differentiation of Osteogenic Bone Metastases and Bone Islands Using Conventional Single-energy CT Value and Monochromatic CT Value from Spectral CT in Patients with Bronchogenic Carcinoma

Yue Dong (Presenter) ; Shaowei Zheng ; Bing Wang ; Ruxin Wang ; Lifei Sun

PURPOSE

To evaluate the diagnostic efficacy of single-energy CT and single-source Dual-energy CT in the identification of osteogenic bone metastases and bone islands in patients with bronchogenic carcinoma.

METHOD AND MATERIALS

45 cases of osteogenic metastases in patients with pathologically proven bronchogenic carcinoma and 43 cases of bone islands were confirmed via MRI, single-photon emission computed tomography (SPECT) and one year follow-up. All subjects underwent dual-energy spectral CT imaging using a high definition CT (Discovery CT750 HD, GE). The means, standard deviation (SD) and coefficient variation (CV) of 140kVp-quality check (QC) CT values and virtual monochromatic (40-140 keV) CT values of osteogenic metastases and bone islands were measured and compared with independent-samples t-test. The lesion center was selected as ROI (20-30mm2). ROC curves were used to compare the diagnostic efficacies of conventional single-energy CT and monochromatic CT in the identification of osteogenic bone metastases and bone islands.

RESULTS

The mean mono-energy CT values (40-140 keV) and QC CT value of osteogenic bone metastases were all significantly lower than that of bone islands (p

CONCLUSION

Both conventional single-energy CT and monochromatic CT were reliable for differential diagnosis of osteogenic bone metastases and bone islands. SD of monochromatic CT value at higher keV has better diagnostic efficacies.

CLINICAL RELEVANCE/APPLICATION

SD of monochromatic CT value at higher keV has better SD of monochromatic CT value at higher keV has better diagnostic efficacies for differentiation of osteogenic bone metastases and bone islands.

SSK14-05 • Can IDEAL-MR Imaging of Multiple Myeloma Be Used as a Biomarker for Predicting Symptomatic Myeloma?

Miayuki Takasu MD (Presenter) ; Yoko Kaichi ; Miho Ishikawa MD ; Shuji Date ; Yuji Akiyama ; Kazuo Awai MD ; Yoshiaki Kuroda ; Akira Sakai

PURPOSE

Asymptomatic multiple myeloma is an asymptomatic plasma-cell proliferative disorder associated with a high risk of progression to symptomatic multiple myeloma. Predictive factors for the progression of this disease are unclear. This study was performed to evaluate the effect of the iterative decomposition of water and fat with echo asymmetric and least-squares estimation (IDEAL) MRI to predict symptomatic myeloma in patients without visible focal lesions.

METHOD AND MATERIALS

The lumbar spine was examined with 3T-MRI in 47 patients with multiple myeloma (asymptomatic myeloma, 23; symptomatic myeloma, 24). The fat-signal fraction (FSF) obtained by IDEAL sequence was calculated as the mean value from three vertebral bodies. We evaluated factors predictive of symptomatic myeloma. They included sex, age, FSF, MR signal intensity pattern (MR pattern), bone marrow plasma cell percentage (BMPC%) obtained from a biopsy specimen, presence of IgA monoclonal protein, serum monoclonal protein level (M protein), serum albumin level, serum ?2-microglobulin (72m) level, the 72m/albumin ratio, reductions in levels of uninvolved immunoglobulins, and the ?2m/albumin ratio. For data analysis, univariate and multivariate logistic regression analyses, as well as receiver operating characteristic curves, were used. A difference with P < .05 was considered significant.

RESULTS

Univariate analysis demonstrated that MR pattern, FSF, BMPC%, M protein, the reduction in uninvolved immunoglobulins, ?2m, and the ?2m/albumin ratio were significantly associated with symptomatic myeloma. Results of multivariate analysis demonstrated that ?2m, FSF, and the reduction in uninvolved immunoglobulins had significant effects in differentiation between asymptomatic and symptomatic myeloma. The area under the curve was 0.805 for FSF, 0.844 for ?2m, and 0.793 for BMPC%.

CONCLUSION

Fat quantification results using the IDEAL sequence in MRI were significantly different in patients with symptomatic- and asymptomatic myeloma. The FSF and ?2m facilitated the discrimination of symptomatic- from asymptomatic myeloma.

CLINICAL RELEVANCE/APPLICATION

Predictive factors for the progression to symptomatic myeloma included FSF and ?2m. The discriminative performance of FSF is comparable to that of BMPC% obtained from biopsy specimen.

SSK14-06 • Magnetic Resonance Imaging Differentiation between Malignant Marrow Replacing Lesion and Benign Red Marrow Deposition of Vertebra Using T2*-corrected Fat Fraction Map Imaging Based on Three-point Dixon-VIBE Sequence

Yong Pyo Kim (Presenter) ; Sungjun Kim MD ; Tae Sub Chung ; Yaena Kim MD ; Munyoung Paek ; Choon Sik Yoon MD ; Young Han Lee MD ; Ho-Taek Song MD ; Jin-Suck Suh MD

PURPOSE

To assess feasibility of T2*-corrected fat fraction map using three-point Dixon-VIBE sequence as a tool for differentiation between malignant marrow replacing lesion and benign red marrow deposition of vertebra.

METHOD AND MATERIALS

From Mar. 2012 to Feb. 2013, magnetic resonance imaging was performed for consecutive 33 patients who were referred for vertebral marrow abnormality assessment. Twenty two pathologically confirmed malignant marrow replacing lesions and 11 benign red marrow lesions from the patients were subjects of this study. Three sequences were applied using a 1.5-T MR imaging scanner like follows: three-point Dixon-volume interpolated breath-hold REAL sequence (VIBE) for fat fraction (FF) measurement; conventional T1 weighted
**RESULTS**

AUCs of FF, LDR, CER were 0.96, 0.83, 0.74. FF showed superior AUC than CER with statistical significance. The optimal cut-off value and the corresponding sensitivity/specificity in percentage were like follows: 16, 0.81/1 in FF; 116.2, 1/63.6 in LDR; 93.4, 0.68/0.81 in CER.

**CONCLUSION**

T2*-corrected fat fraction measurement using a three-point Dixon-VIBE sequence showed superior diagnostic performance than contrast enhanced T1WI, and it showed excellent specificity in differentiation between malignant marrow replacing lesion and benign red marrow deposition of vertebra.

**CLINICAL RELEVANCE/APPLICATION**

T2*-corrected fat fraction measurement using a three-point Dixon-VIBE sequence is expected to play an important role to differentiate benign red marrow from malignant marrow lesion.

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**SSK14-07 • Diagnostic Efficacy of Whole-body Ultra Low Dose CT (WBULDCT) in Comparison with Spinal Magnetic Resonance Imaging (SMRI) in the Assessment of Disease in Patients with Multiple Myeloma (MM)**

Valeria Besostri MD (Presenter); Davide Ippolito MD; Pietro A Bonaffini MD; Valentina Bartolo; Alessandra Cuccia; Sandro Sironi MD

**PURPOSE**

To compare the diagnostic value of Whole-Body Ultra Low-Dose CT (WBULDCT) with dedicated Spinal Magnetic Resonance Imaging (SMRI) in the identification of bone marrow involvement of patients with Multiple Myeloma (MM).

**METHOD AND MATERIALS**

A total of 30 patients (17 males and 13 females; mean age 68 years, range 52-83 years), with histologically proven MM, undergoing WBULDCT and a dedicated SMRI (9/30 for staging, 21/30 during follow-up), were evaluated in our study. Unenhanced WBULDCT was performed on a 256-slice scanner (ICT, Philips), with the following parameters: tube voltage 120 kV, tube current time product 40 mAs, collimation 128x0.65. Spine MRI was performed on a 1.5T magnet (Achieva, Philips), with the following protocol: T1 TSE and T2 STIR.

**RESULTS**

In 21/30 patients (70%), WBULDCT and SMRI were concordant, detecting (14/21) or excluding (7/21) involvement of the axial skeleton. In 9/30 patients (30%) WBULDCT and SMRI were discordant in terms of axial skeleton involvement: in 2/9 patients SMRI was positive and WBULDCT was negative, while in 7/9 patients only WBULDCT was positive. The corresponding sensitivity for lesion detection in the spine was 73% for WBULDCT and 53% for SMRI, respectively. Only one patient with a negative WBULDCT scan showed multifocal lesions on SMRI. Moreover, in 22/30 of cases (73%) WBULDCT detected additional osteolytic lesions in other extra-assial districts (skull, sternum and ribs, pelvis, upper and lower limbs).

**CONCLUSION**

WBULDCT demonstrated superior capability as compared to SMRI, for the detection of disease in the axial skeleton and also offers detailed information about extra-assial involvement, which could be potentially missed with dedicated SMRI alone.

**CLINICAL RELEVANCE/APPLICATION**

WBULDCT imaging appears to be helpful in detecting spinal involvement in patients with MM, reserving SMRI in case of negative results in symptomatic patients.

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**SSK14-08 • Appearance of Monoclonal Plasma Cell Diseases in Whole-body MRI and Correlation with Parameters of Disease Activity**

Jost Kloth (Presenter); Jens Hillengass MD; Karin Listl MD; Stefan Delorme MD; Hans-Ulrich Kauczor MD *; Marc-Andre Weber MD *; Hartmut Goldschmidt MD

**PURPOSE**

To examine a possible association of the presence of focal lesions (FL) or a diffuse infiltration pattern of bone marrow in whole-body MRI (WB-MRI) with the disease stage and established markers of disease activity in patients with monoclonal plasma cell disease.

**METHOD AND MATERIALS**

Institutional review board approval was obtained. We examined the WB-MRI scans in 547 consecutive, unselected and untreated patients with monoclonal gammopathy of undetermined significance (MGUS, n=138), smoldering multiple myeloma (SMM, n=157) and multiple myeloma (MM, n=252) on two identical 1.5 Tesla MRI-scanners with body array coils. Assessment was done by two experienced radiologists blinded to the diagnosis of the patients in consensus.

**RESULTS**

We found focal lesions in 23.9% (MGUS), 34.4% (SMM) and 81.3% (MM), respectively. A diffuse infiltration pattern was detected in 38.4%, 45.9%, and 71% of the corresponding patients. Infiltration patterns were significant (p < 0.001).

**CONCLUSION**

The frequency of focal or diffuse bone marrow abnormalities as well as the severity of diffuse signal changes in bone marrow are significantly associated with the stage of plasma cell disease as well as established markers of disease activity.

**CLINICAL RELEVANCE/APPLICATION**

Considering nearly riskless application and non-invasiveness of wb-MRI its future application in the prognostic evaluation of MM and its asymptomatic precursors MGUS and SMM is promising.

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**SSK14-09 • Whole-body MRI for Diagnosing Multiple Myeloma and Evaluating Treatment Efficacy**

Min Zong MD, PhD (Presenter); Dehang Wang MD; Si-Guang Zhu MD; Li-Juan Chen

**PURPOSE**

To investigate the initial diagnostic value and treatment efficacy of the whole-body MRI for Multiple Myeloma.

**METHOD AND MATERIALS**

Forty-seven Multiple Myeloma patients confirmed with histopathology were enrolled in the study. All patients underwent whole-body MRI before chemotherapy, and follow up scan at 3 and 6 months after the first and second rounds of chemotherapy treatment, respectively. The lesions found by whole-body MRI of each patient were counted at different time points and compared by one-way ANOVA statistical analysis.

**RESULTS**

Five imaging patterns were identified on whole-body MRI, which were smoldering type (5 patients), diffuse type (7 patients), focal type...
A retrospective review of patients receiving RFA as a treatment for metastatic osseous lesions using the STAR System between March

**METHOD AND MATERIALS**

Thirty-six consecutive patients (51-82 years) with vertebral localization of multiple myeloma were included in the study and randomly divided into two groups: 18 patients (Group A) that underwent radiofrequency ablation and then vertebroplasty and 18 patients (Group B) that underwent only vertebroplasty. Primary endpoints were technical success and pain relief score rate measured by the visual analogue pain scores (VAS) and Roland-Morris Questionnaire (RMQ); secondary endpoint was the amount of administered analgesia. Survival and complications were compared between the two groups.

**RESULTS**

Technical success was 100% in both groups. The VAS score (at 24h and 6-weeks post procedure) decreased in equal manner for both groups from a mean of 9.1 to 3.4 and 2.0 for Group A and from a mean of 9.3 to 3.0 and 2.3 for Group B without statistically significant difference. RMQ mean score prior to the procedure was 19.8 for Group A and 19.9 for Group B and decreased to a mean of 9.6 and 8.2 for Group A and 9.5 and 8.7 for Group B at 24h and 6-weeks post procedure respectively. The amount of medication was equally decreased in the two groups. No major complication occurred and two patients died from other causes.

**CONCLUSION**

The use of percutaneous vertebroplasty alone appears to be effective on the pain management of the patients with vertebral involvement of multiple myeloma. The use of radiofrequency ablation does not offer any clear added benefit on the mid-term pain management of such patients.

**CLINICAL RELEVANCE/APPLICATION**

Vertebroplasty alone is a suitable choice as pain treatment for vertebral localization of myeloma.

**LL-MKS-WEA** • A Preliminary T2 Mapping MRI Study of How Anterior Lumbar Fusion Accelerates Adjacent Segment Degeneration in the Intervertebral Disc Anterior Anulus Fibrosus of Adjacent Segments

**Hajimu Goto** MD, PhD (Presenter); **Yuki Iwama** MD; **Kenichiro Kakutani** MD, PhD; **Kotaro Nishida** MD, PhD; **Nobukazu Aoyama** RT; **Masahiko Fujii** MD; **Kazuro Sugimura** MD, PhD *

**PURPOSE**

To investigate the early stages of alteration of adjacent discs both above and below the affected segment after posterior lumbar fusion, and to demonstrate the potential benefits of biochemical magnetic resonance imaging (MRI) T2 mapping of intervertebral discs with regards to detection of the early stages of degenerative disc disease.

**METHOD AND MATERIALS**

From March 2010 to April 2013, 25 patients (22 female and 3 male) with a mean age of 68.2 years (range, 54-83 years) who underwent posterior lumbar fusion were included in this study. The patients underwent follow-up MRI for over two years. In total, MRIs of over 300 discs were evaluated: one disc in an adjacent segment above an affected lumbar disc, and one disc in an adjacent segment below an affected lumbar disc at each follow-up point. For two upper vertebrae, one disc was selected as a control disc. Selected discs were divided into three parts: anterior anulus fibrosus (AF), posterior AF, and nucleus pulposus (NP). One-Way Repeated-Measures ANOVA and post-hoc tests according to the Tukey test were performed to evaluate the significance of the variation in T2 mapping between 3-months, 1-year, and 2-years of follow-up. A p value of less than 0.05 was considered statistically significant.

**RESULTS**

After posterior lumbar fusion, adjacent segment disc T2 values decreased mainly in the anterior AF. The adjacent segment above the affected fused disc had a significantly larger degree of decrease in T2 values compared to below the affected fused disc. There was no significant relationship between T2 values and degree of fusion and the number of fused discs.

**CONCLUSION**

Adjacent segment disc degeneration may be caused by altered lumbar biomechanics, which occurs in the anterior AF after lumbar fusion. T2 mapping can be used to detect early stages of alteration in adjacent discs after posterior vertebral fusion.

**CLINICAL RELEVANCE/APPLICATION**

Clarification of the factors that effect ASD could be used to select patients who would benefit from operative therapy and to show the benefits of T2 mapping for understanding early disc degeneration.

**LL-MKS-WE3A** • Treatment of Metastatic Osseous Lesions with a Bipolar Navigational Radiofrequency Ablation Device: Retrospective Study

**Praveen Anchala** MD (Presenter); **Winston D Irving** MD; **Michael V Friedman** MD; **Travis J Hillen** MD *; **Jack W Jennings** MD

**PURPOSE**

To report the safety and efficacy of radiofrequency ablation (RFA) of malignant spinal lesions using the STAR System which includes a navigational electrode with two active thermocouples.

**METHOD AND MATERIALS**

From March 2010 to April 2013, 25 patients (22 female and 3 male) with a mean age of 68.2 years (range, 54-83 years) who underwent posterior lumbar fusion were included in this study. The patients underwent follow-up MRI for over two years. In total, MRIs of over 300 discs were evaluated: one disc in an adjacent segment above an affected lumbar disc, and one disc in an adjacent segment below an affected lumbar disc at each follow-up point. For two upper vertebrae, one disc was selected as a control disc. Selected discs were divided into three parts: anterior anulus fibrosus (AF), posterior AF, and nucleus pulposus (NP). One-Way Repeated-Measures ANOVA and post-hoc tests according to the Tukey test were performed to evaluate the significance of the variation in T2 mapping between 3-months, 1-year, and 2-years of follow-up. A p value of less than 0.05 was considered statistically significant.

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**CONCLUSION**

Adjacent segment disc degeneration may be caused by altered lumbar biomechanics, which occurs in the anterior AF after lumbar fusion. T2 mapping can be used to detect early stages of alteration in adjacent discs after posterior vertebral fusion.

