99th Scientific Assembly and Annual Meeting
December 1–6 | McCormick Place | Chicago

RSNA 2013
THE POWER OF PARTNERSHIP

2013 RSNA (Filtered Schedule)

Sunday, December 01, 2013
10:45-12:15 PM • SSA04 • Room: S404CD • Chest (Vascular)
10:45-12:15 PM • SSA05 • Room: N228 • Emergency Radiology (Imaging Chest Emergencies)
10:45-12:15 PM • SSA22 • Room: S104A • Radiation Oncology and Radiobiology (Lung I)
12:30-01:00 PM • LL-CHS-SUA • Room: Lakeside Learning Center • Chest - Sunday Posters and Exhibits (12:30pm - 1:00pm)
01:00-01:30 PM • LL-CHS-SUB • Room: Lakeside Learning Center • Chest - Sunday Posters and Exhibits (1:00pm - 1:30pm)
02:00-03:30 PM • RC101 • Room: E451B • Lung Cancer Screening: How I Do It
02:00-03:30 PM • RC104 • Room: E353C • Sports Injuries in the Chest and Abdominal Wall: A Core Curriculum of the Body's Core
02:00-03:30 PM • RC112 • Room: S105AB • Thoracic Aorta: Key Concepts (An Interactive Session)

Monday, December 02, 2013
07:15-08:15 AM • SPSH21 • Room: E353A • Hot Topic Session: Therapies for Early Stage I Lung Cancer: Options and Controversies
08:30-10:00 AM • RC201 • Room: E353C • Practical Issues in Chest Imaging: Case-based Approach (An Interactive Session)
08:30-10:00 AM • RC225 • Room: N229 • Quantitative Imaging: Diffuse Lung Disease Assessment Using CT
10:30-12:00 PM • SSC04 • Room: S404AB • ISP: Chest (Lung Nodule/Screening)
10:30-12:00 PM • SSC15 • Room: S104A • Radiation Oncology and Radiobiology (Lung II)
12:15-12:45 PM • LL-CHS-MOA • Room: Lakeside Learning Center • Chest - Monday Posters and Exhibits (12:15pm - 12:45pm)
12:45-01:15 PM • LL-CHS-MOB • Room: Lakeside Learning Center • Chest - Monday Posters and Exhibits (12:45pm - 1:15pm)
03:00-04:00 PM • SSE05 • Room: S404CD • ISP: Chest (Intervention)
04:30-06:00 PM • SPDL21 • Room: E450A • RSNA Diagnosis Live™: Chest and Abdomen

Tuesday, December 03, 2013
07:15-08:15 AM • SPSH30 • Room: E351 • Hot Topic Session: Lung Adenocarcinoma - Evolving Concepts
08:30-10:00 AM • RC301 • Room: E450A • High-Resolution CT: A Pattern-based Approach (An Interactive Session)
08:30-12:00 PM • VSPD31 • Room: S102AB • Pediatric Radiology Series: Chest/Cardiovascular Imaging I
10:30-12:00 PM • SSG04 • Room: S404CD • Chest (Functional Lung/ Perfusion)
10:30-12:00 PM • SSG05 • Room: S405AB • Chest (Subsolid Nodule, Neoplasia)
12:15-12:45 PM • LL-CHS-TUA • Room: Lakeside Learning Center • Chest - Tuesday Posters and Exhibits (12:15pm - 12:45pm)
12:45-01:15 PM • LL-CHS-TUB • Room: Lakeside Learning Center • Chest - Tuesday Posters and Exhibits (12:45pm - 1:15pm)
01:30-06:00 PM • VSIO31 • Room: S405AB • Interventional Oncology Series: Lung
03:00-04:00 PM • SSJ06 • Room: S404CD • Chest (Digital Imaging)
03:30-05:00 PM • MSCC34 • Room: S406A • Case-based Review of Nuclear Medicine: PET/CT Workshop-Cancers of the Thorax (In Conjunction with SNMMI) (An I...
04:30-06:00 PM • RC401 • Room: E451A • Interactive Game: The Audience Participation Game (Chest Imaging)

Wednesday, December 04, 2013
08:30-10:00 AM • RC501 • Room: N228 • Chest Imaging: How Radiologic-Pathologic Correlation Informs Interpretation
10:30-12:00 PM • SSK04 • Room: S404CD • Chest (Diffuse Lung Disease)
12:15-12:45 PM • LL-CHS-WEA • Room: Lakeside Learning Center • Chest - Wednesday Posters and Exhibits (12:15pm - 12:45pm)
12:45-01:15 PM • LL-CHS-WEB • Room: Lakeside Learning Center • Chest - Wednesday Posters and Exhibits (12:45pm - 1:15pm)
01:30-03:00 PM • MSES43 • Room: S100AB • Essentials of Chest Imaging
01:30-03:00 PM • MSSR43 • Room: S402AB • RSNA/ESR Emergency Symposium: Chest Emergencies (An Interactive Session)
03:00-04:00 PM • SSM05 • Room: S404CD • Chest (Thoracic Malignancy)
03:00-04:00 PM • SSM18 • Room: S102AB • Pediatrics (Chest)
04:30-06:00 PM • SPSC41 • Room: E450A • Controversy Session: Lung Cancer Screening: Conflict of 'Dollars and Sense?'
04:30-06:00 PM • SPSC44 • Room: S404AB • Controversy Session: The Evolving Role of Image-guided Pulmonary, Hepatic, and Renal Mass Biopsy: Current Indi...

Thursday, December 05, 2013
08:30-10:00 AM • MSCP51 • Room: S406A • Case-based Review of Pediatric Radiology: Pediatric Thoracic Imaging (An Interactive Session)
08:30-12:00 PM • VSCH51 • Room: E351 • Chest Series: Hot Topics in Chest Imaging: Emerging Technologies and Clinical Applications
10:30-12:00 PM • SSQ04 • Room: S405AB • Chest (Radiation Dose Reduction)
12:15-12:45 PM • LL-CHS-THA • Room: Lakeside Learning Center • Chest - Thursday Posters and Exhibits (12:15pm - 12:45pm)
12:45-01:15 PM • LL-CHS-THB • Room: Lakeside Learning Center • Chest - Thursday Posters and Exhibits (12:45pm - 1:15pm)
04:30-06:00 PM • RC701 • Room: S406B • Pulmonary Thromboembolism: Concepts and Controversies 2013

Friday, December 06, 2013
08:30-10:00 AM • RC801 • Room: N230 • Waiting to Exhale: What's the Latest with Inhalation Lung Diseases?
08:30-10:00 AM • RC808 • Room: E353C • Emergency Radiology Case-based Countdown (An Interactive Session)
08:30-10:00 AM • RC813 • Room: N229 • Chest/Cardiovascular Imaging II
10:30-12:00 PM • SST04 • Room: E451B • Chest (Airways, Emphysema)

Spectrum of Progression Curves for Subsolid Nodules: Detection in Low-Dose CT Lung Cancer Screening and Prospective Observation for 8 Years

LL-CHE3091
Ryutaro Kakinuma , MD, PhD
Shuji Yamamoto , PhD
Yukio Muramatsu , MD
Masahiko Kusumoto , MD
Akiko Maeshima
Koji Tsuta , MD
Hiroaki Onaya , MD
Hisao Asamura
Noriyuki Moriyama , MD, PhD

PURPOSE/AIM
To learn the types of progression curves of subsolid nodules based on volume obtained during low-dose CT lung cancer screening and followed-up prospectively for 8 years.
CONTENT ORGANIZATION
1. Subsolid nodules detected in 2004 and after January 2005 were examined. 2. Classification of the progression curves for subsolid nodules based on prospective observations: 1) pathologically diagnosed ground-glass nodules (GGNs): increasing type (rapidly or slowly), and stable type, 2) not-pathologically diagnosed GGNs: increasing type, stable type, decreasing type, and fluctuating type. 3. Representative case presentations for each type showing sequential thin-section CT images and progression curves.

SUMMARY
The main teaching point of this exhibit is to understand the natural history of subsolid nodules based on progression curves of volume on the horizontal axis for cases ranging from birth to 100 years old.

Differentiation of Central Lung Cancer from Atelectasis: Comparison of Diffusion-weighted MRI with PET/CT

LL-CHE3092
Ruimeng Yang
Xinqing Jiang , MD
Xinhua Wei
Mei Wu , MD, PhD
Lei Mo
Yongmei Guo
Lisha Lai
Yunhai Huang

PURPOSE/AIM
Prospectively assess the performance of diffusion-weighted magnetic resonance imaging (DW-MRI) for differentiation of central lung cancer from atelectasis.
CONTENT ORGANIZATION
38 consecutive lung cancer patients who were referred for thoracic MR imaging examinations were enrolled. MR examinations were performed using a 1.5-T clinical scanner and scanning sequences of T1WI, T2WI, and DWI. Cancers and atelectasis were measured by mapping of the apparent diffusion coefficients (ADCs) obtained with a b-value of 500 s/mm2.
Results: PET/CT and DW-MR allowed differentiation of tumor and atelectasis in all 38 cases, but T2WI did not allow differentiation in 9 cases. Comparison of conventional T2WI and DW-MRI indicated a higher contrast noise ratio of the central lung carcinoma than the atelectasis by DW-MRI. ADC maps indicated significantly lower mean ADC in the central lung carcinoma than in the atelectasis ($p < 0.0001$). ADC values of small cell lung carcinoma were significantly greater than those from squamous cell carcinoma and adenocarcinoma ($p < 0.0001$ for both).
SUMMARY
DW-MR imaging provides valuable information not obtained by conventional MR and may be useful for differentiation of central lung carcinoma from atelectasis. Future developments may allow DW-MR imaging to be used as an alternative to PET-CT in imaging of patients with lung cancer.

Is Magnetic Resonance Imaging the Future of Lung Cancer Imaging? A Pictorial Review and Comparison with Computed Tomography and Positron Emission Tomography

LL-CHE3093
Kathryn M Olsen , MD
Kayla M Marchese , BS
John Ford , PhD
Geoffery Hugo , PhD
Daryl H Turlington , BS, RT
Elisabeth Weiss

PURPOSE/AIM
The standard of care for lung cancer imaging includes baseline assessment and staging with positron emission tomography/computed tomography (PT/CT) and chest computed tomography (CT). Magnetic resonance imaging (MRI) has not been the preferred modality due to reduced spatial resolution compared to CT, image degradation from both respiratory and cardiac motion, and the inability to identify viable tumor. We review an MRI protocol for the evaluation of lung cancer, both highlighting several advantages MRI offers compared to PT/CT and demonstrating the potential MRI has in differentiating viable from nonviable tumor.
CONTENT ORGANIZATION
Our exhibit will be presented as a pictorial review with the following organization: 1.) Display MR images used in morphologic assessment of lung cancer. 2.) Discuss additional MRI sequences that may aid in assessment, albeit not included in our standard protocol. 3.) Explain how we interpret DWI/ADC sequences. 4.) Compare data obtained with DWI/ADC to PT/CT.
SUMMARY
Although MRI of lung cancer is not currently the standard imaging modality, this modality may become a feasible method in establishing baseline disease and staging, providing both morphologic and tumor viability information. This modality has the future potential to replace PT/CT in lung cancer imaging.

Which Nodule Does Shake Your Confidence?: 312 Pulmonary Nodules Gallery from a Reading Test by Eleven Radiologists

LL-CHE3094
Koji Sakai
Koji Fujimoto , MD, PhD
Takeshi Kubo , MD
Ryo Sakamoto
Hiroyuki Sekiguchi
Kaori Togashi , MD, PhD *
Gakuto Aoyama
Masami Kawagishi
Yoshio Iizuka
Hiroyuki Yamamoto
Masahiro Yakami , MD, PhD
Yutaka Emoto , MD, PhD
Naozo Sugimoto

PURPOSE/AIM
To demonstrate which nodules need special attention in the diagnosis of lung nodules on multi-detector CT images, by visual presentation of the relationship between radiologists' diagnostic accuracy and their confidence level.
CONTENT ORGANIZATION
1. 312 nodules whose diagnoses were determined clinically were retrospectively collected (104 primary lung cancer, 104 benign, 104 metastasis).
2. Eleven experienced radiologists interpreted each nodule and recorded the confidence level, i.e., subjective likelihood of the nodule being each of three categories in percentages that add up to 100% (e.g. primary: 60, metastasis: 10, benign 30).
3. Mean confidence level of 11 radiologists was plotted on triangular coordinates ('mean confidence triangle').
4. Nodule gallery: According to the 'mean confidence triangle', we divided every 312 nodules to 10 categories and displayed them all, in association with their final diagnoses and mean diagnostic accuracy (%).
SUMMARY
This poster exhibit displays 312 images of nodules at a glance, organized according to radiologists' diagnostic confidence level and diagnostic accuracy. This exhibit defines the characteristics of puzzling and elusive lung nodules. The knowledge of such nodule characteristics may help improve the accuracy of individual radiologists.

The Biostatistics of Lung Cancer Screening: A Primer for Radiologists

LL-CHE3095
Michael A Kadoch , MD
Vinit B Amin , MD
Chenchan Huang , MD
Grace C Lo , MD
Vivian Bishay , MD
Serge Sicular , MD

PURPOSE/AIM
1. Review the major biostatistical considerations in lung cancer screening so that physicians can make appropriate recommendations to their patients.
2. To review the epidemiology of lung cancer and the results from randomized controlled trials of lung cancer screening.
3. To review the potential harms of screening that may contribute to patient apprehension.
4. To compare lung cancer screening with some of the other major screening programs from a biostatistical perspective.
CONTENT ORGANIZATION
Biostatical considerations in screening
- Relative risk reduction and survival (disease-specific and all-cause mortality)
- Absolute risk reduction and number needed to screen
Epidemiology of lung cancer
Results from randomized controlled trials of lung cancer screening
Potential harms of lung cancer screening
- False positives
- Overdiagnosis and overtreatment
- Radiation exposure
Comparing lung cancer screening with other screening programs
Illustrative cases and examples – a balance of benefits and harms
Summary
SUMMARY
Teaching points:
1. To review the major biostatistical considerations in lung cancer screening so that radiologists are properly prepared to engage in the informed decision process.
2. To review the benefits and harms of lung cancer screening.
3. To compare lung cancer screening with other screening programs.

Imaging Appearances on Computer Tomography Following Image Guided Pulmonary Radiofrequency Ablation-A Pictorial Review

LL-CHE3096
Annette L Johnstone , FRCR, MRCP
Bobby Bhartia , MBBCh, FRCR
Jonathan T Smith , MBChB, FRCR
Michael Darby
Tze M Wah , MBChB, FRCR

PURPOSE/AIM
Pulmonary radiofrequency ablation (RFA) is becoming a more commonly used treatment option for both primary lung tumors and pulmonary metastases. From June 2008 to April 2013 we have performed a total of 93 image guided pulmonary RFA treatments in 69 patients at our university teaching institution. Our aim is to illustrate the normal, expected imaging appearances and complications on computer tomography (CT) following pulmonary RFA.
CONTENT ORGANIZATION
We present a pictorial review of post pulmonary RFA appearances based on our experience at a teaching institution. Computed tomography is used to assess the treatment effect post pulmonary RFA. The review aims to present radiology that demonstrates normal expected appearances during longitudinal follow up post treatment. This also includes the illustration of classic appearances of the hyper-attenuating area surrounding the treated nodule, shrinkage of the ablation zone following RFA as well as other imaging appearances such as cavitation and the pattern of recurrence disease in the zone of ablation. In addition, CT detection of both immediate and delayed complications post pulmonary RFA will be illustrated.
SUMMARY
This pictorial review will increase both the radiologists and trainees' awareness of these expected normal appearances as well as complications for image guided pulmonary RFA.

Typical and Atypical CT Finding of Localized Fibrous Tumor of the Pleura

LL-CHE3098
Yoo Kyeong Yeom
Mi Young Kim
Hyun Joo Lee

PURPOSE/AIM
1. To review the common as well as uncommon imaging features of fibrous tumor of the pleura (FTP) on enhanced CT in 43 consecutive patients.
2. To highlight the important clues and pitfalls resulting in an accurate diagnosis of atypical FTP in comparison to their mimickers.
CONTENT ORGANIZATION
1. Brief review of typical imaging features of FTP
2. Atypical appearance
1) Mimicking neurogenic tumor or other mediastinal mass,
2) Pulmonary solitary pulmonary nodule,
3) Mimicking sarcoma or lymphoma,
4) Mimicking lung cancer,
5) Mimicking metastasis
SUMMARY
The major teaching points are:
Awareness of the characteristic and atypical CT manifestations of localized fibrous tumor of the pleura is very important. Thus, familiarity with various CT features of fibrous tumor of the pleura is critical in order to make correct diagnosis.

Understanding Pulmonary Pathophysiological Concepts through Interactive E-Graphic Design

LL-CHE3099

Alfonso Esguerra , MD
Bibiana Pinzon , MD
Carolina Rumie Valois
Andres Vasquez , MD

PURPOSE/AIM
Interactive e-Graphic Design can be an effective learning tool for radiologists- in- training in the understanding of pulmonary pathophysiological phenomena. It does not require specialized expertise for its implementation and its technical and graphic aspects can be self-learned. The object of this exhibit is to illustrate its value by presenting three mini-Tutorials based on the ones we have designed in the past six years at the Fundacion Santa Fe de Bogota Center for Interactive Digital Education in Radiology (www.fsfbcider.edu. org).
CONTENT ORGANIZATION
As examples of effective interactive e-graphic design in the understanding of pulmonary pathophysiology , three mini e-Interactive Tutorials will be presented on the following topics:

- Postcapillary pulmonary hypertension
- Air trapping
- Spontaneous pneumomediastinum

SUMMARY
Interactive e-Graphic Design can be an effective learning tool for radiologists- in- training in the understanding of pulmonary pathophysiological phenomena. It does not require specialized expertise for its implementation and its technical and graphic aspects can be self-learned. Mini e-Interactive Tutorials on pulmonary post capillary hypertension, air trapping, and spontaneous pneumomediastinum, illustrate its usefulness.

Unusual Masses and Mass Like Lesions in Chest-A Review

LL-CHE3100
Srinadh Boppana , MD
Eshwar C Nandury , MD
Balaji Varaprasad Mallula , MD
Ravinder Reddy , MD
Jaya Shankar , MD

PURPOSE/AIM
To showcase a spectrum of rare chest masses and mass like lesions ranging from innocent looking rare tumors to aggressive looking benign infections.
CONTENT ORGANIZATION
To describe the imaging features, discuss the differential diagnosis of few chest lesions that are very rarely encountered in regular practice including
• Pleuro pulmonary blastoma
• Pleural fibroma /solitary fibrous tumor
• Pleural Rosai Dorfman disease
• Bronchial atresia
• Endobronchial hamartoma
• Cryptococcosis and mucormycosis presenting as aggressive destructive mass lesions
• Chest wall Ewings sarcoma
• Pulmonary AVM
• Pulmonary leiomyoma
• Chest wall malignant peripheral nerve sheath tumor.
SUMMARY
• This exhibit is intended to throw light on a variety of cases, most of which are very rare with only few case reports available. These cases are compiled with complete work up and histological confirmation.
• This exhibit reviews the radiological and clinical features that help in diagnosing these unusual tumors or infection and to distinguish them from their more common differentials

Incidental Lung CT Findings in Autoimmune Lymphoproliferative Syndrome that Mimic Infection: A Pictorial Assay

LL-CHE3101
Vana M Derderian , BS
Chuen-Yen Lau , MD, MPH
Katie Perkins , RN
Ken Olivier
V. K Rao
Les R Folio , DO, MPH

PURPOSE/AIM

1. Use an atlas to demonstrate presence of abnormal lung CT findings in patients with disproportionately few pulmonary symptoms in inflammatory conditions such as Autoimmune Lymphoproliferative Syndrome (ALPS).
2. Review chest CT findings of infiltrative extranodal lymphoproliferation that mimic infection, but are not due to infection, in ALPS.
3. Revisit appropriate use of longitudinal lung CT for diagnosis, minimizing radiation dose, and management of lung lesions in ALPS.

CONTENT ORGANIZATION

1. Atlas of representative chest CT images of ALPS patients with infiltrative extranodal lymphoproliferation
2. Description of lung CT scans in the largest global ALPS patient cohort
3. Discussion of management of lung CT findings in conjunction with other clinical information

SUMMARY

1. Lung CT findings that appear suspicious for infection in asymptomatic patients were most often not due to infection in our cohort of 358 ALPS patients.
2. Many ALPS patients with lymphocytic and interstitial processes may be safely managed with immunosuppressive therapy or observation.
3. Incorrectly assuming that findings resembling infection are actually infection can result in mismanagement (inappropriate radiation dose, CT scans, diagnostic work-up and antibiotics).

Percutaneous Needle Biopsy of the Thorax: Clinical Utility with Histologic Correlation

LL-CHE3102
Karl Sayegh , MD
Jessica L Wang , MD

Amita Sharma , MBBS
Subba R Digumarthy , MD
Carol C Wu , MD *
Jo-Anne O Shepard , MD *
Matthew D Gilman , MD

PURPOSE/AIM
To illustrate how the various indications for transthoracic needle biopsy can alter patient management.
Specific indications will be illustrated by case examples demonstrating CT-guided biopsy images and histologic/cytologic confirmation.
CONTENT ORGANIZATION
1. Introduction
2. Patient selection and technique
3. Malignant Diseases

- Small cell vs non small cell lung cancer
- Metastatic disease vs primary lung cancer
- Confirm primary malignancy in nonsurgical candidates with metastases prior to chemotherapy
- Establish diagnosis in non surgical candidates pre-ablative or radiation therapy
- Tissue for molecular testing in primary lung ca or mets from extra thoracic primary (EGFR, KRAS, BRAF etc…)
- Lymphoma, PTLD
- Mediastinal mass pre neoadjuvant therapy (eg thymoma)

4. Non-malignant diseases

- Infections in immunocompromised patients (eg aspergillus, mucormycosis)
- Infections in immunocompetent patients (TB, atypical mycobacterial, cocci, histo)
- Diagnosis hamartoma
- Diagnose cancer mimics (rounded atelectasis, sarcoid, LCH)
- Confirm diagnosis of pleural masses (fibrous tumor, neurofibroma)

SUMMARY
There are various diseases and clinical situations in which transthoracic needle biopsy results can significantly alter the diagnostic and therapeutic approach to the patient.

Testing Your ICU Skills on New and Traditional Images-How Well Can You Pick Out a Tiny Foreign Body on a Portable Chest X-ray with 5-10 Other Findings? Can You Identify Interstitial Pulmonary Edema on Lung Ultrasound?

LL-CHE3103
Brian P Kennedy , BA
Sri Hari Sundararajan , MD
Akshay Goel , BS
Judith K Amorosa , MD
Sabiha Hussain , MD
Anjani P Naidu , MD
Alicia Huang , BS
Eugene C Kennedy , MD, MBBCh
Alberto F Goldszal , PhD, MBA *

PURPOSE/AIM
. In view of the most recent ACR AC update guidelines about ICU imaging (Amorosa et al ACR Appropriateness Criteria Routine Chest Radiographs in Intensive Unit Patients J Am Coll Radiol 2013;10: 170-174) we created a test to see how well radiologists and radiology residents recognize critical conditions and 'hardware' from the ICU.
CONTENT ORGANIZATION
Cases from a Level I Trauma Center ICUs will be presented in a quiz format, some in a pair format: a case with a comparison to emphasize appropriate placement of lines and critical conditions in evolution. Ultrasound imaging by the intensivists complementing critical diagnoses in some cases will also be presented. Modalities will include chest X-ray, chest ultrasound and CT. Examples: lobar atelectasis before and after, counter-pulsation baloon in left subclavian artery and then in descending aorta, Dobhoff feeding tube in right lower lobe bronchus, Impella LVAD, early pulmonary edema on ultrasound, pacer/AICD misplacement and proper placement, disrupted pacer wire, aspirated opaque objects.
SUMMARY
In summary, presentation will be a useful tool for radiologists, radiology residents, ICU clinicians, medical students. By presenting the images in an interactive, comparison before and after format, attendee will be able to assess their observational skills about ICU imaging.

Rare Manifestations of Thoracic Sarcoidosis

LL-CHE3104
Elidor Agolli
Admir Sulovari
Emine D Yilmaz Bayhan
Atadan Tunaci , MD

PURPOSE/AIM
Sarcoidosis is a multisystem chronic inflammatory disease with thorax being the most commonly site involved. Apart from the commonly encountered typical manifestations, rarely encountered findings such as unilateral or isolated lymphadenopathy, airway consolidation, ground-glass, linear or miliary opacities, fibrocystic changes, mosaic attenuation, tracheobronchial involvement and pleural disease may also be seen. Our study provides examples of rare manifestations in thoracic sarcoidosis.
CONTENT ORGANIZATION
Between 1990-2012 in all cases of sarcoidosis presented to our hospital a few of them revealed rare findings in radiography and CT examination. More specifically these rare findings were: asymmetrical, lower lobe, unilateral, predominantly peripheral, pleural, vascular and tracheal involvements, and in the form of cavitary lesions. All cases were proven by biopsy with histological specimen confirming the disease. We provide both radiologic imaging and pathologic findings of all these rare and uncommon sarcoids.
SUMMARY
One must be aware of the rare manifestations of sarcoidosis and not to directly atribute this forms to other, more common diseases such as tuberculosis, fungal infection and maligniencies.

Micronodular Lung Diseases: A Schematic Review

LL-CHE3105
Marie-Michele Theriault , MD
Patricia Diez Martinez , MD
Jean Chenard , MD
Denis Bergeron , MD

Junie Lecours , MD
Gerald Gahide , MD, PhD

PURPOSE/AIM
Explain and illustrate the three patterns of micronodular lung diseases (perilymphatic, centrolobular and random distribution) and expose a systematic approach to narrow the differential diagnoses for each one of these three patterns.
CONTENT ORGANIZATION
1- Definition of micronodular lung disease and brief review of secondary pulmonary lobule anatomy. 2- Presentation of the three patterns of micronodular lung diseases. 3- Diagrammatic reasoning for narrowing the differential diagnoses for each one of the three micronodular lung disease patterns. 4- Résumé of the most common micronodular lung diseases and of some less common but revelant micronodular lung diseases.
SUMMARY
Our aim is to present a diagrammatic reasoning for micronodular lung diseases to establish an accurate and short differential.