**CLINICAL RELEVANCE/APPLICATION**

Clarification of the factors that effect ASD could be used to select patients who would benefit from operative therapy and to show the benefits of T2 mapping for understanding early disc degeneration.
A retrospective review of patients receiving RFA as a treatment for metastatic osseous lesions using the STAR System between March 2012 and March 2013 was performed. A total of eighty-two metastatic lesions were identified in forty patients who underwent a total of thirty-seven procedures. Cement augmentation was performed using the same ablation cannula when required. Follow-up consisted of Visual Analogue Scales (VAS) obtained preoperatively as well as postoperatively at the one week, one month, and six month time points. Additionally, interval change in the patients' pain medications was also recorded. Postoperative imaging was used to assess stability at the treated level in cases in which it was available.

RESULTS
RFA was technically successful in all of the lesions. Our study demonstrated significant (p<0.05) benefit of RFA, with 100% technical success and no evidence of local recurrence or device migration.

CONCLUSION
The STAR System is a safe and effective device for the treatment of metastatic osseous lesions. The navigational osteotome allows the operator to steer the ablation tip to reach previously untreatable lesions. Additionally, the two thermocouples on the device allow for real-time monitoring of the peripheral ablation edge, avoiding damage to neural tissue and providing an accurate ablation cavity size. Cement can be delivered after ablation via the same working cannula. This new device allows RFA treatment of lesions that were previously considered untreatable, and also allows for the reduction of pain in lesions not controlled by systemic or radiation therapy. Prospective clinical trial is under preparation.

CLINICAL RELEVANCE/APPLICATION
Modifications within this new RFA device allows for safe and effective ablation of previously untreatable osseous metastatic lesions.

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**LL-MKS-WE5A • Magnetic Resonance Imaging Differentiation between Malignant Marrow Replacing Lesion and Benign Red Marrow Deposition of Vertebra Using T2*-corrected Fat Fraction Map Imaging Based on Three-point Dixon-VIBE Sequence**

**Yong Pyo Kim** (Presenter) ; **Sungjun Kim MD** ; **Tae Sub Chung** ; **Yaena Kim MD** ; **Munyoung Paek** ; **Choon Sik Yoon MD** ; **Young Han Lee MD** ; **Ho-Taek Song MD** ; **Jin-Suck Suh MD**

**PURPOSE**
To assess feasibility of T2*-corrected fat fraction map imaging using three-point Dixon-VIBE sequence as a tool for differentiation between malignant marrow replacing lesion and benign red marrow deposition of vertebra.

**METHOD AND MATERIALS**
From Mar. 2012 to Feb. 2013, magnetic resonance imaging was performed for consecutive 33 patients who were referred for vertebral marrow disorder assessment. Twenty two pathologically confirmed malignant marrow replacing lesions and 11 benign red marrow lesions from the patients were subjects of this study. Three sequences were applied using a 1.5-T MR imaging scanner like follows: three-point Dixon-volume interpolated breath-hold GRE sequence (VIBE) for fat fraction (FF) measurement; conventional T1 weighted imaging (T1WI); pre- and post-contrast enhanced fat-suppressed T1WI (CE). To measure fat fraction or signal intensity (SI) region of interest (ROI) was placed at the target lesions. Average measurements from consecutive three slices of the target lesions were used for data analysis. Three parameters from the measurements were obtained like follows for each lesion: FF from VIBE; LDR (lesion-disc ratio; [SI of marrow lesion / SI of disc]*100) for T1WI; CER (contrast enhancement ratio; [LDR of post-contrast T1WI-LDR of pre-contrast T1WI]*100 / LDR of pre-contrast T1WI) for CE. To evaluate diagnostic performance of the three parameters, receiver operating characteristic (ROC) curves were obtained and areas under curves (AUCs) of the parameters were compared to each other. The sensitivity and specificity at the most ideal cut off values for the parameters were obtained.

**RESULTS**
AUCs of FF, LDR, CER were 0.96, 0.83, 0.74. FF showed superior AUC than CER with statistical significance. The optimal cut-off value and the corresponding sensitivity/specificity in percentage were like follows: 16, 0.81/1 in FF; 116.2, 1/63.6 in LDR; 93.4, 0.68/0.81 in CER.

**CONCLUSION**
T2*-corrected fat fraction measurement using a three-point Dixon-VIBE sequence showed superior diagnostic performance than contrast enhanced T1WI, and it showed excellent specificity in differentiation between malignant marrow replacing lesion and benign red marrow deposition of vertebra.

**CLINICAL RELEVANCE/APPLICATION**
T2*-corrected fat fraction measurement using a three-point Dixon-VIBE sequence is expected to play an important role to differentiate benign red marrow from malignant marrow lesion.

**LL-MKS-WE6A • Do the OS Trigonum Play a Fundamental Role as a Determining Factor of Ankle Instability?**

**Sarah Marques Llano** (Presenter) ; **Hector Vidal Trueba** ; **Javier Arnaiz Garcia MD** ; **Andres Garcia Gamez** ; **Tatiana Piedra Velasco MD** ; **Alex A Thompson** ; **Ana Canga MD**

**PURPOSE**
The purpose of this work is to analyze the role of the os trigonum as a determining factor in ankle instability.

**METHOD AND MATERIALS**
Retrospective analysis of 34 anke MRIs of patients presenting chronic ankle instability from January 2011 until December 2012. Of the patients studied, 91.2% had MRI signs of chronic ankle instability such as: sinus tarsi syndrome, flexor tenosynovitis and focal synovitis.

We analyzed the prevalence of os trigonum in patients presenting chronic ankle stability with and without anterior talofibular fascicle.

**RESULTS**
Of the 34 patients, 11 have an os trigonum (32%) (compared to 7-8% of prevalence in the normal population). If we classify by gender, the prevalence of os trigonum reaches a 40.9% of men with chronic instability in terms of age, the average age in men with chronic instability and os trigonum is 35.6 years vs. 41 years in the overall and 59.5 years in women. The patients studied with chronic instability have a 70.5% of breakage of the anterior talofibular fascicle. 36% of patients with chronic ankle instability and ruptured anterior talo-fibular fascicle have os trigonum. 77.7% of patients with chronic ankle instability and intact anterior talo-fibular fascicle have os trigonum. If we separate by gender, the prevalence of os trigonum, without injury to the anterior talar peroneal fascicle, in males, reaches a 83%.

**CONCLUSION**
With the results of this study, we conclude that the os trigonum plays a fundamental role in chronic ankle instability and acute instability that injuries the anterior talofibular ligament.

**CLINICAL RELEVANCE/APPLICATION**
Understanding the role of os trigonum in acute and chronic ankle instability can allow a better diagnostic characterization of the ankle MRI examination and open new therapeutic options and techniques.

**LL-MKE-WE7A • Ultrasound in Ulnar Collateral Injuries of the Thumb-Are We Getting It Right?**

**Rakesh Gadvi MBBS, FRCR (Presenter) ; Surabhi Choudhary MD, FRCR ; Rajive Jose**

**PURPOSE**
- Ulnar collateral ligament (UCL) injuries of the thumb are frequently encountered by sports physicians and orthopaedic/hand surgeons.
- It is caused by an abduction/hyperextension injury to the metacarpophalangeal joint of thumb, often associated with skiing

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*Note: The text is not complete as it seems to be cut off or incomplete in some sections.*
While partial ligament injuries may heal with conservative treatment, a complete UCL rupture will need operative repair due to interposition of adductor aponeurosis (Stener lesion).

Ultrasound (US) is increasingly used in conjunction with clinical examination in assessment of the ligament and has been reported in literature as having high sensitivity and specificity in the diagnosis of complete UCL tears.

We report findings of an audit on diagnostic performance of US in characterising UCL injuries and also revisit the role of high resolution US in this subgroup of hand injuries.

Whilst previous studies have assessed US in complete ulnar collateral ligament tears, authors in the present study attempt to elucidate the role of US in surgical decision making in the entire spectrum of thumb UCL injuries, with emphasis on technique and common pitfalls.

METHODS

- Retrospective data was collected on all US examinations of the thumb for suspected UCL injuries from Jan 2010 to Sept 2012 using radiology information system (RIS).
- Findings on clinical examination and US were recorded. Clinical notes and operative findings in these patients from hand clinic were accessed from the online clinical portal system.
- In surgically explored patients, operative findings were used as a gold standard. In patients who were conservatively managed, follow up clinic letters documenting stability of metacarpophalangeal joint on stress testing was used as gold standard for undisplaced tears.
- Data was also collected on date and mechanism of injury, date of attendance to Accident and Emergency, mode of referral to Hand Unit (through AandE, General Practice or external referral from another hospital), date when the patient was seen for the first time in hand clinic and date when US was requested.

Parameters analysed were:
1. Sensitivity, specificity, positive and negative predictive value of US in UCL injuries in conservatively managed and surgically treated patients.
2. Average interval from Casualty attendance (if relevant) to hand clinic
3. Average interval from US request to US date

RESULTS

- 45 patients were included in the study (21 males; 24 females).
- 25 (56%) of these patients were referred to hand clinic from casualty, 2 (4%) were referred from general practitioners and 18 (40%) were external patients referred from other hospitals in the region.
- Patients referred from casualty were seen in hand clinic in an average of 12.7 days following their attendance.
- The average wait for an ultrasound scan following request from hand clinic was 14.7 days. 12 (27%) were treated surgically and 33 (73%) were treated conservatively.
- US findings correlated with clinical examination in 94% (31 out of 33 pts) in the conservative group.
- In one patient, US reported complete tear of the UCL at MCP joint but clinically it was felt that UCL was intact and patient was treated conservatively resulting in satisfactory outcome. In the second patient, US reported as majority of UCL being intact with only a small tear of the volar deep fibres at its distal insertion (<20% of the ligament thickness). However, clinically the UCL was thought to have complete rupture. Patient was managed conservatively with resolution of symptoms, suggesting good correlation with US.
- US reported 6 stener lesions (out of 45 pts) of which 5 had surgical exploration which confirmed US findings.
- 1 patient with stener lesion on US opted for conservative management, although clinical examination also suggested complete rupture of the ligament.
- The positive predictive value (PPV) of US for displaced UCL tears (n=5) was 80%, 1 patient showing partial tear at surgical exploration when US suggested a displaced tear.
- The negative predictive value (NPV) for surgically explored patients (n=7) was 100%.
- Overall, accuracy of US was 89% in patients with UCL injuries including both conservatively and surgically treated patients.

CONCLUSION
US is useful in investigation in UCL injuries, with sensitivity of 100% in surgically operated patients and overall accuracy rate of nearly 90% in the entire group of surgically and conservatively managed patients.

LL-MKE-W8A • Pictorial Essay: Non-tumor Musculoskeletal Complications in Haematological Diseases

Elena Ocon MD, PhD (Presenter) ; Monica Ciguenza Sancho ; Diana M Castano Palacio ; Monica Caba Cuevas ; Irene Zabala Martin-Gil ; Nieves Gomez Leon MD ; Luz Parra

PURPOSE/AIM
To illustrate the imaging spectrum of musculoskeletal complications in haematological diseases.
To assess key findings to differentiate tumour involvement from musculoskeletal complications related to treatment with magnetic resonance (MR) and computed tomography (CT).

CONTENT ORGANIZATION
Our aim is to show a wide spectrum of musculoskeletal abnormalities in haematological patients treated with chemotherapy and / or radiotherapy.
Patients with a diagnosis of lymphoma, leukaemia or multiple myeloma in treatment may suffer complications mainly due to immunosuppression, osteoporosis or avascular necrosis. It is important to differentiate these disorders from disease progression in order to choose appropriate therapy.
We show the CT and MR features of septic disorders (cellulitis, pyomyositis, osteomyelitis and spondylodiscitis), avascular necrosis and insufficiency fractures, and the differential diagnosis with tumour involvement.

SUMMARY
CT and MR play an important role in the management of musculoskeletal complications of haematological diseases in which accurate diagnosis is essential for an adequate treatment.

**Musculoskeletal - Wednesday Posters and Exhibits (12:45pm - 1:15pm)**

**Wednesday, 12:45 PM - 01:15 PM • Lakeside Learning Center**

**LL-MKS-Web • AMA PRA Category 1 Credit ™: 0.5**

**LL-MKS-WE1B • Effect of Intravenous Contrast on Attenuation Measurements of the Lumbar Vertebrae on Clinical CT: Application to Bone Density Assessment**
There is increasing interest in the use of clinical CT exams as a tool to assess bone density. Our purpose was to evaluate the effect of intravenous contrast on attenuation measurements in the lumbar vertebrae.

METHOD AND MATERIALS
Subjects were 200 patients (133 male, age 67 ± 11.7, range 30-97) undergoing unenhanced and multiple-phase contrast-enhanced abdominal CT exams (unenhanced, arterial, venous, and delayed acquisitions). The mean attenuation (HU) was recorded using an elliptical ROI placed over the trabecular bone of L1, L2, and L3 in a standardized fashion (central sagittal image of intended vertebrae). Mean attenuation was also measured in a 1 cm diameter ROI within the aorta at the level of the SMA take-off. Corrected vertebral attenuation enhancement calculations were calculated by multiplying an adjustment factor, 250 HU/measured aortic HU (where 250 HU is considered standard attenuation of the arterial phase aorta). The correlation between arterial aorta and lumbar vertebrae attenuation values and the association of patient age/gender with attenuation values was assessed.

RESULTS
The absolute change in vertebral attenuation (compared to unenhanced) was 8 ± 8.6, 19 ± 8.8, and 7 ± 6.9 for the arterial, venous, and delayed acquisitions, respectively. The percent change in vertebral attenuation (compared to the unenhanced) was 8 ± 10.4, 18.7 ± 16.8, and 7.2 ± 9.7 for the arterial, venous, and delayed acquisitions, respectively. The corrected percent change in vertebral attenuation was 7.1 ± 9.4 for the arterial, 16 ± 14.8, and 6 ± 9 for the arterial, venous, and delayed acquisitions, respectively. Both absolute and percentage change in vertebral attenuation values were poorly correlated with the aortic attenuation value (r= 0.15-0.17). Increased patient age trended toward greater enhancement on delayed phase acquisition (p=0.12, Fisher's Exact Test).

CONCLUSION
Administration of intravenous contrast is associated with only a modest increase in vertebral attenuation independent of attenuation values in the aorta.

CLINICAL RELEVANCE/APPLICATION
Contrast-enhanced clinical CT examinations may be suitable for bone density assessment. Further investigation is needed to fully characterize the effect of contrast on vertebral attenuation values.

LL-MKS-WE4B • A Comparison of the Two Diagnostic Accuracy between the Use of Two Different Bone Biopsy Systems
Gunhild E Aandal MD (Presenter); Ronald D Novak PhD; Salim E Abbad MD; Christos Kosmas MD; Mark R Robbin MD

PURPOSE
Two of the most common bone biopsy systems used in CT guided bone biopsy procedures are Laurane Bone Biopsy Kit and Bonopty Bone Biopsy Kit. In our department, we changed from using the Bonopy system to using the Laurane system in October 2008. The Laurane system was considered by our MSK radiologists to be both technically easier to use and appeared to generate larger osseous sample cores. The purpose of this study was to compare the two systems to determine which provided the best accuracy compared to the final clinical diagnosis.

METHOD AND MATERIALS
This retrospective study was a review of bone biopsies performed in which the Laurane Biopsy Kit was used in 88 consecutive patients and the Bonopty Biopsy Kit was used in 93 consecutive patients. The Laurane cohort consisted of 58% females and 42% males with a mean age of 60.8 years (median = 62.4 years). The Bonopty cohort consisted of 64% females and 36% males with a mean age of 62.9 years (median = 64.4 years). All biopsies were core samples from suspected neoplasms. Spine biopsies for evaluation of discitis/osteomyelitis were excluded from this study. Differences in proportions of accurate diagnoses were measured using the Chi-Square differences in proportions test. P-values less than 0.05 were considered to be significant.

RESULTS
A comparison of diagnostic accuracy derived from Laurane and Bonopty samples was not found to be statistically significantly different, 87.5%(Laurane) vs 79.6%(Bonopty), p=0.212. Retrospective review of pathology reports showed there was no significant difference in sample quality provided to pathology when the two biopsy systems were compared (p=0.455). Lesion location and prevalence of malignant versus benign disease were also not significantly different between the two patient cohorts.

CONCLUSION
The results of this pilot study suggest that there is no statistically significant difference in diagnostic accuracy of core samples derived from osseous lesions using either of the bone biopsy systems. Other factors (cost, availability, convenience, etc.) may be considered in the determination of which bone biopsy system to be used.

CLINICAL RELEVANCE/APPLICATION
A comparison of two commercially available bone biopsy systems did not demonstrate significantly different diagnostic accuracy, exempting accuracy as a criterion for either purchase and/or utilization.
**Clinical Relevance/Application**
Radiographic changes in femoral and tibial enchondromas after total knee arthroplasty may result from surgical technique. Awareness of this phenomenon may help avoid confusion with malignancy.

**LL-MKS-WE5B • The Value of T2 Color Maps in the Patellar Cartilage Grading Injury**

*Shao Wu Wang* (Presenter); *Qian Cui*; *Yue Dong*; *Shaowei Zheng*; *Qingwei Song* BS, BEng

**Purpose**
To investigate the value of T2 color maps in assessment of patellar cartilage injury grading.

**Method and Materials**
62 patients who underwent knee MR and arthroscopic surgery patients were collected, including 32 males and 30 females, aged 30-51 years, mean 40.7 years. GE Company Signa3.0T MR was used. The scan sequence include: FSE-T1WI, FSE-T2WI, FS-FSE-PDWI and T2 mapping. T2 mapping images were sent to the GE-ADW 4.3 workstation to generate T2 color maps of patellar cartilage. Arthroscopic patellar cartilage grading standards, to explore T2 color maps value of the patellar cartilage grading injury.

**Results**
T2 color maps would be reliable in classification of patellar cartilage damage assessment.

**Clinical Relevance/Application**

**LL-MKS-WE6B • Diagnostic Value of MRI with Diffusion Weighted Images for Evaluation of the Treatment Response of Bone Marrow Lesions, in Patients with Multiple Myeloma (MM)**

*Fabrizio Mazzamurro* MD (Presenter); *Francesca Maccioni* MD; *Carlo De Felice* MD; *Najwa Al Ansari* MD; *Pietro Guerrisi* MD; *Carlo Catalano* MD

**Purpose**
The aim of this preliminary study is to prospectively evaluate the diagnostic potential of single-shot echo-planar imaging sequences (diffusion-weighted imaging (DWI)), T1-weighted spin-echo (T1w-SE) and T2 short inversion time inversion-recovery (T2w-STIR) for evaluation of the treatment response of bone marrow lesions, in patients with Multiple Myeloma (MM).

**Method and Materials**
Ten patients (4 females, 6 males, median age 61 yo) with a known diagnosis of MM were included. All patients were treated with chemotherapy and stem cell transplantation and underwent bone marrow biopsy. All examinations were performed on a 1.5 T MRI scanner (Magnet, Avanto, Siemens), before and after treatment. DWI sequences (b values of 0 and 800 s/mm2), T1-w SE sequences and T2w STIR images were available for all patients. Signal intensity and apparent diffusion coefficients (ADC) were analyzed for all lesions detected in the spine or in pelvis.

**Results**
A significant difference (p< 0.01) in T2w-STIR, DWI and ADC measurements was observed between the examinations performed before and after treatment: signal intensity was higher for lesions in remission and without plasma cells infiltration after treatment. T1w-TSE did not provide significant (p> 0.01) variation of signal intensity between the lesions pre- and post treatment.

**Conclusion**
T2w-STIR and DWI with ADC measurements are powerful techniques for evaluating treatment response in pts with MM.

**Clinical Relevance/Application**
T2w-STIR and DWI with ADC measurements are powerful techniques for evaluating treatment response in pts with MM.

**LL-MKE-WE7B • Demystifying Injuries of the Thumb and Fingers: Anatomic Characterization at 11.7T with Demonstration of Commonly Encountered Pathology Using Clinical MR Protocols at 1.5 and 3.0T**

*Cosette M Stahl* DO (Presenter); *Eric Y Chang* MD; *Paul A DiCamillo* MD, PhD; *Sheronda Statum*; *Graeme M Bydder* MBChB *; *Christine B Chung* MD

**Purpose/Aim**
The purpose of this study is to define the anatomy of the metacarpophalangeal and interphalangeal joints of the thumb and fingers with images obtained using an 11.7T MR scanner. Commonly encountered pathologic lesions involving these joints will be depicted with clinical protocols at 1.5 and 3.0T, emphasizing diagnostic criteria.

**Content Organization**
The anatomy and structure of the thumb and fingers will be profiled using high resolution MR imaging at 11.7T in human cadaveric donors. Commonly encountered pathologic lesions will then be demonstrated and characterized, reviewing diagnostic criteria and pertinent grading systems. Lesions will include commonly encountered injuries such as collateral ligament injuries, pseudo-Stener lesions, sagittal band injuries, central slip extensor tendon tears, pulley lesions, and Boutonniere and pseudo-Boutonniere deformities.

**Summary**
Review of the complex anatomic structures of the thumb and fingers with high resolution imaging will further ameliorate the radiologist's understanding of pathologic lesions and injury involving those joints.

**LL-MKE-WE8B • The Spring in Your Step: High Resolution 3T MRI of the Spring Ligament**

*Hythem A Omar* MD; *Mina F Hanna* MBCh (Presenter); *Lena A Omar* MD; *Daniel S Moore* MD; *Gina Cho Sims* MD; *George Liu*; *Avneesh Chhabra* MD *

**Purpose/Aim**
1. Review the normal high resolution 3T MR appearance of the various components of the spring ligament of the ankle, with an emphasis on those components critical to stability.
2. Identify/generate the MR appearance of injury to the various components of the spring ligament including frequently associated ligament/tendon injuries and related syndromes.
3. Discuss the current treatments of spring ligament injury.

**Content Organization**
1. High resolution 3T MR imaging of the various components of the spring ligament
   - Sample cases with pointers to help identify normal components
2. MR/intraoperative imaging of spring ligament injury
   - Sample cases
   - Associated ligament/tendon injuries
   - Associated syndromes
3. Treatment algorithm
SUMMARY
The spring ligament is a complex support structure of the foot and ankle. High resolution 3T MR imaging has enabled superb visualization. Understanding the anatomy and associated injuries/syndromes is critical for the radiologist, as is knowing which components are the most important from a clinical point of view.

ASRT@RSNA 2013: Musculoskeletal Imaging: New Ways to Image the Same Old Bones

Wednesday, 01:00 PM - 02:00 PM • N230

MSRT41 • AMA PRA Category 1 Credit ™:1 • ARRT Category A+ Credit:1
Jordan B Renner , MD

LEARNING OBJECTIVES
At the end of this presentation, participants should have a better appreciation of challenges facing conventional radiography. They should also understand new approaches to image orthopaedic implants using computed tomography and magnetic resonance imaging. They will also appreciate the importance of newer approaches to the evaluation of articular cartilage.

ABSTRACT
Since the discovery of the x-ray almost 120 years ago, musculoskeletal imaging, like all of radiology, has evolved. As new technologies were introduced and their roles delineated, most imaging modalities were employed in musculoskeletal imaging, at least temporarily. Many of the currently-popular and important technologies are of relatively recent origin, whereas others have been important in musculoskeletal imaging since the beginning of radiology, and still others have been abandoned. Because of its central importance in musculoskeletal imaging, the role of conventional radiography and some of the challenges it faces will be presented. Recent and ongoing work has focused on the use of cross sectional imaging of orthopaedic implants and on decreasing imaging artifacts arising from these implants. Efforts to improve imaging of these implants with both CT and MRI will be discussed. This presentation will also focus on the imaging of articular cartilage and on efforts to apply information about the health of articular cartilage in ongoing research in osteoarthritis.

ISP: Musculoskeletal (Ankle/Foot)

Wednesday, 03:00 PM - 04:00 PM • E450A

SSM13 • AMA PRA Category 1 Credit ™:1 • ARRT Category A+ Credit:1
Moderator
Corrie M Yablon , MD
Moderator
Donald J Flemming , MD *

SSM13-01 • Musculoskeletal Keynote Speaker: New Developments in Foot and Ankle Imaging
Corrie M Yablon MD (Presenter)

SSM13-02 • Do Conventional MRI, Ultrasound, Ultrashort-TE MRI, and Compressive Elastography Overestimate Achilles Tendinosis? A Cadaver Study with Histologic Correlation
Aubrey J Slaughter MD (Presenter) ; Michael L Loftus MD, MBA ; Theodore T Miller MD ; Matthew F Koff PhD * ; Giorgio Perino MD ; Parina Shah

PURPOSE
Ultrashort TE (UTE) MRI and compressive elastography (CE) have the potential to identify subtle tendon pathology before conventional MRI and ultrasound (US). Our purpose was to determine if UTE and CE would overestimate collagen disorganization and lead to false positive imaging.

METHOD AND MATERIALS
A pilot study utilizing five fresh-frozen human cadaveric legs was performed (mean age 71.4 years, range 65-76 years). Each specimen underwent conventional 3T MRI, UTE 3T MRI, conventional US, and CE at five standardized levels along the Achilles tendons. Conventional MR images were graded according to Lohman et al: grade 0 (normal signal), grade 1 (punctate hyperintensities), and grade 2 (larger hyperintensities), and T2* values from 2D UTE imaging were calculated from a multi-echo acquisition. Conventional US images were graded according to Archambault et al: grade 1 (normal tendon with parallel margins and homogenous echotexture), grade 2 (enlarged tendon), and grade 3 (hypoechoic area with or without tendon enlargement). CE images were evaluated per an experimentally proven color grading system (hardest tissues are blue to green and softest tissues are red), and by measuring peak strain ratios. The Achilles tendons were harvested and underwent both gross and histologic examination.

RESULTS
All five Achilles tendon specimens demonstrated normal imaging and quantitative characteristics at all five levels on conventional MRI, UTE MRI, conventional US, and CE without abnormal results from either UTE or CE. Sonoelastography strain ratios demonstrated an average mean strain ratio of 0.14 (range 0.13-0.18), and a mean T2* value of 7ms (range 5.98ms). No evidence of tendinosis was identified at gross pathologic or histologic examination.

CONCLUSION
Conventional MRI, UTE MRI, conventional US and CE did not overestimate disease in this sample of specimens without pathology.

CLINICAL RELEVANCE/APPLICATION
This pilot study established a baseline of normative data to support the next study phase in which we will evaluate UTE and CE in Achilles tendons with chemically-induced collagen disruption.

SSM13-03 • 3D Printing in the Pre-operative Assessment of Subtalar Coalitions Compared to 2-D and 3-D CT Datasets
Zbigniew Starosolski PhD (Presenter) ; J. H Kan MD ; Scott B Rosenfeld MD ; Ananth Annapragada PhD *

PURPOSE
3D printing is an emerging technology that can be used to generate physical models of 3D images. It has promise for treatment planning as well as patient education. The purpose of this paper is to explore its use in the preoperative phase for subtalar coalitions. In patients with subtalar coalitions, a 50% area threshold is used to decide between surgical arthrodesis and coalition resection. We tested if 3D prints based on a CT dataset correctly displays the CT dataset and the degree of subtalar coalition joint involvement.

METHOD AND MATERIALS
Anonymized CT images of the hindfoot from 12 patients ages 8-17 (who had been previously diagnosed with subtalar coalition based on those images) were used to segment the calcaneus and talus for 3D printing. The area of coalition was estimated in 4 ways: (1) a _}
CONCLUSION

RESULTS

CLINICAL RELEVANCE/APPLICATION

SSM13-04  •  Lateral Ligament Injury of the Ankle: Value of Additional Oblique MR Image Plane with Arthroscopic Correlation

Ji Eun Lee MD (Presenter) ; Jang Gyu Cha MD ; Hyun Joo Kim MD ; Young Koo Lee ; Jai Soung Park ; Eun Hye Lee MD ; Heon Lee

PURPOSE

To determine whether the additional oblique coronal and axial MR imaging planes play a valuable role in assessing the anterior tibiofibular(ATIFL) and anterior talofibular(ATFL) ligament injuries.

METHOD AND MATERIALS

Data was collected retrospectively for 25 patients (M:F= 13:12) with lateral ankle injury who underwent 3T MR imaging for diagnosis of ATIFL and ATFL injuries. MR was performed in both standard three orthogonal planes and in additional coronal and axial oblique planes with 1mm thickness. Features of ligament injuries were each subdivided into two groups (ATIFL: normal/abnormal, ATFL: partial tear/complete tear). Ligaments were first reviewed with routine MR imaging planes only, and then with additional oblique MR imaging planes. Arthroscopic result was considered as the standard of reference. Two musculoskeletal radiologists independently reviewed the MR images. Descriptive statistics were performed and receiver operating characteristic(ROC) curve analysis was used to compare the improvement of diagnostic performance in using additional oblique MR imaging planes.

RESULTS

When imaging diagnosis of ATIFL injury was based on routine MR images only, the diagnosis was made with a sensitivity of 40%, and a specificity of 60-67%. With additional oblique MR imaging planes, the sensitivity and specificity increased up to 90% and 60-80%, respectively. Area under the curve(AUC) values showed significant difference (p<0.05). The interobserver agreement(?) regarding injury of the ATIFL and ATFL were good to excellent in both the routine and additional oblique imaging planes (0.66-0.88) except in evaluation of ATFL in routine MR images (0.43)

CONCLUSION

Using additional oblique MR imaging planes in patients with lateral ligament injury of the ankle can significantly improve the sensitivity and specificity in diagnosing ATIFL injury.

CLINICAL RELEVANCE/APPLICATION

Using additional oblique MR imaging planes provides better diagnostic performance, leading to optimal management for ankle injuries.

SSM13-05  •  Magnetic Resonance Microscopy of the Tendons, Pulleys, and Plantar Plates of the Toes at 11.7T

Paul A DiCamillo MD, PhD (Presenter) ; Sheronda Statum ; Christine B Chung MD ; Graeme M Bydder MBChB *

PURPOSE

MR studies of the anatomy of the tendons, pulleys and plantar plates of the toes have been performed with clinical systems at field strengths up to 3T. In this study we used a high performance small bore 11.7T system to study the anatomy of the toes in detail.

METHOD AND MATERIALS

Following institutional policy human cadaveric great and lesser toes were collected and imaged with a 11.7T Bruker BioSpec 117/16USR system (Bruker BioSpin, Billerica, MA) fitted with a 750 mT/m gradient system, using resonators (60 and 72mm internal diameter) with and without receive-only four element semi-circular surface array coils. Both spin echo (80x80x400um resolution, TE 7-14ms, TR 5000ms, 2 echoes, fat sat, NEX 5-15, 4-6 hour scans) and gradient echo (90-150um isotropic resolution, TE 6ms, TR 25ms, fat sat, NEX 9-25, 4-6 hour scans) images were acquired.

RESULTS

Unprecedented spatial resolution and contrast was achieved, with well over 20 times greater spatial resolution than previous reported in anatomic studies using clinical systems. Our acquisitions parameters reversed the typical contrast pattern of previous non-fat saturated studies. Tendons, pulleys, and plates had a high signal relative to the saturated fat. Flexor tendons, extensor apparatus, annular and cruciate pulleys as well as the fiber plates within the planes were well seen.

CONCLUSION

Use of a high performance 11.7T system allow detailed anatomic imaging of the tendons, pulleys and plates of the toes at a level that has not previously been described. These results are likely to help in the recognition of injury and disease of the tendons, pulleys and plates of the toes as stronger field strengths become clinically available.

CLINICAL RELEVANCE/APPLICATION

High resolution 11.7T anatomic images of the tendons, pulleys and plates of the toes were acquired. These results may indicate what will be achievable on higher field clinical systems.

SSM13-06  •  Early Detection of Tendinopathy and Chondropathy in Patients with Diabetes Mellitus Type I by Means of Quantitative Sodium Imaging at 7 Tesla MRI

Wolfgang Markl MD (Presenter) ; Veronika Schof ; Stefan Zbyn ; Manuela Karner ; Bernhard Ludvik MD ; Siegfried Trattnig MD

PURPOSE

The purpose of this study was to investigate possible biochemical alterations of tendons and cartilage caused by diabetes mellitus (DM) Type 1 using quantitative in vivo sodium imaging at 7 Tesla.

METHOD AND MATERIALS

Eight patients (4f/4m, mean age 43a, SD 16,9a) with established diagnosis of DM Type 1 and no history of knee trauma were examined on a 7 Tesla whole body MR with a dedicated knee coil and compared with nine healthy volunteers. Controls were age and weight matched (3f/6m, mean age 40a, SD 17,2a). In all patients and volunteers axial, sagittal and coronal proton-density sequences were obtained for morphological diagnosis and localization of anatomical sites for Region of interest (ROI) analysis. For sodium imaging an optimized GRE sequence with variable TE was used and sodium-signal intensity was measured. Region of interest (ROI) analysis was performed manually for the femoral condyle cartilage layers and the patella tendon. Mean sodium intensity values were compared between both groups using the analysis of variance.

RESULTS

CONCLUSION
The preliminary data suggest that, although cartilage and tendons in patients with DM Type 1 appear morphologically intact, changes in the glycosaminoglycan content have already occurred. Thus, sodium imaging seems to be a promising noninvasive approach for early detection of tendinopathy and chondropathy in patients suffering from Diabetes mellitus Type 1.

CLINICAL RELEVANCE/APPLICATION
Quantitative sodium imaging due to its higher sensitivity compared to morphological imaging may improve early detection of tendinopathy and chondropathy in patients suffering from Diabetes mellitus Type 1.

RSNA Diagnosis Live™: Neuroradiology and Musculoskeletal Radiology

Wednesday, 04:30 PM - 06:00 PM • E451A

Paul J Chang, MD *
Neety Panu, MD, FRCPC
Gregory L Katzman, MD *

LEARNING OBJECTIVES
1) The participant will be introduced to a series of radiology case studies via an interactive team game approach designed to encourage active consumption of educational content. 2) The participant will be able to use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) The attendee will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Image-guided Biopsy of the Spine (Hands-on Workshop)

Thursday, 08:30 AM - 10:00 AM • E260

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.

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.

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.

RC650F • 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.
LEARNING OBJECTIVES
1) Identify anatomic structures which can impinge or move abnormally in the hip and ankle causing pain during normal range of motion. 2) Describe the ultrasound anatomy and scanning technique for a dynamic examination of these lesions. 3) Position patients optimally for the dynamic evaluation of the hip and ankle respecting ergonomics.