Percutaneous Approach to the Solitary Pulmonary Nodule: Maximizing Accuracy and Minimizing Complications and Dose. A Review of Pre-, Intra-, and Post-procedural Issues

LL-CHE3106
Mark Landis , MD, FRCPC
Jonathan Chung , MD
Kristin VanSligtenhorst

PURPOSE/AIM
To review the indications, diagnostic imaging, interventional methods, contraindications, and potential complications of percutaneous transthoracic needle biopsy of lung nodules/masses To review recent technical innovations and dose reduction techniques in percutaneous transthoracic needle biopsies
CONTENT ORGANIZATION
This presentation will review: 1. What is a nodule? 2. The methods/modalities available to diagnose pulmonary nodules 3. Pre-procedure lesion, anatomic, and patient-related clinical factors that affect approach and sampling techniques 4. The interventional approach to diagnosis examining: traditional computed tomography (CT) guided biopsy approaches, the use of CT fluoroscopy and point-and-shoot CT techniques, fine needle aspiration vs. core biopsy sampling, and post-procedure care issues. 5. Discuss more recent innovations in thoracic intervention such as preoperative localization techniques for semisolid and ground-glass nodules 6. Intraprocedural dose reduction techniques
SUMMARY
Following review of this education exhibit, the reader will have a more clear understanding of the lesion, patient- and procedure-related factors, dose reduction techniques, and newer technical innovations in transthoracic needle lung interventions.

Marking Small Pulmonary Nodules Using CT Guidance in Cancer Patients before Video-assisted Thoracoscopic Surgery: How and When

LL-CHE3107
Eunice A Lara Garcia , MD
Carlos E Rojas Marin , MD
Luis A Rodriguez Palomares , MD
Franco Gonzalez
Edgar J Rosero Garcia , MD
Jose F Corona-Cruz , MD

PURPOSE/AIM
1. To describe the types and techniques of localization of small lung nodules using CT guidance.
2. To review the utility of this radiologic tool in the successful of non invasive thoracic surgery
3. To show the pathological correlation

CONTENT ORGANIZATION
A.Pulmonary nodule in a cancer patient setting
• Indications of resection a small lung nodule
B.Marking CT guide technique protocol
• Hook-wire localization
• Methylene blue injection
• Radio tracer injection
• Microcoils insertion
• Complications
C.Video-assisted resection:
• Technique, time after localization and duration procedure.
D.Macroscopic and histopathology correlation
SUMMARY
1. To recognize the roll of an interventional radiology technique, in cancer patients, like a useful tool in minimally invasive thoracic surgery.
2. To be familiarize with the different kinds of localization of small lung nodules also with the indications and complications.

Preoperative CT-Guided Localization of Suspicious Ground-glass Opacities Using a Metallic Clip

LL-CHE3108
Chiang J Tyng , MD
Almir Bitencourt , MD
Maria Fernanda A Almeida
Paula N Barbosa , MD
Joao Paulo K Matushita, Jr. , MD
Rubens Chojniak , MD, PhD
Marcos D Guimaraes , MD

PURPOSE/AIM
To describe the technique of preoperative localization of ground-glass opacities (GGO) through computed tomography (CT)-guided placement of a metallic clip inside the lesion and to discuss this new technique in comparison to those previously described.
CONTENT ORGANIZATION
Ground-Glass Opacities - Definition - Malignancy potential - Intraoperative localization Described Preoperative Localization Methods - Image-guided surgery (intraoperative ultrasound and CT fluoroscopy) - Injection of liquid materials through fine needles (dyes, contrast media or radionuclides) - Placement of percutaneous wires and microcoils though CT guidance Preoperative Localization using Metallic Clip - Technique - Indications - Advantages - Complications
SUMMARY
Intraoperative localization of GGO is difficult because they are not easy to palpate and may be invisible at radioscopy. The preoperative localization using a metallic clip is a simple, useful, versatile and cheap tool in the surgical diagnostic workup and treatment of patients

presenting with small pulmonary lesions. The metallic surgical clip used provides a palpable marker that can also be located through fluoroscopic guidance. Our initial experience shows that this technique is safe, easy and accurate for preoperative localization of GGO, with low rates of complications.

Imaging Appearance of Complications of Surgery for Thoracic Outlet Syndrome

LL-CHE3109
Jeanette Hemp , MD
Cynthia E Wagner , MD
John A Kern , MD
Kenneth J Cherry , MD
Juan M Olazagasti , MD
Michael Hanley , MD

PURPOSE/AIM
The purpose of this exhibit is: 1. To familiarize the radiologist with the regional anatomy, surgical approach, and possible procedural complications of surgery for thoracic outlet syndome (TOS). 2. To identify complications of surgery for TOS detectable on routine post operative radiographs. 3. To review clinical implications and management of imaging findings. 4. To promote effective communication between radiologists and surgeons.
CONTENT ORGANIZATION
Anatomy of the thoracic outlet Overview of cervical or first rib resection Index radiographs demonstrating complications of surgery for thoracic outlet syndrome - Pneumothorax - Hemothorax - Apical hematoma - Thoracic duct injury - Phrenic nerve injury Clinical management and tips for effective communication of findings
SUMMARY
The major teaching points of this exhibit are: 1. Surgical correction of TOS may result in complications specific to the regional anatomy and surgical technique of first/cervical rib resection. 2. Complications should be recognized on routine post operative radiographs. 3. Effective communication of pertinent findings may assist the surgeon in management of TOS post-surgical complications.

CT Chest in Hematological Malignancies: Imaging Patterns that Every Radiologist Should Know

LL-CHE3111
Ananya Panda , MBBS, MD
Sanjay Thulkar , MD
Sheragaru H Chandrashekhara , MD
Manisha Jana , MD, FRCR
Devasenathipathy Kandasamy

PURPOSE/AIM
To describe pulmonary and thoracic pathologies in patients with hematological malignancies using a pattern approach
CONTENT ORGANIZATION
Hematological malignancies include leukemia and lymphoma. Compromised immunity make these patients prone to opportunistic infections. Other treatment or disease related complications include pulmonary edema, hemorrhage and massive lymphadenopathy causing superior mediastinal syndrome. The exhibit will depict disease spectrum in these patients using the following patterns: Pattern 1: Ground-glass attenuation with /without septal thickening
a) Opportunistic infection (PCP, CMV, fungal, atypical viral)
b) Acute lung disease (ARDS, pulmonary edema, hemorrhage)
c) Drug induced
Pattern 2: Nodules
a) Infection: Fungal ,TB, Viral
b) Lymphomatous/leukemic deposits
Pattern 3: Consolidation
a) Infection: pyogenic/ mixed
b) Tumour deposits
c) Pulmonary edema, hemorrhage
Pattern 4: Mediastinal nodal mass
a) TB
b) Primary/relapsed lymphoma
c) Post Transplant Lymphoproliferative Disorder
Pattern 5: Serosal effusions
a) Infections
b) Pulmonary edema, ARDS
SUMMARY
The spectrum of chest pathologies in hematological malignancies is diverse . A pattern approach helps in initial streamlining of differentials. Further correlation with clinical history can suggest correct diagnosis for optimal patient management.

Imaging of PE in Pregnancy: Choice of CT Angiography or Nuclear Medicine Ventilation/Perfusion Scan

LL-CHE3112
Laura Miller , MD
Fang Lu , MD
Josephina A Vossen , MD, PhD
Greg B Marrinan , MD

PURPOSE/AIM
- To review published data on the risks of radiation exposure in pregnancy from VQ scan or Chest CTA. - To summarize the current literature and recommendations regarding use of VQ or CTA for evaluation of pulmonary embolism in pregnancy. - To review protocols to optimize acquisition and interpretation of both studies in a pregnant patient.
CONTENT ORGANIZATION
1. Radiation risk during pregnancy with CTA and VQ will be compared. 2. Current literature and recommendations will be reviewed regarding: -Choice of test for pregnant patients. -Protocols for optimization of both tests in pregnant patients.
SUMMARY
Making a confident diagnosis of pulmonary embolism is an important role of imaging. Anticoagulation carries significant risks, especially during pregnancy. However, minimizing radiation exposure is a concern for a pregnant patient. Evaluation for PE can be performed with either nuclear medicine ventilation/perfusion (V-Q scan) scan or CTA. At the end of the presentation, the reader will gain a better understanding of the comparative risks of nuclear medicine V-Q scan and CTA during pregnancy. The current recommendations on choice of test and methods to optimize both exams will also be discussed.

Donâ€™t Compromise: Pulmonary Infections in Immunocompromised AIDS Patients

LL-CHE3113
George Mikhail , MD
Samantha D Glass , MD
Sarel Gaur , MD
Robin P Cunningham , MD
Robert W Perone , MD

PURPOSE/AIM
Immunocompromised patients with HIV disease and AIDS are susceptible to a host of infections that are not commonly seen in the general population and as a result, these less often encountered opportunistic infections may present a diagnostic dilemma. As patients with HIV are living longer, these infections are now more commonly seen in emergency departments around the country. Familiarity with the imaging findings coupled with clinical history and CD4 counts can facilitate prompt and accurate diagnosis. This ultimately is critical to minimizing patient morbidity by enabling quicker initiation of appropriate therapy.
CONTENT ORGANIZATION
In a case based format, signature chest radiographic and High Resolution CT (HRCT) imaging patternsrelated to common opportunistic infections found in HIV patients will be illustrated. These radiologic findings will be combined with related history and CD4 counts to help highlight pearls needed to make an early and prompt diagnosis of these infections.
SUMMARY
Identifying opportunistic infections in immunocompromised patients with HIV/AIDS in the emergent setting is of the utmost importance. Our goal is to provide a visual imaging vocabulary of the more common opportunistic infections thus strengthening the radiologist's diagnostic acumen and facilitating the accurate and prompt administration of appropriate medical treatment.

Imaging of Thymic Epithelial Tumors: Current Status and Future Prospect

LL-CHE4195
Ahmed Abdel Razek , MD

PURPOSE/AIM
1-To review basic background, pathology and staging of thymic epithelial tumors
2-To review CT and MR imaging appearance of thymic epithelial tumors
3-To illustrate imaging appearance according to histologic classification and clinical staging of thymic epithelial tumors
CONTENT ORGANIZATION
1-Clinical presentation and associated findings of thymic epithelial tumors
2- WHO histologic classification and Masaoka clinical stage of thymic epithelial tumors
3-Plain radiography of thymic epithelial tumors
4-CT and PET/CT of thymic epithelial tumors
5- MR imaging of thymic epithelial tumors
6- Diffusion and perfusion MR of thymic epithelial tumors
7-Correlation of imaging findings with histologic classification and clinical staging of thymic epithelial tumors
8-Imaging findings differentiate thymic epithelial tumors from other thymic lesions
9-Role of imaging in monitoring and follow up after therapy
10-Summary and future directions
SUMMARY
The major teaching points of this exhibit:
1-To be familiar of radiologist with typical and atypical imaging appearance of thymic epithelial tumors at different imaging modalities
2-Imaging appearance of thymic epithelial tumors correlated with histologic classification and clinical staging

---

Mediastinal Lines and Stripes Revisited: Anatomical Description Using 3D CT Images, and Related Lesions That Could Influence the Mediastinal Lines and Stripes

LL-CHE4196
Itsuko Okuda , MD
Masahiro Irimoto , MD
Kazuaki Hirata , PhD
Shigeru Nawano , MD
Yasuo Nakajima , MD

PURPOSE/AIM

- Three-dimensional (3-D) CT is performed routinely, and the mediastinal lines and stripes depicted on plain chest radiograph can be evaluated using reconstructed CT images objectively.
- Commentary of anatomical components constituting lines and stripes by sterically-CT images.
- To illustrate lines and stripes as an index to avoid misdiagnosis and to detect lesions in the anatomical blind areas on plain chest radiograph.

CONTENT ORGANIZATION
-Anatomical description of the lines and stripes by coronal and sagittal reconstructed CT images (lung, pleura, tracheobronchus, aorta, esophagus, spine)
-Review of anatomical blind areas on plain chest radiograph
-Brief demonstration of the various lesions that could influence the lines and stripes
1) Normal
2) Normal variation
3) Abnormal
-Exposition of the correlation between plain radiograph and reconstructed CT images
SUMMARY

1. Plain chest radiograph is a screening study, and can guide further examination.
2. That the mechanism which the mediastinal lines and stripes depicted on plain chest radiograph, is illustrated using reconstructed CT images.
3. Understanding the complex anatomy of the lines and stripes, and the various chest structures is a key to successful interpretation.
4. Lines and stripes could be useful index to prevent misdiagnosis in the blind areas of plain chest radiograph.

Thoracic Manifestations of Autoimmune Gastrointestinal and Hepatobiliary Disease: A Radiological Review

LL-CHE4197
David Bowden , MBBChir
Anu Balan , MBBS, MRCP
Judith L Babar , MBChB

PURPOSE/AIM
The purpose of the exhibit is to: 1. Review the pathophysiology of the thoracic manifestations of autoimmune gastrointestinal (GI) and

hepatobiliary (HPB) disease
2. Present the spectrum of radiological findings, with an emphasis on multidetector CT (MDCT)
3. Review the complications of therapy for autoimmune disease, with an emphasis on drug-related pneumotoxicity
CONTENT ORGANIZATION

- Review of the pathophysiology of autoimmune GI/HPB disease and its relationship with pulmonary disease
- MDCT-focused illustration of the radiological findings, including:

1. Airway disease (eg. diffuse tracheal involvement, bronchiectasis)
2. Parenchymal disease (eg. interstitial lung disease, organizing pneumonia, sarcoidosis, drug-related pneumotoxicity)
3. Extrapulmonary disease (eg. thromboembolic disease, fistula formation)

- Sample cases
- Summary

SUMMARY
Major teaching points are:

- Pulmonary manifestations of autoimmune GI/HPB disease occur in a significant proportion of cases, with up to 60% demonstrating abnormal lung function tests
- IBD-related thoracic complications are under-recognized despite their presence in patients with sub-clinical disease
- Early recognition of such complications, in particular drug-related pneumotoxicity, is of importance in helping the pulmonologist manage this challenging patient group

Aortic Arch Variants: Angiographic Findings

LL-CHE4198
Mina Boussalah , MS
Najwa Touil
Omar Kacimi
Nabil Chikhaoui , PhD

PURPOSE/AIM
Congenital anomalies of the aortic arch complex are frequent and may be incidentally revealed in asymptomatic forms. There detection is useful, even essential preoperatively, in order to adapt the intervention and limit potential complications. We aim to provide an overview of its variants met in our department.
CONTENT ORGANIZATION
Congenital anomalies of the aortic arch are frequent. They must be detected, essential preoperatively, in order to adapt intervention and limit potential complications.
SUMMARY
This pictorial essay reviews the angiographic and computed –tomography appearances of many congenital variations of the right aortic arch met in our department. A literature review helps us showing embryogenesis of some of these anomalies, describing their frequencies, clinical and radiological appearances.

Adenocarcinoma Spectrum of the Lung- Radiological-pathological Correlation, Molecular Markers, Imaging Guidelines

LL-CHE4199
Pooria Javadi , MD
Jennifer Ha
Luis A Landeras , MD
Robert C Gilkeson , MD *
Michael Yang
Prabhakar Rajiah , MD, FRCR

PURPOSE/AIM
1. To review the latest adenocarcinoma spectrum classification by IASLC/ATS/ERS
2. Rad- Path correlation of the lesions in the spectrum.
3. To understand the clinical significance of molecular markers.
4. To discuss the latest imaging guidelines for the follow-up of subsolid nodules.
CONTENT ORGANIZATION
1. Review of the 2011 adenocarcinoma spectrum classification
2. Rad-path correlation of lesions in the spectrum with sample cases- PREMALIGNANT (Atypical adenomatous hyperplasia; Adenocarcinoma in situ MALIGNANT (Minimally invasive adenocarcinoma; Invasive adenocarcinoma (Lepidic, acinar, papillary, micropapillary, solid Variants (Invasive Mucinous, colloid, fetal, enteric).
3. TNM staging, survival
4. Molecular analysis- EGFR, KRAS, ALK rearrangement (Rad-path, therapeutic implications)
5. 2012 Fleischner society guidelines for management of subsolid nodules
6. CT protocols and techniques
SUMMARY

1. The IASCL classification has diagnostic, therapeutic and prognostic implications.
2. The new management guidelines for subsolid nodules are based on pathological subtypes of adenocarcinoma and their prognosis. The lack of solid component and size = 5 mm pertain a favorable prognosis. 3. EGFR mutation indicates response to tyrosine kinase inhibitors; KRAS indicates poor response. ALK rearrangement indicates response to ALK inhibitors.

â€œDid I Miss THAT?ï¿½?: Subtle and Commonly Missed Findings on Chest Radiographs

LL-CHE4200
Alan M Ropp , MD
Jay Patel , MD
Stephen A Waite , MD
Deborah L Reede , MD
Jennifer M Martino , MD

PURPOSE/AIM
The purpose of this exhibit is to provide examples of commonly missed lesions and describe methods of image evaluation to enhance the detection of subtle or ambiguous abnormalities on chest radiographs.
CONTENT ORGANIZATION
Cases will be presented as unknowns in a quiz format. Typical blind spots will be emphasized and pertinent clinical information will be presented as we discuss each case. Case examples include: - Missed lung cancer under the right hemidiaphragm - Missed Apical lung cancer - Squamous cell cancer of the trachea - Left paraspinal line widening in a patient with traumatic aortic rupture - Subcutaneous air in

necrotizing fascitis - Hilar lung cancer missed on the frontal view - Sternal fracture - Retained/embolized guidewire from central venous catheter placement - Manubrial plasmacytoma - Pneumomediastinum - External braid artifact mimicking a mass - Subtle apical mass mimicking the humeral head on lateral view - Bronchogenic cyst mimicking the contour of the aortic arch - Azygous continuation
SUMMARY
After completing this educational exhibit, the learner will be more confident in their ability to read a chest radiograph. This exhibit will enhance chest radiograph interpretation skills by increasing awareness of common blind spots and frequently overlooked or misdiagnosed findings.

PET-MRI of Lung Cancer

LL-CHE4201
Prabhakar Rajiah , MD, FRCR
Andres Kohan , MD *
Christian Rubbert , MD *
Ryan T Huber , MD
Raymond Muzic , PhD *
Robert C Gilkeson , MD *
Peter F Faulhaber , MD *

PURPOSE/AIM
The recent advent of PET/MRI has added a sophisticated tool in the evaluation of lung cancers. The purpose of this exhibit is to share our experience in imaging lung cancers using an integrated whole- body PET/MRI scanner (Philips Ingenuity TF) and review the current status of PET/MRI in the evaluation of lung cancers.
CONTENT ORGANIZATION
The exhibit will review and illustrate the following topics related to PET-MRI of lung cancers 1. Physics of PET/MRI
2. Advantages of integrated PET/MRI
3. Workflow
4. Patient preparation
5. PET/MRI imaging protocol, including MRI sequences
6. Attenuation correction
7. PET/MRI in lung cancer staging- TNM system
8. PET/MRI vs PET/CT- Sample cases
9. PET/MRI in lymph nodal involvement vs PET/CT
10. Chest wall invasion
11. Mediastinal invasion
12. Challenges and limitations
13. Current scientific evidence
SUMMARY
The major teaching points of this exhibit are 1. PET-MRI is an effective alternative to PET-CT in the evaluation of lung cancers without the need for ionizing radiation 2. PET/MRI may be superior to PET/CT in specific circumstances such as the evaluation of mediastinal or chest wall invasion.

Sub-second Low-dose Volumetric Dynamic Imaging of the Airway Using High-pitch Helical Dual-Source CT

LL-CHE4202
Prabhakar Rajiah , MD, FRCR
Calen Frolkis , BA
Abed Ghandour , MD
Jennifer Paczak
Leslie Ciancibello , RT
Robert C Gilkeson , MD *

PURPOSE/AIM
To demonstrate the utility of dual-source CT scan using high-pitch helical acquisition in the dynamic inspiratory-expiratory evaluation of airways.
CONTENT ORGANIZATION
1. Technical considerations
-Siemens Dual-source 128 slice scanner.
-Topogram for coverage of airways
-Low-dose volumetric image of the entire airway
-End-inspiratory images (285 mAs, 120 kVp, collimation-2mm, pitch-3.2)
-Expiratory images at onset of forced expiratory effort following deep breath
-Virtual bronchoscopic images in both the phases
2. Advantages
-Dynamic volumetric acquisition of the entire airway
-Subsecond acquisition mimics physiological states more than a regular expiratory phase imaging.
3. Samples cases
Tracheomalacia, saber-sheath trachea, tracheitis, post-intubation stenosis, post-surgical stenosis, post-radiation, neoplasms, extrinsic compression by goiter, vascular anomalies/aneurysms,obstructive sleep apnea.
4. Challenges, artifacts
SUMMARY
High-pitch helical acquisition with a dual-source CT is a novel technique for low- dose dynamic evaluation of the airway. Volumetric images of the entire length of the airway is obtained within a second, which is a closer approximation to the physiology than the currently used technique. Volumetric dynamic evaluation detects abnormalities of the entire airway that may be missed with select axial acquisitions.

Diseases in the Aortopulmonary Window: Imaging Findings

LL-CHE4203
Kiyomi Furuya , MD
Kotaro Yasumori , MD
Sadanori Takeo
Seiya Momosaki , MD, PhD
Yoshio Matsuo
Toru Muranaka , MD
Yoshihuku Nakayama
Toshiro Kuroiwa
Masahir Sakai

PURPOSE/AIM
CONTENT ORGANIZATION
SUMMARY

The AP window plays an important role as a pathway in the growth and spread of various inflammatory process and neoplasm. CT and MRI reveal these findings in detail very well. FDG-PET CT provides additional information. Awareness of the imaging manifestations of these broad conditions and careful attention to the clinical information will help in making the correct diagnosis.

Malignant Pleural Mesothelioma: Diagnosis, Staging, and Management

LL-CHE4204
Mike S Nguyen , MD
Abhishek Chaturvedi , MD
John C Wandtke , MD *

PURPOSE/AIM
This exhibit presents and discusses key radiological and histologic features of malignant pleural mesothelioma to help diagnose and stage the disease.
CONTENT ORGANIZATION
Malignant pleural mesothelioma is an uncommon but highly lethal malignancy that originates from the pleura. Asbestos is the principal risk factor that is associated with all forms of mesothelioma. Malignant pleural mesothelioma can be difficult to diagnose. Patients usually present with chest radiographs that show unilateral pleural abnormalities and effusions. Diagnosing malignant mesothelioma is difficult because various benign and metastatic tumors can occur in the pleural cavity and some can appear histologically similar to mesotheliomas. Staging and management depend on radiologic studies to determine extent of disease. Key radiological and histologic features of malignant pleural mesothelioma will be illustrated with radiographic, CT, MR, and PET studies.
SUMMARY
After reviewing this exhibit, the attendee will be able to: 1. Identify the key radiologic and histologic features of malignant pleural mesothelioma.
2. Describe the staging system used for malignant pleural mesothelioma.
3. Discuss common surgical and nonsurgical management techniques for malignant pleural mesothelioma.

Didactic Architecture: Structuring Junior Radiology Resident Education According to a Pyramid of Articles from Current Literature Sources

LL-CHE4205
Michael E Hahn , MD, PhD
Paul Stark , MD

PURPOSE/AIM
Junior radiology residents are faced with an abundance of educational material. We aim to describe a series of pertinent articles structured in a didactic fashion that serve as a foundation for the incremental study of chest radiology.
CONTENT ORGANIZATION
We plan to present a collection of useful and pertinent articles that cover the basics of chest radiology. These articles are categorized according to important educational topics: anatomy, physiology, approach to the chest radiograph, emphasis on blind spots, psychophysics, congenital abnormalities, diffuse lung disease, atelectasis, ICU, infection, lung cancer diagnosis, staging, and screening, pulmonary vascular disease, mediastinum, trauma, surgical procedures, CT and MRI technology, PET, among others. Importantly, a large number of these articles are drawn from high-quality RSNA material, published in Radiology and Radiographics.
SUMMARY
We describe a series of high-yield articles drawn from high quality publications that serve as a solid foundation for junior radiology residents as they begin to study chest radiology. These articles supplement traditional attending readouts and aid trainees in developing an effective approach to imaging and interpretation of thoracic diseases in the adult. This approach stimulates trainees to embark on life-long learning while perusing the current literature.

Pulmonary Radiofrequency: Looking to the Future

LL-CHE4206
Hector Vidal Trueba
Sarah Marques Llano
Jose Antonio Parra , MD, PhD
Gerardo Blanco
Eduardo Torres Diez
Angelica Lamagrande Obregon
Sara Sanchez Bernal

PURPOSE/AIM
Surgical resection is the treatment of choice in patients with lung cancer stages I and II. However there is a group of patients by age, performance status, poor lung function and comorbidity, are not considered for surgery. We want to discuss the indications,technical aspects of the procedure, treatment methods, contraindications, and complications of pumonary radiofrecency.
CONTENT ORGANIZATION
1. To describe the technique radiofrequency ablation of malignant lung lesions guided by CT. 2. To know the most typical complications during the procedure. 3. To show the conditions to be met by the patient. 4. To display typical errors and complications that occur in patients undergoing radiofrequency. 5. Follow up management. 6. To evince the cooperation with other specialties.
SUMMARY
CT-guided RFA of malignant lung lesions is a minimally invasive technique that can be used as an alternative to standard treatment in selected cases. We show our experience over the last two years, to demonstrate that pulmonary radiofrecuency is an alternative in patients with significant comorbidity.

Chest Tubes: Common and Uncommon Complications Reported by the Radiologist

LL-CHE4207
Frederico F Souza , MD
Giorgio Aru , MD

PURPOSE/AIM
Our purpose is: to briefly describe : 1. Indications for chest tubes placement 2. Types of chest tubes and what size to choose acoording to the indication We will focus our presentation on: 3. common and uncommon complications after chest tube placement, describing them and showing imaging examples from a large academic medical hospital.
CONTENT ORGANIZATION
Indications for chest tubes placement include pneumothorax, transudates, exudates, trauma, malignant effusion, bronchopleural fistula. The choice of the chest tube and the technique for placement vary according to the indication for placement. Complications after chest tube placement can simply be classified as technical or infective. Technical causes include tube malposition, blocked drain, chest drain dislodgement, reexpansion pulmonary edema, subcutaneous emphysema, nerve injuries, cardiac and vascular injuries, oesophageal injuries, residual/postextubation pneumothorax, fistulae, tumor recurrence at insertion site, herniation through the site, chylothorax, and

cardiac dysrhythmias. Infective complications include empyema and surgical site infection including cellulitis and necrotizing fasciitis.
SUMMARY
Tube malposition is the commonest complication of tube thoracostomy and is more common when tubes are inserted under suboptimal conditions and in urgent tube thoracostomy.