ABSTRACT
This course will demonstrate standardized techniques of performing the dynamic examination of hip and ankle lesions that are only or best demonstrated dynamically. These include the snapping hip, peroneal tendon subluxation/dislocation, flexor hallucis longus impingement, and ankle ligament instability. In the first portion of the course, probe positioning will be demonstrated on a model patient with overhead projection during live scanning. In the second portion of the course, an international group of expert radiologists will assist participants in learning positioning and scanning of hip and ankle joint lesions described. An emphasis on dynamic maneuvers and ergonomic documentation of tissue dynamics will be taught. Participants will be encouraged to directly scan model patients.
184 subjects were stratified by age as follows: n=63(50-59 y.o.), 64(60-69 y.o.), 38(70-79 y.o.), 17(80-89 y.o.), 2(90-99 y.o.).
Percentage of gluteus medius tendon abnormalities were: 34.9%(50-59 y.o.), 53.9%(60-69 y.o.), 82.9%(70-79 y.o.), 73.5%(80-89 y.o.), 100%(90-99 y.o.).
For the gluteus medius, tendinosis accounted for 68.2% of tendon pathology in 50-59 y.o., low grade tears accounted for 42.0% in 60-69 y.o., and high grade tears accounted for 17.5% in 70-79 y.o.. Average gluteus medius atrophy scores were as follows: 0.3(50-59 y.o.), 0.6(60-69 y.o.), 1.2(70-79 y.o.), 1.6(80-89 y.o.), and 3.0(90-99 y.o.). Percentage of gluteus minimus tendon abnormalities were: 30.2%(50-59 y.o.), 50.0%(60-69 y.o.), 86.8%(70-79 y.o.), 79.4%(80-89 y.o.), and 100%(90-99 y.o.).
For the gluteus minimus, tendinosis accounted for 73.7% of tendon pathology in 50-59 y.o., low grade tears accounted for 53.1% in 60-69 y.o., and high grade tears accounted for 7.6% in 70-79 y.o.. Average gluteus minimus atrophy scores were as follows: 0.4(50-59 y.o.), 0.3(60-69 y.o.), 1.7(70-79 y.o.), 2.4(80-89 y.o.), and 3.8(90-99 y.o.).

CONCLUSION
Gluteus medius and minimus tendon pathology and muscle atrophy increase with age above 50 years. There appears to be progression from tendinosis to tendon tears with advancing age with an associated progression in muscle atrophy.

CLINICAL RELEVANCE/APPLICATION
Given tendon tear may prelude atrophy and atrophy is greater in fall-related hip fractures, more aggressive therapy could be useful to prevent subsequent falls in patients with gluteus tendon tears.

VSMK51-04 • Intraarticular Hip Pathology
Kawan S Rakha MD (Presenter)

LEARNING OBJECTIVES
1) Review MRI techniques and protocols for investigating intraarticular causes of hip pain. 2) Recognize the common internal derangements of the hip joint.

ABSTRACT
VSMK51-05 • Ischiofemoral Impingement. Do You Want to Believe?

Roque Oca MD (Presenter); Raquel Prada MD; Maria Gonzalez Vazquez; Maria Costas Alvarez; Gonzalez Tardaguila de la Fuente MD; Ana Fernandez Del Valle MD; Alex Grande Astorquiza MD; Ariana C Bustos Fiore MD

PURPOSE
To find out if there are anatomic and MRI criteria to diagnose ischiofemoral impingement.

METHOD AND MATERIALS
290 MRIs of the hip were retrospectively reviewed from June 2012 to January 2013. A total of 9 ischiofemoral impingement were diagnosed and 20 normal patients were included as control.

RESULTS
Differences in ischiofemoral space, quadratus femoris space and femoral inclination angle were studied between pathological and control cases. The interobserver reliability was obtained for quantitative variables.

RESULTS
Asymmetric psoas atrophy was present in 24/109 (22%) study subjects with reader consensus but only 5/180 (2.7%) control subjects (p<0.001).

CONCLUSION
Asymmetric psoas atrophy can be accurately diagnosed following anatomic and MRI criteria.

CLINICAL RELEVANCE/APPLICATION
Being aware of it turns diagnosis faster and more accurate.

VSMK51-06 • Psoas Muscle Atrophy in Patients with Ipsilateral Groin Pain: Is there an Association with Prior Hip Surgery and Why?

Adam C Zoga MD (Presenter); George P Hobbs MD; Andrew S Chi MD, MS; Suzanne S Long MD; William C Meyers MD; William B Morrison MD *

PURPOSE
We sought to establish the incidence of unilateral or asymmetric psoas muscle atrophy in subject group with groin pain and a history of ipsilateral hip or lower abdominal surgery, and then correlate with the prevalence of psoas atrophy in a population without prior surgery.

METHOD AND MATERIALS
A database of patients with pelvic MR for hip/groin pain was queried for a history of prior hip or abdominal surgery, generating 109 subjects; demographics, surgical history, and pain situs were recorded. 2 MSK radiologists independently reviewed MR exams retrospectively for the presence and degree of psoas muscle atrophy (mild = intramuscular signal abnormality, moderate = 50% loss), atrophy within other core muscles, postsurgical lesions and native muscle, tendon or intrinsic hip injuries. A control group of 180 subjects with MR for groin pain but no history of regional surgery was reviewed for asymmetric psoas muscle atrophy. Potential causes of this phenomenon were then explored.

RESULTS
Asymmetric psoas atrophy was present in 24/109 (22%) study subjects with reader consensus but only 5/180 (2.7%) control subjects (p<0.001).

CONCLUSION
We have documented a significant incidence of asymmetric psoas muscle atrophy at MR patients with hip/groin pain after ipsilateral hip or abdominal surgery. The majority of these subjects had hip arthroscopy and preoperative MRs showed normal psoas bulk when available.

CLINICAL RELEVANCE/APPLICATION
The cause and significance of postoperative psoas atrophy warrants further investigation. Potential contributors include traction during arthroscopy, surgical exposure and periooperative trauma.

VSMK51-07 • Imaging of Sports Pubalgia

Lawrence M White MD (Presenter) *

LEARNING OBJECTIVES
1) Review the causes of acute and chronic athletic pubalgia. 2) Understand the etiologic theories as to origin of chronic athletic pubalgia.
3) Review the spectrum of imaging findings observed in the setting of athletic pubalgia. 4) Understand the value and limitations of imaging findings in guiding clinical management of patients with athletic pubalgia.

ABSTRACT
VSMK51-08 • Arthroplasties - What You Need to Know

Jonelle M Petscavage-Thomas MD, MPH (Presenter) *

LEARNING OBJECTIVES
CONCLUSION

An increase in hip abductor group atrophy grade was associated with a 2.47 (95% CI 1.09-3.85) point decrease in Oxford hip score \((p = 0.05)\). Grade 2 or higher atrophy in both abductor muscles was seen in 25 cases \( (31.25\%) \). A linear regression model showed that an increase in post-operative mass, 3=greater than 70% fatty change with 80% loss in muscle. A linear regression model was used to quantify the value of grading abductor atrophy as a predictor of hip function.

RESULTS

Osteolysis, joint effusion and synovitis were characterized on MAVRIC images with higher confidence \((p = 0.05)\). The size of metal artifacts was significantly reduced with the MAVRIC \((p = 0.05)\). MAVRIC significantly reduced metal artifacts and added important diagnostic information to standard FSE images in patients status post total hip arthroplasty, particularly, when there was concern for AVAI or oleositis.

CLINICAL RELEVANCE/APPLICATION

Multiacquisition variable-resonance image combination \((MAVRIC)\) sequence adds significant diagnostic information to evaluation of Total Hip Replacement.

VSMK51-09 • Evaluation of Metal Artifact Reduction MRI in Patients with Total Hip Arthroplasty

Lorenzo Nardo MD (Presenter) ; Roland Krug PhD ; Misung Han ; Craig Sam ; Kevin Koch PhD * ; Andrew Lai ; Pia M Jungmann MD ; Hans Liebl MD ; Ursula R Heilmeier MD ; Thomas M Link MD, PhD *

PURPOSE

The goal of our study was to assess weather adding a multiacquisition variable-resonance image combination \((MAVRIC)\) sequence to the standard hip MRI post total hip replacement \((THR)\) protocol improved the characterization of pathological findings.

METHOD AND MATERIALS

In fifty-five patients with symptoms of hip pain \( (30 \text{ males}, 25 \text{ females}, \text{aged 57-75}) \) hip MRI at 3.0 T was performed with an eight-channel phased-array cardiac coil. The sequence protocol included: MAVRIC PD \((\text{coronal})\), MAVRIC STIR \((\text{axial})\), 2D-FSE T1 \((\text{axial and coronal})\), 2D-FSE PD \((\text{axial and coronal})\), STIR fat suppression \((\text{axial and coronal})\). Each sequence was assessed by two radiologists, independently, for joint effusion and synovitis including findings of aseptic lymphocyte dominated vasculitis-associated lesions \((\text{ALVAL})\), bone marrow edema pattern, osteolysis and insertion tendinopathy at the greater trochanter using a four-point scale \((\text{absent (0), probably absent (1), present (2), present (3)})\). Furthermore the extent of the metal artifacts was measured. Wilcoxon signed rank test was used to compare the data from standard FSE sequences to data from MAVRIC sequences. Agreement between the two readers was determined by calculation of kappa values.

RESULTS

Osteolysis, joint effusion and synovitis were characterized on MAVRIC images with higher confidence \((p = 0.05)\). The size of metal artifacts was significantly reduced with the MAVRIC \((p = 0.05)\). MAVRIC significantly reduced metal artifacts and added important diagnostic information to standard FSE images in patients status post total hip arthroplasty, particularly, when there was concern for AVAI or oleositis.

CLINICAL RELEVANCE/APPLICATION

Multiacquisition variable-resonance image combination \((MAVRIC)\) sequence adds significant diagnostic information to evaluation of Total Hip Replacement.

VSMK51-10 • Metal-on-Metal Hip Complications

Christian W Pfirrmann MD, MBA (Presenter) *

LEARNING OBJECTIVES

1) To understand the causes of complications in patients with Metal-on-Metal hip implants. 2) To understand the role of imaging in the workup of patients with Metal-on-Metal hip implants. 3) To review the spectrum of imaging findings observed in the setting of Metal-on-Metal hip complications.

VSMK51-11 • Investigating the Painful Metal-on-Metal Hip Arthroplasty: Is 3DCT a Suitable Substitute for MARS MRI?

Elizabeth Robinson (Presenter) ; Shiraz Sabah BSc ; Johann Henckel MD ; Keshthra Satchithananda MBBS * ; Thomas Parsons ; Michael Khoo MRCP, FRCR ; John A Skinner MBBS ; Alister Hart MBBS

PURPOSE

To compare the imaging findings of 3DCT against the gold-standard, MARS MRI. To demonstrate the role of 3DCT and MARS MRI in the evaluation of the painful MOM hip arthroplasty.

METHOD AND MATERIALS

We conducted a cohort study to determine the diagnostic accuracy of 3-dimensional computed tomography compared with metal artifact reduction sequence MRI for detection of pathologies associated with MOM hip replacements. 20 patients with painful prostheses were consecutively recruited. MARS MRI images were acquired with a 1.5T scanner and CT images with a 64-slice scanner, according to published protocols. Imaging was reported according to objective criteria by two MSK radiologists blinded to clinical data. Soft tissue lesions, muscle atrophy, osteolysis and tendon avulsion were evaluated. Diagnostic test characteristics were calculated.

RESULTS

CONCLUSION

3DCT was an unsuitable substitute for MARS MRI to image soft tissues around MOM hips. 3DCT showed poor ability to detect pseudotumor and provided inadequate information to permit lesion classification.

3DCT was not a reliable assessment tool for muscle atrophy and provided no information on tendinous pathologies.

However, 3DCT is a useful modality for detecting periprosthetic osteolysis.

CLINICAL RELEVANCE/APPLICATION

MARS MRI should be used for the diagnosis of painful MOM hip arthroplasties. Where MARS MRI is contraindicated or unavailable 3DCT is an unsuitable substitute and other modalities should be considered.

VSMK51-12 • Post-operative Muscle Atrophy on MARS MRI: Clinical-radiological Correlation for 80 Metal-on-Metal Hips

Thomas Parsons (Presenter) ; Shiraz Sabah BSc ; Johann Henckel MD ; Elizabeth Robinson ; Michael Khoo MRCP, FRCR ; Keshthra Satchithananda MBBS * ; John A Skinner MBBS ; Alister Hart MBBS

PURPOSE

1) To assess the reliability of hip abductor muscle atrophy seen on MARS MRI as an indicator of hip function. 2) To estimate the prevalence of hip abductor muscle atrophy in a metal-on-metal hip cohort.

METHOD AND MATERIALS

179 patients \((200 \text{ hips})\) were referred to a tertiary centre with problematic metal-on-metal hip implants. 80 patients with unilateral implants, an Oxford hip score \((\text{scored 0-48})\) and a MARS MRI scan of the pelvis were retrospectively selected. Peri-prosthetic muscles were graded 0-3 using \(3DCT\) according to the Bal and Lowe system \((0=\text{normal}, 1=\text{not exceeding }30\% \text{ decrease in mass}, 2=30-70\% \text{ fatty change with decreased mass}, 3=\text{greater than }70\% \text{ fatty change with }80\% \text{ loss in muscle})\). A linear regression model was used to quantify the value of grading abductor atrophy as a predictor of hip function.

RESULTS

80 patients \((40 \text{ males}, 40 \text{ females})\) underwent primary hip surgery \((64 \text{ resurfacing}, 16 \text{ modular})\) at a median age of 54 years \((\text{range 25-83})\). All patients had a MARS MRI scan and Oxford hip score performed between December 2007 and February 2012, a median of 32 months \((\text{range 1-129})\) after primary implantation. Grade 2 or higher atrophy was observed in either gluteus medius or minimus in 35 cases \((43.75\%)\). Grade 2 or higher atrophy in both abductor muscles was seen in 25 cases \((31.25\%)\). A linear regression model showed that an increase in hip abductor group atrophy grade was associated with a 2.47 \((95\% \text{ CI }1.09-3.85)\) point decrease in Oxford hip score \((p = 0.05)\).
large unexplained variance is present and therefore makes this an unreliable method of assessing function.

CLINICAL RELEVANCE/APPLICATION
MARS MRI provides a non-invasive aid to pre-operative planning of revision surgery but should not be used as a substitute for clinical evaluation of hip function.

VSMK51-13 • Hip Tumor Imaging and Mimics

Mark J Kransdorf MD (Presenter)

LEARNING OBJECTIVES
1) Identify the common bone and soft tissue lesions in and around the hip joint. 2) Recognize the tumor and tumor-like lesions associated with hip arthroplasty. 3) Identify differentiating features.

ABSTRACT
There are a wide variety of bone and soft tissue tumors, as well as tumor-like conditions, which have a predilection for the hip. Rather than a complete review, this session will highlight the common lesions in and around the hip, emphasizing imaging and diagnosis. The imaging evaluation of a suspected tumor always begins with radiographs. For osseous lesions, radiographs can be highly specific and accurately characterize biological activity. In the assessment of suspected soft tissue lesions, they can depict characteristic calcifications or ossifications, as well as secondary osseous changes, such as remodeling or invasion. MR imaging has emerged as the preferred imaging modality for evaluating osseous and soft tissue masses of the hip by providing information for diagnosis and staging. The MR imaging signal characteristics and enhancement patterns of malignant and benign hip tumors permit specific diagnoses in the majority of cases. This presentation will review the imaging of common tumors in and around the hip, highlighting those lesions with a characteristic imaging appearance.
Fifty consecutive patients with known MM who underwent unenhanced pelvic MRIs were included in the study. Control group was composed of 50 patients with no known malignancy in the same age group. T1-W and T2-W fat suppressed axial and coronal images of the pelvis were reviewed. MRIs were reviewed for presence of marrow blood vessels (subtle, moderately prominent, and very prominent), and red marrow. MRIs of MM patients were additionally evaluated for presence or absence of focal myeloma lesions.

RESULTS
There were 18 females and 32 males. Age range of the patients was 41 to 88 (average 61). In the MM group 6 patients had very prominent and 16 patients had moderately prominent bone marrow vascularity. Two MM patients had no appreciable marrow vascularity whereas 56 of patients had subtle vascularity. Four MM patients had completely fatty marrow and the remaining 46 had mild to moderate background of red marrow. In the control group, there were no patients with very prominent or moderately prominent bone marrow vascularity. Eight cases in the control group had no marrow vascularity visualized and 42 patients had subtle vascularity seen. Six patients in the control group had completely fatty marrow and the remaining 44 had mild areas of red marrow.

CONCLUSION
Prominent bone marrow vessels are evident on MRI in patients with known MM corresponding to this well known histologically well established finding.

CLINICAL RELEVANCE/APPLICATION
In patients with an established diagnosis of MM, large marrow vessels should not be mistaken for lesions of myeloma. In the patient without known MM, the observation of large vessels in elderly patients

SSQ13-02 • Vertebral Body Enhancement in Patients with Central Venous Obstruction
Debbie L Bennett MD (Presenter) ; Frank J Simeone MD

PURPOSE
There have been isolated case reports of vertebral body marrow enhancement on contrast-enhanced CT imaging in patients with central venous obstruction. Recognition of this phenomenon is important as these regions of enhancement can be confused with sclerotic metastatic disease. The purpose of this project is to determine the incidence of marrow enhancement in patients with central venous obstruction, as we hypothesize that this is an under-recognized phenomenon. Additionally, this project identifies various patterns of enhancement that can be seen in central venous obstruction.

METHOD AND MATERIALS
Using a departmental radiology report searching program, all chest CTs performed between 1/1/2000 and 12/15/2012 which mentioned the terms 'SVC obstruction,' 'SVC syndrome,' 'superior vena cava obstruction,' 'superior vena cava syndrome,' 'venous obstruction,' or 'central venous obstruction' were identified. Each CT was reviewed by consensus to determine whether central venous obstruction was present. Of the cases with central venous obstruction, the vertebral bodies were evaluated for the presence or absence of marrow enhancement. When vertebral marrow enhancement was present, the levels involved, portion of the vertebral body involved, and pattern of enhancement were recorded.

RESULTS
There were 357 chest CT reports which mentioned central venous obstruction; of these, 53 (15%) were found to have central venous obstruction. Of the 53 patients with central venous obstruction, 25 (47%) demonstrated vertebral body enhancement. The enhancement was classified as either linear (n=9, 17%), nodular (n=9, 17%) or both (n=7, 13%). Five cases (9%) of vertebral body enhancement were reported as metastasis or concerning for metastasis.

CONCLUSION
Vertebral body marrow enhancement can be seen in patients with central venous obstruction. Two distinct patterns of marrow enhancement were identified: linear and nodular. Nodular enhancement was at times confused with metastatic disease, a misinterpretation which could result in incorrect staging of known malignancies or unnecessary procedures in patients without known malignancy. Marrow enhancement should be considered when interpreting studies with central venous obstruction.

CLINICAL RELEVANCE/APPLICATION
Patients with central venous obstruction may demonstrate cervical and/or thoracic vertebral body enhancement in a pattern which can be confused for sclerotic osseous lesions.

SSQ13-03 • Single Focal Abnormality on Spine MRI of Cancer Patients during F-up: Metastasis or Not?
Seun Ah Lee MD (Presenter) ; Min Hee Lee MD ; Sang Hoon Lee ; Hye Won Chung MD ; Myung Jin Shin MD

PURPOSE
To evaluate single focal bony abnormalities found on spine MRI of cancer patients during F-up in order to enhance diagnosis of metastasis.

METHOD AND MATERIALS
After scanning a database for patients who were diagnosed with primary cancer and received spine MRI for detecting metastasis during F-up from 2000 to 2012, 353 patients with abnormal bony lesions were identified. Those with more than two bony lesions and with unavailable pathologic confirmation were excluded. Finally, 46 patients with a single, focal bony abnormality seen on spine MRI and pathologically proven, were included. The primary cancer was from lung (15), GI tract (8), HCC (4), kidney (4), bladder (3), breast (3), cervix (2), lymphoma (2), bile duct (1), thyroid (1), osteosarcoma (1), MPNST (1), and trophoblastic tumor (1). Medical records were reviewed for pathology reports of bony lesions. MRI findings were evaluated for location (anterior or posterior element of vertebra, pelvic bone), disc involvement, margin, paravertebral soft tissue mass. Statistical significance was assessed using Fisher's exact test.

RESULTS
Of 46 bony lesions, metastasis (mets) was 27 (58.7%) cases. Non-metastasis was 19 (41.3%), including no tumor present (suggesting non-metastasis, 12), hematopoietic bone marrow (4), infection (1), radiation osteitis (1), inadequate tissue (1). On MR, margin was ill-defined in 6 (mets:4, non-mets:2), well-defined in 40 (mets:26, non-mets:14). Compared with hematopoietic marrow, ill-defined margin was found in all (4/4) hematopoietic marrow and only one (1/27) in mets, showing significant difference (p=0.05).

CONCLUSION
When a single, focal bony abnormality was detected on spine MRI of cancer patients during F-up, incidence of metastasis was greater than half, but not as high as expected. Although most MR findings may not be characteristic, margin of lesions can aid in differentiating metastasis from focal hematopoietic bone marrow.

CLINICAL RELEVANCE/APPLICATION
When a single, focal bony abnormality was detected on spine MRI of cancer patients during F-up, incidence of metastasis was greater than half, but not as high as had been expected.

SSQ13-04 • Evaluation of Lumbar Vertebral Body Using IDEAL MRI and Micro CT
Won C Bae PhD (Presenter) ; Reni Biswas ; Mark Bydder PhD * ; Koichi Masuda MD * ; Jiang Du PhD ; Christine B Chung MD ; Eric Y Chang MD ; Prema S Karunanithi

PURPOSE
To perform quantitative IDEAL MR imaging of fat content in cadaveric vertebral body of the lumbar spine and to compare the measures against reference standards of fat content as well as trabecular bone structures using micro CT analysis.
SSQ13-05 • Ultrasound Short-time-to-Echo MRI of Cartilaginous Endplates of Human Lumbar Spines In Vivo: A Feasibility Study

Won C Bae PhD (Presenter) ; Prema S Karunanithi ; Richard Znamirowski ; Sheronda Statum ; Jiang Du PhD ; Christine B Chung MD

PURPOSE
To perform morphologic MR imaging of cartilaginous endplates (CEP) of intervertebral discs (IVD) in healthy volunteers using ultrashort time-to-echo (UTE) technique.

METHOD AND MATERIALS
The lumbar spine of an asymptomatic male (29 yrs) and female (20 yrs) was imaged using a conventional fat saturated fast spin echo (FOV=26 cm, slice=3 mm, TR=3500 ms, TE=120 ms, ETL=27, matrix=384x384, scan time=4 min) and 2D UTE MR (TR=300 ms, TE=0.012 and 8.8 ms, scan time=11 min) sequences at 3T, using a clinical spine coil. UTE echo subtraction image was obtained by subtracting the 2nd echo image from the 1st echo image. Morphology of the IVD and CEP were evaluated by a board-certified radiologist.

RESULTS
In conventional T2-weighted FSE images, the nucleus pulposus (NP; Figure A, square) was seen with homogeneous high signal intensity as expected in healthy human subjects. However, the region of the CEP (Figure A, arrows) exhibited low signal intensity and could not be evaluated directly. In contrast, UTE MR image clearly showed the region with high linear signal intensity (Figure B, arrows). Our previous study on cadaveric spines (Figure C), comparing conventional MRI (Figure C-I), UTE MRI (Figure C-II) and histology (Figure C-III to -v), suggested that this UTE MR signal intensity is due to the presence of the CEP (thick uncalcified and thin calcified layers), but not the disc proper or subchondral bone. In addition, UTE MRI is able to show abnormal morphology of the CEP (Figure D-I), invisible in conventional images (Figure D-II).

CONCLUSION
Abnormal changes in histologic morphology and composition of the CEP have been found in aging IVD and certain pathology such as scoliosis. It has been difficult to evaluate the CEP adequately using MRI, due to intrinsically short T2 value of the tissue. Along with recent validation study, the present study suggests clinical feasibility of UTE MR evaluation of the CEP in vivo. Additional studies may elucidate relationship between CEP changes and disc degeneration, and back pain.

CLINICAL RELEVANCE/APPLICATION
The UTE MR technique provides sensitive and direct means of evaluating the CEP in vivo. It may be useful for early detection of CEP pathology, and understanding of pathogenesis of disc degeneration.

SSQ13-06 • Standing MRI Exaggerates the Degree of Lumbar Stenosis but Does Not Improve Correlation with Patient Symptoms

Ka Lok Lee MBChB (Presenter) ; James Griffith ; Yvonne Lau ; Defeng Wang ; Shi L Lin ; Alex Ng

PURPOSE
Only modest correlation exists between patient symptoms and supine MRI findings in lumbar degenerative disease. This study investigates whether upright MRI in the standing position improves correlation with patient symptombatology.

METHOD AND MATERIALS
Prospective study performed between January 2012 and March 2013. 49 patients (M:F=35:14, mean age of 58.2± 9.2) with clinically diagnosed lumbar spinal stenosis were examined by low field 0.25T MRI (G-Sscan, Esaote, Italy) in the supine and standing positions. Morphological changes including dural sac cross-sectional area (DSCA), grading (0-4) of lateral recess and foraminal stenosis at L3/4, L4/5 and L5/S1 levels were measured in the two positions and compared. Severity of clinical symptoms (including symptom duration, walking tolerance, walking distance, Visual Analogue Score of lumber and lower limb pain, Oswestry Disability Index and SF-16) was assessed and correlated with MRI findings.

RESULTS
Dural sac cross-sectional area (mm2) was significantly lower in the standing (L3/4: 101.7: vs 142.2, p = 0.04; L4/5: 72.3: vs 108.2, p = 0.04; L5/S1: 54.6 vs 79.4, p=0.04). The degree of lateral recess and foraminal stenosis was greater in the standing in supine (p: 0.23 to 0.42). Inter- and intraobserver agreement for dural sac cross-sectional area and grading stenosis were substantial (r: 0.61 0.73). Overall there was still only poor to mild correlation (r: 0.12 0.38) between clinical symptoms and MRI morphological changes.

CONCLUSION
MRI in the standing position increases central canal, lateral recess and foraminal stenosis. Standing MRI, did not however, increase the correlation between patient's symptoms and MR morphological changes, which remained low to modest.

CLINICAL RELEVANCE/APPLICATION
Open system 0.25T MRI allows scanning of the lumbar spine in standing position; standing MRI, did not however, increase the correlation between patient's symptoms and MR morphological changes.

SSQ13-07 • Image Quality Optimization after Spinal Fusion Surgery Using Iteratively Reconstructed Dual Energy CT High keV Monoenergetic Datasets

Holger Haubenerreissner (Presenter) ; Miriam Hahn ; Rene Schmidt ; Paul Apfaltrer MD ; Martin U Sedlmair MS ; Bernhard Schmidt PhD * ; Stefan O Schoenberg MD, PhD * ; Thomas Henzler MD

PURPOSE
To prospectively evaluate the effectiveness of high keV dual-energy CT (DECT) in combination with sinogram-affirmed iterative
Lenalidomide treatment promoted significant increases in bone strength. Mechanical properties, assessed by a CT/FEM, provided useful information about treatment response in multiple myeloma.

**RESULTS**
A total of 28 datasets were reconstructed for each patient (14 FBP, 14 IR). Image noise was significantly lower in all IR datasets when compared to the corresponding FBP datasets (p < 0.001).

**CONCLUSION**
IR of DECT raw data leads to improved objective and subjective image quality of high keV monoenergetic datasets that allow valuable metal artifact reduction in patients after spinal fusion surgery.

**CLINICAL RELEVANCE/APPLICATION**
Iteratively reconstructed DECT raw data improves image quality of calculated high keV monoenergetic CT image data potentially leading to a more accurate assessment of the postoperative spine.

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**SSQ13-08 ● Dual-energy CT in Detecting Bone Marrow Edema of Vertebral Compression Fractures**

**Aina O Venkataramy (Presenter); Jean-Claude Dosch; Stephane Kremer MD, PhD; Jean-Louis Dietemann MD; Guillaume Bierry MD, PhD**

**PURPOSE**
To prospectively evaluate the performance of virtual non-calcium (VNC) dual-energy CT (DECT) images for the demonstration of trauma-related abnormal marrow attenuation in vertebral compression fractures (VCF).

**METHOD AND MATERIALS**
Twenty patients (16 females, 4 males; age=69±14 years) presenting with benign VCF on radiographs were consecutively and prospectively included in this IRB-approved study, and underwent MR and DECT of the spine. MR examination, evaluated by an independent reader, served as reference standard for edema (acute nature of fracture) assessment. Two other independent readers visually evaluated all vertebrae for abnormal marrow attenuation (CT edema) on VNC DECT images using a binary scale; specificity, sensitivity, predictive values, intra- and inter-observer agreements were calculated. A last reader performed a quantitative evaluation of CT numbers, and cut-off values for CT edema were calculated using ROC analysis.

**RESULTS**
In the visual detection of CT edema, VNC DECT images had a sensitivity of 84%, a specificity of 97%, a PPV of 81% and a NPV of 97% compared to MR as a reference standard; intra- and inter-observer agreements were good to excellent, ranging from k= 0.74 to k= 0.90. CT numbers were significantly different between vertebrae with edema on MR and those without (p < 0.001).

**CONCLUSION**
VNC DECT images allowed an accurate demonstration of trauma-related abnormal attenuation in VCF, revealing the acute nature of the fracture.

**CLINICAL RELEVANCE/APPLICATION**
Thanks to its high sensitivity and predictive values, DECT technique can be seen as an interesting triage tool for the investigation of patients with suspected acute vertebral compression fracture.

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**SSQ13-09 ● A Longitudinal CT Study of Lenalidomide and Bortezomib Treatment for Multiple Myeloma: Trabecular Microarchitecture and Biomechanics Assessed by a CT-based Finite Element Model**

**Miyuki Takasu MD (Presenter); Yoko Kaichi; Miho Ishikawa MD; Shuji Date; Masao Kiguchi RT; Kazuo Awa MD*; Yoshiaki Kuroda; Akira Sakai**

**PURPOSE**
Lenalidomide and bortezomib have been successfully used in the treatment of multiple myeloma (MM), of which bone disease is a key feature. Bortezomib has been linked to increased bone formation and osteoblastic activity; however, the effect of lenalidomide on bones remains unknown. Therefore, in this study, trabecular microstructural analysis and biomechanics assessed by a clinical CT-based finite element model (CT/FEM) were used to investigate whether lenalidomide affects the microarchitecture of bones.

**METHOD AND MATERIALS**
Sixty-seven MM patients (male, n=37; mean age, 67.1±10 years; female, n=30; mean age, 68.6±10 years) were examined by 64-detector CT after a mean period of six months of either therapy with bortezomib- (n=33) or lenalidomide (n=19), or follow-up without treatment (n=15). Using a bone mineral calibration phantom and a 3D image analysis system, bone mineral content per tissue volume (BMC/TV), trabecular parameters, and mechanical properties of the third lumbar vertebrae were calculated. The statistical significance of the change with respect to baseline over time was assessed using a two-way analysis of variance with repeated measures. To investigate whether baseline geometric or biomechanical indices predict the subsequent response to treatment, the Spearman rank correlation test was performed for each baseline index with respect to post-treatment changes.

**RESULTS**
At the second CT examination, trabecular number, failure load and stiffness increased in the lenalidomide group (P < 0.05).

**CONCLUSION**
Lenalidomide treatment resulted in significant increases in BMC/TV, trabecular number and CT/FEM-derived estimates of bone strength, while failure load and stiffness decreased in the bortezomib group. Baseline BMC/TV and trabecular spacing predicted lenalidomide-induced bone changes.

**CLINICAL RELEVANCE/APPLICATION**
Lenalidomide treatment promoted significant increases in bone strength. Mechanical properties, assessed by a CT/FEM, provided useful information about treatment response in multiple myeloma.

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**ASRT®RSNA 2013: Elbow and Forearm Trauma: Mechanisms of Injury and Patterns of Fractures**

**Thursday, 10:40 AM - 11:40 AM ● N230**

**LEARNING OBJECTIVES**
1) Review the anatomy of the elbow joint in three dimensions. 2) Demonstrate the standard radiographic views of the elbow. 3) Discuss
techniques for performing CT of the elbow. 4) Illustrate that the forearm is a ring, and show how specific mechanism of injuries yield specific fracture patterns. 5) Teach the four keys to looking at elbow radiographs.

**ABSTRACT**

Designed for non-radiologists and radiologists alike, this course explores elbow and forearm trauma, using multicolored 3-D images as well as dynamic illustrations. After reviewing the anatomy of the elbow joint, the presentation will show how this anatomy can be optimally imaged, both radiographically and with CT. Using a model of the forearm as a ring, the lecture will demonstrate how one common mechanism, the Fall on Palm Heel (FOPH), can cause a variety of fracture patterns, depending on how the forces travel up the forearm. This model will be used to illustrate and differentiate the classic forearm fractures, including both bone forearm fracture, Monteggia, Galeazzi and Essex-Lopresti. The presentation also will focus on the elbow joint, illustrating the radiographic appearance of common elbow injuries in adults and children, including non-displaced radial head supracondylar, lateral condylar, and medial epicondylar fractures. The 4 Keys to assessing elbow radiographs are emphasized throughout the talk:

1) The radial head always points to the capitellum.
2) Fat pads are your friends.
3) The anterior humeral line passes through the middle third of the capitellum.
4) When in doubt, get the other side.

**RESULTS**

Serial follow-up ultrasonography was useful to evaluate the effect of PRP injection therapy in rotator cuff pathology. Postinjection bursal effusion was seen in 13 tendons at 1 month FU. Thickened bursa was partially improved in 4 tendons and was not changed in 3 tendons at 3 months FU. Intratendinous or intrabursal crystal formation was seen in 1 tendon at a month FU, and in 2 tendons at 3 months FU. Postinjection bursal effusion was seen in 13 tendons at 1 month FU. Thickened bursa was partially improved in 4 tendons and was not changed in 4 tendons at 3 months FU.

**CONCLUSION**

This study identifies factors predictive of UGBCI outcome.

**CLINICAL RELEVANCE/APPLICATION**

Clinicians can more accurately set patient expectations, recommend modifications to increase the probability of therapeutic success and identify those at risk for therapeutic failure.

**LL-MKS-TH2A • Serial Ultrasound Follow Up after Platelet Rich Plasma Injection Therapy in Rotator Cuff Pathology**

**Doo Hoe Ha** MD (Presenter) ; **Sang Min Lee** MD

**PURPOSE**

Platelet rich plasma (PRP) is a concentrate of platelets, obtained with centrifugation of whole blood, and contains a number of growth factors(TGF-β, PDGF, VEGF, etc). PRP has been used to enhance bone and tendon healing. In case of rotator cuff repair, additional PRP augmentation has also been used, but its effectiveness is still debated. The purpose of this study is to evaluate any change of the rotator cuff using serial ultrasound (US) follow up (FU) after isolated PRP injection therapy.