Artifacts Associated with MR Angiography (MRA) for Pulmonary Embolism (PE)

LL-CHE4208
Cristopher A Meyer , MD *
Mark L Schiebler , MD *
Scott B Reeder , MD, PhD
Christopher J Francois , MD
Scott K Nagle , MD, PhD *

PURPOSE/AIM
1. Brief review of MRA technique for detection of PE
2. Illustrate the spectrum of MR artifacts that may simulate or obscure pulmonary emboli and how to identify these artifacts.
3. Explain the origin of these artifacts and propose real time solutions to limit artifacts on repeat acquisitions or future exams.
CONTENT ORGANIZATION
1. Contrast related: bolus timing (Maki effect), bolus duration, transient interruption of the bolus, dual injection errors
2. MR Reconstruction: Gibbs ringing artifact, corner cutting
3. Parallel imaging: wrap, acceleration factor, coil selection
4. Motion: respiratory
5. Amplifier gain: over-ranging

SUMMARY
PIOPED III concluded that MRA for PE should only be performed in centers that have experience with this technique and in patients in whom standard tests are contraindicated. Over 600 MRA-PE studies have been performed at our institution between 2008 and 2011. This educational exhibit will review an effective imaging protocol for PE and describe commonly encountered artifacts. Techniques to mitigate these artifacts that might confound the correct diagnosis of PE will also be discussed.

As Best as You Can: Learning the Thoracic Imaging Findings of Asbestos Exposure

LL-CHE4209
Christopher J Norbet , MD
Sanjeev Bhalla , MD
Fernando R Gutierrez , MD
Santiago E Rossi , MD *
Ignacio Rossi

PURPOSE/AIM
- To review a wide spectrum of thoracic manifestations resulting from asbestos exposure
- To discuss the salient imaging findings of these various manifestations
CONTENT ORGANIZATION
- Introduction
- Pathophysiology of asbestos exposure
- Pleural manifestations of asbestos exposure
- Pleural Effusions
- Pleural Plaques
- Diffuse Pleural Thickening
- Parenchymal manifestations of asbestos exposure
- Rounded atelectasis
- Dependent atelectasis versus early peribronchial fibrosis
- Asbestosis
- Thoracic malignancies related to asbestos exposure
- Mesothelioma
- Bronchogenic carcinoma
- Conclusion
SUMMARY
The thoracic complications resulting from asbestos exposure remain leading causes of morbidity and mortality both in the United States as well as in developing countries. It is essential to recognize the plain radiographic, CT, and MR findings of these diseases in order to direct proper surveillance and management of these patients and to prevent further complications. In this exhibit, we will demonstrate imaging features of the various thoracic manifestations resulting from asbestos exposure. Our exhibit will focus on pleural disease, parenchymal disease, and malignancies related to asbestos exposure.

Thoracic Venous Anomalies

LL-CHE4210
Rogerio Pinetti , MD
Danilo M Sales , MD
Gustavo Pinto , MD
Alberto R Leao
Emerson L Gasparetto , MD
Roberto Blasbalg , MD

PURPOSE/AIM
Evaluate the main congenital and acquired anomalies of venous structures of the thorax.
CONTENT ORGANIZATION
Thoracic venous anomalies can be divided anatomically into sistemic or pulmonary. Range from isolated anatomic variations in asymptomatic pacients to more complex and symptomatic changes of greater clinical significance, and its knowledge is of great importance to avoid unnecessary procedures or help physician in the correct treatment. The authors describe and illustrate with cases of CT and MRI major congenital and acquired thoracic venous anomalies: SYSTEMIC: - Left superior vena cava - Duplicated superior vena cava - Anomalous left brachiocephalic vein - Azygos and hemiazygos continuation of inferior vena cava - Azygos lobe - Primary and secondary tumor of vena cava - Superior vena cava obstruction from fibrosing mediastinitis PULMONARY: - Partial anomalous pulmonary venous return - Pulmonary vein stenosis - Intrapulmonary vein varix - Pulmonary veins agenesis - Scimitar syndrome - Hepatopulmonary syndrome
SUMMARY
Recognition of anatomic variations and patologic conditions of thoracic venous systems is of great importance for the radiologist to provide

the correct manegement of pacientes.

â€˜Xâ€™ Marks the Spot; or Does It? Clinical Significance and Management of Non-diagnostic Transthoracic Biopsies

LL-CHE4211
> **Jeffrey F Chick** , MD
> **Nikunj R Chauhan**
> **Ruth M Dunne** , MBBCh
> **Beatrice Trotman-Dickenson** , FRCR, MRCP
> **Andetta R Hunsaker** , MD
> **Francine L Jacobson** , MD, MPH
> **Alarice Lowe** , MD
> **Rachna Madan** , MD

PURPOSE/AIM
Discuss the significance and management of non-diagnostic transthoracic biopsies and highlight benign and malignant causes of such biopsies.
CONTENT ORGANIZATION
1. Review the significance of non-diagnostic transthoracic biopsies.
2. Provide examples of non-diagnostic biopsies covering an array of benign and malignant conditions.
3. Emphasize the multidisciplinary approach in management of non-diagnostic biopsies.
4. Highlight, using case-based-scenarios, management in non-diagnostic cases including re-biopsy, resection, surveillance imaging, infectious screening, vasculitis testing, and expert consultation.
SUMMARY
Transthoracic biopsies are utilized in a variety of situations including evaluating nodules, differentiating tumors from infections, and staging malignancies. Unfortunately, such biopsies are non-diagnostic in upwards of 35% of cases, due to inadequate specimens, non-specific-inflammation, and the presence of atypical cells. Non-diagnostic transthoracic biopsies, which may be due a variety of benign processes including sarcoid, infections, and vasculitides or malignant processes including bronchogenic carcinoma and lymphoma, often lead to clinical confusion and repeated biopsies. This exhibit highlights non-diagnostic transthoracic biopsy scenarios and provides a guide to clinical decision-making and management of these challenging cases.

Adenocarcinoma of the Lung with Lepidic Growth: Spectrum of CT Findings with Pathologic Correlation

LL-CHE4212
> **Juan Arenas** , MBBS
> **Elena Garcia-Garrigos**
> **Ana Teruel**
> **Lara Jaques** , MD
> **Ana Culianez**
> **Ignacio Aranda**

PURPOSE/AIM
Discuss the spectrum of imaging findings of adenocarcinoma of the lung with lepidic growth on CT, making emphasis on the pathologic correlation of the different CT components with their histological correlates.
CONTENT ORGANIZATION
Introduction of the malignant and premalignant lesions that exhibit pathologic lepidic growth. Review of the varied CT appearance expected for each condition. Correlation of the different components found at CT (ground glass, solid component, consolidation, pseudocavitation) with the histopathological findings in specimens of each lesion (pure lepidic growth, airspace collapse and stromal infiltration, mucinous component and presence of emphysema, dilated bronchioles ..., respectively). Discussion of the different pathologic correlation of solid component in part solid lesions. Pathologic explanation of mucinous adenocarcinoma CT appearance. Entities that can mimic these lesions with pathologic correlation.
SUMMARY
Adenocarcinoma of the lung with lepidic growth include several categories with varied pathological, CT and prognostic characteristics. By correlating CT with histopathological findings in specimens, radiologist can better understand the differences among those categories, that can assist in their better diagnosis and management.

CT and PET/CT Assessment of Complications after Chemo and Radiation Therapy in Esophageal Carcinoma

LL-CHE4213
> **Sonia L Betancourt Cuellar** , MD
> **Diana M Palacio** , MD
> **Brett W Carter** , MD *
> **Santiago Martinez**
> **Marcelo K Benveniste** , MD
> **Mylene T Truong** , MD

PURPOSE/AIM
To describe and review the CT and PET/CT findings of complications associated with radiation and chemotherapy in patients with esophageal carcinoma.
CONTENT ORGANIZATION
CT and PET/CT are useful in assessing response after combined-modality therapy for advance esophageal carcinoma. Interpretation of PE/CT and CT is optimized by knowledge of the potential complications associated with non-surgical treatment for esophageal carcinoma. Complications associated with radiation therapy include: radiation-induced lung disease (RILD), pericardial and pleural effusions, esophagitis, esophageal ulceration, esophageal stenosis, and liver injury. Complications associated with chemotherapy result include cardiomyopathy and a broad spectrum of lung toxicity including diffuse alveolar damage (DAD), nonspecific interstitial pneumonia (NSIP), and bronchiolitis obliterans with organizing pneumonia (BOOP).
SUMMARY
Awareness of the spectrum of appearances of complications following radiation and chemotherapy for esophageal carcinoma is important in preventing misinterpretation.

High Resolution Computed Tomography of Chromosomal Disorders

LL-CHE4214
> **Jeffrey R Kunin** , MD *
> **Santiago Martinez-Jimenez** , MD *
> **Melissa L Rosado De Christenson** , MD *
> **Christopher M Walker** , MD *

PURPOSE/AIM

1. Review high resolution computed tomography (HRCT) findings in patients with various chromosomal disorders.
2. Provide recommendations for appropriate additional imaging in certain chromosomal disorders.
3. Suggest guidelines for appropriate genetic counseling based on imaging diagnoses.

CONTENT ORGANIZATION
Chromosomal abnormalities may result in pulmonary abnormalities on HRCT. The following diseases will be discussed: cystic fibrosis, X-linked agammaglobulinemia, tuberous sclerosis complex, alpha 1-antitrypsin deficiency, Hermansky-Pudlak syndrome, primary ciliary dyskinesia, hereditary hemorrhagic telangiectasia, Birt-Hogg-Dubé and others. Knowledge of the characteristic imaging findings may alert the radiologist to suggest the underlying disorder in the differential diagnosis and recommend appropriate additional imaging. In addition to identifying the diagnosis, referral for genetic counseling may be indicated in certain conditions.
SUMMARY
The major teaching points of this exhibit are:

1. Certain chromosomal disorders are associated with pulmonary abnormalities on high resolution CT.
2. Multisystem involvement may occur in certain chromosomal disorders and require further imaging studies.
3. The radiologist may make the initial diagnosis of a chromosomal disorder and alert the clinician to the need for genetic counseling.

Subsolid/Ground Glass Opacities in the Lungs: A Pictorial Review of the Radiologic and Pathologic Correlations

LL-CHE4215
Daisy Q Huang , MD
Bradley B Pua , MD *
Naveen Gumpeni , MD
Andrew Schreiner
Kyungmouk S Lee , MD

PURPOSE/AIM
Persistent ground glass opacities (GGO) or those with increasing solid components can be attributed to a wide spectrum of disease processes from inflammatory conditions to adenocarcinoma. This pictorial exhibit will review the imaging characteristics of of these nodules in various diseases and present a pattern approach to the diagnostic interpretation on CT.
CONTENT ORGANIZATION
This exhibit will introduce how GGO and subsolid nodules are defined and subdivided. We will review the spectrum of disease processes attributed to GGO, from benign inflammatory processes to (pre)malignant conditions (atypical adenomatous hyperplasia, adenocarcinoma in situ). We will present a pattern approach to interpretation of GGO/subsolid nodules that relies on lesion distribution (i.e. solitary, diffuse, centrilobular). Radiologic-Pathologic correlation will be made with examples from percutaneous biopsies and surgical resection.
SUMMARY
The diagnostic interpretation of solid pulmonary nodules in lung cancer screening has been well established. GGO, however, remains more difficult as these lesions are also associated with various non-malignant/pre-malignant processes. This exhibit will present a pictorial review of the variety of radiologic and pathologic correlations of these nodules emphasizing a systematic pattern approach to the diagnostic interpretation.

Bronchial Arteries: Anatomy, Function, Hypertrophy and Interventions

LL-CHE4216
Melissa L Rosado De Christenson , MD *
Santiago Martinez-Jimenez , MD *
Christopher M Walker , MD *
Jeffrey R Kunin , MD *
Brandt C Wible , MD *

PURPOSE/AIM
1. Understand bronchial artery anatomy and function 2. List differential diagnosis of bronchial artery hypertrophy 3. Outline indications for bronchial artery interventions
CONTENT ORGANIZATION
1. Bronchial artery anatomy and anatomic variants 2. Differential diagnosis of bronchial artery hypertrophy: Chronic infectious/inflammatory processes (e.g. tuberculosis, mediastinal fibrosis, bronchiectasis), pulmonary hypertension (e.g. chronic pulmonary thromboembolic disease, idiopathic pulmonary hypertension), congenital anomalies (bronchial-to-pulmonary artery shunts, proximal interruption of the pulmonary artery, anomalous left coronary artery from the pulmonary artery) 3. Bronchial artery interventions: Indications and complications
SUMMARY
Bronchial arteries contribute to 1% of the cardiac output but can be recruited to provide systemic circulation to the lung. Knowledge of bronchial artery anatomy is important in the identification of abnormal bronchial arteries and the formulation of an appropriate differential diagnosis. Hypertrophied bronchial arteries should alert the radiologist to disorders of the pulmonary circulation and should prompt exclusion of related lesions including chronic inflammatory processes, chronic thromboembolic disease and congenital anomalies. Bronchial artery interventions may be successfully employed to treat affected patients.

Cardiac Devices on Chest Radiographs: What Do We Need to Know?

LL-CHE4217
Tyson S Chadaz , MD
Steven Lee , MD
Abhishek Chaturvedi , MD
Susan K Hobbs , MD, PhD

PURPOSE/AIM
Imaging is increasingly being used to evaluate cardiac devices. It is important to be familiar with the imaging characteristics of these devices, their functions, their indications, expected locations, and complications while interpreting radiographs. In addition, knowledge of which of these are MRI compatible is also very important.
CONTENT ORGANIZATION
1. Review of the different types of cardiac devices in question and answer format: ECG recording Loop device, Pacemakers, Defibrillators, ECMO, Ventricular assist devices 2. Plain radiograph imaging characteristics and correct anatomic location of cardiac devices 3. Pictorial companion cases of early and late complications 4. Discussion of which cardiac devices are MRI safe.
SUMMARY
The key learning points of the exhibit are: 1. Correct identification of cardiac devices on radiographs, and their expected anatomic locations. 2. Appreciate and recognize the associated complications.

Coming to Terms with CT Radiation in the Chest: A Primer

LL-CHE4218
Clinton E Jokerst , MD
Constantine A Raptis , MD
Andrew J Bierhals , MD
Juan Carlos Ramirez Giraldo , PhD
Sanjeev Bhalla , MD

PURPOSE/AIM
-Review definition of basic technical terms dealing with ionizing radiation from computed tomography (CT)
-Discuss the information contained in a CT dose report
-Explain some of the commonly utilized dose reduction techniques available on CT scanners
-Provide an easy to follow presentation which can be referenced when faced with questions about radiation from chest CT
CONTENT ORGANIZATION
Introduction
Basic terms, their definition, and how they impact radiation exposure including but not limited to:
-Tube Voltage
-Tube Current
-CT Dose index
-Dose-Length Product
-Size-specific Dose Estimate
-Effective Dose
The CT dose report explained (including examples)
Vendor-neutral discussion of essential principles of CT dose reduction techniques including how to maximize their efficacy and avoid their limitations; including but are not limited to:
-Automated mAs modulation
-kVp selection (automated/manual)
-Iterative reconstruction
-Bismuth breast shields
Summary with Future Directions
SUMMARY
Teaching points:
-Understanding relevant terminology is essential for understanding the information contained in a CT dose report
-A grasp of basic radiation physics as well as an understanding of dose reduction techniques and limitations are essential to ensure that quality CT imaging of the chest is obtained with minimum risk to the patient

Aortic Arch Native Mobile Embolic Source (Arch NMES): Demographics, Clinical Presentation, Cross-sectional Imaging Findings, and Outcomes

LL-CHE4219
Rodrigo I Lopez Costa , MD
Clinton E Jokerst , MD
Travis S Henry , MD *
Sanjeev Bhalla , MD

PURPOSE/AIM
The purpose of this exhibit is to: -Review patient demographics and presenting symptoms in patients with ARCH NMES -Discuss location, possible etiologies, cross-sectional imaging appearance, and differential diagnosis of ARCH NMES -Assess how patient's with ARCH NMES are managed clinically with attention to outcomes
CONTENT ORGANIZATION
Introduction with Background
Patient demographics
Common presenting symptoms with clinical case examples
Location of Arch NMES with proposed etiologies and discussion of aortic flow modeling
Common appearances on CT and MRI with several case examples
Arch NMES mimics including ulcerated atherosclerotic plaque, intimal sarcoma
Arch NMES management with clinical outcomes
Summary
SUMMARY
-Patients with Arch NMES are typically younger, present with embolic phenomena, and have little or no aortic atherosclerosis
-Arch NMES is mobile, tends to arise from the undersurface of the arch near the isthmus, and often attaches to the aortic wall via a thin stalk
-The differential diagnosis includes ulcerated plaque and intimal sarcoma
-There is no consensus on clinical management; most patients get anticoagulation, some undergo thrombectomy
-Patient demographics, symptoms, and imaging findings help the cardiothoracic imager avoid pitfalls and make the proper diagnosis, appropriately guiding management

Collateral Networks in States of Congenital Absence of Major Thoracic Veins

LL-CHE4220
Brett W Carter , MD *
Beth Chasen , MD
Patricia M De Groot , MD
Marvin H Chasen , MD

PURPOSE/AIM
The purpose of this educational exhibit is to demonstrate, through models and radiologic correlation, compensatory venous networks within the thorax that reconstitute blood flow to the right heart when expected interconnections between venous structures are congenitally absent. All material within this exhibit is from patients being evaluated for malignancy at our Cancer Center.
CONTENT ORGANIZATION
The reconstitution of blood flow, when one or more expected venous structures is congenitally absent, is accomplished by a circular ring of inner veins that connect to a vertical set of veins that are the draining pathways to the right heart. These pathways will be outlined through the utilization of three-dimensional models. Correlative radiographs and CTs will enhance the understanding of how the models demonstrate the compensatory venous networks that must come into play when there is congenital absence of venous structures within the thoracic venous system.
SUMMARY
Congenital absence of venous structures within the thorax results in the formation of compensatory venous pathways that facilitate the return of blood to the right heart. It is incumbent upon the radiologist to recognize such networks and formally report them in order to prevent difficulties during important clinical procedures such as placement of central and/or therapeutic lines.

Approach with Caution: Recognizing Vascular Masses of the Mediastinum

LL-CHE4221
Brett W Carter , MD *
John P Lichtenberger , MD
Leila Khorashadi , MD
Bradley S Sabloff , MD
Gerald F Abbott , MD *
Carol C Wu , MD *

PURPOSE/AIM
The purpose of this educational exhibit is to illustrate the wide variety of vascular abnormalities centered within the mediastinum that may manifest as masses on imaging studies of the chest.
CONTENT ORGANIZATION
Specific abnormalities of vascular origin arising within the mediastinum will be presented on chest radiography, CT, PET/CT, and MRI performed on adult patients. Pathophysiology, diagnosis, and treatment of all presented entities will be discussed.
SUMMARY
Vascular masses are common abnormalities of the mediastinum that represent approximately 10% of mediastinal masses identified on chest radiography. Mediastinal vascular masses comprise a myriad of disease processes, from aneurysms, congenital anomalies, and malformations of systemic and pulmonary arteries and veins to benign and malignant primary and secondary vascular tumors. Correctly identifying vascular masses on advanced modalities such as CT, PET/CT, and MRI is important to avoid unnecessary biopsies and surgeries that could result in increased morbidity and mortality. Therefore, it is important for the radiologist to be aware of the spectrum of imaging findings that may be encountered in the evaluation of vascular mediastinal masses.

Pulmonary Embolism and beyond: Congenital and Acquired Abnormalities of the Pulmonary Arteries

LL-CHE4222
Brett W Carter , MD *
John P Lichtenberger , MD
Leila Khorashadi , MD
Bradley S Sabloff , MD
Gerald F Abbott , MD *
Carol C Wu , MD *

PURPOSE/AIM
The purpose of this educational exhibit is to illustrate the wide variety of congenital and acquired abnormalities of the pulmonary arteries that may be encountered by the radiologist when interpreting imaging studies of the chest.
CONTENT ORGANIZATION
Specific abnormalities of the pulmonary arteries, including congenital anomalies and acquired pathologies, will be presented on chest radiography, CT, PET/CT, and MRI performed on adult patients. Pathophysiology, diagnosis, and treatment of all presented entities will be discussed.
SUMMARY
Abnormalities of the pulmonary arteries have been encountered more frequently in the adult population due to the widespread use of imaging. Many congenital anomalies, such as proximal interruption of a pulmonary artery and anomalous origin of the left pulmonary artery from the right pulmonary artery, may be asymptomatic and only identified on examinations performed for other indications. Acquired abnormalities of the pulmonary arteries, the most common of which is pulmonary embolism, are more likely to manifest clinically and may be identified on examinations tailored to their evaluation, although these entities may also be encountered incidentally. It is important for the radiologist to be familiar with the myriad of anomalies that may affect the pulmonary arteries and convey the clinical importance of these entities.

The Role of PET/CT in Assessing Response to Therapy in Lung Cancer

LL-CHE4223
Brett W Carter , MD *
Sonia L Betancourt Cuellar , MD
Myrna C Godoy , MD, PhD
Osama R Mawlawi , PhD
Edith M Marom , MD
Mylene T Truong , MD

PURPOSE/AIM
The purpose of this educational exhibit is to demonstrate the role of PET/CT in response evaluation of patients treated for lung cancer.
CONTENT ORGANIZATION
Representative PET/CT examples illustrating various responses of primary lung cancers to treatment will be presented. Established response criteria pertaining to PET/CT imaging (RECIST 1.1 and PERCIST 1.0) will be discussed. Limitations of PET/CT in assessing treatment response, as well as potential pitfalls due to therapy-related inflammation/infection, will be reviewed.
SUMMARY
In the evaluation of therapeutic response, PET/CT provides a means by which the metabolism of malignancies may be assessed. A reduction in FDG uptake within treated lung cancer has been associated with pathologic response and increased survival. However, treatment regimens may be either cytotoxic or cytostatic, and different criteria are used to determine response in these scenarios. Familiarity with the spectrum of appearances of treated lung cancer on PET/CT, the guidelines used to determine treatment response, and the limitations and potential pitfalls is important in preventing misinterpretation.

PERCIST 1.0: PET Response Evaluation in Thoracic Malignancies

LL-CHE4224
Ana Paula Benveniste , MD
Brett W Carter , MD *
Marcelo K Benveniste , MD
Osama R Mawlawi , PhD
Mylene T Truong , MD
Jeremy J Erasmus , MD

PURPOSE/AIM
To review the Positron Emission Tomography Response Criteria in Solid Tumors guidelines (PERCIST 1.0). To illustrate with representative examples the use of PERCIST 1.0 in thoracic malignances. To discuss potential limitations of PET/CT in the assessment of therapeutic response.
CONTENT ORGANIZATION
In the evaluation of therapeutic response, accurate measurement of the change in tumor size is important and primarily assessed on CT. However, novel targeted therapy may have cytostatic and not cytotoxic effect and may not lead to regression in tumor size. Accordingly, there is increasing interest in functional imaging techniques to assess and quantify tumor cell metabolism. PET/CT is being used in the evaluation of treatment response in patients with intrathoracic malignancies. PERCIST has been proposed to standardize the use of PET in the determination of treatment response. Illustrative examples of the use of PERCIST include cases of lung cancer, esophageal cancer, and

mesothelioma.
SUMMARY
PERCIST 1.0 permits the evaluation of metabolic response to therapy in the absence of anatomic change. Awareness of the PERCIST 1.0 guidelines is important for radiologists to refine and validate quantitative approaches to monitoring PET tumor response in the clinical setting.

Ultra-high-Resolution CT Images of Lung Adenocarcinomas Obtained Using a Prototype Scanner

Back to Top

LL-CHE4225
Ryutaro Kakinuma , MD, PhD
Yukio Muramatsu , MD
Masahiko Kusumoto , MD
Akiko Maeshima
Koji Tsuta , MD
Hisao Asamura
Noriyuki Moriyama , MD, PhD

PURPOSE/AIM
1. To learn ultra-high-resolution CT (U-HRCT) images of lung adenocarcinomas based on the new IASLC/ATS/ERS international classification and phantoms and to compare them with conventional high-resolution CT (C-HRCT) images. 2. To understand image noise of a prototype U-HRCT scanner
CONTENT ORGANIZATION
SUMMARY
The main teaching points of this exhibit are to illustrate U-HRCT images of lung adenocarcinomas based on the new IASLC/ATS/ERS international classification and to learn image noise of a prototype U-HRCT scanner.

Indemnity of the Aortic Wall, the Thin Layer That Supports Life. Signs That Help Diagnose Parietal Damage in Acute Aortic Syndrome and Aneurysmal Rupture

Back to Top

LL-CHE4226
Luciana Della Rosa
Lisandro Sicer
Evangelina D Lugones
Stella M Batalles , MD
Roberto L Villavicencio , MD
Norberto O Sanchez

PURPOSE/AIM

- To highlight the pathological aortic wall changes in acute aortic syndrome, ruptured aneurysm, and signs of impending rupture.
- To review the normal anatomy of the aorta and the pathophysiology of wall damage.
- To emphasize the importance of using multislice tomography in the differential diagnosis to provide appropriate therapy.
- To establish the relationship between the imaging findings and parietal lesion types.

CONTENT ORGANIZATION
Normal anatomy and pathophysiology of wall damage.
Review of the most common causes of acute aortic syndrome:
intramural aortic hematoma
Aortic dissection
penetrating atherosclerotic aortic ulcer
ruptured aneurysm Exhibition of cases performed at our image service
Key points to consider in the differential diagnosis
SUMMARY
Multislice tomography is useful for finding signs related to the aortic wall alteration. Aortic dissection: The contrast images demonstrate the intima-media flap.
Intramural hematoma: A smooth thickening, crescentic or circumferential aortic wall, which decreases the size of the light.
Pentrating atherosclerotic ulcer: The atheromatous ulcer falls within the intima calcified ulcer while penetrating therethrough.
Aneurysmal rupture: Active extravasation and presence of contrast out of the aorta and into the retroperitoneal hematoma.