**METHOD AND MATERIALS**

Seventeen shoulder joints which were treated by PRP injection for 4 months and had serial US FU were included. Female to male ratio was 11:6, and mean age was 52.2 years. Pretreatment cuff pathologies were 15 partial thickness tears and 1 tendinosis of subscapularis tears. Missed supraspinatus or subscapularis tears d. Missed symptomatic SD/SA bursitis Negative factors for injection success: 1. >50 YO 2. Overhead throwing athletes 3. Diabetes, arthritis, infection or arthrofibrosis 4. >1 surgery to same shoulder 5. Females 6. No PT 7. Concomitant GIRD, shoulder impingement, SLAP, tendon tear or arthrofibrosis 5. NSI: a. High-grade partial LH tendon tears b. LH tendon subluxations/dislocations c. Missed supraspinatus or subscapularis tears d. Missed symptomatic SD/SA bursitis 8. Symptoms > 6 months before first injection 9. No significant relief from prior injection Repeat injection was helpful for select patients.

**RESULTS**

Change of torn gap width was showed in increase, no change, and in decrease as follows; in 2, 8, 7 tendons at 1 month FU, and in 3, 3, 4 tendons at 3 months FU, respectively. Comparing with initial US and 3 months FU US, torn gap width was increased in 2 tendons, decreased in 5 tendons, and not changed in 3 tendons. But statistically there were not significant in any intervals. Tendon echogenicity was improved in 2 tendons and aggravated in 1 tendon at a month FU, and improved in 1 tendon and aggravated in 4 tendons at 3 months FU. Intratendinous or intrabursal crystal formation was seen in 1 tendon at a month FU, and in 2 tendons at 3 months FU. Postinjection bursal effusion was seen in 13 tendons at 1 month FU. Thickened bursa was partially improved in 4 tendons and was not changed in 4 tendons at 3 months FU.

**CONCLUSION**

PRP injection therapy of partial thickness tear of the rotator cuff tendon was not so effective in short term follow up with ultrasound.

**LL-MKS-TH3A • Four-year Experience Follow-up in the Treatment of Degenerative Disease of the Supraspinatus Tendon by Ultrasound Guided Injections of PRP. Clinical and Radiological Evidence**
The hip capsule thickness is no different in cam-FAI patients compared to those with non-FAI hip pathology. The mean alpha angle measurements were 57.3 degrees in the cam-FAI group and 46.5 degrees in the non-FAI group (p = 0.002). There was no significant gender difference in capsule thickness within either subject group. The mean maximal capsule thicknesses (mm) anteriorly for males, females were: cam-FAI 5.02, 4.96, respectively, and non-FAI 5.03, 4.93, respectively. There was no significant difference between the cam-FAI and non-FAI groups at either location. The mean maximal hip capsule thicknesses (mm) at the anterior and superior locations were: cam-FAI 4.99, 6.97; non-FAI 4.94, 6.68.

RESULTS

Performed. A p-value (two-tailed paired t-test for both), and correlation of capsule thickness with the alpha angle (Pearson correlation coefficient) were evaluated with receiver operating characteristic curve (ROC). MR images were also evaluated for findings suggestive of associated pathologies. Inter- and intraobserver reliabilities were analyzed with intraclass correlation coefficient (ICC). Diagnostic performance of the capsular thickness was evaluated with receiver operating characteristic curve (ROC). MR images were also evaluated for findings suggestive of associated pathologies.

RESULTS

Capsular thickness of the hip joint was significantly thicker in patients with adhesive capsulitis compared with that of control subjects (estimated mean thickness: patients: 4.39±0.26mm, controls: 2.70±0.17mm). Patients’ age, sex and laterality (right or left) of the lesion did not affect the capsular thickness. Inter- and intraobserver reliabilities were excellent. Area under the receiver operating characteristic curve (AUC) showed moderately accurate diagnostic performance. Associated pathologies such as labral lesions, degenerative changes, synovitis, ligamentum teres abnormality, and FAI were found in 15 of 21 patients (24 of 36 hips).

CONCLUSION

In conclusion, MR imaging, particularly measuring the capsular thickness, may be helpful for diagnosis of adhesive capsulitis of the hip. Furthermore, MR imaging may offer additional information for the various associated pathologies of adhesive capsulitis of the hip.

CLINICAL RELEVANCE/APPLICATION

MR imaging including capsular thickness-measurement may be helpful for diagnosis of adhesive capsulitis of the hip and offer additional information about associated pathologies.

LL-MKS-TH4A ● MR Imaging of Adhesive Capsulitis of the Hip: Relevance of Capsular Thickness and Associated Pathologies

Jung Hyo Rhim MD, PhD; Jung-Ah Choi MD; Eugene Lee (Presenter); Eugene Joe; Sung Hwan Hong MD; Heung S Kang MD

PURPOSE

To evaluate the relevance of capsular thickness and associated pathologies on magnetic resonance (MR) images for the diagnosis of adhesive capsulitis of the hip.

METHOD AND MATERIALS

Institutional review board (IRB) approval was obtained. MR images of 21 consecutive patients with clinical diagnosis of adhesive capsulitis of the hip joint were retrospectively evaluated. Capsular thickness of the hip joints was measured and compared with that of control subjects. Difference of the capsular thickness of hip joints was analyzed with generalized estimated equation (GEE). Inter- and intraobserver reliabilities were analyzed with intraclass correlation coefficient (ICC). Diagnostic performance of the capsular thickness was evaluated with receiver operating characteristic curve (ROC). MR images were also evaluated for findings suggestive of associated pathologies.

RESULTS

Capsular thickness of the hip joint was significantly thicker in patients with adhesive capsulitis compared with that of control subjects (estimated mean thickness: patients: 4.39±0.26mm, controls: 2.70±0.17mm). Patients’ age, sex and laterality (right or left) of the lesion did not affect the capsular thickness. Inter- and intraobserver reliabilities were excellent. Area under the receiver operating characteristic curve (AUC) showed moderately accurate diagnostic performance. Associated pathologies such as labral lesions, degenerative changes, synovitis, ligamentum teres abnormality, and FAI were found in 15 of 21 patients (24 of 36 hips).

CONCLUSION

In conclusion, MR imaging, particularly measuring the capsular thickness, may be helpful for diagnosis of adhesive capsulitis of the hip. Furthermore, MR imaging may offer additional information for the various associated pathologies of adhesive capsulitis of the hip.

CLINICAL RELEVANCE/APPLICATION

MR imaging including capsular thickness-measurement may be helpful for diagnosis of adhesive capsulitis of the hip and offer additional information about associated pathologies.

LL-MKS-TH5A ● Hip Capsule Thickness in Femoroacetabular Impingement (FAI)

Andrew A Bonura MBBS (Presenter); Robert J Nairn MBBS; Mark E Schweitzer MD; Paul E Beaule MD *; Nicholas M Kolanko MD; Kawan S Rakhra MD

PURPOSE

To determine the hip capsule thickness in patients with cam-FAI and non-FAI hip pathology using preoperative magnetic resonance imaging (MRI). The hypothesis was that in cam-FAI the capsule would be thicker related to chronic impingement of the cam deformity against the capsule.

METHOD AND MATERIALS

Research ethics board approval was obtained. Forty-one hips (40 patients) were included, with surgically proved cam-FAI (9M,7F; age 22-58 yrs) and 25 with non-FAI chondrolabral pathology (4M,21F; age 18-63 yrs). All subjects had undergone preoperative 3T MRI including oblique axial and oblique coronal, FSE proton density weighted sequences, with parameters: FOV 180mm, Matrix 320 x 256, Slice thickness 3.5mm, TE 30ms, TR 2310ms, ETL 7, NEX=2. The hip capsule thickness was measured at two locations, anteriorly (3 o'clock) and superiorly (12 o'clock) on single oblique axial and oblique coronal images, respectively, at the thickest portion of the visualized capsule on the given slices. Comparison of the maximal hip capsule thickness between the two groups and gender analysis (two-tailed paired t-test for both), and correlation of capsule thickness with the alpha angle (Pearson correlation coefficient) were performed. A p-value

RESULTS

The mean maximal hip capsule thicknesses (mm) at the anterior and superior locations were: cam-FAI 4.99, 6.97; Non-FAI 4.94, 6.68, respectively. There was no significant difference between the cam-FAI and non-FAI groups at either location. The mean maximal capsule thicknesses (mm) anteriorly for males, females were: cam-FAI 5.02, 4.96, respectively, and non-FAI 5.03, 4.93, respectively. There was no significant gender difference in capsule thickness within either subject group. The mean alpha angle measurements were 57.3 degrees in the cam-FAI group and 46.3 degrees in the non-FAI group (p = 0.002).

CONCLUSION

The hip capsule thickness is no different in cam-FAI patients compared to those with non-FAI hip pathology. There is no gender difference in hip capsule thickness with either cam-FAI or non-FAI hip pathology. In cam-FAI subjects, there is no
CLINICAL RELEVANCE/APPLICATION

Hip capsule thickness cannot be used as a specific marker or sign of cam-FAI.

LL-MKS-TH6A  •  Large-scale Population Imaging to Investigate the Genetic Epidemiology of Radiographic Scheuermann's Disease: The Rotterdam Study

Ling Oei MD, MA (Presenter) ; Salih El Saddy ; Ater A Makurthou ; Martha Castano-Betancourt ; Karol Estrada ; Carolina Medina-Gomez ; Albert Hofman MD, PhD ; Joyce B Van Meurs ; Andre G Uitterlinden PhD ; Edwin H Oei MD, PhD ; Fernando Rivadeneira MD, PhD

PURPOSE

Scheuermann's disease is a form of osteochondrosis of the spine, characterized by increased posterior rounding of the thoracic spine in association with structural deformity of the vertebral elements. Although the etiology remains largely unknown, there is evidence that genetic factors play a role. A Danish twin study has found a heritability estimate of 74%. Nevertheless, no associated genes have been found to date. Our aim was to find genetic susceptibility factors for Scheuermann's disease.

METHOD AND MATERIALS

The radiographic criteria of Sorensen, Hart and Sachs et al. were applied to diagnose the Scheuermann's disease cases. Lateral spine radiographs were available for 2,753 participants from a population-based study (age 45 years and over), of which 111 cases were diagnosed with Scheuermann's disease. A genome-wide association study (GWAS) was conducted by applying a logistic model adjusted for sex and admixture principal components. To facilitate analysis of variants with lower allele frequency 1000 Genomes imputation (version: 06-2010) was applied.

RESULTS

We found a SNP (minor allele frequency 3%) on chromosome 4 associated at genome-wide significant level with radiographically diagnosed Scheuermann's disease (P=3.9 *10^-10, odds ratio 5.3). The SNP maps an intron of the tolloid-like-1 gene (TLL1). TLL1 is a protease that shares structural similarity to BMP1 (Bone morphogenetic protein 1) and is involved in collagen and chordin synthesis. TLL1 has been described to induce formation of cartilage in vivo and it has a high mRNA expression in the femoral growth plate.

CONCLUSION

This is the first GWAS for radiographic Scheuermann's disease, where we found a SNP associated at genome-wide significant level with Scheuermann's disease mapping to TLL1. Biologically interesting is that TLL1 is a protease that is involved in collagen and chordin synthesis and can induce formation of cartilage in vivo. However, our GWAS had a small sample size because of the relatively low disease prevalence the population-based study design resulted in a limited sample size. A replication study is necessary to confirm this finding.

CLINICAL RELEVANCE/APPLICATION

Gene discovery for Scheuermann's disease will aid diagnostics and development of therapies. More generally this will help us better understand the musculoskeletal biology of the spine.


Adriana F Nguyen MD (Presenter) ; Christopher J Gottsegen MD ; George R Matcuk MD ; Dakshesh B Patel MD ; Deborah M Forrester MD ; Eric A White MD

PURPOSE/AIM

This exhibit will provide a comprehensive review of soft tissue, articular and osseous masses found within the hand and wrist including multimodality imaging characteristics with emphasis on MRI, differential diagnoses, demographic/clinical features and management.

CONTENT ORGANIZATION

1. Benign Soft Tissue Masses: ganglion cyst, giant cell tumor of tendon sheath, fibromatosis, lipoma, fibrolipomatous hamartoma and vascular malformations
2. Malignant Soft Tissue Masses: soft tissue sarcomas including epithelioid and synovial sarcoma
3. Benign Osseous Masses: enchondroma, osteochondroma, giant cell tumor, bizarre parosteal osteochondromatous proliferation (BPOP), florid reactive periostitis
4. Malignant Osseous Masses: osteosarcoma, metastatic disease
5. Miscellaneous Masses: infectious processes, gouty tophi, foreign bodies

SUMMARY

Palpable hand and wrist masses are a common clinical presentation. The majority of these lesions are benign. MR signal characteristics along with radiographic/CT features, anatomic location, site of origin and specific demographic factors can help differentiate among neoplastic and non-neoplastic lesions. This educational exhibit will provide the reviewing participant with a thorough discussion of the imaging and clinical features of an extensive list of soft tissue, articular and osseous masses located about the hand and wrist.

LL-MKE-TH8A  •  Virtual Monochromatic Spectral Imaging with Dual Energy Technology: Evaluation Flexor Tendon after Operations by Using Palmar Locking Plate for Distal Radius Fracture

Norimi Nishiyama (Presenter) ; Yoshihiro Takeda MD ; Yuki Kobayashi

PURPOSE

Many medical institutions perform operations by using palmar locking plate for distal radius fracture because they are very efficient. With an increase in this operative procedure, we received critical complication reports which are called Flexor Disorders by palmar locking plate for distal radius fracture.

The evaluation of flexor tendon and locking plate by Computed Tomography (CT) scan after operation was impossible because of the metal artifacts and it could not estimate the patient's prognosis. With a CT system using Dual energy technology, possibility of the metal artifacts reduction of the palmar locking plate for distal radius fracture by Virtual Monochromatic Spectral (VMS) Imaging and a postoperative flexor tendon evaluation examined possible keV and examined the usefulness of the Flexor Disorders prediction by VMC Imaging.

METHODS

To evaluate metal artifact by VMC Imaging of four kinds of phantoms which were rolled by bolus on artificial bone installed palmar locking plate for distal radius fracture by using Dual Energy Technology.

The materials of palmar locking plate for distal radius fracture were;
Three kinds of titanium consist of 90% of titanium, 6% of aluminum, 4%of vanadium and one kind of pure titanium.
The screws to fasten the plate were titanium alloy consists of 90% of titanium, 6% of aluminum and 4% of vanadium.
The phantom was examined with a CT system and reconstructed VMC Imaging every 5keV from 40keV to 140keV. Analyzed the least metal artifacts keV and evaluated post-operation flexor by clinical image.

RESULTS

We could confirm the reduced metal artifact by VMS Imaging.

VMS Imaging at 95 keV was the least metal artifacts at the closest part between palmar locking plate for distal radius fracture and flexor.
The purpose of this study is to determine the optimal dose of 0.75% ropivacaine for an ultrasonography-guided suprascapular nerve block using 0.75% ropivacaine in patients with chronic shoulder pain: What is the optimal dose?

PURPOSE
The purpose of this study is to determine the optimal dose of 0.75% ropivacaine for an ultrasonography-guided suprascapular nerve block using 0.75% ropivacaine in patients with chronic shoulder pain.
High-Field (3.0T) MRI

**LL-MKS-TH5B • 3D Isotropic Protocol**

The degree of active synovitis, volume of enhancing synovial tissue and level of perfusion by dynamic contrast-enhanced MRI is helpful in grading cervical neural foraminal stenosis. To evaluate the incidence of acute soleus strains associated with an acute rupture of the anterior cruciate ligament.

**METHOD AND MATERIALS**

The MRI of 787 patients with surgically confirmed complete ACL tears between 2007 and 2012 were retrospectively reviewed for soleus muscle strains, defined as interstitial edema or intramuscular hematoma. Imaging was performed on 1.5 and 3 Tesla MRI scanners. Chronic ACL tears, partial tears, tibial avulsion injuries and ACL graft disruptions were excluded from the study. The images were reviewed by a musculoskeletal radiologist and fellow. The soleus muscle abnormalities were evaluated for location, size, grade, and presence of hematoma.

**RESULTS**

We evaluated 481 patients (average age of 27.1 years, range 12 to 60 years). 65 patients had grade I strains defined as interstitial edema and 73 patients had grade II strains defined as intramuscular hematoma formation. The incidence of acute soleus strains in our study group was 28.7%. The soleus muscle actively contracts when the tibia begins to translate anteriorly thus aiding in its stabilization, along with the gastrocnemius muscle, by way of the Achilles tendon. This occurs through a vestibulocochlear response. The soleus injury occurs during contraction when an ACL ruptures.

**CONCLUSION**

The agonist and antagonist properties of the knee muscles are important as secondary stabilizers to the integrity of the knee. There is a high incidence of acute soleus strains in patients with complete ACL tears which occurs when the tibia translates anteriorly against eccentric contraction of the soleus muscle.

**CLINICAL RELEVANCE/APPLICATION**

An understanding of the agonist behavior of the soleus muscle on the knee explains the high incidence of strains in patients with ACL tears.

**LL-MKS-TH4B • MRI Grading of Cervical Neural Foraminal Stenosis: Reliability Study with Comparison of 2D Conventional and 3D Isotropic Protocol**

To determine and compare the reliability of 2D and 3D MRI interpretations in cervical neural foraminal stenosis.