Viruses, Immunity and Unusual Lymphoproliferative Disorders of the Chest: Integrating Pathogenesis, Imaging and Clinical Scenarios

Back to Top

LL-CHE4227
Amy Law
Judah Burns , MD
Linda B Haramati , MD, MS *

PURPOSE/AIM
The purpose of this exhibit is:
1. To describe the current understanding of the role of viruses and immunity in the pathogenesis of lymphoproliferative disorders.
2. To integrate this pathogenesis with clinical and imaging scenarios demonstrating the different disorders presenting with thoracic involvement.
CONTENT ORGANIZATION
We will give an overview of the pathogeneses of viruses associated with unusual lymphoproliferative disorders of the chest. Then the relevant clinical, radiological, and histopathologic characteristics will be reviewed.
SUMMARY
Overstimulation of the normal lymphoid tissue in the thorax, via viruses and/or immune dysfunction, gives rise to lymphoproliferative disorders. These viruses are Epstein-Barr virus, human herpesviruses-6 and -8, and human immunodeficiency virus. Unusual lymphoproliferative disorders with thoracic involvement and viral association include entities such as lymphomatoid granulomatosis, lymphoid interstitial pneumonia, Rosai-Dorfman disease, Castleman's disease, post-transplant lymphoproliferative disorder, acquired immunodeficiency syndrome related lymphoma, and primary effusion lymphoma. A broad approach using radiological, clinical and histopathological findings along with knowledge of pathogenesis can aid in patient diagnosis and management.

Thoracic Manifestations of Amyloidosis: Modern Cross-sectional Imaging

Back to Top

LL-CHE4228
Sue S Chen , MD
Carl R Fuhrman , MD
Diane C Strollo , MD

Page 17 of 136

Ferenc Czeyda-Pommersheim , MD

PURPOSE/AIM
1. Discuss etiology, pathophysiology, classification, and diagnosis of amyloidosis. 2. Review contemporary CT and MR imaging (MRI) findings of thoracic amyloidosis 3. Highlight unique thoracic imaging features and provide a differential diagnosis for its non-specific radiologic manifestations.
CONTENT ORGANIZATION
1. Introduction 2. Etiology, pathophysiology, classification, clinical manifestations, and diagnosis. 3. Imaging features of thoracic amyloidosis including lung, airway, mediastinal lymphadenopathy, cardiac manifestations and their differential diagnoses.
SUMMARY
Amyloidosis is a rare condition due to extracellular deposition of insoluble fibrillar proteins. Lung involvement may manifest as diffuse reticulonodular thickening or as nodules that may calcify, cavitate, and slowly enlarge. Tracheobronchial involvement may exhibit airway wall thickening, mural nodules, submucosal calcification, and airway obstruction. Mediastinal and hilar lymph nodes may enlarge and frequently calcify. On cardiac MRI, the left ventricular wall is typically thickened, and late gadolinium enhancement characteristically exhibits global transmural or subendocardial distribution. Imaging manifestations strongly suggestive of amyloidosis and differential considerations will be highlighted to help refine the diagnosis. However, biopsy is almost always needed for confirmation.

How to Perform a Brilliant PE (Pulmonary Embolism) Report: On Our Way to Perfection

LL-CHE4229
    Uxia Sobrino Castro , DiplPhys
    Inmaculada Herraez Ortega
    Abelardo Fuentes Moran
    Jose Daniel Samper Wamba , MD
    Cristina Antolin Perez
    Marta Tijerin Bueno , MD

PURPOSE/AIM
The aim of this exhibit is:

- to bring and share an **structured, complete and simple** guide to **help the radiologist** on call coping with the **challenge** of reporting a **PE study brightly**, getting to an **exact diagnosis** and **accurate prognosis**

CONTENT ORGANIZATION

- BACKGROUND: technical parameters, anatomy
- THE REPORT:

1. **Filling defects:** presence or absence: the diagnosis
2. **Type of thrombus:** acute, chronic and combined based on the morphology
3. **PE extension:** central, peripheral
4. **Parenchymal affection:** hemorrhage, infarction, atelectasis
5. **Secondary pulmonary hypertension:** how and where to measure
6. **Right ventricle overload** and failure: right/left ventricle, the septa and wall. The main prognostic factor
7. **Incidental findings**
8. **Conclusion:** clear, concise and systematic in only one sentence

Complete descriptive report with a precise conclusion including diagnostic and prognostic data is essential
SUMMARY
Major teaching points are:

- A **systematic reading helps** the **diagnostical** and **prognostical** approach and prevents from **pitfalls**
- We necessarily **have to evaluate**: the presence of thrombus, the chronicity, extension, parenchymal repercussion, and possible data on pulmonary hypertension and right ventricle failure
- Performing an **structured**, **complete** and **simple report** is essential for an **accurate managment** and **follow up**

A Review of Practical Applications of Dual-energy CT Angiography

LL-CHE4230
    Anthony S Tadros , MD
    Joy Liau , MD, PhD
    Laurel Ball
    Afshin Karimi , MD

PURPOSE/AIM
We summarize recent developments in dual-energy CT angiography and show how it can be used in routine clinical practice to improve the diagnostic information from contrast enhanced CT studies.
CONTENT ORGANIZATION
We review the physical principles of dual-energy CT and summarize recent developments. In particular, we focus on iodine contrast load reduction by lower kilovoltage (kV) reconstructions near the k edge of iodine, iodine perfusion maps to increase sensitivity of angiographic studies, and the decreased variability in absolute Hounsfield measurements by using monoenergetic versus the traditional polyenergetic absorptions. In studies requiring a pre-contrast scan, a noncontrast image can be reconstructed to evaluate for intramural hematoma or absolute contrast enhancement without additional radiation dose. Practical aspects of dual-energy acquisitions, such as radiation dose, injection protocols, and use of iterative reconstruction technique will be discussed.
SUMMARY
Dual energy CT angiography methods are summarized, and we provide a practical guide to how they can be used in routine clinical practice to improve diagnosis. Specifically, we discuss low kV reconstructions, iodine perfusion maps, reduced iodine contrast load in the setting of renal insufficiency, and reduced radiation dose for studies requiring pre-contrast scans.

Low Radiation Dose Chest CT: A Review and a Novel 140 Kilovoltage Approach

LL-CHE4231
    Joy Liau , MD, PhD
    Laurel Ball
    Afshin Karimi , MD

PURPOSE/AIM
We summarize low radiation dose chest CT methods and suggest a novel 140 kilovoltage(kV) approach.
CONTENT ORGANIZATION
We review methods to reduce chest CT radiation dose, with special focus on modulating tube current and voltage. We also introduce a new low radiation dose technique that uses a combination of increased tube voltage(140 kV) and reduced tube current(automA max 110 mA).

Previous methods have focused on reducing tube voltage since it has a quadratic dependence on radiation dose while tube current has a linear dependence. In our practice, we found this produced poor image quality in subjects with higher body mass index(BMI). Also, low kV low radiation dose technique has greater susceptibility to metal and beam hardening artifacts. Using the 140 kV method, a low radiation dose can be achieved over a range of BMIs with reduced artifacts and only a negligible loss of signal to noise and contrast to noise ratios. The radiation dose reduction allows new opportunities, such as the option to acquire a retrospectively gated cardiac study with the same dose as a prospectively gated study.

SUMMARY

Low radiation dose chest CT methods are reviewed, and we propose a new 140 kV method that can be easily implemented in clinical practice to reduce radiation dose and artifact across patients with a broad range of BMIs while maintaining diagnostic image quality.

'Induced Hemorrhage Technique' in CT Guided Core Needle Biopsy of Small Pulmonary Nodules

LL-CHE4232
Bhavin Jankharia , MD *
Nishigandha P Burute , MBBS, MD

PURPOSE/AIM

To demonstrate a successful biopsy technique for sub-centimeter pulmonary nodules suspected to be metastases

CONTENT ORGANIZATION

Approval for this retrospective study was granted by the IRB. 12 pulmonary nodules in 12 patients suspected to be metastatic, ranging from 7.2 – 9.8mm (mean 8.5 mm) were biopsied under CT fluoroscopy guidance with a 64-slice MDCT. Lesions were localized with the patient in shallow breathing. A 20G coaxial needle was introduced in the nodule. In case of the nodule slipping, (8/12) the gun was fired adjacent to it, to induce hemorrhage causing the nodule to be fixed. A minimum of 6 cores were obtained per nodule. Mild perilesional hemorrhage in all 12, and pneumothoraces upto 1.0cm that stabilized in < 5 minutes in 3 cases were seen. On histopathology, 10 nodules were confirmed to be metastatic, 1 necrotic with no specific diagnosis and 1 was a granuloma. Inducing hemorrhage to stabilize sub-centimeter metastatic nodules aided biopsy with adequate diagnostic samples achieved in all.

SUMMARY

Biopsy of small lung nodules is a challenge, especially in metastatic workup. Hemorrhage may be used as an aid for nodule stabilization in smaller, slippery nodules. This technique of induced hemorrhage with CT fluoroscopy and a gun-canula allows for easy biopsy of sub-centimeter nodules.

Explore the Heart â€œwithoutï¿½? ECG-Gating!; A Practical Approach to Evaluate Cardiac Function on Non-ECG-Gated Thoracic CT

LL-CHE4233
Mitsutomi Ishiyama , MD
Takuya Ueda , MD
Masaki Matsusako , MD, PhD
Akari Makidono , MD
Saya Horiuchi , MD
Yukihisa Saida , MD
Takaharu Suzuki
Goto Makoto

PURPOSE/AIM

The purpose of this case-based presentation is to show
1. Key imaging findings of various cardiac diseases and signs which indicate cardiac function on routine non-gated thoracic CT by correlating with ECG-gated cardiac CT and MRI
2. Importance of evaluation of the heart on routine non-gated thoracic CT in asymptomatic population by presenting successful and failed cases to provide patients with early diagnosis and treatment.
This presentation will guide radiologists toward understanding how to detect heart diseases and evaluate cardiac function on routine non-gated thoracic CT. We hope this presentation will enhance the value of our daily radiology reports and lead more patients to proper management.

CONTENT ORGANIZATION
1. Ischemic heart disease
-Acute myocardial infarction
-Old myocardial infarction and its complication
2. Cardiomyopathy
-Hypertrophic cardiomyopathy
-Hypertensive cardiomyopathy
-Arrythmogenic right ventricular cardiomyopathy
3. Valvular heart disease
-Aortic stenosis and regurgitation
-Mitral stenosis and regurgitation
4. Restrictive pericarditis
5. Atrial fibrillation

SUMMARY

The heart sometimes could be a blind spot on routine thoracic CT. However, it is possible to evaluate the cardiac function and then prevent serious consequences that could affect patients' quality of life by examining even routine non-gated images.

CT-Guided Percutaneous Lung Biopsy: What Every Radiologist Needs to Know

LL-CHE4234
Hisham W Mikhael , MD, MSc
Michelle Zhang , MD
Tamador F Gazzaz , MBBS, MD
Kashayar Rafaat Zand , MD
Genevieve Belley , MD

PURPOSE/AIM

1. To familiarize with the indications, technique, type of needles and chest tubes used, potential complications and patient care involved with CT-guided percutaneous needle lung biopsy.
2. To describe the procedure from beginning to end, including tips to decrease the rate of complications.

CONTENT ORGANIZATION
1. **Introduction**
a. Current practices and statistics.
b. Indications and contraindications.
2. **Preparation**
a. Various needles and chest tubes.
3. **Procedure**
a. Different techniques, in particular fine-needle aspiration versus core biopsy.

b. Step-by-step description of the procedure.
c. Patient positioning.
d. Useful tips and common pitfalls that can be avoided.
4. **Post-procedure**
a. Complications: how to recognize, reduce their occurrence and manage them.
b. Patient monitoring.
5. **Patient care**
a. Instructions given to the patient prior to and after the procedure.
b. Common physician and patient concerns.
SUMMARY
Following the exhibit, the reader should have a better understanding of:
1. The indications and contra-indications.
2. The different types of needles and chest tubes to use.
3. The common techniques with a step-by-step description, including tips and pitfalls.
4. The post-procedural complications.
5. The periprocedural patient care. for CT-guided percutaneous needle lung biopsy.

Chest Wall Tuberculosis: Cross Sectional Imaging Spectrum

LL-CHE4235
    Prashant S Naphade , MBBS, MD
    Abhijit A Raut , MD
    Rahul B Gujrathi , MD
    Abhishek Keraliya
    Rahul M Nikam , MBBS, DMRD
    Vivhek Pai
    Hina J Shah , MBBS

PURPOSE/AIM
The purpose of this exhibit is to illustrate the role of cross sectional imaging in the diagnosis of chest wall Tuberculosis (TB).
CONTENT ORGANIZATION
Chest wall TB, caused by Mycobacterium tuberculosis, is not an uncommon entity in endemic areas. Chest wall swelling over a period of several weeks associated with constitutional symptoms is the usual presentation. Caseating granulomas are the hallmark of tubercular infection. It usually manifest as loculated collection in the chest wall with a peripheral enhancement on postcontrast scan. Erosions and marrow edema involving rib/sternum is usually seen. Involvement of costovertebral and sternoclavicular joints can be seen. Additional findings such as pleural, parenchymal TB and mediastinal lymphadenopathy reinforce the diagnosis of TB.
SUMMARY
The major teaching points of this education exhibit are 1. Imaging presentations include peripherally enhancing loculated collection and rib/sternal osteomyelitis. 2. Cross sectional imaging plays an important role in its diagnosis, assessing the extent and image guided aspiration and. 3. We should be conversant with the imaging features of chest wall TB, especially in endemic areas, to allow for early accurate diagnosis and appropriate patient management.

Complications of Thoracic Tuberculosis: Imaging Spectrum

LL-CHE4236
    Prashant S Naphade , MBBS, MD
    Abhijit A Raut , MD
    Abhishek Keraliya
    Hina J Shah , MBBS
    Rahul M Nikam , MBBS, DMRD
    Vivhek Pai

PURPOSE/AIM
Resurgence of Tuberculosis (TB) is seen worldwide due to multidrug resistant TB especially in immune-compromised hosts. The purpose of this exhibit is 1. To demonstrate the pulmonary(PC) and extra pulmonary(EPC) complications of thoracic TB
2. To illustrate the role of cross sectional imaging in the diagnosis and management of complications of thoracic TB.
CONTENT ORGANIZATION
Retrospective evaluation has been performed in pathologically verified cases of pulmonary tuberculosis presenting with involving airways, vessels, mediastinum, pleura, and chest wall. Imaging findings- Pulmonary complications-destruction of lung, acute respiratory distress syndrome, aspergilloma and bronchogenic carcinoma developing in scar tissue. Extra pulmonary complications-bronchiectasis, tracheobronchial stenosis, esophagobronchial/bronchopleural fistulae, hypertrophied bronchial arteries/Rasmussen aneurysm presenting with haemoptysis, secondary pulmonary hypertension, extensive mediastinal adenopathy causing mass effect, pleuropericardial complications and osteomyelitis.
SUMMARY
A variety of pulmonary and extra pulmonary complications can occur in pulmonary TB. Contrast enhanced CT scan is an accurate modality for detection of these complications guiding appropriate treatment.

What Happens after the Biopsy? Cytologic and Histologic Characterization of Thoracic Biopsy Samples, with Implications for Biopsy Approach and Clinical Management

LL-CHE4237
    Michael A Bolen , MD
    Charles T Lau , MD
    Joseph T Azok , MD
    Ahmed El-Sherief , MD
    Rahul D Renapurkar , MD
    Peter Mazzone , MD
    Valeria Arrossi , MD
    Jennifer Brainard , MD
    Carol Farver , MD

PURPOSE/AIM
Obtaining an early, accurate diagnosis improves treatment options for patients with cancer in the chest. In most instances, cytologic or histologis confirmation of malignancy is required before initiating treatment. Detailed characterization of biopsy samples is gaining importance as treatment of malignancy is becoming more complex and varied. The aim of this education exhibit is to review the cytologic and pathologic testing that follows biopsy acquisition, and its implications for acquisition technique, with particular focus on transthoracic image guided approach, as well as clinical managment.
CONTENT ORGANIZATION
A brief introduction to tissue acquisition techniques, including transthoracic approach, bronchoscopy, mediastinoscopy, and thoracoscopy. This will be followed by a review of rapid onsite cytologic evaluation, analytic techniques for cell blocks and core samples, as well as molecular testing. Potential implications of these techniques for tissue sampling will then be explored. Finally, the impact of characterization

of biopsy samples on clinical management will be reviewed.
SUMMARY
This educational exhibit will review the cytologic and histologic characterization of thoracic biopsy samples, the implication of these techniques on sampling approach, in particular image guided transthoracic technique, and their role in clinical management.

Towards Building a Comprehensive Chest MRI Examination: Emerging Tools a Radiologist Needs to Know

LL-CHE4238
    Rahul D Renapurkar , MD
    Ahmed El-Sherief , MD
    Joseph T Azok , MD
    Michael A Bolen , MD
    Charles T Lau , MD

PURPOSE/AIM
The aim of this exhibit is to provide an overview of newer MRI techniques which add value to evaluation of chest disorders.
CONTENT ORGANIZATION
1) Basic MRI tissue characterization 2) Current role of chest MRI 3) Emerging applications:
a) *In and out of phase imaging*
•Principles
•Application- Lesion characterization with emphasis on thymus.
b) *Steady state free precession (SSFP) imaging*
*SSFP cine imaging
•Principles
•Application- Evaluation of ventricular function (RV in pulmonary hypertension).
*Real-time imaging
•Principles
•Application- Assessment of fat planes of the mass to adjacent structures and evaluation of diaphragmatic pathology.
*Navigator gated SSFP magnetic resonance angiography (MRA)
•Principles
•Application- In patients with poor renal function.
c) *Diffusion weighted MRI*
•Principles
•Application-In assessing cellularity of masses and lymph nodes.
d) *Contrast enhanced MRA*
-ECG gated MRA and time resolved MRA.
-Blood pool agents.
e) *Lung parenchymal imaging (ultra-short TE sequences)*
•Principles
•Application- In patients who need repeated follow-up imaging. 4) Future applications- Lung perfusion imaging and PET/MRI
SUMMARY
From this exhibit, the viewers will be able to understand:
-Current applications of chest MRI.
-Emerging sequences, their relevant principles and potential roles they offer.

The Secondary Pulmonary Lobule: An Important Anatomic Structure in the Detection and Characterization of Lung Disease on HRCT

LL-CHE4239
    Sarel Gaur , MD
    George Mikhail , MD
    Samantha D Glass , MD
    Robin P Cunningham , MD
    Robert W Perone , MD

PURPOSE/AIM
The secondary pulmonary lobule (SPL) is the basic anatomic unit of lung, best visualized on HRCT. Knowledge of its anatomic components can provide the framework for comprehending virtually all pathologic lung processes. The three main components of the SPL can be defined and assessed on HRCT. Identification of the distribution of disease within the lobule can provide an accurate differential diagnosis, simplifying a vast array of pulmonary pathology.
CONTENT ORGANIZATION
The secondary pulmonary lobule will be defined and its anatomic components illustrated. Diseases will be categorized based on their distribution within the SPL and the HRCT pattern produced: increased or decreased opacity, cystic changes, nodular and mixed patterns including mosaic attenuation. A pictorial essay demonstrating important disease entities affecting the SPL and the resultant HRCT patterns will be presented.
SUMMARY
The secondary pulmonary lobule is a basic anatomic unit of lung which is well defined on HRCT. Understanding its anatomy and the distribution of pathology within the lobule will enhance the diagnostic acumen of the radiologist, thus simplifying an otherwise broad differential diagnosis of disease entities.

Thoracic Manifestations of Connective Tissue Diseases-What the Radiologist Needs to Know

LL-CHE4240
    Carina A Ruano , MD
    Rita N Lucas , MD
    Joao Lourenco
    Cecilia I Leal
    Sofia Pinheiro
    Otilia Fernandes
    Luisa Figueiredo

PURPOSE/AIM
Illustrate the most common thoracic manifestations of Connective Tissue Diseases (CTD).
Review patterns of interstitial lung disease (ILD) related to CTD.
Alert to treatment complications, such as drug toxicity and opportunistic infections.
CONTENT ORGANIZATION
CTD-related lung disease
• Interstitial lung disease
• Pulmonary arterial hypertension
Thoracic findings in CTD
• Progressive Systemic Sclerosis

- Rheumatoid Arthritis
- Systemic Lupus Erythematosus
- Mixed Connective Tissue disease
- Sjögren syndrome

Treatment complications
- Drug toxicity
- Opportunistic infections

SUMMARY
When evaluating patients with CTD, the radiologist should recognize lung involvement, identify patients likely to respond to treatment, assess treatment efficacy and exclude treatment-related complications, such as drug toxicity and opportunistic infections.
Optimizing CT protocols contributes to accurate detection and characterization of ILD.
Thoracic changes may precede CTD systemic manifestations. Underlying CTD should be sought at diagnosis and during follow-up of NSIP.
Identifying esophageal dilation in patients with ILD may help differentiating ILD related to Progressive Systemic Sclerosis from other etiologies.
Detection of consolidation, large nodules or effusion in patients with Sjögren syndrome should alert to the possibility of pulmonary lymphoma.

Imaging and Diagnosis of the Acute Aortic Syndromes: What the Radiologist Needs to Know

LL-CHE4241
Cameron Hassani , MD
Leah M Lin , MD
Alison Wilcox , MD *
Farhood Saremi , MD
Christopher Lee , MD

PURPOSE/AIM
1) To define the pathologic conditions which can present as "acute aortic syndrome."
2) To formulate the optimal imaging techniques for diagnosing acute aortic syndromes, focusing on multidetector CT.
3) To differentiate the key imaging findings of aortic dissection, intramural hematoma, and penetrating atherosclerotic ulcer.

CONTENT ORGANIZATION
I. Definition of "acute aortic syndrome"
II. Pathophysiology of acute aortic syndromes
a. Aortic dissection
b. Intramural hematoma
c. Penetrating atherosclerotic ulcer
d. Relationships of these conditions along disease spectrum
III. Imaging of acute aortic syndromes
a. Multidetector CT protocol
b. Value of cardiac gating
c. Radiation dose considerations
IV. Imaging findings of acute aortic syndromes
a. Aortic dissection
b. Intramural hematoma
c. Penetrating atherosclerotic ulcer
V. Sample cases and pitfalls
SUMMARY
The "acute aortic syndrome" refers to a spectrum of non-traumatic aortic conditions with a similar clinical presentation. Given the acute setting in which these patients present, it is imperative that the radiologist understands the pathophysiology and imaging findings of aortic dissection, intramural hematoma, and penetrating atherosclerotic ulcer. Multidetector CT can allow for the confident diagnosis of these related but distinct entities.

A New Procedure to Improve Safety of Percutaneous Lung Biopsy: Description and Initial Experience of the Track Embolization Technique

LL-CHE4242
Amanjit S Baadh , MD
Jason C Hoffmann , MD
Ahmed Fadl , MD
Vijay Bhat , BS
Nicholas A Georgiou , MD
Man Hon , MD

PURPOSE/AIM
To describe the procedural technique and present initial outcomes of track embolization with absorbable hemostat gelatin powder (Surgifoam) during percutaneous CT-guided lung biopsy and/or fiducial marker placement
CONTENT ORGANIZATION
We describe a new technique to decrease the pneumothorax (PTX) and chest tube placement rates during CT-guided percutaneous lung biopsy and/or fiducial marker placement. The technique involves track embolization with Surgifoam as the biopsy trocar is withdrawn. We describe the technique and present outcomes in our first 37 cases. In our initial study populaiton, the overall rate of procedure-related PTX was 18.9%. This can be subdivided into rate of PTX occurring at time of needle placement (13.5%) and rate of PTX occurring at time of needle removal after tract embolization with Surgifoam (5.4%). None of the pneumothoraces occurring at time of needle placement increased in size with the track embolization technique. The rate of PTX requiring chest tube placement was 0%. This compares favorably to previously published rates of PTX and chest tube placement of up to 61% and 15%, respectively.
SUMMARY
CT guided percutaneous lung biopsy and/or fiducial marker placement can be performed more safely when the track embolization technique is used. While our initial results are very encouraging, an additional prospective study is needed.

CT and PET/CT Features of the Post Ablation Zone of Lung Tumours That Have Undergone Radiofrequency Ablation. What's Normal?

LL-CHE4243
John Adu , MBBCh, MRCS
Richard J Smith , MBBChir, MA
Jonathan D Colledge , MBChB, BSc
Zelena Aziz

PURPOSE/AIM
Interpretation of the post-RFA ablation zone can be difficult for those unfamiliar with to what to expect, and are unaware of the key imaging features suggestive of residual or recurrent disease. The purpose of the exhibit is to:

1. To illustrate the "normal"/expected imaging features of the post-RFA ablation zone
2. To illustrate the imaging features of suggestive of recurrent or residual disease

CONTENT ORGANIZATION
Normal/expected findings

- Early phase (
- Intermediate phase (>1 week – 2 months)
- Late phase (>2 months)

The above categories include images illustrating:

1. CT appearance
2. Size
3. Enhancement
4. PET appearance

CT and PET/CT features suggestive of recurrent disease

- Change from ground glass to solid opacity
- Growth of ablation zone beyond early phase
- Enhancement more than preablation tumour
- Persistent uptake centrally or at region of ablated tumour

SUMMARY
The major teaching points are:

1. Reliable post RFA ablation imaging is essential for the evaluation of the success of treatment.
2. A solid understanding of the expected and unexpected imaging findings of the post-RFA ablation zone is crucial for accurate assessment of the treatment response and early detection of incomplete ablation or disease recurrence.

Comparative Assessment of Strengths and Pitfalls of CTA and V/Q Scanning in Evaluation of Pulmonary Embolism

LL-CHE4244
Esther N Udoji , MD
Andrei S Purysko , MD
Ahmed El-Sherief , MD
Joseph T Azok , MD
Michael A Bolen , MD
Charles T Lau , MD
Rahul D Renapurkar , MD

PURPOSE/AIM
The aims of this exhibit are to: 1) Discuss the roles of V/Q scanning and CTA in diagnosis of pulmonary embolism. 2) Illustrate the merits and disadvantages of each technique using case examples.
CONTENT ORGANIZATION
SUMMARY
With this exhibit, the viewers will be able to: 1) Review the roles of CTA and V/Q scanning in diagnosis of pulmonary embolism. 2) Understand the merits and limitations of both studies. 3) Choose the appropriate test for special clinical scenarios.

Thoracic Outlet Made Easy

LL-CHE4245
Laura B Barnes , MD
Mohammad Sarwar , MD

PURPOSE/AIM
Understanding the anatomy of thoracic outlet can be daunting, yet it is extremely important for diagnosing brachial plexopathy and other diseases related to the structures inhabiting it. We will demonstrate the anatomy by scrolling CT images in all three planes, identifying the labeled structures and highlighting them with corresponding colored illustrations.
CONTENT ORGANIZATION
A. Anatomy including three outlet compartments, namely the interscalene triangle, costoclavicular space, and retropectoral space. B. Some illustrative cases demonstrating, in particular, trauma-related vascular and neurologic injury, as well as specific attention to brachial plexopathy.
SUMMARY
It is mandatory that anyone interpreting thoracic imaging have at least working knowledge of thoracic outlet anatomy so that important diseases, especially trauma-related neurologic and vascular injury, are not misdiagnosed or simply missed. After viewing this presentation, the viewer will have obtained more knowledge of thoracic outlet anatomy and the diseases occuring in it.