**METHOD AND MATERIALS**

Forty-one patients with possible cervical spinal stenosis prospectively underwent cervical spine MRI in which the protocol included 2D T1 and T2-weighted fast spine-echo sequences in sagittal and axial planes, and a single sagittal 3D T2-weighted fast spin-echo sequence. The sagittal 3D data sets were reformatted at 1-mm slice thickness without a gap in 2 oblique sagittal plane (perpendicular to both right and left neural foram). Three radiologists independently and blindly rated the severity of neural foraminal stenosis at C2-3 to C7-T1 with a 4-point scale, which was done in two separate 2D and 3D interpretation sessions with more than a month of interval. Kendall’s rank correlation test was used to characterize inter-reader reliability for categorical rating data.

**RESULTS**

Overall, interobserver agreement in ordinal ratings of neural foraminal stenosis was substantial in 2D (Kendall tau-b, 0.61-0.89) and substantial to excellent in 3D MRI (Kendall tau-b, 0.61-0.92). Interobserver agreement at C3-4 to C6-7 level was slightly higher in 3D protocol than in 2D protocol (Kendall tau-b: C3-4, 0.80 vs. 0.78; C4-5, 0.89 vs. 0.78; C5-6, 0.90 vs. 0.88; C6-7, 0.90 vs. 0.84). At C2-3 and C7-T1, performance of reading of cervical neural foraminal stenosis did not differ between the two MR protocols (Kendall tau-b: C2-3, 0.61; C7-T1, 0.71).

**CONCLUSION**

We found that the MRI reading of cervical neural foraminal stenosis showed substantial interobserver agreement or above, and that 3D isotropic protocol slightly reduced the degree of interobserver variability.

**CLINICAL RELEVANCE/APPLICATION**

3D isotropic MRI helps to increase the reliability in grading cervical neural foraminal stenosis.

**LL-MKS-TH5B • Dynamic Contrast-enhanced Low Field (0.25T) MRI of the Wrist in Rheumatoid Arthritis: Comparison with High-Field (3.0T) MRI**

The degree of active synovitis, volume of enhancing synovial tissue and level of perfusion by dynamic contrast-enhanced MRI is helpful in determining the status of the synovium.
determining therapeutic response in rheumatoid arthritis patients. These particular parameters have not been assessed on low-field MRI. The aim of this study is to compare assessment of wrist synovitis severity, enhancing synovial volume and synovial perfusion indices of low-field (0.25T) MRI in patients with rheumatoid arthritis with high-field (3.0T) MRI.

**METHOD AND MATERIALS**

Prospective study of 10 patients (F:M = 9:1, mean age 48 ± 9 years) with active rheumatoid arthritis. Dynamic contrast-enhanced MRI examination of the most severely affected wrist was performed on both 0.25T (G-SCAN, Esaote, Genoa, Italy) and 3.0T (Achieva TX-series, Philips Medical Systems, Best, Netherlands) whole-body imaging systems. Three MRI parameters [synovitis severity (RAMRIS grade), active synovitis volume (ml3), and synovial perfusion indices (maximum enhancement (%), enhancement slope (%/sec))] were compared.

**RESULTS**

Comparing 0.25T and 3.0T MRI, there was strong agreement (r: 0.91-0.95, p < 0.001). 0.25T MRI yields comparable synovial and perfusion parameters to 3T MRI and can be used to assess therapeutic response in rheumatoid arthritis patients.

**CONCLUSION**

0.25T MRI is easier available than high field MRI in some of the places and this study shows that 0.25T MRI of wrist can be used to assess therapeutic response in rheumatoid arthritis patient.

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**LL-MKS-TH6B • Ultrasonography Measurement of Surgical Outcome in Carpal Tunnel Syndrome: Validation of the Most Optimal Carpal Bone Level for Measurement of Median Nerve Cross-sectional Area**

Youngno Yoon (Presenter); Sungjun Kim MD; Choon Sik Yoon MD; Yaena Kim MD; Ho Jung Kang; Young Han Lee MD; Ho-Taek Song MD; Jin-Suck Suh MD

**PURPOSE**

To determine the most optimal carpal bone level for measurement of median nerve cross-sectional area (CSA) using ultrasonography (US) in the diagnosis and surgical outcome measure of carpal tunnel syndrome (CTS).

**METHOD AND MATERIALS**

Between Mar. 2011 to Mar. 2013, US was done for 39 wrists from the 29 female patients with CTS and 27 wrists from 14 non-symptomatic control group. CSAs of median nerves were measured at four different levels with carpal bones adopted as the landmark: pronator quadratus (PQ); lunate; pisiform; and hamate. Six parameters were used for analysis. The 3 parameters were CSA values at lunate, pisiform, and hamate. Additional 3 parameters were CSA value differences between lunate and PQ (L-PQ), between pisiform and PQ (P-PQ), and between hamate and PQ (H-PQ). The 6 parameters were subjected to receiver operating characteristic (ROC) curve analysis to test diagnostic performances, and areas under curves (AUCs) of the parameters were compared to each other. The sensitivity and specificity for each parameter at the most ideal cut off values was obtained. Clinical symptom with/without electrodiagnostic test results was used as the reference standard. Additionally, for the 39 wrists for which carpal tunnel release was done, the parameters were validated whether they can be used as a predictor of surgical outcome by correlating their post-op decrease with the post-op percent decrease of Boston Carpal Tunnel Questionnaire (BCTQ) scores with the use of Spearman rho test.

**RESULTS**

The CSA of the median nerve at lunate level appears to be the parameter with the highest diagnostic performance. CSA difference between lunate and PQ was the only parameter that correlated with surgical outcome.

**CLINICAL RELEVANCE/APPLICATION**

CSA measurement for median nerve at the lunate level appears to be sufficient to diagnose CTS. To assess surgical outcome using US, CSA difference between lunate and PQ level appears to be optimal.

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**ASRT®RSNA 2013: Improving Practice in Pediatric Skeletal Radiography**

Thursday, 03:40 PM - 04:40 PM • N230

Maryann Hardy, MD, MSc, PhD

**LEARNING OBJECTIVES**

1) Understand the main features of skeletal growth and development in childhood. 2) Understand how skeletal growth and development can result in predictable pathological appearances on radiographs that may inform image acquisition techniques. 3) Appreciate how normal
Variations in the juvenile skeleton can mask or mimic common pathologies and influence the interpretation of radiographic images. 4) Examine, through the use of case studies, the appropriateness of diagnostic radiography image acquisition techniques and image quality assessment criteria.

**ABSTRACT**

Children are an important patient group accounting for an estimated 20% of imaging examinations. Many published papers and authors have stated that imaging children requires a unique set of skills and knowledge as children are not little adults. Much of this literature explores psychosocial development in children, communication and interaction. However, radiographers working with children also need to have a good understanding of anatomical growth and development to improve image acquisition techniques and appreciation of the distinctive radiographic appearances associated with the juvenile skeleton. Using case studies from clinical practice, this presentation will explore how knowledge of skeletal development during childhood can prevent the misapplication of image acquisition techniques and quality assessment criteria and the misinterpretation of normal developmental variations.

**Interactive Game: Musculoskeletal Pitfalls and Pearls**

**Thursday, 04:30 PM - 06:00 PM • E450A**

**RC704 • AMA PRA Category 1 Credit :1.5 • ARRT Category A+ Credit:1.5**

**LEARNING OBJECTIVES**

This interactive session will use RSNA Diagnosis Live. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

**RC704A • Pediatric Cases**

**Lane F Donnelly** MD (Presenter) *

**LEARNING OBJECTIVES**

1) Identify both normal pediatric musculoskeletal findings that may be interpreted as normal as well as potentially overlook abnormal findings that are easily overlooked.

**ABSTRACT**

The pediatric musculoskeletal system is continuously changing throughout development. With maturing states of cartilage and bone, the appearance of normal is different at different ages. In addition, the types of pathology and their presenting appearances are different at different ages of childhood. This presentation will review normal findings that have at times been interpreted as abnormal as well as reviewing abnormalities that can be easily overlooked. The intent is that by reviewing these two types of scenarios, the attendee will be less apt to make an error when encountering these situations in practice.

**RC704B • Appendicular Trauma**

**Mark E Schweitzer** MD (Presenter)

**LEARNING OBJECTIVES**

1) Review some subtle imaging findings indicative of significant derangements. 2) Review the locations where joint effusions can be reliably described radiographically. 3) Emphasize some normal variant of appendicular trauma.

**ABSTRACT**

Appendicular trauma is common and most patients are imaged initially by conventional radiography. In these patients it is important to use an a systematic approach looking at alignment and soft tissues changes, especially the presence of effusions. It is also important to be cognizant that there are specific fractures and soft tissue injuries that are indicative of major soft tissue or visceral trauma. It is no less important to be aware that some glaring radiographic findings may be associated with less severe trauma. We will review the concepts behind and locations of osteoporotic fractures, and what defines the risk of and the locations for pathologic fractures. Specific mechanisms for specific injuries will be discussed as well.

**RC704C • Tumor**

**Donald J Flemming** MD (Presenter) *

**LEARNING OBJECTIVES**

1) Describe common errors in image interpretation of possible tumors of the musculoskeletal system. 2) Describe common nonneoplastic entities that are referred to orthopedic oncology practice because of errors in image interpretation. 3) Describe imaging features of nonneoplastic entities that are often confused with tumor.

**ABSTRACT**

Errors in interpretation of possible tumors of the musculoskeletal system can lead to both underdiagnosis or overdiagnosis of neoplasm. One of the more common errors seen in an orthopedic oncology referral practice is confusing a common nonneoplastic disease with a neoplastic diagnosis. The purpose of this presentation is to discuss entities such as fracture, arthropathy and systemic diseases that are commonly confused with tumor. Key imaging features that help distinguish these entities from neoplasm will be reviewed.

**Emergency Musculoskeletal Radiology: The Usual (and Unusual) Suspects**

**Thursday, 04:30 PM - 06:00 PM • E350**

**RC708 • AMA PRA Category 1 Credit :1.5 • ARRT Category A+ Credit:1.5**

**RC708A • Noncardiac Chest Pain: Musculoskeletal Causes**

**Joseph S Yu** MD (Presenter)

**LEARNING OBJECTIVES**

1) Discuss musculoskeletal conditions that may present with chest pain. 2) Review appropriate imaging algorithm for different processes. 3) List differential diagnosis for location-specific sources of pain.

**ABSTRACT**

Non-cardiac chest pain is a symptom that is frequently encountered in medicine. It tends to elicit a long list of differential diagnoses. The vast majority of people who present with chest pain do not have pathology related to the musculoskeletal system. Occasionally, however, the sternum, clavicles, and ribs along with their articulations may be an unsuspected source of pain. Initial assessment of the thorax begins with a routine radiographic series of the chest. Properly exposed upright PA and lateral radiographs made in full inspiration are often sufficient, but in certain instances, these projections may not allow adequate visualization of the osseous anatomy owing to the superimposition of structures with the mediastinal soft tissues or an incomplete depiction of the contour of the bones, such as the ribs and sternum. As such, a more tailored approach may be required, utilizing cross-sectional imaging modalities such as computed tomography (CT) or magnetic resonance imaging (MRI).
tomography (CT) and magnetic resonance (MR) imaging for evaluating pathologic processes that affect the sternum and sternoclavicular joints, or a dedicated bone-detail rib series for evaluation of the ribs. Occasionally, a coned-down fluoroscopic or radiographic evaluation is adequate, such as a lateral view of the sternum for a dislocation. Scintigraphic examinations such as bone scintigraphy, gallium scanning, and white blood cell scanning are efficacious for assessing metabolic processes that increase bone turnover or produce an inflammatory response. In this course, a differential diagnosis for painful noncardiac and extrapleural conditions of the chest will be discussed including fractures and dislocations, stress fractures, arthritis, costochondritis, sternocostoclavicular hyperostosis, condensing osteitis, infection, muscle tears, and tumors.

RC708B • Acute Hip Pain in the ED: Fracture and Beyond
Bharti Khurana MD (Presenter)

LEARNING OBJECTIVES
1) To provide an understanding of the proximal femoral and pelvic fractures. 2) Describe the multi modality approach to acute hip pain in the Emergency Department. 3) Review the critical findings relevant to orthopedic surgeons for managing these fractures and avoid potential complications.

ABSTRACT
Hip fracture is a common injury with current incidence exceeding 250,000 per year in the United States. The incidence is increasing with increase in life expectancy and elderly population. A prompt diagnosis of hip fracture is important since morbidity and mortality increases as time elapses from the original injury. A thorough knowledge of anatomy, normal variations, pathophysiology and morphologic types of fractures can increase the sensitivity and specificity of plain radiographs and cross sectional imaging in detecting these injuries. Although radiography has been reported more than 90% sensitive in detecting fracture, 2-11% of ED patients harbor radiographically occult fractures. Detection of fracture on MRI is based on presence of marrow edema around the fracture site and does not rely on cortical or trabecular displacement. Awareness of treatment principles and potential complications will help radiologists in improving the value of their service to orthopedic colleagues. Other causes of acute hip pain include muscle injuries, infection, neoplasms, transient osteoporosis, osteonecrosis and rapidly progressive osteoarthritis. Abbreviated MRI protocols are helpful in the ED. A checklist for a systematic approach is critical for the radiologists interpreting these studies in ED to avoid potential misses and pitfalls.

RC708C • Radiologic Detection and Characterization of Retained Foreign Bodies in Extremities
Ken F Linnau MD,MS (Presenter)

LEARNING OBJECTIVES
1) Identify the most common extremity foreign bodies encountered in Emergency Radiology. 2) Discern the most appropriate imaging modality (computed radiography, ultrasound, CT, and MRI) to visualize a suspected retained foreign body at high conspicuity. 3) Describe the imaging characteristics of various retained foreign materials across the various modalities (computed radiography, ultrasound, CT).

ABSTRACT
PURPOSE/AIM: To review the prevalence and describe the imaging characteristics of the most commonly encountered subcutaneously retained extremity foreign bodies in the emergency room setting on various imaging modalities (CR, US, CT, MR). CONTENT ORGANIZATION
Overview of the most commonly retained subcutaneous foreign bodies and review of the current literature. Display the different categories of foreign bodies and their imaging characteristics. Foreign body categories will include plastic, wood, glass, gravel, fish bones, needles and tubing. Describe each foreign body appearance on computed radiography, ultrasound, CT and MRI and provide illustrative clinical examples.

Common Spinal Injection Procedures for Diagnosis and Treatment of Back Pain (Hands-on Workshop)
Thursday, 04:30 PM - 06:00 PM • E263

A. Orlando Ortiz , MD, MBA *
John M Mathis , MD, MSc
Chi-Shing Zee , MD
Bassem A Geogy , 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 proper injection 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.

Emergency Radiology Case-based Countdown (An Interactive Session)
Friday, 08:30 AM - 10:00 AM • E353C

Faisal Khosa FFRRCSI, FRCP (Presenter)

LEARNING OBJECTIVES
The audience will be shown cases with acute presentations in the ER, the format will be interactive utilizing audience response system. At the end of the session the participants will be able to efficiently deal with complex situations presenting as acute emergency in the ER with resultant improved patient care.
2.

ABSTRACT
The Top 10 countdown will comprise of interactive audience response system in which 10 unknown Thoracic emergencies will be presented. The salient features of the cases would be illustrated along with more complex imaging modalities and possible differential diagnoses where appropriate.

RC808B • Abdominal Top 10 Countdown
Joel A Gross MD, MS (Presenter)

LEARNING OBJECTIVES
1) Select among varying imaging techniques to optimize the appropriate study for the patient. 2) Recognize classic and subtle signs of radiologic pathology, and avoid some common pitfalls and errors.

ABSTRACT
The Abdominal Top 10 Countdown is an interactive audience response based presentation in which 10 unknown abdominal cases from the emergency department will be presented. The participants are encouraged to interact with the cases. The salient features of the cases are then illustrated along with more complex imaging modalities, if appropriate. The interactive nature will challenge the learners’ skill and knowledge applications.

RC808C • Musculoskeletal Top 10 Countdown
Manickam Kumaravel MD, FRCR (Presenter)

LEARNING OBJECTIVES
1) Analyze varying imaging techniques and will be able to apply this knowledge to improve effective patient care. 2) Be proficient in scrutinizing subtle radiographic signs in musculoskeletal presentations in the emergency department and in understanding the use of more complex imaging techniques to ascertain the underlying pathology.

ABSTRACT
The Top 10 countdown is an interactive audience response based system in which 10 unknown Musculoskeletal cases from the emergency room will be presented. The participants are encouraged to interact with the cases. The salient features of the cases are then illustrated along with more complex imaging modalities, if appropriate. The interactive nature will challenge the learners’ skill and knowledge applications.

Musculoskeletal Radiology Series: Elbow, Hand and Wrist Imaging
Friday, 08:30 AM - 12:00 PM • N228

VSMK61 • AMA PRA Category 1 Credit ™:3.25 • ARRT Category A+ Credit:3.5
Moderator
Bruce B Forster, MD *
Mark D Murphey, MD

VSMK61-01 • Sports Related Injuries of the Elbow
Bruce B Forster MD (Presenter) *

LEARNING OBJECTIVES
1) Demonstrate an understanding of the technical and procedure-related considerations in MR imaging of the elbow. 2) Identify the normal anatomic structures and variants within the four compartments of the elbow. 3) Diagnose common sports injuries of the elbow, using this compartmental approach.