Lung Cancer Screening Using Ultra-low Dose Computed Tomography: Standardization Based on Reduction in Tube Currency Can Be Really Useful?

LL-CHE4246
Noritoshi Ushio , RT
Yukihiro Nagatani , MD
Norihisa Nitta , MD
Masayuki Mayumi , RT
Kazumasa Kobashi
Masashi Takahashi , MD
Jyousei Ueda
Masatake Imai
Kiyoshi Murata , MD

PURPOSE/AIM
The purpose of this exhibit is; 1. To demonstrate variation in relationships between tube current and absorption dose among CT scanner with different specification and 2. To introduce our observer performance study using chest phantom for assessment of influence some factors such as the kind of reconstruction kernel, noise reduction algorithm at ultra-low dose and bodily habitus on pulmonary nodule detectability and signal-to-noise ratio.
CONTENT ORGANIZATION
* Conventional definition of radiation exposure level in low or ultra-low dose CT for lung cancer screening * Rediscovery of variation in absorption dose among CT scanners with different specification even at the identical tube current * Our experimental study using simulated

pulmonary ground glass nodules superimposed on chest phantom
SUMMARY
The major teaching points of this exhibit are: 1. Definition of low dose exposure level only with the value of tube current could have crucial deficit for standardization in data acquisition in the lung cancer screening. 2. Influence of various factors other than tube current on the actual absorption dose can be larger than expected. 3. Difference in image reconstruction kernel and association of noise reduction technique with CT scanner may alter lung nodule detectability even at the identical absorption exposure level.

Imaging Review of Infection in Lung Transplant Patients

LL-CHE4247

Christine N Hopper , MD
Michael R Peterson , MD
Ralph Drosten , MD

PURPOSE/AIM
The purpose of this exhibit is to:
1. To review the imaging findings of various types of lung infections which occur in lung transplant patients
2. To evaluate the time frames along which different infections are likely to occur after transplant
3. To correlate imaging features with clinical presentation
CONTENT ORGANIZATION
Imaging and Clinical Features of Infections
• Viral Infections
o CMV
o RSV
o Herpes simplex virus
o Other community acquired viruses
• Bacterial Infections
o *Pseudomonas aeruginosa*
o *Klebsiella* species
o *Staphylococcus aureus*
o Chlamydia pneumonia
o Pneumocystis jiroveci
• Fungal Infections
o Aspergillus
o Candida
o Coccidioidomycosis
Time Frame of Particular Infections after lung transplant
• First month
• Months 2-6
• 6 months and beyond
SUMMARY
The major teaching points of this exhibit are:
1. Importance of distinguishing imaging features of infection from other complications in lung transplant patients
2. Determining the time frame along which certain types of infections are likely to present
3. Defining specific clinical features which favor particular types of infection in lung transplant patients

---

Plain Radiograph Appearances of Modern Cardiorespiratory Support Devices: What a Radiologist Needs to Know

LL-CHE4248

Sharath R Hosmane , MBBS, MRCS
Tanzilah A Barrow , MBBCh
Julian Barker
Elaine Smith , FRCR

PURPOSE/AIM
This exhibit aims to:

1. Demonstrate the appearances and appropriate positioning of various modern cardiac and respiratory support devices, with particular focus on ventricular assist devices (VADs) and extracorporeal membrane oxygenation (ECMO) apparatus.
2. To educate the general radiologist reporting chest radiographs on the various modern specialised devices used for cardiac and respiratory support.
3. Highlight the importance of understanding device function and recognise complications associated with their use.

CONTENT ORGANIZATION

1. Common indications for device use.
2. Pictorial review of plain radiographic device appearances correlating with selected CT images.
3. Highlight correct anatomical positioning.
4. Demonstrate device related complications (examples to include malpositioning/migration, air and fluid collections, ARDS and thromboembolism).

Devices to include:

• VADs (LVAD, RVAD and BiVAD)
• Peripheral ECMO (veno-arterial and veno-venous)
• Central ECMO (veno-arterial)

SUMMARY
By the end of this exhibit the viewer should:

1. Understand the indication for modern cardiac and respiratory support devices.
2. Recognise modern cardiorespiratory devices (especially VADs and ECMO), their correct anatomical positioning and associated complications on plain radiograph and cross sectional imaging.

Iodine Mapping of the Lung Using Subtraction Imaging for Pulmonary Embolism: Technique and Initial Clinical Experience

LL-CHE4249

Monique Brink , MD, PhD *
Eva M Van Rikxoort , PhD
Jean Paul Charbonnier
Sarah J Van Riel , MD
Cornelia M Schaefer-Prokop , MD *

Mathias Prokop , MD, PhD *

PURPOSE/AIM
To describe a technique of deriving iodine maps of the lungs using subtraction CTA. To provide our initial clinical experience of this technique and comparison to iodine maps derived from dual energy imaging
CONTENT ORGANIZATION
A. Principles
B. Data acquisition
C. Postprocessing: Registration, motion correction and filtering
D. Clinical examples
E. Comparison with dual energy CT
F. Advantages and limitations
SUMMARY
Iodine maps derived from dual energy CT have been successfully used for assessment of acute pulmonary embolism. We present technical principles and initial results of a technique deriving iodine maps from subtracting precontrast scans from pulmonary CTA.
Accurate image registration is crucial: Artifacts may arise from pulsation, motion or differences in inspiratory level. With good registration, partially obstructed vessels can be distinguished from complete occlusions and correlated with perfusion defects in the lung parenchyma.
Color coding of lung parenchyma can enhance perfusion differences at a quality that is superior to iodine maps from dual energy imaging.
Radiation dose can be kept below 5 mSv for standard size patients.
This subtraction technique allows for excellent evaluation of lung parenchyma and pulmonary vessels and achieves a more than 3 times higher contrast-to-noise ratio than dual energy images at identical dose.

Histiocytic Disorders of the Lung: CT Findings

LL-CHE4250
Jitesh Ahuja , MD, MBBS
Jeffrey P Kanne , MD *
Cristopher A Meyer , MD *

PURPOSE/AIM
1 Describe the clinical and histopathologic findings of primary and secondary histiocytic disorders affecting the lung
2 Illustrate the respective CT findings of these histiocytic disorders
CONTENT ORGANIZATION
1 Definitions
2 Primary histiocytic disorders: Pulmonary Langerhans cell histiocytosis, Erdheim-Chester disease, Rosai Dorfmann disease
3 Secondary histiocytic disorders: a. Storage diseases: Niemann Pick disease, Gaucher disease, Fabry disease
b. Respiratory bronchiolitis: Desquamative interstitial pneumonia spectrum
c. Pneumoconiosis: Silicosis, Coal workers' pneumoconiosis, Hard metal pneumoconiosis
d. Infection: Whipple disease, Malakoplakia (Rhodococcus equi)
SUMMARY
Pulmonary Langerhans cell histiocytosis is the best known histiocytic lung disease; however this spectrum of disorder includes various other diseases. Integrating the clinical and imaging features may help in reaching a presumptive diagnosis and guide further management.

Diaphragm Appearance: A Clue to the Diagnosis of Pulmonary and Extrapulmonary Pathology

LL-CHE4251
Geraldine N Abbey-Mensah , MD
Stephen A Waite , MD
Deborah L Reede , MD
Alan C Legasto , MD
Cameron Hassani , MD

PURPOSE/AIM
1. Review normal anatomy and appearance of the diaphragm on CXR's
2. Learn imaging features associated with pulmonary and extrapulmonary pathologies
3. Demonstrate an image based interpretation algorithm to facilitate imaging selection and diagnosis
CONTENT ORGANIZATION
A review of anatomy and plain film appearance of the diaphragm is followed by a discussion of pulmonary and extrapulmonary pathologies associated with abnormal diaphragmatic configurations. 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: Contour abnormalities: Subpulmonic effusion, drop metastasis, tumor (pleural and diaphragm), juxtaphrenic peak Defects: Hernias (Morgagni, Bochdalek, and hiatal), rupture Flattening: COPD, Alpha-1-antitrypsin, lymphangioleiomyomatosis Elevation: Liver lesions, paralysis, lupus Adjacent lucency: Pneumomediastinum, pneumothorax, pneumoperitoneum

Calcifications: Asbestosis, fibrothorax
SUMMARY
Variations in the appearance of the diaphragm on CXR's may be due to pulmonary, neural, abdominal or pleural pathology. After viewing this module, the user will be familiar with common causes for alterations in the appearance of the diaphragm. An algorithm is provided to facilitate appropriate additional imaging selection.

Thoracic Metastases from Gynecological Neoplasms: How They Differ from Other Metastases, Specific Patterns of Spread, and Pitfalls in Imaging Interpretation

LL-CHE4252
Santiago Martinez-Jimenez , MD *
Melissa L Rosado De Christenson , MD *
Christopher M Walker , MD *
Jeffrey R Kunin , MD *
Sonia L Betancourt Cuellar , MD
Paul P Pettavel , MD

PURPOSE/AIM
1. List patterns of thoracic metastases from gynecological neoplasms 2. Understand pathophysiology of metastatic spread 3. Review typical imaging findings and pitfalls in imaging diagnosis
CONTENT ORGANIZATION
1. Common metastases from gynecological neoplasms (i.e. leiomyoma; ovarian, endometrial, cervical, vulvar and fallopian tube cancers)
2. Typical patterns of thoracic metastatic spread for each neoplasm (e.g. pleural involvement in ovarian and fallopian tube cancers, lymphadenopathy in endometrial cancer, and lung metastases in uterine leiomyoma, cervical cancer and gynecological sarcomas) 3. Imaging interpretation pitfalls including true positive and false negative findings (e.g findings mimicking benign conditions in patients with rising CA-125, metastatic calcified lymph nodes in ovarian cancer, small pleural effusions/nodules in ovarian/fallopian tube cancers).
SUMMARY

Thoracic metastases from gynecological neoplasms exhibit various imaging features including lung and pleural metastases and mediastinal lymphadenopathy. Knowledge of typical manifestations of thoracic metastases in each type of neoplasm allows radiologists to accurately assess metastatic involvement and avoid misdiagnosis of atypical metastases that may mimic benign conditions. Correlation with tumor markers may help suggest metastatic disease in patients with subtle findings.

Extrapleural Space on MDCT: The Disregarded Backyard of the Chest

LL-CHE4253
Mario G Santamarina , MD
Ignacio Beddings Moreno , MD
Guillermo Lermanda Holmgren , MD
Mariano Volpacchio , MD
Hector Opazo Sanchez , MD

PURPOSE/AIM
To depict the normal anatomy of the extrapleural space. To review diseases that involve the extrapleural space. To emphasize imaging signs typical for certain diseases that allow for differential diagnosis in MDCT.
CONTENT ORGANIZATION
Anatomy of extrapleural space. Review of entities that involves the extrapleural space:
- Prominent extrapleural fat (increased fat deposition, chronic inflammatory changes, fat containing tumors
- Expansion of extrapleural space (extrapleural air, extrapleural hematoma
- Disease entities causing fat stranding (inflammatory processes
- Lymph node involvement in extrapleural space;
- Direct infiltration of extrapleural space (neoplasms, lymphoma).
SUMMARY
This frequently overlooked space lies beetwen the parietal pleura and the internal rib surface. It contains fat, loose connective tissue, vessels, the endothoracic fascia, and the innermostintercostal muscle. Various pathologic processes may involve this space and its appropiate recognition through image interpretation offers a useful diagnostic clue that assists in generating differential diagnosis. MDCT with its multiplanar capabilities plays a prominent role in the identification and characterization of abnormalities of the extrapleural space that in conjunction with other thoracic findings provides relevant information in the diagnostic process.

Imaging of Cardiovascular Calcifications: What the Radiologist Should Know?

LL-CHE4254
Ivan Mauricio Vargas Orozco , MD
Carmen Ruiz
Lina M Cruz Hernandez , ARRT
Carmen Cereceda Perez , MD
Andres Enriquez-Puga , MBChB, MSc
Mar Cespedes Mas
Soledad Fernandez Zapardiel

PURPOSE/AIM
- To review the different causes of cardiovascular calcifications. - To show the radiological findings of cardiovascular calcifications in chest radiography and CT.
CONTENT ORGANIZATION
1. Cardiac calcifications:
- Myocardial calcifications
Left ventricular papillary muscle
- Endocardial calcifications
Right and left atrium
- Pericardial calcifications
Postsurgical constrictive pericarditis and other causes
- Heart valves calcifications
Mitral annulus and valve
Aortic valve
Tricuspid valve
- Intracavitary calcifications
Cardiac tumors
Cardiac thrombus 2. Vascular calcifications:
- Great vessels
Thoracic aorta and pulmonary artery
- Small vessels
Coronary arteries
Supraaortic vessels
Bronchial arteries and pulmonary veins 3. Other causes:
- Left ventricle pseudoaneurysm
- Arteriosus ductus
- Diverticulum ductus
- Post surgical

SUMMARY
- Cardiovascular calcifications can be a marker of increased risk of cardiovascular morbidity/mortality
- The amount of calcification may also predict the extent and severity of underlying disease
- The radiologist should be aware of the significance of these imaging findings and their implications in the patient management to help the clinics to predict the risk of cardiovascular disease

Not Just a Nodule But a Nidus: A Pictorial Review of the Imaging Findings, Treatment Approaches and Complications in Pulmonary Arteriovenous Malformations

LL-CHE4255
James J Kazam , MD
Daisy Q Huang , MD
Theresa Salerno
Bradley B Pua , MD *

PURPOSE/AIM
Pulmonary arteriovenous malformations (PAVM) describe a spectrum of any abnormal communication with arteries and veins. Not surprisingly, these malformations may present in varying forms dependent on the patient symptomatology and imaging modalities. This pictorial exhibit will review the imaging characteristics of PAVM and treatment approaches, including recent advances in interventional

options.
CONTENT ORGANIZATION
This exhibit will introduce the spectrum of PAVM from congenital (i.e. Osler-Weber-Rendu) to acquired (i.e. cirrhosis) forms. We will review the imaging characteristics of PAVM on radiography, CT, nuclear scan and MR with an emphasis on how cross-sectional imaging can detail vessel anatomy in complex PAVM. We will also review the diagnostic imaging algorithm in the workup for suspected PAVM. The exhibit will review the treatment approaches to PAVM including widely-accepted embolotherapy to experimental covered stents.
SUMMARY
PAVM, while not common, is part of the differential for the nonspecific pulmonary nodule and should be considered in patients presenting with hemoptysis or hypoxemia. This exhibit will present a pictorial review of the classification, imaging findings, and treatment approaches of these vascular malformations with an emphasis on recent interventional options.

No More Bronchioalveolar Carcinoma (BAC)! The New 2011 International Classification of Lung Adenocarcinoma with Radiologic-pathologic Correlation and Management Implications

LL-CHE4256
Jay A Karajgikar , MD
Michael Esposito , MD
Karen C Naar , MD
Arfa Khan , MD

PURPOSE/AIM
The purpose of this exhibit is: 1.) To discuss the changes in the 2011 classification as compared with the prior 2004 classification. 2.) To discuss the impact of these changes on CT diagnosis, biopsy, histopathological testing for genetic markers and on treatment.
CONTENT ORGANIZATION
1.) Discussing the major changes made in the 2011 classification, in particular, no more bronchioalveolar carcinoma (BAC). (5 slides) 2.) Side by side radiologic-pathologic images and correlation for the following entities: Atypical Adenomatous Hyperplasia (AAH), Adenocarcinoma in situ (AIS), Minimally invasive adenocarcinoma (MIA), lepidic predominant adenocarcinoma(nonmucinous), acinar, papillary, micropapillary or solid predominant adenocarcinoma, and invasive mucinous adenocarcinoma. (8-10 slides). 3.) Size of the invasive component and prognosis (1-2 slides). 4.) Impact on testing for genetic markers and TNM staging of adenocarcinoma (2-4 slides).
SUMMARY
The 2011 classification clarifies many of the ambiguities of the 2004 classification. It is of utmost importance to the radiologist to be aware of these changes and appropriately describe adenocarcinoma lesions in keeping with the new classification, to follow lesions based on Fleischner's guidelines and ultimately help guide pathologic diagnosis and further management.

Pseudo Lung Point Sign. A Potential Pitfall in the Sonographic Diagnosis of a Pneumothorax

LL-CHE4257
Jason Young , MD
Pratish A Shah , MD
Samantha Lavin , RT
Mary Connell , MD
Dan G Gridley , MD

PURPOSE/AIM
This exhibit will: 1. Introduce sonographic evaluation of pneumothorax. 2. Inform viewers of the sonographic 'lung point' sign and a potential false positive finding associated with it. 3. Provide guidelines to improve sonographic evaluation of pneumothorax.
CONTENT ORGANIZATION

1. Introduction to sonographic evaluation for pneumothorax, including proper technique.
2. Explain the 'lung point' sign.
3. Identify a potential false positive lung point sign. A video will be shown of a false positive lung point sign due to ultrasound gain settings too low with underlying liver mimicking a pneumothorax.
4. Strategies to reduce false positive rate of pneumothorax. A video will be show with proper ultrasound gain settings, elucidating a normal pulmonary / liver interface.
5. Summary

SUMMARY
Major Teaching Points:

- Sonography is a useful exam for the critical evaluation for pneumothorax.
- The sonographic lung point sign has been reported as being very specific for pneumothorax.
- A potential false positive lung point sign is the liver / pulmonary interface when gain settings are too low.
- Increasing gain settings and proper probe positioning will help improve the lung point sign specificity.

Diffuse Parenchymal Abnormalities in Collagen Vascular Disease: Differential Diagnosis on High-resolution CT

LL-CHE4258
Cleonice Isabela Silva Muller , MD, PhD
Fernanda D Gonzalez Guindalini , MD *
Andrew Churg
Nestor L Muller , MD, PhD

PURPOSE/AIM
The aim of this exhibit is present an approach to the differential diagnosis of diffuse parenchymal lung diseases in patients with collagen vascular disease (CVD) based on clinical history and pattern and distribution of findings on high-resolution CT. The differential diagnosis includes interstitial pneumonias related to CVD, diffuse alveolar damage (DAD), diffuse pulmonary hemorrhage, opportunistic infection and drug toxicity. Patients with CVD may have more than one histologic interstitial lung disease (ILD) pattern and that they may develop acute exacerbation of their ILD.
CONTENT ORGANIZATION
1. CT patterns of ILD related to CVD including diffuse alveolar damage 2. CT patterns in patients with more than one ILD related to CVD 3. Acute exacerbation of ILD in CVD 4. Diffuse parenchymal disease related to drug toxicity including biologic disease-modifying agents 5. Opportunistic infection in CVD
SUMMARY
The differential diagnosis of diffuse parenchymal lung disease in CVD is based on clinical history, previous imaging, and pattern and distribution of findings on high-resolution CT. In most cases a confident clinic-radiologic diagnosis can be made obviating lung biopsy.

FDG PET/CT of Idiopathic Interstitial Pneumonias

LL-CHE4259

Tucker F Johnson , MD
Nicole L Fischer
Brian J Bartholmai , MD
Vanessa Zavaletta , PhD
Patrick J Peller , MD *
Christopher H Hunt , MD
Anne-Marie G Sykes , MD
Geoffrey B Johnson , MD, PhD

PURPOSE/AIM
1. To review the pathophysiology and imaging of idiopathic interstitial pneumonias (IIP).
2. To correlate emerging FDG PET/CT imaging findings with high resolution CT.
3. To demonstrate how high resolution CT and FDG PET/CT can help identify certain IIP subtypes and differentiate additional pathologies.
CONTENT ORGANIZATION
I. Idiopathic Interstitial Pneumonia
a. Clinical features
b. Progression
c. Pathophysiology
II. Imaging techniques for IIP subtype
a. High resolution CT
b. FDG PET/CT
III. Clinical examples
a. Usual interstitial pneumonia
b. Non-specific interstitial pneumonia
c. Cryptogenic organizing pneumonia
d. Desquamative interstitial pneumonia
e. Lymphoid interstitial pneumonia
f. Systemic causes of inflammatory lung disease
IV. Potential imaging pitfalls
SUMMARY
1. Multimodality imaging can help identify certain IIP subtypes and differentiate additional thoracic pathologies such as secondary cancer from inflammatory change.
2. Knowledge of characteristic IIP imaging patterns can allow for early recognition of IIP on FDG PET/CT scans ordered for other indications.
3. FDG PET/CT can play a role in the identification of systemic causes of inflammatory lung disease.

Lung Cancer Staging: 2013 Update

LL-CHE4260
Hemant T Patel , MD
Ankur Shah , MD
Megha Sanghvi , MD
Mrunali I Shah , MBBS
Nishat Goyal , MBBS, DMRD
Jay V Shah , MBBS

PURPOSE/AIM
The purpose of this exhibit is: 1. To review the various imaging modalities available for staging of lung cancer 2. To outline advantages and limitations of available imaging modalities 3. To address the complexities of the 7th edition lung cancer stage classification system in a clinically relevant format 4. To make radiologists familiar with recent classification of lung staging with use of appropriate imaging modality
CONTENT ORGANIZATION
• Pathophysiology of lung cancer • Staging of lung cancer according to seventh edition of the lung cancer staging system with its pitfalls • Imaging modalities especially focusing MDCT,Lung nodule analysis and PET CT • Sample cases and mimics
SUMMARY
The major teaching points of this exhibit are: 1. Despite the importance of accuracy in lung cancer staging, however, correct staging remains a challenging task for many radiologists 2.By recognizing the relevant radiologic appearances of lung cancer, understanding the appropriateness of staging disease with the TNM classification system, and being familiar with potential imaging pitfalls, radiologists can make a significant contribution to treatment and outcome in patients with lung cancer

---

A Radiological Review of the Spectrum of Pulmonary Neuroendocrine Proliferations and Neoplasms

LL-CHE4261
Pilar Olmedilla
Susana Hernandez-Muniz
Isabel Marquina , MD
Beatriz Alvarez De Sierra Garcia , MD
Isabel Salmeron Beliz , MD
Virginia Quintana , MD

PURPOSE/AIM
1.To categorize the types of lung tumors and proliferations with neuroendocrine morphology 2.To describe their radiological and pathological features 3.To show illustrative cases 4.To review treatment options and prognosis
CONTENT ORGANIZATION
Description of the neuroendocrine (NE) cells, normally present in the tracheobronchial epithelium, which are considered the origin of most NE tumors of the lung.

Review classification of NE proliferations and tumors, that has evolved with our understanding of NE system. Imaging findings of diffuse idiopathic pulmonary NE hyperplasia (DIPNEH), a benign lesion, and precursor of the development of tumorlets and carcinoids. Imaging manifestations of NE neoplasms of the lung, emphazising computed tomography (CT) features and their correlation with hystopathologic grade of malignancy. Review of treatment options and utility of imaging methods in the management of these diseases.
SUMMARY
There is a broad spectrum of lung pathology associated to NE cell proliferation.
We present a review of these lesions based on imaging and pathological features.
The knowledge of imaging findings will allow us to suggest the possibility of a neuroendocrine origin, helping the pathologist to make an accurate diagnosis.
Radiologist has a role in the management and follow-up of NE lung pathology.

Tubes and Lines Illuminated

LL-CHE4262
Stacey O Verzosa , MD
Matthew D Gilman , MD

Gerald F Abbott , MD *
Carol C Wu , MD *
Jo-Anne O Shepard , MD *

PURPOSE/AIM
Provide an up to date review of the anatomic considerations, proper placement, malpositions and complications of the major tubes and lines commonly seen in critical care imaging with detailed illustrations of the relevant anatomy and concepts.
CONTENT ORGANIZATION
Introduction
Endotracheal tube (ETT)

- Anatomic considerations and illustrations
- Single and double lumen ETT placement and complications

Central lines and PICC lines

- Anatomic considerations and illustrations
- Central venous catheters and PICC lines

Pulmonary artery catheter (PAC)

- Anatomic considerations and illustrations
- Complications and considerations unique to PACs

Transvenous pacing leads

- Anatomic considerations and illustrations
- Proper placement and complications

Intra-aortic balloon pump

- Indications, mechanism of action
- Anatomic considerations and illustrations
- Proper placement and complications

Chest tubes

- Anatomic considerations and illustrations
- Types, placement, complications

Enteric Tubes: feeding and NGT

- Proper placement
- Complications

SUMMARY
Understanding the anatomic considerations, proper placement, potential malpositions and complications of tubes and lines is important for the care of critically ill patients.

Hemorrhagic and Vascular Complications in Lung Infections: High-Resolution CT and Pathologic Findings

LL-CHE4263
Tomas C Franquet , MD
Melissa L Rosado De Christenson , MD *
Jeffrey P Kanne , MD *
Edson Marchiori , MD, PhD
Santiago Martinez-Jimenez , MD *
Ana Gimenez , MD

PURPOSE/AIM
Review the spectrum of hemorrhagic and vascular pulmonary complications in infectious diseases using cases and illustrations
Correlate imaging findings with histopathologic features
Provide a structured framework for formulating a differential diagnosis
CONTENT ORGANIZATION

- **Types of hemorrhagic and vascular complications:**
  1) Infarction and hemorrhage: Fungi (Aspergillus, Mucor, Histoplasma Viruses (Herpes)
  2) Aneurysm (Rasmussen):

M. tuberculosis
3) Septic pulmonary embolism: Bacteria (*S.aureus*; Actinomyces sp. Fungi
4) Focal and diffuse hemorrhage: Viruses (CMV; Influenza A (H1N1 Dengue), Leptospira
5) Pulmonary gangrene: Bacteria (*C. perfringens*; *K. pneumoniae*)
6) Hemoptysis: Bacteria (Actinomyces sp. Fungi (Mycetoma Nontuberculous mycobacteria, *M. tuberculosis* (broncholithiasis)
7) Vascular neoplasms: Viruses (Herpes virus 8 related KS)
SUMMARY
Hemorrhagic and vascular complications of lung infections differ according to the type of microorganisms and the immunologic status of the patient. Recognition of the imaging morphology of these lesions and the underlying histopathologic changes allows the radiologist to present a focused differential diagnosis and help direct appropriate management.

Fatty Lungs: What Do Radiologists Need to Know about Lipoid Pneumonia?

LL-CHE4264
Marie Laure Chabi
Alexandra Goracci
Pierre-Yves Brillet , MD *
Dominique Vadrot
Audrey Lupo
Marie-Pierre Revel

PURPOSE/AIM
To illustrate the various radiological manifestations of exogenous lipoid pneumonia,focusing on the tumor-like presentation and tips for avoiding unnecessary surgery
CONTENT ORGANIZATION
-Causes and physiopathological mechanisms -Clinical manifestations -Radiologic presentations -Histopathological findings -Differential diagnosis -Complications, treatment and outcome
SUMMARY

Based on a large series on pathologically proven cases, the different imaging features of exogenous lipoid pneumonia will be reviewed, together with predisposing factors, traditional and new causes, such as lipase inhibitors for treatment of obesity. In case of tumor-like presentation of lipoid pneumonia, the importance of careful image analysis will be emphasized, focusing on the key finding which is the demonstration of fat-containing areas within the lesions. Technical factors ensuring reliable attenuation measurements will be detailed. The possibility of PET false positivity for malignancy will also be described.

The contributions of bronchoalveolar lavage and of percutaneous core biopsies will be shown. Complications such as atypical mycobacterium infection, suspected in cases where CT consolidations extend despite exposure discontinuation, will be described and illustrated

Rheumatoid Nodules. A Pictorial Review of Typical and Atypical CT Features

LL-CHE4265

Inmaculada Rubio Marco
Helena Gomez Herrero
Marta Tirapu Tapiz
Ainhoa Ovelar Ferrero
Jokin Zabalza Unzue
Carmen Sainz Gomez

PURPOSE/AIM
The purpose of this exhibit is:
1. - To describe the typical appearance of rheumatoid nodules
2. - To review the different evolutions of rheumatoid nodules in the course of the rheumatologic disease
3. - To recognize atypical radiological features that should make radiologists recommend histological studies to rule out malignancy
CONTENT ORGANIZATION
Pathophysiology and relationship of rheumatoid nodules to rheumatoid arthritis (RA): Rheumatoid nodules are a rare manifestation of lung disease associated to RA althought they are the most specific thoracic manifestation associated with this arthritis..Their prevalence in radiologic studies is 0, 4% . Appearance and evolution in the course of the RA of the rheumatoid nodules is variable and can even precede the joint disease. . Nodular lesions are typically asymptomatic. Complications as cavitation and pneumothorax are described. Some examples of these different forms of evolution are presented **Imaging findings**: Rheumatoid nodules are usually rounded, multiple, and pleural based. Typical radiologic semiology of rheumatoid nodules and other atypical manifestations which require histological diagnosis to rule out tumors are shown.
SUMMARY
Review of typical and atypical CT features of rheumatoid nodules and knowledge of their different forms of evolution to make a correct diagnosis and to rule out malignancy.

To Breathe or Not to Breathe: A Pictorial Essay of Endotracheal Tubes and Related Complications

LL-CHE4266

Ramya S Gaddikeri , MD
John Donatelli , MD
Ashkan Ghaneie , MD
Leelakrishna Nallamshetty
Carlos Andres Rojas , MD
Todd R Hazelton , MD

PURPOSE/AIM
Endotracheal tubes are commonly used in multiple clinical settings. Recognition of their normal imaging appearance and location is necessary to recognize them, identify abnormal position and assess for associated complications. In this pictorial essay we briefly describe the normal imaging appearance of endotracheal tubes and discuss the appropriate location of the tubes. We will demonstrate various common and uncommon complications of inadequate tracheal intubation such as selective bronchial intubation with secondary atelectasis, esophageal intubation with secondary gastric perforation, overinflated oversized cuff with secondary vascular compression and others.
CONTENT ORGANIZATION
1. Discuss the different types of tracheal tubes and tracheal intubation.
2. Describe the normal appearance and position of endotracheal tubes on radiography and computed tomography.
3. Recognition of normal , abnormal, common and uncommon complications associated with intubation and their clinical implications.
SUMMARY
At the end of the presentation, the reader will:
1. Be familiar with the types of tubes and intubation for airway maintenance.
2. Be able to recognize the normal and abnormal appearances of endotracheal tubes on radiography and computed tomography.
3. Recognize common and uncommon complications associated with intubation and their clinical implications.

Pulmonary Aspiration: A Pictorial Review

LL-CHE4267

Andrew D Prather , BS, MD
Tristan R Smith , MD
Todd R Hazelton , MD
Leelakrishna Nallamshetty
Jonathan H Chung , MD *
Carlos Andres Rojas , MD

PURPOSE/AIM
To review the different imaging manifestations of aspiration, including the different patterns of lung injury.
CONTENT ORGANIZATION
Content will be organized as a pictorial review, with representative images for different types of aspiration, including a discussion of pertinent findings, pathophysiology, and predisposing clinical factors.
SUMMARY
Aspiration is an under-recognized clinical entity, with varied and often nonspecific radiographic manifestations, making diagnosis difficult. Moreover, aspiration actually represents a spectrum of disease, including diffuse aspiration bronchiolitis, Mendelson's Syndrome and aspiration pneumonia. Complicating matters, many patients who aspirate do not present with disease, suggesting that pathophysiology is related to a variety of factors, including decreased levels of consciousness, dysphagia, impaired mucociliary clearance, composition of aspirate, and impaired host defenses. Here, we present a pictorial review of the different manifestations of aspiration, including exogenous lipoid pneumonia, lung abscess, foreign body aspiration, vegetable aspiration, and organizing pneumonia, in addition to the entities listed above, with a focus on characteristic radiographic findings to aid diagnosis.

The ABCs of Cardiovascular Calcifications

LL-CHE4268

Diego Varona Porres , MD

Oscar Persiva Morenza , MPH
Esther Pallisa , MD
Alberto Roque , MD
Jordi Andreu

PURPOSE/AIM
1. Describe the causes of cardiovascular calcifications, including uncommon and atypical 2. Illustrate the imaging findings on chest radiography and multislice CT 3. Discuss the usefulness of these techniques for diagnosing cardiovascular calcifications
CONTENT ORGANIZATION
In this exhibit, we discuss the effectiveness of simple chest radiography and multislice CT for studying cardiovascular calcifications according to a classification into 3 groups: 1. Cardiac: Pericardial, myocardial, valvular, and intracavitary. 2. Vascular: Great arteries (aorta and pulmonary arteries) and small vessels (coronary, bronchial, and supraaortic arteries, and pulmonary veins). 3. Atypical: Pseudoaneurysms, ductus arteriosus, and postoperative (cardiac surgery, coronary revascularization). Correct identification and characterization of cardiovascular calcifications in terms of morphology and location facilitates the diagnosis of the underlying conditions. Multislice CT has significantly improved the sensitivity of detecting and measuring such calcifications, and is particularly useful for calcium deposits in certain locations associated with cardiovascular morbidity and mortality.
SUMMARY
Cardiovascular calcifications are associated with several causes and their study by chest radiography and multislice CT is essential for the diagnosis.

Oops! A Quiz Based Review of Malpositioned Support Lines and Tubes

LL-CHE4269
Jenanan Vairavamurthy , MD
Pratik Shukla
Alan C Legasto , MD

PURPOSE/AIM
1. To review the purpose of commonly used lines and tubes in the critical care setting. 2. Review the radiographic appearance of properly placed tubes and lines.3. Provide several examples of malpositioned support lines and tubes in a quiz-based manner.
CONTENT ORGANIZATION
1. Commonly used support lines and tubes. a. Clinical uses. b. Desired positions. 2. Normal radiographic appearance of the different tubes. a. Endotracheal tube. b. Intravascular lines. c. Pleural drains. d. Cardiac devices. e. Feeding tubes. 3. Quiz-based review of improperly placed support lines and tubes.
SUMMARY
The radiographic assessment of support tubes and lines is an important aspect of film interpretation due to the severe complications of malpositioned equipment. By improving familiarity with both normal and abnormal findings, we aim to improve the radiology resident's ability to correctly identify malpositioned equipment. We allow reviewers to assess their own knowledge by providing a quiz-based review of improperly placed tubes and lines.

Metastatic Disease to the Chest, Not Always so Easy: Spectrum of Typical and Atypical CT Findings and Their Mimics

LL-CHE4270
Juan Arenas , MBBS
Elena Garcia-Garrigos
Ana Teruel
Yanne Aviles
Javier De La Hoz
M Dolores Guirau-Rubio

PURPOSE/AIM
To review and describe the spectrum of typical and atypical CT presentation of metastases to the chest.
To correlate atypical presentations with histopathological findings.
To review the conditions that can mimic metastatic disease and lead to an inappropriate management.
CONTENT ORGANIZATION
Typical multinodular and lymphangitic appearance, effusions and chest wall involvement. Review of atypical metastatic presentations (cavitation, calcification, ground glass opacities and halo , tree-in-bud, primary-like with and without nodal involvement, endobronchial, intravascular,...) with their histologic correlation and primary tumors involved. Review of conditions that can mimic metastatic disease and clues for diagnosis and management (inflammatory and infectious, infarction, sarcoidosis, drug toxicity, second primary tumor, organizing pneumonia, thymic rebound, ...).
SUMMARY
Radiologists dealing with oncologic patients can find a varied range of typical and atypical imaging features of metastases. On the other hand, a number of benign conditions can mimic metastatic disease. We discuss both metastases and their mimics, their clinical and CT findings, histopathologic aspects and clues for diagnosis.

Don't Be Up-staged by Findings on PET/CT

LL-CHE4271
Marie-Helene Levesque
Amita Sharma , MBBS
Christopher M Walker , MD *
Carol C Wu , MD *
Victorine V Muse , MD
Subba R Digumarthy , MD
Jo-Anne O Shepard , MD *

PURPOSE/AIM
PET/CT is an established method of staging patients with thoracic malignancy, but it is well recognized that FDG- PET avidity may occur in non-malignant lesions that are mis-interpreted for metastatic disease. The aim of this exhibit is to describe these pitfalls in order to prevent radiologists from possible up-staging of a tumor.
CONTENT ORGANIZATION
CT and PET findings of benign, FDG-avid conditions will be shown, in patients presenting for staging of intrathoracic malignancy. Abnormalities will be divided into location sites. Examples include: Skin and soft tissues: Infected sebaceous cysts may be misdiagnosed as metastatic subcutaneous nodules. Bones: Degenerative changes in the joints, and rib fractures can mimic bony metastatic disease. Pleura : Prior talc pleurodesis is associated with intense PET avidity that can mimic pleural metastatic disease. Lungs: Pulmonary infections, sarcoid and interstitial lung disease all cause PET avid lesions Mediastinum: Brown fat may mimic nodal metastases. Heart: Lipomatous hypertrophy of the interatrial septum mimics cardiac involvement
SUMMARY
Distinguishing features that allowed the radiologist to make the correct diagnosis will be presented in an educational and interactive exhibit. Knowledge of these causes of increased FDG PET activity is imperative in preventing up-staging of a tumor.

Aortic Pathology Layer by Layer: Classification and Radiologic Findings

LL-CHE4272

Maria C Ageitos Casais , MD
Sandra Baleato Gonzalez , MD
Anxo Martinez De Alegria , MD
Amadeo Arango , MD
Roberto Garcia Figueiras , MD
Carmen Villalba Martin , MD
Miguel Dominguez Robla , MD

PURPOSE/AIM
The aim of this exhibit is to:

1. Illustrate and classify aortic diseases depending on the layer involved.
2. Explain and Review the pathogenesis of each entity.
3. Identify the radiologic key findings that lead to an accurate diagnosis.

CONTENT ORGANIZATION
Detailed anatomy of the aorta will be revisited. Various entities, including congenital, inflammatory, infectious and traumatic pathology, will be discussed and classified depending on which aortic layer is affected, focusing on the characteristic imaging features.
SUMMARY
Imaging techniques play a vital role in the diagnosis of aortic pathology. Radiologists will be able to:

1. Understand the etiopathogenesis of aortic diseases and correlate with the radiologic findings.
2. Recognize the relevant imaging clues to reach an adequate diagnosis and proper treatment.

Imaging of Well Differentiated Neuroendocrine Tumors of the Lung

LL-CHE4273

Archana T Laroia , MD
Yusuf Menda , MD
Sandeep T Laroia , MD

PURPOSE/AIM
The aim of this presentation is an educational review of the clinical data, structural and functional imaging of well differentiated neuroendocrine tumors of the lung.
CONTENT ORGANIZATION
This is an educational review of the clinical data, structural and functional imaging of well differntiated neuroendocrine tumors of the lung. A pictorial review of the conventional radiography, MDCT with 3 D reconstructions and functional imaging with Indium 111Y labeled somatostatin analogues (octreotide) will be presented. These tumors are not fluorodeoxyglucose (18F) avid on PET-CT (Positron emission tomography - computed tomography). 68 Ga-DOTATATE is a newer promising imaging PET/CT agent for imaging well-differentiated neuroendocrine somatostatin receptor–expressing tumors . A combination of cross-sectional and functional imaging is vital for initial staging and assessment of therapeutic response.
SUMMARY
Structural and functional imaging is essential for accurate staging, treatment monitoring, and surveillance of the well differentiated neuroendocrine tumors of the lung. No one functional imaging test is perfect due to the variable affinity for different radiotracers. Hence, a combination of different imaging modalities helps to provide a comprehensive evaluation of this disease.

Ultrasound Assessment of Pleural Effusions and Marking a Safe Site for Intercostal Drain Insertion

LL-CHE4274

An T Ngo , BMBS, MRCP
Mary E Roddie , MD
Yaron J Berkowitz , MBBChir, MRCS
Ali Alsafi , MBBS
Amish Lakhani , MBBS, MA
James Burn , MBBS, BSc

PURPOSE/AIM
The risks and fatal complications of intercostal drain insertion have been well documented. In the context of non-emergency but clinically pressing intercostal drain insertion for pleural effusion, the radiologist may be called upon for a rapid assessment of the thorax, and to mark a site deemed safe for the subsequent insertion of an intercostal drain by the clinical team. We aim to review the ultrasound assessment of pleural effusions, with emphasis on safety precautions in marking a site for intercostal drain insertion.
CONTENT ORGANIZATION
Ultrasound assessment of pleural effusions: - thoracic ultrasound anatomy - standard views to obtain - what the clinician needs to know - how to demonstrate a 'safe' site for intercostal drain insertion on ultrasound - when is it not safe to mark? - common pitfalls in the ultrasound assessment of pleural effusions
SUMMARY
- Understand the role of ultrasound in the assessment of pleural effusions.
- How to establish a safe site for intercostal drain insertion.
- When not to proceed with marking a site for drain insertion.

Radiological Assessment of Post Operative Lung Resection Patients: Normal Postoperative Appearances and Complications

LL-CHE4275

Eoghan J McCarthy , MBBCh
John Kavanagh , MBBCh, MRCPI
Oisin J Flanagan , MBBCh, MRCPI
Niamh O'Mahony , MBBCh, MRCPI
Ronan Ryan
Vincent Young
Peter Beddy , MD, FRCR

PURPOSE/AIM
To illustrate the normal post-operative cross sectional imaging appearances in patient post thoracic resection for lung cancer and discuss the significance of imaging findings of post-operative complications.
CONTENT ORGANIZATION
Lobectomy and pneumonectomy are the most commonly performed surgery for Bronchogenic carcinoma. Post-operative imaging can be

challenging to interpret due to the complex nature of the surgery and variety of procedures performed. Newer treatments such as VATS assisted lobectomy and non anatomical wedge resections have changed the surgical approach and potential complications. Drawing on a database of almost 1,500 resections from a tertiary referral Cardiothoracic centre, we will demonstrate the normal post-surgical cross sectional imaging appearances. We will also give diagramtic illustrations of the types of surgical procedures correlating these with intraoperative images and post operative cross sectional imaging. In addition, we will highlight the range of possible complications including, anastamotic dehisence, prolonged airleak, brochopleural fistula and contralateral lung injury.
SUMMARY
There are a wide variety of normal cross sectional imaging appearances post lung resection. A radiologist must understand the surgical technique and the normal post operataive imaging appearances in order to accurately diagnose complications.

Understanding Transient Interruption of the Contrast Bolus: Imaging Features and Techniques for Prevention

LL-CHE4276

Sebastian A Rossini
Constantine A Raptis , MD
Carlos A Capiel , MD
Sebastian A Costantino , MD
Matias Landi , MD
Fernando R Gutierrez , MD

PURPOSE/AIM
Review the pathophysiology of transient interruption of the contrast bolus.
Describe the MDCT imaging features of transient interruption of the contrast bolus.
Discuss strategies for preventing transient interruption of the contrast bolus.
Explore different conditions that can cause transient interruption of the contrast bolus.
CONTENT ORGANIZATION
Transient interruption of the contrast bolus is a physiologic/technical artifact that can result in poor opacification of the pulmonary arteries on pulmonary CT angiographic studies. Transient interruption of the contrast bolus results from inflow of unopacified blood from the inferior vena cava, often during deep inspiration. These flow-related artifacts can in turn lead to indeterminate CT pulmonary angiography studies and misdiagnosis of pulmonary embolism.
The radiology information system was queried for patients with the diagnosis of transient interruption of the contrast bolus. We review the imaging findings in transient interruption of the contrast bolus and discuss the different technical variations to avoid this artifact.
SUMMARY
The knowledge and correct understanding of transient interruption of the contrast bolus is helpful to avoid misdiagnosis of pulmonary embolism.
The radiologist should be familiar this relatively common artifact and strategies to prevent or correct it.

Overlooking the Obvious: Cardiac Findings Missed on Non-gated Chest CT

LL-CHE4277

Umar S Chaudhry , MBBS
Archana T Laroia , MD

PURPOSE/AIM
With much improved image quality and rapid acquisition of images using multi detector CT (MDCT), the details of the cardiac chambers are increasingly well recognized on the routine non gated chest CTs. Our aim is to present a variety of morphological and functional information of the heart seen on the non gated chest CTs and chest angiograms (CTA). Cardiac findings in the era of multi detector CTs provides great detail of cardiac structure even in the absence of EKG gating. Furthermore broad assessment of the right and left heart function is possible on non-gated chest CT.
CONTENT ORGANIZATION
We will present the cross sectional anatomy of the heart, which is now quite well seen on the routine non-gated MDCT of the chest. The poster will illustrate a variety of pathologies of the heart like thrombus, tumor, metastatic disease, apical thinning, cardiac aneurysm, aberrant coronary artery origin etc. that can be seen on routine chest CT/CTA. We will also present how to assess the right and left heart function on non-gated chest CT
SUMMARY
Since the inception of CT in the 1970's there has been tremendous progress in multi-slice scanners. When reviewing non-gated scans, radiologists tend to ignore essential cardiac findings, which though not optimally imaged, are never the less available and help in prompt diagnosis leading to better patient care.

Endovascular Repair for Ulcer-like Projection in Patients with Intramural Hematoma of the Aorta: Indications and Serial Changes

LL-CHE4278

Eijun Sueyoshi , MD
Hiroki Nagayama
Ichiro Sakamoto
Masataka Uetani , MD

PURPOSE/AIM
The purpose of this exhibit is:
1. To present imaging findings of ulcer-like projection (ULP) in patients with intramural hematoma of the aorta (IMH)
2. To show the strategy of endovascular repair for ULP in patients with IMH.
3. To present serial changes of imaging findings of ULP in patients with IMH after endovascular repair.
4. To describe indications of ULP in patients with IMH.
CONTENT ORGANIZATION
1. Presentation of imaging findings of ULP in patients with IMH
2. Methods of endovascular repair for ULP in patients with IMH
3. Illustrative cases
Review of serial changes of imaging findings of ULP in patients with IMH after endovascular repair.
4. Discussion
5. Directions and summary
SUMMARY
1. To know the imaging findings of ULP in patients with IMH
2. To know he strategy of endovascular repair for ULP in patients with IMH
3. To know serial changes of imaging findings of ULP in patients with IMH after endovascular repair.
4. To know the indications of ULP in patients with IMH

Diffuse Alveolar Damage (DAD): Do You Really Know This Fatal Pathologic Pattern?

LL-CHE4279

Takeshi Johkoh , MD, PhD *
Kazuya Ichikado , MD, PhD
Kiminori Fujimoto , MD, PhD
Hiroyuki Taniguchi *
Junya Fukuoka
Noriyuki Tomiyama , MD, PhD
Hiromitsu Sumikawa , MD
Osamu Honda , MD, PhD

PURPOSE/AIM
To recognize the spectrum of diseases showing DAD
To review CT findings
To acknowledge pathological backgrounds for CT findings.
To introduce Ichikado's CT score
To learn tips in the diagnosis on CT and chest radiography (CXR)
CONTENT ORGANIZATION
A. Spectrum of diseases
B. CT findings
C. Pathologic correlation
Pathological phase; exudative, organizing, fibrotic.
Traction bronchiectasis is not seen in early exudative phase and more widely distributed as fibrosis progresses.
Areas with early exudative phase may show normal on CT.
D. Ichikado's CT score
This score correlates with prognosis.
E. Tips in the diagnosis
In early exudative phase, the diagnosis is too difficult even with CT. Repeated chest radiographs may help diagnosis because they can detect rapid progress.
SUMMARY
We will summarize disease spectrum of DAD, its important CT and CXR findings, and CT score for prognosis. Traction bronchiectasis is the key finding for the diagnosis of DAD and more widely distributed as fibrosis progresses. In early exudative phase, CT is sometimes normal and repeated chest radiographs may help diagnosis because they can detect rapid progress. Moreover, we let you understand their pathological backgrounds by using many impressive histological and CT images.

Look Widely: Don't Miss the Thoracic Muscles in Chest CT

LL-CHE4280
Eun Cho , MD
Ki-Nam Lee , MD, PhD
Ji-Yeon Han , MD
Ji Hyun Lee
Bosung Kim
Eun-Ju Kang

PURPOSE/AIM
To review CT anatomy of muscles in the chest wall, which may not arouse radiologist's eye appeal.
To bring attention to chest muscles using axial imaging as well as coronal and sagittal imaging.
CONTENT ORGANIZATION
•Anatomy will be presented as axial, coronal and sagittal chest CT scans. •Correlation with schematic diagram of chest muscles. •Each anatomic area of listed below will be followed by quiz with clinical cases involving chest wall disorders such as ches wall tumors, metastasis, infectious disease or abscess. 1) Anterior chest wall muscles
2) Shoulder muscles
3) Posterior chest wall muscles
4) Neck muscles
SUMMARY
The major teaching points to be emphasized on this exhibit are: 1. To provide fluency in identifying muscle anatomy of the chest wall. 2. To gain expertise with interpreting chest wall muscles using the axial, coronal, and sagittal imaging. 3. To provide sufficient knowledge to recognize accurate localization of the diseases, such as chest wall tumors, metastasis, infectious diseases or abscess, and to communicate with clinical physicians.

Radiologic-pathologic Correlation of Lung Adenocarcinoma according to the New Multidisciplinary Classification/Recommendations for Subsolid Nodules Follow-up: What a Radiologist Should Know

LL-CHE4281
Paola Franchi
Anna Rita Larici , MD
Mariaelena Occhipinti , MD
Frediano Inzani
Gianluigi Petrone
Lorenzo Bonomo , MD

PURPOSE/AIM
1.To describe the new pathologic classification of lung adenocarcinoma (LA) 2.To illustrate:
- LA thin-section computed tomography (CT) appearance according to histologic subtypes
- The management of subsolid nodules, which frequently represent the histologic spectrum of adenocarcinoma, according to the new recommendations from the Fleischner Society
CONTENT ORGANIZATION
To address advances in oncology, molecular biology, pathology, radiology and surgery of LA, a new international multidisciplinary classification was created with the aim of providing uniform terminology and diagnostic criteria for LA. In this exhibit we show:
- LA histological subtypes, including pre-invasive lesions, and their pathologic characteristics
- The radiologic spectrum according to histological subtypes into atypical adenomatous hyperplasia, adenocarcinoma in situ, minimally invasive adenocarcinoma and invasive adenocarcinoma
- The new recommendations for follow-up of subsolid nodules
- Cases from our archive, attempting a histologic diagnosis, and compare them with pathologic specimens to demonstrate radiologic-pathologic correlation
SUMMARY
The major teaching points of this exhibit are:
1.How to identify and measure lesions that can represent a LA
2.How to manage subsolid nodules allowing an earlier recognition of LA and then a less invasive surgical treatment

Central Airway Pathology: Clinic Features, Multislice Computed Tomography Findings with Pathologic Correlation and Virtual Endoscopy with Endoscopic Correlation

LL-CHE4282
Jose Gutierrez , MD
Marcelo Sanchez , MD
Pedro Arguis , MD
Mariana N Benegas Urteaga , MD
Daniel Barnes
Teresa Maria De Carlat , MD
Rosario J Perea , MD

PURPOSE/AIM
To analyze the focal and diffuse imaging features of the central airways correlating MDCT findings with pathology and endoscopy
To describe the MDCT technique to study the airways, and the keys to achieve an adequate differential diagnosis.
To provide a schematic diagnostic approach, based on CT findings and clinical information
CONTENT ORGANIZATION
Introduction Anatomy and histology MDCT technique Classification

- Focal lesions

1. benign neoplasm (hamartoma, leiomioma, papiloma)
2. malignant lesions (squamous carcinoma, cystic adenoid carcinoma)
3. focal infection
4. trauma

- Diffuse lesions

1. with dilatation (Mounier-Khun)
2. with stenosis (TBC, aspergillus, rynoscleromatosis, amyloidosis, sarcoidosis, Wegner's granulomatosis, relapsing polychondritis, osteochondroplastic tracheobronchopathy)
3. tracheobronchomalacia

Schematic diagnostic approach Conclusions
SUMMARY
MDCT is an excellent diagnostic method in the detection and classification of central airway pathology Addressed MDCT protocols according to clinical suspicion are necessary to improve the the MDCT diagnostic accuracy Virtual endoscopy is non-invasive approach which has good correlation with direct-endoscopy

To recognize the central airway disorders avoid unnecessary diagnostic tests, and delays in treatment

---

Ruptured Thoracic Aorta in Nontraumatic Condition: Pictorial Essay

LL-CHE4283
Hyo Weon Kim
Yu Sung Yoon , MD

PURPOSE/AIM
The clinical importance of ruptured thoracic aorta related with high mortality is widely recognized. But most studies have focused on analysis of the pathophysiology and image findings of throughout acute thoracic aortic diseases. While literatures about ruptured abdominal aorta are easily available, few data are addressed about ruptured thoracic aorta. Thus, we places an emphasis on describe multi-detector CT findings in terms of not only the pathophysiology and image finding of acute thoracic aortic disease but also variable forms of ruptured thoracic aorta.
CONTENT ORGANIZATION
1. Aortic rupture of aortic dissection, intramural hematoma, penetrating atherosclerotic ulcer, and atherosclerotic aortic aneurysm
A. High attenuation fluid on precontrast scan
B. Extravasation of contrast media
C. Luminal irregularity of false lumen or aortic wall
D. Progression from penetrating atherosclerotic ulcer to ruptured saccular aneurysm
2. Mycotic aneurysm
3. Tuberculosis
A. Aortoesophageal fistula
B. Aortic pseudoaneurysm by paraspinal abscess
SUMMARY
Multi-detector CT image may be useful in detecting variable manifestations of ruptured thoracic aorta

---

Costal Lesions on Chest CT: What the Thoracic Radiologist Should Know

LL-CHE4284
Thiara C Memoria , ARRT
Thiago Luiz P Scoppetta
Luiz A Ferreira Filho , MD
Livia Silva
Cassio G Reis
Alexandre M Silva , MD

PURPOSE/AIM
Review and illustrate rib pathologies that must be recognized by the radiologist.
CONTENT ORGANIZATION
The advent of multislice tomograpy increased accuracy in the characterization of costal lesions.The radiological analysis must be systematic in order to detect them early.Variety of benign and malignant neoplasms costal represent diagnostic and therapeutic challenge.
SUMMARY
Costal lesions are frequent findings in tomopraphic evaluation of the chest and may have traumatic, neoplastic, metabolic and infectious etiologies. Anatomic variants are also important. Neoplasms are uncommon, accounting for 5% of thoracic and 1-2% of all malignancies. More than half are malignant.Primary tumors are rare.Osteochondroma, fibrous dysplasia, enchondroma are benign and chondrosarcoma, Ewing's sarcoma, osteosarcoma and plasmacytoma are malignant. The study reviews and illustrates rib pathologies that must be recognized by the radiologist.Patients were submitted to Chest Multislice CT in the hospital from 2009-2012. Systematic analysis was performed by thoracic radiologist..The advent of MDCT increased accuracy in the characterization of costal lesions. The radiological analysis must be systematic in order to detect them early. The recognition of imaging findings is essential to differential diagnosis of theses lesions.