ABSTRACT
VSMK61-02 • Accuracy of 3 Tesla MR Arthrography versus Conventional 3 Tesla MR Imaging of the Elbow as Compared with Arthroscopy
Thomas H Magee MD (Presenter)

PURPOSE
MR arthrography of the elbow has been found to be useful in the diagnosis of full versus partial thickness tears of the collateral ligaments. MR arthrography is also useful for characterization of chondral defects. We assess the accuracy of 3 Tesla MR arthrography of the elbow versus conventional 3 Tesla MR imaging of the elbow as compared with arthroscopy.

METHOD AND MATERIALS
43 consecutive conventional elbow MR and MR arthrography exams performed on the same patients who went on to arthroscopy were reviewed retrospectively by consensus reading of two musculoskeletal radiologists. Full or partial thickness tears of the collateral ligaments, full or partial thickness tears of the extensor and flexor tendons, chondral defects and loose bodies in the joint space were assessed.

RESULTS
In thirty one patients, the diagnoses made on MR and MR arthrogram exams were the same. In seven patients MR arthrogram exams demonstrated additional findings that were not clearly demonstrated on conventional MR exams. There were three full thickness extensor tendon tears, three radial collateral ligament tears and one ulnar collateral ligament tear seen on MR arthrography exam that were not well seen on conventional MR exam. In five patients MR arthrogram demonstrated ligaments and tendons to be intact that appeared torn on conventional MR exam. There were three ulnar collateral ligaments and two common flexor tendons demonstrated to be intact on MR arthrography exam that appeared torn on conventional MR exam. All MR arthrography findings were confirmed at arthroscopy.

CONCLUSION
MR arthrography of the elbow is more accurate in detection of intact or torn tendons and ligaments than conventional MR imaging of the elbow at three tesla. These five cases are most likely due to the tears healing with fibrous tissue allowing the tendon and ligament tissues to coapt.

CLINICAL RELEVANCE/APPLICATION
MR arthrography is more accurate in detection of intact or torn tendons and ligaments than conventional MR imaging of the elbow at three tesla. This is useful in pre surgical planning.
LEARNING OBJECTIVES
1) Identify the common sites of nerve entrapment in the upper extremity. 2) Describe the normal peripheral nerve anatomy and muscle innervation in the upper extremity with an emphasis on sites of compression. 3) Recognize the imaging features peripheral nerve entrapment in the upper extremity.

ABSTRACT

VSMK61-03 • Entrapment Neuropathies of the Upper Extremity

Ali M Naraghi (Presenter)

PURPOSE
To identify the common sites of peripheral nerve entrapment in the upper extremity.

METHOD AND MATERIALS
Patient and control population information is provided with imaging sequences and parameters.

RESULTS
Detailed visualization of the peripheral nerves was achieved with a spatial resolution well over 10 times greater than previously reported. Instead of the low signal, low contrast appearance seen in the TFCC with clinical T2 weighted images, high signal was observed. Anatomic structures and degree of artifacts were rated on a five-point scale (0-4). ANOVA and adjusted Wilcoxon-signed-rank tests were applied. The study was approved by the institutional review board and all patients gave informed consent prior to inclusion.

CONCLUSION
The T2 values were significantly larger in the CTS patients than in the controls (p < 0.05). The T2 values at the distal radioulnar joint did not differ between the groups (p = 0.99). The CSAs of the median nerve at all levels of the carpal tunnel were significantly larger in the CTS patients than in the controls (p < 0.05).

CLINICAL RELEVANCE/APPLICATION
T2 mapping can be useful for measuring an increase in the median nerve T2 values. Quantitative measurements of T2 values can complement measurements of the median nerve CSA in the evaluation of CTS.

VSMK61-04 • T2 Mapping of the Median Nerve in the Wrist Joints: Preliminary Study in Patients with Carpal Tunnel Syndrome and Healthy Volunteers

Ji Eun Lee MD (Presenter) ; Jang Gyu Cha MD ; Jong Kyu Han MD, PhD ; Soo Bin Im ; Sung Byung Kim

PURPOSE
To perform a prospective quantitative analysis of median nerve T2 values and cross-sectional area (CSA) in patients with carpal tunnel syndrome (CTS) and in asymptomatic volunteers.

METHOD AND MATERIALS
Twelve CTS patients with positive nerve conduction results and 12 healthy volunteers (controls) were enrolled and underwent axial T2 mapping of the wrist joints. Median nerve T2 values and CSAs at the distal radioulnar joint, pisiform, and hook of hamate levels were compared between the groups.

RESULTS
The T2 values at the proximal and distal carpal tunnel were higher in the CTS patients than in the controls (p < 0.05). The T2 values at the distal radioulnar joint did not differ between the groups (p = 0.99). The CSAs of the median nerve at all levels of the carpal tunnel were significantly larger in the CTS patients than in the controls (p < 0.05).

CONCLUSION
It is feasible to use T2 mapping to measure an increase of the median nerve T2 value in CTS patients. Quantitative measurements of T2 values can complement measurements of the median nerve CSA in the evaluation of CTS.

CLINICAL RELEVANCE/APPLICATION
T2 mapping can be useful for measuring an increase in the median nerve T2 values. Quantitative measurements of T2 values can complement measurements of the median nerve CSA in the evaluation of CTS.

VSMK61-05 • Comparison of Various 3D and 2D MR Imaging Sequences of the Wrist at 3 Tesla

Christoph Rehnitz MD (Presenter) ; Bastian Klaan ; Falko Stillfried ; Erick Amarteifio MD ; Hans-Ulrich Kauczor MD * ; Marc-Andre Weber MD *

PURPOSE
To quantitatively and qualitatively compare both image quality and diagnostic performance of 2D and 3D sequences for dedicated wrist imaging.

METHOD AND MATERIALS
16 healthy volunteers (mean age, 26.4 years) and 18 patients (mean age, 36.2 years) with wrist pain were examined using an 8-channel wrist-coil at 3 Tesla MRI. The imaging protocol consisted of 2D-proton-density fat-saturated (PDfs), isotropic 3D MEDIC, 3D-TrueFISP and 3D-PDfs-SPACE sequences. Signal-to-noise-ratios (SNR) and contrast-to-noise-ratios (CNR) of cartilage/bone/muscle/fluid and mean overall SNR/CNR were calculated using region-of-interest analysis. Qualitative analysis included overall image quality (OIQ), visibility of important structures and degree of artifacts rated on a five-point scale (0-4). ANOVA and adjusted Wilcoxon-signed-rank tests were applied. The study was approved by the institutional review board and all patients gave informed consent prior to inclusion.

RESULTS
Mean overall SNR/CNR for 2dPDfs; 3D-PDfs-SPACE; 3D-TrueFISP; 3D-MEDIC was 96/73; 43/28; 61/53; 77/45. SNR and CNR were higher (p

CONCLUSION
Comparison of various sequences shows that 3D-MEDIC (cartilage) and 3D-TrueFISP (ligaments/TFCC) exhibit additional advantages, while 3D-PDfs-SPACE is currently not advantageous.

CLINICAL RELEVANCE/APPLICATION
When imaging the wrist at 3 Tesla, the sequence protocol should include 2D-PDfs. An additional 3D-TrueFISP sequence can be recommended for assessing cartilage and a 3D-MEDIC for ligaments and TFCC.

VSMK61-06 • Magnetic Resonance Microscopy of the Triangular Fibrocartilage Complex at 11.7T

Paul A DiCamillo MD, PhD (Presenter) ; Sheronda Statum ; Christine B Chung MD ; Graeme M Bydder MBChB *

PURPOSE
Anatomic studies of the Triangular Fibrocartilage Complex (TFCC) have been performed on clinical systems at field strengths up to 7T. In our study, we assessed the use of an 11.7T small bore system with high performance gradients and multi-array coils for detailed imaging of the TFCC.

METHOD AND MATERIALS
Human wrist samples were collected per institutional policy, and imaged on an 11.7T Bruker BioSpec 117/16USR system (Bruker BioSpin, Billerica, MA) fitted with a 750 mT/m gradient system, using solenoidal and four element semi-circular array coils. Both gradient and spin echo sequences were used (FLASH: 90-120um3 isotropic resolution, TE 6ms, TR 25ms, fat sat, NEX 9-25, 4-6 hour scans; Multislice Spin Echo: 80x80x400um resolution , TE 7-14ms, TR 5000ms, 2 echoes, fat sat, NEX 5-15, 4-6 hour scans).

RESULTS
Detailed visualization of the TFCC was achieved at a spatial resolution well over 10 times greater than previously reported. Instead of the low signal, low contrast appearance seen in the TFCC with clinical T2 weighted images, with our acquisitions parameters and high performance system, the TFCC tissues displayed relatively high signal. Fiber structure in the upper and lower laminae, magic angle effects, entheses and the lamella layer of the disc were observed.

CONCLUSION
Unprecedented spatial resolution and contrast were achieved, with clear demonstration of detail in structures previously not particularly well visualized or seen at all. These results are likely to help in the recognition of injury and disease of the TFCC as stronger field strength systems become clinically available.

CLINICAL RELEVANCE/APPLICATION
High resolution 11.7T MR images of the TFCC were generated. These results may indicate what will be achievable on higher field clinical systems.
Osteoarthritis

VSMK61-07 • Sports Related Injuries of the Wrist

Catherine N Petchprapa MD (Presenter)

LEARNING OBJECTIVES
1) Review multiple common injuries of the wrist, as demonstrated on multiple imaging modalities.

VSMK61-08 • Common Tumors in the Hand and Wrist

Mark D Murphey MD (Presenter)

LEARNING OBJECTIVES
1) Identify common tumors that affect the hand/wrist including giant cell tumor of tendon sheath, ganglion, enchondroma and synovial sarcoma. 2) Recognize the imaging appearance and spectrum of these common tumors of the hand/wrist. 3) Understand the pathologic basis of the imaging appearances that may allow differentiation of these lesions.

VSMK61-09 • 11.7T Magnetic Resonance Microscopy of the Pulleys and Plates of the Fingers and Thumb

Paul A DiCamillo MD, PhD (Presenter) ; Sheronda Statum ; Christine B Chung MD ; Graeme M Bydder MBChB *

PURPOSE
Excellent anatomical studies on clinical systems have been done to demonstrate the detail of the digital pulleys and plates at fields up to 7T. In our study, using an 11.7T system with high-performance gradients and micro-array coils, we attempted to visualize details of these structures which have previously been refractory to MR imaging.

METHOD AND MATERIALS
Human fingers and thumbs were collected per institutional policy, firmly immobilized, and placed into the bore of an 11.7T Bruker BioSpec 11/16USR system (Bruker BioSpin, Billerica, MA) fitted with a 750 mT/m gradient system. Ten fields of view finger: proximal, middle, distal phalanx, PIP, DIP and MCP; thumb: proximal, distal phalanx, IP and MCP were independently imaged with both gradient and spin echo sequences (FLASH: 90-120um² isotropic resolution, TE 6ms, TR 25ms, fat sat, NEX 9-25, 4-6 hour scans; Multislice Spin Echo: 35x35x250um to 60x60x500um resolution, TE 7-14ms, TR 5000ms, 2 echoes, fat sat, NEX 5-15, 4-6 hour scans).

RESULTS
Detailed visualization of fibers in tendons, ligaments, pulleys, plates, and entheses of the fingers and thumbs was achieved. A series of structures that correlate with anatomic descriptions of entities which have not previously been captured in detail in imaging studies was visualized. A partial list includes the cruciate pulleys of the finger; finger pulleys A₁ and A₅; thumb pulleys A₁, Aᵥ, A₂; the oblique thumb pulley; and the fibrous structure of the palmar plates.

CONCLUSION
Unprecedented spatial resolution and contrast was achieved, with well over 10 times greater spatial resolution than previously reported. This allows for clear demonstration of the fiber direction in these structures, as well as production of the first MR images of structures such as the cruciate pulleys of the finger. A high performance MR system together with coil repositioning for each of the 10 target locations was instrumental in meeting our resolution and contrast goals. These results are likely to help in the recognition of injury and disease of the pulleys and plates as stronger field strengths become clinically available.

CLINICAL RELEVANCE/APPLICATION
High resolution 11.7T MR images of the pulleys and plates of the finger were generated. These may facilitate the interpretation of normal anatomy as higher field clinical systems become available.

VSMK61-10 • MR Findings in Avulsion Injuries at the Extensor Carpi Radialis Brevis Insertion and the Os Styloideum: A Case Series of Lesions in Hockey Players and Other 'Stick Swinging' Athletes

Pranshu Sharma MD (Presenter) ; Adam C Zoga MD ; William B Morrison MD * ; Diane M Deely MD ; Randall W Culp MD

PURPOSE
To detail initial and follow-up imaging findings in athletes with avulsion injuries at the insertion of the Extensor Carpi Radialis Brevis (ECRB) tendon, and its relation to the os styloideum and carpal boss, with operative and 'return-to-play' correlation.

METHOD AND MATERIALS
A database of wrist MR exams over 18 months was searched for athletes with avulsion injuries at the dorsal wrist in the region of the extensor carpi radialis brevis (ECRB) insertion. 6 subjects were identified and demographics, athletic activity, and trauma vs. overuse were documented. The initial MR was reviewed by two MSK radiologists in consensus and the presence of an os styloideum or carpal boss was noted. MR findings and surgical findings when applicable were documented. The initial MR was reviewed by two MSK radiologists in consensus and the presence of an os styloideum or carpal boss was noted. MR findings and surgical findings when applicable were documented.

RESULTS
3 were pro hockey players with powerful extension injuries. 1 was a collegiate golfer and the other 2 sustained falls on flexed wrists. 6 of 6 had os styloidea with bone marrow edema at the os. The ECRB inserted on the metacarpal base in 2, on the os in 2, and on both in 2. 3/6 had displacement of the os with a fracture extending to the metacarpal base at initial MR. No high grade tendon tear was observed. There was an anatomical and injury spectrum in athletes with avulsion lesions at the ECRB insertion. The ECRB can insert on the os styloideum, the base of the metacarpal, or both. These injuries can be encountered in athletic activities involving repetitive wrist extension against resistance while holding a stick, such as hockey and golf.

CONCLUSION
There is an anatomical and injury spectrum in athletes with avulsion lesions at the ECRB insertion. The ECRB can insert on the os styloideum, the base of the metacarpal, or both. These injuries can be encountered in athletic activities involving repetitive wrist extension against resistance while holding a stick, such as hockey and golf.

CLINICAL RELEVANCE/APPLICATION
Location of the insertion of the ECRB and any fusion of the os to the metacarpal base should be noted to optimize treatment.

VSMK61-11 • Eponyms to Know in Hand and Wrist Imaging

Wilfred C. G Peh MD (Presenter)

LEARNING OBJECTIVES
1) Review the imaging appearance of a variety of hand and wrist injuries that are named after physicians.

VSMK61-12 • Flexor Carpi Radialis Tendinopathy and its Association with Scapho-trapezio-trapezoid and First Carpometacarpal Osteoarthritis

Waseem K Khan MD (Presenter) ; Andrew R Palisch MD ; Suzanne S Long MD ; Adam C Zoga MD ; William B Morrison MD *

PURPOSE

Echo: 35x35x250um to 60x60x500um resolution, TE 7-14ms, TR 5000ms, 2 echoes, fat sat, NEX 5-15, 4-6 hour scans; Multislice Spin Echo: 35x35x250um to 60x60x500um resolution, TE 7-14ms, TR 5000ms, 2 echoes, fat sat, NEX 5-15, 4-6 hour scans).
We sought to establish a potential association between flexor carpi radialis (FCR) tendinosis and/or tears and osteoarthritis of either the scapho-trapezio-trapezoid (STT) or first carpometacarpal (CMC) joints, as identified by magnetic resonance imaging (MRI).

**METHOD AND MATERIALS**
A retrospective analysis was performed by searching a database from a single institution for MRI exams of the wrist performed over a 15 month period with reports including the term 'flexor carpi radialis'. Exams with reports describing the tendon as 'normal' were excluded. Two MSK radiologists evaluated images and confirmed the presence of FCR tendinosis and/or FCR tears. The STT and first CMC joints were then evaluated for evidence of osteoarthritis at MR including eburnation, subchondral cysts/marrow edema, osteophytes and joint space narrowing. FCR tendinosis/tears were then correlated with findings of STT and 1st CMC osteoarthritis.

**RESULTS**
There were 26 wrists with FCR tendinosis and/or tear. M/F= 10/16, with a mean age of 57.8 years (14-80 years). The majority (24/26, 92%) had either STT (20/26, 77%) and/or first CMC (21/26, 81%) osteoarthritis. The two patients with no appreciable STT or first CMC osteoarthritis demonstrated only mild FCR tendinosis at MRI. 14/26 (54%) subjects had either partial (11) or complete (3) FCR tendon tears. 12/14 patients (86%) had tears positioned adjacent to the STT joint, including all three complete tears. The other 2 patients (14%) had tears located adjacent to the first CMC joint. In all FCR tears, volar spurs were noted extending from the affected joint and appeared to impinge upon the FCR.

**CONCLUSION**
This retrospective series suggests that there may be an association between FCR tendinosis or tear and osteoarthritis at the scapho-trapezio-trapezoid and first carpal-metacarpal joints. Further, partial or complete FCR tendon tears appear to be more often positioned near an STT joint with osteoarthritis. Potential etiologies of this association include osseous productive changes at the STT and 1st CMC joints impinging the FCR during dynamic activities.

**CLINICAL RELEVANCE/APPLICATION**
FCR tendinosis and tearing should be suspected and observed at MR if there are findings of osteoarthritis at either the STT or first CMC joints associated with volar/radial sided pain.
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