Quantification of Movement of Lung Parenchyma Using Dynamic Respiratory CT

LL-CHE4285
Hiroshi Moriya , MD

Koutarou Sakuma
Manabu Nakagawa
Noboru Fujii

PURPOSE/AIM
This presentation covers the following topics: 1. Quantification of movement of lung parenchyma using dynamic respiratory CT and voxel tracking method. 2. Usefulness of 4D registration method in low dose intermittent scanning.
CONTENT ORGANIZATION
1. 320-row ADCT scan protocols 2. 4D registration method (voxel-to-voxel mapping). The voxel-to-voxel mapping enables the employment of additional algorithms that reduce noise, improve motion coherence, and measure kinetic function (moving direction, velocity, acceleration, etc.). 3. Phantom study. Pig raw lungs were used. Accurate measurement of bronchi can be obtained by dynamic MPR and dynamic CPR. 4. Clinical study. Chest wall adhesion/invasion of lung cancer, COPD, and IPF. The kinetic parametric map overlaid on the volume rendered images can be manipulated while in motion.
SUMMARY
Dynamic respiratory motion imaging using 320-row ADCT is a respiratory functional imaging that can be clinically applied to many pulmonary diseases. And, techniques of quantify respiratory kinetics have been developed.

Idiopathic Pleuroparaenchymal Fibloelastosis (IPPFE): Do You Know This Novel Rare Entity?

LL-CHE4286
Takeshi Johkoh , MD, PhD *
Hiromitsu Sumikawa , MD
Noriyuki Tomiyama , MD, PhD
Michio Shigematsu , MD, PhD
Yoshie Morita , MD
Junya Fukuoka
Kiminori Fujimoto , MD, PhD
Tomonori Tanaka , MD

PURPOSE/AIM
To summarize characteristic clinical appearances
To present common findings of chest radiography (CXR) and CT
To show precise radiologic-pathologic correlation
CONTENT ORGANIZATION
A. Clinical appearances
Underweight, and pneumothorax in common.
Disease progress in 60%, and death in 40%.
B. Two types of IPPFE
1. pure PPFE, 2 PPFE with UIP or NSIP
C. CXR and CT findings
Dense subpleural consolidation with traction bronchiectasis, upper lobe volume loss
D. Pathologic correlation
The same pathological findings as apical caps
Intra-alveolar fibrosis with septal elastosis relates to dense consolidation on CT.
E. Other diseases pathologically showing PPFE.
Chronic hypersensitivity pneumonitis, pneumoconiosis, collagen vascular diseases, et
SUMMARY
IPPFE is a recently reported group of disorders characterized by predominantly upper lobe pleural and subjacent parenchymal fibrosis. In the new ATS-ERS international multidisciplinary classification of idiopathic interstitial pneumonias (IIPs), it is included in rare IIPs. Because IPPFE is progressive and sometimes fatal, radiologists should know this novel rare IIPs. We will summarize common CXR and CT findings and let you understand their pathological backgrounds with many impressive pathological and CT images.

Feasibility Study of Reduced Iodine Volume at Gemstone Spectral CT for Pulmonary Artery CT Angiography

LL-CHE4287
Wei Xia
Jing-Tao Wu , MD, PhD
Xiao Rui Yin

PURPOSE/AIM
To assess the feasibility of low volumes of contrast medium (35 mL) at gemstone spectral CT for pulmonary artery CT angiography on the technical quality and diagnostic performance.
CONTENT ORGANIZATION
Forty-eight patients suspected with pulmonary embolism were referred for pulmonary CT angiography prospectively and consecutively on multi-slice spiral CT from February 2012 to November 2012. Institutional review board approval and informed patient consent were obtained.Those patients were randomly assigned to one of two protocols: twenty-four patients (group A) underwent scanning at gemstone spectral CT with Reduced Iodine Volume (35ml), Tracing method: monitoring the superior vena cava. The other twenty-four patients (group B) underwent scanning at 64-detector spiral CT with conventional Iodine Volume (80-90ml), Tracing method: monitoring pulmonary artery trunk. The image objective evaluation: CT values of the pulmonary trunk and the subsegmental level pulmonary and CNR of group A were significantly higher than those of group B. Subjective evaluation of the image:Image quality of group A was significantly better than the group B.
SUMMARY
The image quality of pulmonary CTA on gemstone spectral CT with low Iodine Volume (35ml) can be improved comparing with conventional pulmonary CTA on spiral CT (80-90ml).

Physiology and Imaging Considerations in ECMO (Extracorporeal Membrane Oxygenation)

LL-CHE4288
Steven Lee , MD
Abhishek Chaturvedi , MD
Apeksha Chaturvedi , MD

PURPOSE/AIM
While ECMO is commonly seen in pediatric respiratory failure, it is not uncommon to encounter ECMO in severely ill adults. Understanding the indications for ECMO, the different types of cannulas, and the physiology behind this device is important in both protocoling and interpreting cross sectional exams as well as radiographs.
CONTENT ORGANIZATION
1. Indications for ECMO
2. Types of ECMO
3. Expected locations and types of cannulas
4. Considerations when protocolling contrast enhanced studies used to evaluate vascular structures such as the aorta and pulmonary

arteries
5. Complications related to ECMO
SUMMARY
The key learning points of the exhibit are:

1. Understanding the physiology of veno-arterial and veno-venous ECMO.
2. Be familiar with expected radiologic appearance of cannulas on imaging.
3. Understand expected complications while acquiring contrast enhanced imaging of vascular structures.

Granulomatous Lung Diseases: Correlation of CT and Histologic Features

LL-CHE4289
Karina De Souza Giassi , MD
Hye J Lee , MD
Ricardo V Auad , MD
Guilherme H Bachion , MD
Andre N Costa
Cristina Aparecida T Mitteldorf , MD
Claudia D Leite , MD, PhD *

PURPOSE/AIM
Granulomatous diseases of the lung are among the most complex abnormalities encountered in pulmonary medicine and often pose a diagnostic challenge to radiologists due to its variety of radiologic manifestations. This study aims to review lung diseases which main pathologic feature is granuloma formation, to do a case-based review of the HRCT appearances of these conditions and to correlate CT findings and histologic features.
CONTENT ORGANIZATION
We reviewed chest HRCT scans performed in our institution between 2008 and 2013 that revealed features of granulomatous lung diseases pathologically proven by analysis of lung biopsy specimens. Selected cases were classified into two groups: infectious and noninfectious granulomatosis. Based on the most representative cases, we selected images and their respective photomicrographs to illustrate the most important patterns of lung involvement and its close relationship to the histologic features.
SUMMARY
Granulomatous lung diseases can be a diagnostic challenge to any radiologist, and HRCT is the modality of choice to distinguish patterns of lung involvement that may suggest the diagnosis. Our goal is to perform a case-based review of the most representative pulmonary granulomatous diseases with a confident radiologic-pathologic correlation.

Clinical Experience on Evaluation of Pulmonary Embolism from Early Detection-Extent Identification-Follow up Monitoring Using Gemstone Spectral Imaging

LL-CHE4290
Shufeng Fan , MD
Ying Chen
Chunguang Zeng
Yucheng Mi , MD, PhD

PURPOSE/AIM
1.To understand the principles of gemstone spectral imaging using a single tube fast KVp switching acquisition.
2.To know the optimal techniques on evaluation of Pulmonary Embolism from early detection- extent identification-follow up monitoring using gemstone spectral imaging d
3.To illustrate the current applications of spectral imaging on evaluation of Pulmonary Embolism with clinical data and images.
CONTENT ORGANIZATION
1.Principles of monochromatic images and material decomposition from gemstone spectral imaging using a single tube fast KVp switching acquisition.
2. Optimal techniques for connecting iodine material distribution images with correlated monochromatic CTPA findings and quantification comparison between distribution defect and normal pulmonary parenchyma.
3. Clinical experience of iodine material density quantification on extent identification of PE and follow up monitoring before and after therapy.
SUMMARY
Spectral CT imaging generated both monochromatic CTPA images for morphologic analysis of PE and material decomposition images for quantitative depiction of pulmonary blood flow and perfusion defects. It will play an important role on evaluation of Pulmonary Embolism from early detection, extent identification and follow up monitoring in the future.

Bringing Back Tomography-An Improved Technique for Those Grey Areas in Chest Radiology-Three Year Experience from a Single Centre

LL-CHE4291
Angie Galea , MD, MRCS
Jon Crighton
Simon Lloyd , MBChB

PURPOSE/AIM
Improvements in computer technology as well as a reduction in radiation dose have given conventional tomography a new lease of popularity - digital tomosynthesis (DTS) as it is now known boasts of better depth and contrast resolution and the elimination of anatomical noise due to composite shadows. Clinically this results in better evaluation of the hilar, earlier detection of small nodules that would otherwise be obscured by ribs or other structures and better distinction between calcified and noncalcified nodules or plaque. This educational quiz allows the reader to assess equivocal CXRs and decide whether or not DTS is a helpful tool in chest radiology. CT images will be included where helpful.
CONTENT ORGANIZATION
Images will include: Equivocal hilar masses (CXR vs DTS) Equivocal lung nodules (CXR vsDTS) Locate the lesion - intrapulmonary or not ? (lateral CXRs will be provided as well as DTS images) Interesting cases: - Bronchial atresia - CAM - Rib notching - Sarcoidosis
SUMMARY
DTS radiology can help with challenging CXRs especially when evaluating the hilar of the lungs. This is a fun, interactive, educational presentation for junior radiologists as well as the more mature clinicians who may remember conventional tomography. We attempt to teach an old dog new tricks or a new dog old tricks ?

Role of Thoracic Computed Tomography in Detection of Restrictive Allograft Syndrome

LL-CHE4292
Miho Horie , MSc *
Tomohito Saito

Heidi C Roberts , MD
David Hwang , MD, PhD
Shafique Keshavjee , MD
Narinder S Paul , MD *

PURPOSE/AIM
One third of lung transplant recipients develop chronic lung allograft dysfunction (CLAD), primarily due to bronchiolitis obliterans syndrome (BOS). However, 30% of patients develop restrictive allograft syndrome (RAS), a recently described novel form of CLAD which is associated with significantly worse prognosis; the median survival after CLAD onset is 541 days with RAS compared to 1421days with BOS. The radiological findings in RAS reflect the development of peripheral lung fibrosis and early detection is important for prognostic determination. The purpose of this presentation is to review the role of thoracic CT in the surveillance of lung transplant recipients particularly RAS patients to improve understanding of the underlying pathophysiology.
CONTENT ORGANIZATION
1. Anatomy – Radiological-Pathological correlation of normal appearances in lung transplants
2. Pathology - Radiological-Pathological correlation of CLAD subtypes: BOS and RAS
3. Imaging - Review of CT features in progressive RAS
4. Imaging - Challenges in using CT for the early detection of RAS
SUMMARY
Thoracic CT has an important role in determining the prognostic outlook for lung transplant recipients by diagnosing CLAD and differentiating between BOS and the more severe RAS. The recognition and further investigation of RAS is important for the thoracic radiologists.

Minimally Invasive Thoracic Surgery (MITS): All You Want to Know

LL-CHE4293
Kyung Bum Nam , MD
Tae Jung Kim
Su Jin Hong , MD
In Sun Lee , MD
Kyung Won Lee , MD, PhD

PURPOSE/AIM
1. Discuss the various kinds of up-to-date minimally invasive surgical procedures in thoracic surgery
2. Discuss the preoperative imaging protocols and consideration for minimally invasive thoracic surgery (MITS)
3. Identify radiographic and CT appearances of normal and complications of MITS
CONTENT ORGANIZATION
1. Introduction
1) History, development and current status of MITS
2) MITS vs open surgery: pros and cons
2. Various Minimally invasive techniques
1) Video-assisted thoracic surgery (VATS): lung, esophagus, mediastinum, pleura, pericardium and thymus
2) Photodynamic therapy (PDT): principle, indications, procedures
3) Robotic thoracic surgery: principle, indications, procedures
4) Intrapleural perfusion hyperthermic chemotherapy (IPHC): principle, indications, procedures
3. Pre- and postoperative imaging evaluation in MITS
1) Normal and complications
SUMMARY
MITS is now widely used in the treatment of variety of thoracic diseases including lung cancer and esophageal cancer, with comparable results to conventional surgery. It is important for radiologists to understand what information is required by surgeons and how to assess this by imaging studies. Knowledge of the characteristic imaging features of complications facilitates its early recognition and prompt management.

Pleurodesis: Indications and Radiographic Appearance

LL-CHE4294
Akinaga Sonoda , MD, PhD
Norihisa Nitta , MD
Seth J Kligerman , MD *
Jason K Lempel , MD
Jean Jeudy , MD
Aletta Ann Frazier , MD
Charles S White , MD

PURPOSE/AIM
Pleurodesis is frequently performed to prevent recurrence of pneumothorax or recurrent pleural effusion, in particular malignant effusions. We often encounter images showing evidence of pleurodesis and these may cause radiological and clinical confusion. It is important to develop an understanding of the reasons for the procedure and its sequelae. Thus, the aim of this exhibit is to review the indications, techniques and post-procedure appearances of pleurodesis from an imaging perspective.
CONTENT ORGANIZATION
1) Review of the radiological imaging of underlying clinical indications(eg. recurrent spontaneous pneumothorax and pleural effusion). 2) Description of the technical aspects of pleurodesis. 3)Thorough assessment of the radiological appearances in the post –pleurodesis setting (esp. radiography, CT scan, FDG-PET).
SUMMARY
The following points will be addressed:1)Diseases suitable for pleurodesis as described in the literature. 2) Technical aspects of pleurodesis. 3) Imaging appearances after pleurodesis.

Early Diagnosis of Acute Pulmonary Distress Syndrome Caused by Smoke Inhalation Injury Using Dual Energy CT

LL-CHE4295
Regina Moritz
Frank L Goerner , PhD *
Val M Runge , MD *
Ernesto Lopez , MD
Gabriele A Krombach , MD
Matthew K Fuld , PhD *
Osamu Fujiwara , MD
Donald Prough , MD
Perenlei Enkhbaatar , MD, PhD

PURPOSE/AIM
Dual energy CT (DECT) continues to evolve giving additional information about tissue characteristics. This exhibit uses DECT images to

visualize pulmonary changes after smoke inhalation injury. It focuses on the characterization of focal perfusion in different lung areas as well as the detection of vascular occlusions and corresponding perfusion defects.

CONTENT ORGANIZATION
a) Characterization of pulmonary changes in a sheep model of smoke inhalation injury using high resolution CT (120 kV) (Siemens Definition Flash, Forchheim, Germany) b) Correlation of the lung tissue (autopsy material) to the individual CT scans c) Characterization of perfusion profiles in smoke inhalation injury using perfusion maps obtained from the dual energy scans (100/140kV) d) Correlation of histological findings to areas of hypo- and hyper-perfusion e) Clinical CT imaging of smoke inhalation injury

SUMMARY
The objective of this exhibit is to improve the radiologists´ understanding of the basic principles of dual energy CT and to explain the advantages of this evolving technique especially in the diagnosis of acute respiratory distress syndrome (ARDS) caused by smoke inhalation injury.

Bronchiectasis: Mechanisms and Imaging Clues of Associated Common and Uncommon Diseases and Syndromes

LL-CHE4296
Bethany Milliron , MD
Brent Little , MD
Travis S Henry , MD *
Srihari Veeraraghavan

PURPOSE/AIM

1. Provide a comprehensive review of bronchiectasis as a radiological finding and associated causative etiologies
2. Review the pathology and mechanisms of specific etiologies
3. Describe the typical appearance and distributions commonly seen in these conditions

CONTENT ORGANIZATION
A thorough review of the following topics: **1. Mechanisms and imaging of common etiologies**
a. Aspiration
b. Infection
c. Atypical mycobacterial infection/Tuberculosis
d. Bronchiolitis Obliterans (air trapping, tree in bud, bronchiectasis)
i. Lung transplant associated
ii. Other solid organ and marrow transplant
iii. Inhalational
e. Sarcoidosis (central, upper, traction)
f. Pulmonary fibrosis / usual interstitial pneumonitis / fibrosing nonspecific interstitial pneumonitis
g. Cystic fibrosis
h. ARDS
2. Uncommon
a. Swyer James
b. ABPA
c. Bronchocentric granulomatosis
d. Mournier Kuhn
e. AIP
f. Inflammatory Bowel Related
g. Williams Campbell
h. Adenocarcinoma related (focal bronchial dilatation)
i. Good syndrome (thymoma and IGG deficiency)
SUMMARY
Provide a comprehensive review of mechanism and imaging findings in common and uncommon etiologies of bronchiectasis with a pathologic correlation as relevant.

2013 Update on Bronchopleural Fistula (BPF): CT Evaluation with Clinical, Bronchoscopic and Surgical Correlation

LL-CHE4297
Kyung Bum Nam , MD
Tae Jung Kim
Su Jin Hong , MD
In Sun Lee , MD
Kyung Won Lee , MD, PhD

PURPOSE/AIM
1. To review and categorize the various causes of bronchopleural fistula (BPF)
2. To demonstrate the CT findings of BPF according to causes and locations
3. To describe the utility of thin-section and multiplanar reformation (MPR) CT images in the diagnosis and management of BPF
CONTENT ORGANIZATION
1. Classification of BPF based on the locations and causes
– central and peripheral
– infection/inflammation and surgery
2. Review of CT findings of BPF
– with emphasis on the usefulness of thin-section axial and MPR images
3. Correlation of CT findings with clinical, bronchoscopic and surgical findings of BPF
4. Review of management strategies for BPF according to types and causes
– with emphasis on the current role of CT in the diagnosis and management of BPF
SUMMARY
1. CT can allow direct visualization and localization of the BPF as well as assessment of the underlying causes.
2. CT also can visualize the indirect or secondary signs of BPF, such as air bubbles beneath the bronchial stump and fistulous tract.
3. Thin-section axial and MPR images are more useful than thick-section axial images in the visualization of BPF.
4. CT can be an initial and primary diagnostic modality when BPF is suspected clinically or radiographically.

Proton Lung MRI-Methods, Applications and Future Perspectives

LL-CHE4298
Sajoscha A Sorrentino , MD
Julius Renne , MD
Jan Hinrichs
Christian Schoenfeld
Marcel Gutberlet , DiplPhys
Frank K Wacker , MD *
Jens Vogel-Claussen , MD

PURPOSE/AIM

The aim is to review magnetic resonance imaging (MRI) sequences, protocols, applications and future perspectives of proton MRI of the lung.

CONTENT ORGANIZATION

1. Lung MRI for:

- Anatomy (True Coherent Gradient Echo, Volume Interpolated Breathhold Examination, Single-Shot TSE/FSE, TSE, T_2 Motion Correction with Radial Blades, Short Tau IR)

- Perfusion (Dynamic MRA with k-space Manipulation, 3D MRA)

- Ventilation (Fourier decomposition)

- Oxygenation (oxygen-enhanced T_1-mapping)

2. Featured clinical applications:

- Oncology

- Thoracic vascular disease

- Pulmonary embolism

- Chronic thromboembolic pulmonary hypertension (CTEPH)

- Chronic obstructive pulmonary disease (COPD)

- Cystic fibrosis

3. Future perspectives of lung MRI

SUMMARY

MRI of the lung is a powerful tool for many clinical as well as scientific applications and can be readily performed in the clinic.

Cardiovascular Fistulas: A Review of Abnormal Connections within the Thorax

LL-CHE4299

Jason K Lempel , MD
Elliott K Gozansky , MD, PhD
Jean Jeudy , MD
Thomas M Cullen , MD
Charles S White , MD

PURPOSE/AIM
To understand the anatomy of the main vasculature in the thorax, including the heart, aorta and pulmonary artery and its relationship to adjacent structures. To recognize the unusual CT imaging manifestations of various abnormal vascular connections within the thorax.
CONTENT ORGANIZATION
1. Review the pathophysiology and possible etiologies of vascular fistulas. 2. Show the unusual CT imaging findings associated with various cardiothoracic fistulas through an interactive case based imaging format. Disease entities to be discussed include the following abnormal connections:

1. Aorto-Pulmonary
2. Aorto-Bronchial
3. Aorto-Esophageal
4. Aorto-Pleural
5. Atrio-Esophageal
6. Pulmonary venous-Mediastinal collateral
7. Coronary-Pulmonary Artery

SUMMARY
Cardiovascular fistulas can cause devastating effects and may potentially be fatal if untreated. Various fistulas have specific radiologic appearances and present with varying symptoms based on their location and affected organs. This exhibit reviews the pathophysiology and unusual CT imaging appearances of various cardiothoracic fistulas, with the intention of helping the radiologist to detect and correctly characterize them when present. It is essential that they be recognized immediately and diagnosed correctly to ensure prompt patient management.

Quality Control Guidelines for Optimizing Quantitative Measurements from Thoracic CT

LL-CHE4300

Peiyun Lu
Hyun J Kim , PhD
Matthew S Brown , PhD *
Jonathan G Goldin , MBChB, PhD

PURPOSE/AIM
There is a growing need to ensure optimized image quality and data validity of quantitative CT measurements in COPD and diffuse lung disease. We propose a schema that can be implemented in clinical trial settings to perform high-quality CT measurements.
CONTENT ORGANIZATION
The accuracy and uniqueness of subject identifier, scan date, and DICOM image acquisition parameters are key elements for image QC. Chronological order of scan date across visits and correct study interval labeling shall be validated in a longitudinal trial. Any deviations for scheduled imaging assessments, duplicated or inconsistent entries shall be reported to study coordinating center. Numerical range checks of lung volume, lung attenuation, airway morphometry, and quantitative disease patterns at lobar and whole lung are critical to validate lobar/airway segmentations. The correlation and temporal reproducibility of lung volumes on CT and PFT are examined by concordance correlation coefficient, Bland-Altman, and time-series plot. The agreement between quantitative imaging measurements and visual assessments is evaluated by Kappa statistics or box plot. Outliers detected by data QC shall be flagged for further investigation

SUMMARY
A comprehensive set of quantitative imaging QC checks can be implemented in clinical trials to ensure accurate and reproducible measurements in thoracic CT.

The Changing Face of Pulmonary Tuberculosis in Tropics- Pictorial Review

LL-CHE4301

Monika S Bapat , MBBS
Karuna Agawane
Jayashree R Jadhav , MBBS, DMRD
Palak B Popat , MBBS, MD
Lohith Ambadipudi , MBBS
Priya Hira , MBBS, DMRD

PURPOSE/AIM
1. To review etiopathopathogenesis of Pulmonary Tuberculosis (TB).
2. To evaluate new atypical imaging findings of TB on HRCT chest.
3. To discuss TB as an underlying cause of acute emergencies.
CONTENT ORGANIZATION
1. Etiopathogenesis of pulmonary TB 2. New atypical patterns of Pulmonary TB on HRCT
- Exclusive lower lobe involvement
- Miliary nodules confined to one or two lobes
- Miliary TB with a cavitatory consolidation
- Consolidation in lower or middle lobe
- Bronchocentric nodules 'tree in bud' (infectious bronchiolitis)
- Multiple cavities
- Cavity in middle or lower lobe
- Pleural based nodules
- Atelectasis or collapse 3. TB presenting as acute chest emergency - Spontaneous pneumothorax/ hydropneumothorax
- Pulmonary embolism
- Pulmonary edema
- SVC obstruction
- Alveolar haemorrhage due to hemoptysis 4. TB mimics
SUMMARY
Teaching points of this exhibit are
1. To illustrate new atypical imaging spectrum of TB as an aid to early diagnosis
2. To identify TB as a cause for acute emergencies in chest medicine
3. To differentiate TB from its mimics

Pulmonary Cavitation: Filling in the Holes. An Imaging Review of Aetiology and Complications

LL-CHE4302

Kristian H Mortensen , MBBS, PhD
Deepa Gopalan , MRCP, FRCR
Judith L Babar , MBChB
Anu Balan , MBBS, MRCP

PURPOSE/AIM
Review the imaging spectrum of cavitating pulmonary disease, using examples from our institutional experience. This exhibit shows how to identify underlying aetiology of cavitating lung disease, focusing in particular on Multi-Detector CT findings. We emphasize the complications of cavitation by showing their imaging manifestations.
CONTENT ORGANIZATION
This exhibit reviews key imaging findings of of pulmonary cavitatory disease, showing possible causes: 1) Infection a) Spectrum of cavitating fungal disease including angioinvasive aspergillosis and aspergilloma with demonstration of 'air crescent signs' b) TB c) Septic emboli d) Lung abscess e) Necrotizing pneumonia 2) Vascular a) Acute and chronic pulmonary thromboembolic disease b) Pulmonary vasculitis 3) Carcinoma: Cavitating squamous lung carcinoma and metastases 4) Trauma: pneumatoceles, haematoceles Uncommon complications and their management will be exhibited e.g. a) Bronchial arterial hypertrophy secondary to chronic aspergilloma b)Pneumothorax secondary to septic emboli c) Empyema necessitans from lung abscess and empyema Lesions mistaken for cavitation will be included e.g. Sequestration, Congenital cystic adenomatoid malformation
SUMMARY
This is a comprehensive imaging review of pulmonary cavitation, enhancing knowledge of causes and potentially serious complications

Mosaic Attenuation: Differential Diagnosis and Pitfalls in Interpretation

LL-CHE4303

Seth J Kligerman , MD *
Teri J Franks , MD
Jeffrey R Galvin , MD

PURPOSE/AIM
Review the different etiologies of mosaic attenuation and discuss methods to differentiate between the various causes on imaging
CONTENT ORGANIZATION
1. Anatomy of the secondary pulmonary lobule 2. Small airways disease with pathologic correlation including various etiologies of constrictive bronchiolitis (transplant, inhalational injury, collagen vascular disease, DIPNECH, etc), cellular bronchiolitis (infection, hypersensitivity pneumonitis, small airways component of asthma, etc), and respiratory bronchiolitis. 4. Pulmonary vascular diseases including idiopathic (primary) and secondary causes of pulmonary hypertension. Pathologic correlation will be provided 5. Diffuse parenchymal ground glass opacity which create a mosaic attenuation with pathologic correlation. This will include discussion of certain infections (pneumocystis pneumonia) and ILDs (organizing pneumonia) 6. Methods to differentiate between these various causes including discussion on patterns of mosaicism, expiratory imaging, airway-vessel ratio, right heart assessment, and other secondary findings. 7. Pitfalls in diagnosis of mosaic attenuation
SUMMARY
1. Mosaic attenuation is a common finding which is most commonly due to either small airways disease, pulmonary hypertension, or diffuse parenchymal GGO. 2. Differentiation is important as treatments are not the same

Radiographic and Pathologic Manifestations of Uncommon and Rare Pulmonary Lesions

LL-CHE4304

Vivek B Kalra , MD
Kyle E Pfeifer , MD

Adebowale Adeniran , MD
Myung S Shin , MD, DSc

PURPOSE/AIM
A significant minority of pulmonary lesions represent clinicopathological entities distinct from infection or malignancy. We present a radiographic and pathologic review of less common reactive and benign neoplastic lesions through a retrospective study of the various pathological entities found upon biopsy.
CONTENT ORGANIZATION
We describe the prevalence, imaging features, histological characteristics, and clinical significance of uncommon and rare non-infectious and benign pulmonary lesions, specifically - organizing pneumonia, hyalinizing granuloma), tumorlet (benign localized neuroendocrine cell proliferations), alveolar hyperplasia, inflammatory myofibroblastic tumor, pulmonary amyloidosis, papillary adenoma, plasma cell granuloma, juvenile xanthogranuloma, lymphangiomatosis, sclerosing hemangioma), and Langerhans cell histiocytosis.
SUMMARY
Awareness of the clinicopathological entities that comprise uncommon and rare pulmonary lesions is essential to broaden the differential diagnosis beyond infection or malignancy. Organizing pneumonia imaging features of band-like opacities, perilobular pattern, and reverse halo sign were neither sensitive nor specific; all clinicopathological entities demonstrated overlapping imaging features.

Medical Imaging of Aortic Graft Complications

LL-CHE4305
Matthew C Martyniuk , BSc
Gage R Watson
Kiat Tan , MD

PURPOSE/AIM
PURPOSE/AIM: Aortic graft complications are uncommon but are increasingly found. As these complications could potentially have devastating consequences, it is important for the radiologist to have a good understanding of these. After going through this presentation, the reader should be able; (1) describe the complications of aortic grafts; (2) understand the imaging characteristics of graft complications.
CONTENT ORGANIZATION
CONTENT ORGANIZATION: 1) Types of aortic grafts; (2) Imaging modalities such as conventional angiography, computed tomography, MRI, Ultrasound and nuclear medicine studies; (3) Complications of aortic grafts, such as endoleaks, infection, graft failure as well as their imaging characteristics; (3) Disease in other organ systems that could be related to the graft (e.g. hydronephrosis and osteomyelitis)
SUMMARY
SUMMARY: Aortic grafts are increasingly encountered in radiological practice. As a result, the radiologist should be aware of the imaging findings of graft complications.

Mediastinal Masses and Video-assisted Thoracic Surgery (VATS): What the Radiologist Should Know

LL-CHE4306
Tanay Y Patel , MD
Carsten Schroeder
Prabhakar Rajiah , MD, FRCR
Luis A Landeras , MD

PURPOSE/AIM
In modern medicine, video-assisted thoracic surgery (VATS) has become a frequently performed procedure in the diagnosis and management of mediastinal masses. The purpose of this educational exhibit is to: 1. Provide an understanding of VATS techniques, its indications and limitations in the diagnosis and management of mediastinal masses. 2. Emphasize the role of CT and MR imaging in the preoperative planning of mediastinal masses. 3. Become acquainted with the normal postsurgical appearance of VATS and its complications on cross-sectional imaging.
CONTENT ORGANIZATION
1. Definition of VATS and technical considerations. 2. VATS versus anterior and cervical mediastinoscopy. 3. CT and MR imaging in the preoperative planning for mediastinal masses. 4. Normal postoperative appearance and complications.
SUMMARY
VATS is a commonly performed procedure in the diagnosis and management of mediastinal masses. The radiologist needs to become acquainted with significant imaging findings that would aid the thoracic surgeon in preoperative planning as well as the normal postsurgical appearance and its complications.

Birt-Hogg-Dubeâ€² Syndrome as an Uncommon Hereditary Cause of Spontaneous Pneumothorax: CT Manifestations and Differentiation from Other Diffuse Cystic Lung Diseases

LL-CHE4307
Eun-Young Kang , MD
Hwan Seok Yong
Ki Yeol Lee , MD, PhD
Yu-Whan Oh , MD
Kyung Won Doo
Bong Kyung Shin

PURPOSE/AIM
Birt-Hogg-Dube' syndrome is an uncommon but not rare cause of pneumothorax in daily practice. In patients with Birt-Hogg-Dube' syndrome, cystic lung disease and pneumothorax are well associated. This exhibit is to review and illustrate CT manifestations of Birt-Hogg-Dube' syndrome and to differentiate Birt-Hogg-Dube' syndrome from other well-known diffuse cystic lung diseases.
CONTENT ORGANIZATION

1. Review of diffuse cystic lung diseases causing spontaneous pneumothorax.
2. Review of Birt-Hogg-Dube' syndrome as an uncommon hereditary etiology of spontaneous pneumothorax.
3. CT characteristics of lung cysts in Birt-Hogg-Dube' syndrome.
4. Differential diagnosis between Birt-Hogg-Dube' syndrome and other diffuse cystic lung diseases causing spontaneous pneumothorax.

SUMMARY

1. Birt-Hogg-Dube' syndrome is suspected in patients with multiple lung cysts, pneumothorax, and a family history.
2. Multiple, discrete, thin-walled cysts of various size and shape are more numerous and larger in the lower and medial lungs in patients with Birt-Hogg-Dubé syndrome.
3. The CT characteristics including zonal predominance of cysts, cyst size, and cyst shape of lung cysts are significantly different between Birt-Hogg-Dube' syndrome and other diffuse cystic lung diseases.

Tips and Tricks: Optimizing Parameters for Thoracic Dual Source Dual Energy CT (DECT) Imaging Acquisition and Reconstruction

LL-CHE4308
Ramesh Yella
Seyed Ameli-Renani , MBBS,FRCR
Farzana M Rahman , FRCR, MBBS
Sarah L Sheard , MBBS, FRCR
Charlie Sayer , MBBS,FRCR
Ioannis Vlahos , MRCP, FRCR *

PURPOSE/AIM
To illustrate the importance of multiple adjustable parameters in the performance of high quality DECT and the reconstruction of diagnostic, accurate and artefact free material specific imaging.
CONTENT ORGANIZATION
With regard to DECT for the availability of low and high kVp spectral interpretation data sets or to reconstruct pulmonary blood volume (PBV), iodine selective or virtual non-contrast (VNC) images the following parameters are considered for 1st and 2nd generation systems:
Acquisition:
• Choice/rationale of specific high-low kVp pairs according to size/indication.
• Radiation dose distribution (high-low kVp Tube A/B assignment
• Contrast volume/rate, flush, timing, bolus tracking, acquisition direction
• Scouts/isocentering
• Collimator/pitch settings to internally correct noise and improve DECT calculation
Reconstruction:
• Kernels and thickness data/overlap choice for accurate material decomposition
• When to alter and when to leave alone advanced parameters (thresholds, substance definitions, contrast media cutoff, range, relative contrast media values)
• Weighting factors adjusted for kVp pairs, sigmoidal blending, monoenergetic imaging
SUMMARY
This exhibit provides a user's guide for thoracic dual source dual energy imaging acquisition and reconstruction parameters to reliably improve image quality and interpretation.

Useful Technical Tips for CT-guided Percutaneous Transthoracic Needle Biopsy of Problematic Lung Lesions

LL-CHE4309
Sang Hyun Paik , MD
Hyorin Kim , MD
Heon Lee
Jang Gyu Cha , MD
Min Hee Lee , MD
Jai Soung Park

PURPOSE/AIM
To explain techniques that allows increasing accuracy and diminishing complications of CT-guided percutaneous transthoracic needle biopsy of lung lesions considering lesion locations, obstacles and sampling errors
CONTENT ORGANIZATION
Content Organization;
A. Lesion locations
i. Deep central lesion
ii. Long tract approach for subpleural lesion
iii. Direct puncture of pleural-based lesion
iv. Accessing via collapsed lung
B. Obstacles
i. Large vessels, fissure and bulla
ii. Internal mammary vessels and intercostals vessels
iii. Ribs and scapula
iv. Patient positioning, arm movement and adjusting respiration
C. Sampling errors
i. Necrotic mass
ii. Associated obstructive pnuemonitis or passive atelectasis
iii. Peripheral inflammation
SUMMARY
CT-guided percutaneous needle biopsy of lung is a safe and effective procedure. However, multiple factors including lesion location and size, underlying pulmonary disease, associated obstructive pneumonitis, and general condition of patient decrease the accuracy of tissue sampling and increase risk of complications. Indivisualized biopsy techniques are helpful for increasing accuracy and diminishing avoidable complications.

Chest CT in Thoracic Trauma: A Review

LL-CHE4310
Marina C Bernal Fernandez , BA
Daphne M Loubriel Torres , BSc
Cedric W Pluguez-Turull , MD
Laura C Figueroa Diaz , BS
Guido E Santacana-Laffitte , MD
Jose A Maldonado , MD

PURPOSE/AIM
To discuss the pathophysiology, imaging findings, management and iatrogenic complications of traumatic chest injuries by examining CT findings in patients at our trauma center along with a review of several classic trauma-related signs.
CONTENT ORGANIZATION
The educational exhibit intends to provide a review of chest CT in thoracic trauma by examining studies of trauma patients at our institution. We will discuss CT imaging of various injuries to the pulmonary, tracheobronchial, mediastinal, cardiovascular, and musculoskeletal systems. The accuracy of CT for elucidating patient anatomy and extent of lesions, including small pneumothoraxes, pneumomediastinum, pulmonary contusions, and lacerations, make it indispensable in managing trauma patients. Several classic signs in chest CT and iatrogenic complications will also be explored. A better understanding of chest CT imaging in trauma patients will enable radiologists to interact more efficiently and effectively with other members of the trauma team.
SUMMARY
Many patients involved in high-energy trauma are sent immediately to CT imaging, obviating chest radiography. Reviewing the pathophysiology, CT imaging findings, iatrogenic complications and management of traumatic chest injuries, along with an illustration of classic trauma-related signs, will help improve outcome in chest trauma patients.

The Usefulness of Evaluating Pulmonary Veins in Diagnostic Various Lung Diseases

LL-CHE4311
Ryoko Egashira , MD
Takahiko Nakazono , MD, PhD
Ken Yamaguchi , MD
Masanori Masuda , MD
Hiroyuki Irie , MD, PhD

PURPOSE/AIM
Pulmonary veins can vary in size or shape in various pathologic conditions. Detail evaluation of pulmonary veins may lead to correct diagnosis. The purposes of our exhibit are;

1. To review the anatomy of pulmonary vessels
2. To illustrate pulmonary veins in various lung diseases on HRCT
3. To present the useful HRCT findings with radiologic-pathologic correlation

CONTENT ORGANIZATION
1. Review the anatomy of pulmonary vessels
2. Pathological meanings of pulmonary veins in various lung diseases
3. Typical and useful CT findings from the viewpoints of the changes of pulmonary veins

- 3-1: Enlargement of the intrapulmonary vein: In lung cancer, enlargement of the draining vein indicates the existence of invasion. In diffuse lung diseases, it corresponds to the edematous change including pulmonary edema and acute subacute lung injury.
- 3-2: Nodules along/on the intrapulmonary vein: intrapulmonary lymphnode, pneumoconiotic or sarcoid nodule
- 3-3: Irregularity of the intrapulmonary vein: Sarcoidosis or usual interstitial pneumonia

SUMMARY
Careful interpretation of HRCT findings with paying attention to existing pulmonary veins is important in addition to evaluate the main lesion itself. This may give the correct anatomical information and speculation of pathophysiological condition and may improve the diagnosing accuracy.

Tuberculosis Presenting as an Acute Respiratory Emergency Requiring ICU Care!!

LL-CHE4312
Palak B Popat , MBBS, MD
Karuna Agawane
Jayashree R Jadhav , MBBS, DMRD
Monika S Bapat , MBBS
Priya Hira , MBBS, DMRD
Amita U Athavale , MBBS, MD
Jairaj P Nair , MBBS, MD

PURPOSE/AIM
Tuberculosis (TB) is known as a chronic granulomatous disease. However it does not always present so. Symptoms of low grade evening fever with loss of weight and appetite are no longer the necessary presentations. The aim is to give an insight into the myriad ways the disease has presented in our ER requiring Respiratory ICU admission
CONTENT ORGANIZATION
TB, a chronic disease with insidious onset, may not be diagnosed, or the patient remains asymptomatic until requiring emergency aid
Ways in which some patients have presented :
a) Acute respiratory distress syndrome with early cardiac failure secondary to miliary TB
b) Acute dyspnoea secondary to pulmonary thromboembolism secondary to TB
c) Acute wheezing not responsive to bronchodilators secondary to mechanical narrowing of bronchus from a tuberculous stricture
d) Acute dyspnoea due to massive pneumothorax with evidence of active TB
e) Massive hemoptysis
f) Unusual cause of SVC obstruction from TB lymph nodes
SUMMARY

TB is increasingly presenting first time as an acute emergency o A high index of suspicion is required to not overlook TB as a background etiology in acute setting, else ensuing further complications

Assessment of Acute Mediastinitis with CT

LL-CHE4313
Sung-Hye You
Yu-Whan Oh , MD
Bo-Kyu Kim , MD
Soo Y Ham , MD, PhD
Eun-Young Kang , MD
Ki Yeol Lee , MD, PhD

PURPOSE/AIM
The purpose of this exhibit is: 1. To demonstrate the CT features of acute mediastinitis 2. To assess the value of CT in differentiating various causes of acute mediastinitis.
CONTENT ORGANIZATION
Causes of Acute Mediastinitis - Direct extension from deep neck infection - Esophageal perforation - Thoracic surgery - Extension from pancreatitis - Infectious spondylitis of thoracic spine **CT Features of Acute Mediastinitis** - Localized vs extensive type of mediastinits - Mediastinal fat infiltration with fluid attenuation (most common) - Mediastinal lymphadenopathy - Pleural effusion and/or pericardial effusion - Pneumomediastinum - Abnormalities of adjacent structures such as abscess in deep neck, distruption of esophageal wall, or spondyitis.
SUMMARY
The major teaching points of this exhibit are: 1. Chest CT is useful in assessing the severity of acute mediastinitis. 2. CT is valuable in determining the primary cause of mediastinitis.

Systematic Approach to Interstitial Lung Disease on HRCT

LL-CHE4314
Avneesh Chhabra , MD *
Kiran Batra , MD

PURPOSE/AIM

Interstitial lung disease (ILD) is considered as 'irritating lung derangement' by many chest readers, fellows and residents due to lack of understanding of pathophysiology and related imaging appearances. We present a systematic approach to its diagnosis with a clear path to differentiation using quiz format among most commonly encountered entities.
CONTENT ORGANIZATION
• Brief review of relevant normal anatomy of the lung interstitium.
• Brief discussion of HRCT technique.
• Classic imaging presentation of spectrum of 20 most commonly encountered interstitial lung diseases in a quiz format.
• Outlining a systematic approach based on clinical history, lung volume, apico-basal distribution, centro-peripheral distribution, predominant imaging pattern (reticular, nodular, ground glass or cystic), typical findings and associated regional findings.
SUMMARY
1. Understand the normal anatomy and imaging appearances of common ILDs.
2. Learn to follow a systematic approach towards their diagnosis.

Rare Idiopathic Intestinal Pneumonias (IIPs) and Histologic Patterns in New ATS-ERS Multidisciplinary Classification of the IIPs: Radiologists Should Memorize and Understand Them!

LL-CHE4315

Takeshi Johkoh , MD, PhD *
Kazuya Ichikado , MD, PhD
Kiminori Fujimoto , MD, PhD
Hiromitsu Sumikawa , MD
Noriyuki Tomiyama , MD, PhD
Junya Fukuoka
Tomonori Tanaka , MD
Michio Shigematsu , MD, PhD
Yasuhiro Kondoh
Hiroyuki Taniguchi *

PURPOSE/AIM
To acknowledge the concept of rare IIPs and histologic patterns in new ATS-ERS multidisciplinary classification of the IIPs
To learn characteristic pathologic .findings of each disease
To memorize characteristic chest radiography(CXR) and CT findings of each disease
CONTENT ORGANIZATION
Rare IIPs
Lymphoid Interstitial Pneumonia (LIP
Mainly involving alveolar septa.
CT: cysts, lower lobe predominance.
Pleuroparenchymal Fibroelastosis (PPFE)
CT: subpleural consolidation, upper lobe predominance Rare histologic pattern
Acute Fibrinous and Organizing Pneumonia(AFOP)
CT: symmetrical, diffuse or lower lobe predominance, consolidation
Bronchiolocentric pattern of interstitial pneumonia;
CT: peribronchovascular consolidation, centrilobular nodules
SUMMARY
Newly appeared ATS-ERS multidisciplinary classification of the IIPs defines both rare IIPs and rare histologic pattern of IIPs. Although they are rare, each disease has characteristic CT and pathologic findings. Cysts in LIP, upper lobe subpleural consolidation in PPFE, symmetrical consolidation in AFOP, and peribronchovascular consolidation in bronchiolocentric pattern are common on CT. We will let you understand rare IIPs and rare histologic pattern of IIPs using many impressive histological, CXR, and CT images.

Houston, We Have a Problem: A Guide to Management of Life-threatening Complications of Computed Tomography-guided Transthoracic Needle Lung Biopsy

LL-CHE4316

Ruth M Dunne , MBBCh
Rachna Madan , MD

PURPOSE/AIM
Review the management of potentially life-threatening complications of transthoracic needle lung biopsy (TTNLB), and discuss pre-procedure assessment of high risk patients to prevent such complications.
CONTENT ORGANIZATION
1. Illustrate, using case-based-scenarios, presentation and management of life-threatening air-leak in high risk patients including large pneumothorax in patients with very low FEV, pneumothorax in patients with prior pneumonectomy and lung transplantation. Pre and post biopsy institutional protocols for management of these high-risk patients will be discussed.
2. Highlight, using specific examples, factors which increase risk of hemoptysis, including underlying pulmonary arterial hypertension, hematologic malignancies, thrombocytopenia, and use of anti-platelet and anti-thrombotic drugs.
3. Discuss rarely seen, but near fatal complications including air embolism and vascular injury with emphasis on urgent management and life saving measures.
SUMMARY
TTNLB plays an integral role in the diagnosis of pulmonary disease. Although safe when performed by appropriately trained and experienced physicians, several complications exist including pneumothorax, hemorrhage, and air embolism. This exhibit serves to underscore, using case-based-scenarios, the management, risk factor assessment, and prevention of life-threatening complications of TTNLB.

The Acute Thoracic Aorta- What, When and Why? An on Call Resident's Perspective

LL-CHE4317

Umar S Chaudhry , MBBS
Archana T Laroia , MD

PURPOSE/AIM
Imaging findings of thoracic aortic abnormalities have been the subject of some attention in the recent years but there still remains a certain tentativeness when approaching some of the more acute pathologies in this realm, especially when it comes to residents and general radiologists. Additionally these are the people exposed to these entities most often. These pathologies are not only common but also life threatening.
CONTENT ORGANIZATION
SUMMARY
As a resident taking call, acute thoracic aortic pathologies are part of your least favored scenarios. Our aim is to make the resident and a general radiologist comfortable in interpreting these acute pathologies. Ultimately making both these cohorts more more apt at tackling these issues, culminating in better patient care.

What a Pain! - Figuring Out the Acute Aortic Syndrome: Take a Quiz!

LL-CHE4318

Lindsey M Conley , MD, BS
Pooja H Doshi , MD
Kristin C Byrne , MD
Stephen C Machnicki , MD
Anuj Malhotra , MD

PURPOSE/AIM
Acute Aortic Syndrome refers to acute chest pain that can be caused by one of several potentiallly life-threatening conditions of the aorta. It is imperative for radiologists to recognize and differentiate the imaging characteristics of these various diseases. This exhibit will review the range of pathologies that cause Acute Aortic Syndrome, including aortic dissection (types A and B), intramural hematoma, penetrating atherosclerotic ulcers, ruptured aneurysms and psuedoaneurysms. A quiz will illustrate a series of cases showing imaging manifestations of the various conditions. A brief discussion after each case will review the differentiating imaging features and highlight the causes and treatments of Acute Aortic Syndrome.
CONTENT ORGANIZATION
1. Anatomical overview of the aorta. 2. Review and illustration of the causes of Acute Aortic Syndrome with a brief discussion about each entity. 3. Case based quiz showing multiple examples of Acute Aortic Syndrome. 4. Brief discussion of the causes and differentiating imaging findings.
SUMMARY
After viewing this exhibit, one should have a thorough understanding of Acute Aortic Syndrome, the causes, treatments and differentiating imaging features.

Central Lines, Ports and Tubes: What Can Go Wrong?

LL-CHE4319

Monda L Shehata , MD
Mohammadreza Hayeri , MD
Oleg Teytelboym , MD

PURPOSE/AIM
Central lines, ports, tubes, pacemakers and other monitoring and therapeutic devices are an essential part of day-to-day hospital practice. Complications are common and can vary from malpositioning to life-threatening complications like great vessel or cardiac perforation. This exhibit aims to illustrate the range of normal and abnormal appearances of monitoring and therapeutic devices on radiographs and cross-sectional imaging.
CONTENT ORGANIZATION
1. Review most common types of lines, tubes, and devices and their optimal placement guidelines. 2. Illustrate common and unusual placement complications. 3. Provide practical tips for using cross-sectional imaging to identify life-threatening complications and patient management guidance.
SUMMARY
Familiarity with normal and abnormal radiographic findings related to therapeutic and monitoring devices is critical for early detection of complications related to their placement and use. Cross-sectional imaging modalities provide powerful tool for diagnosis and management of serious complications.

Pulmonary Mucormycosis: Contribution of MDCT

LL-CHE4320

Moncef Allegue , MD
Riadh Atallah , MD
Faten Bouzayene , MD
Omar Essid , MD
Mohamed Salah Tlili , MD
Molka Chadli , MD

PURPOSE/AIM
Mucormycosis is rare, devastating , opportunistic fungal infection, usually observed in diabetic or neutropenic patients The purpose of this exhibit is : a) To review x ray and CT appearances of pulmonary mucormycosis b) To discuss the contribution of CT to diagnosis and follow up of mucormycosis, with a special focus to angio-pulmonary invasion
CONTENT ORGANIZATION
1) Incidence and etiology 2) Clinical presentation and pathophysiology 3) X ray / MDCT features 4) summary
SUMMARY
Although imaging findings of pulmonary fungal infection are various, ground glass opacity surrounding nodules or masses called ' CT halo sign' is relatively characteristic findings. The CT angiographic technique and the demonstration of vascular pulmonary invasion , had significaly improved the pulmonary mucormycosis diagnosis Combination of clinical setting with recognation of radiological pattern is the best approach to pulmonary fungal diseases

Functional MRI of the Chest: Applications in Oncology

LL-CHE4321

Antonio Luna , MD
Jordi Broncano , MD
Teodoro Martin , MD
Javier Sanchez , MD, PhD *

PURPOSE/AIM
To analyze the technical adjustments and postprocessing steps to perform diffusion-weighted and perfusion-weighted MRI of the chest To review the applications of DWI and PWI in the evaluation of lung, pleural and mediastinal tumors
CONTENT ORGANIZATION
1. Introduction 2. Technical basis 2.a. Diffusion-weighted MRI 2.b. IntraVoxel Incohorent Motion (IVIM) 2.c. Perfusion-weighted MRI 3. Clinical applications 3.a NSLC Pulmonary nodule detection and charcterization Staging Treatment selection and follow-up Detection of recurrence 3.b Mediastinal masses Characterization and staging Postreatment assessment 3.c Pleural tumors 4. Conclusions
SUMMARY
DWI and perfusion MRI are technically feasible in the chest IVIM analysis of DWI allow noncontrast assessment of tumor perfusion DWI and perfusion MRI give functional information of pulmonary, mediastinal and pleural solid lesions, whic can be used for its characterization In the specific case of lung cancer, the combination of both techniques help in characterization, staging, treatment selection and early follow-up of new therapies

The Bionic Chest: A Pictorial Review of Medical Devices of the Chest

LL-CHE4322
Stephanie C Torres , BA
Carlos F Weber , MS
Cedric W Pluguez-Turull , MD
Francisco Santiago , MD
Luis G Perez Perez
Guido E Santacana-Laffitte , MD
Jose A Maldonado , MD

PURPOSE/AIM
This study aims to create a pictorial review of chest devices with detailed image descriptions allowing device identification, recognition of proper positioning and diagnosis of potential complications. Familiarizing radiologists with device appearance will increase report accuracy, especially for x-rays that lack pertinent medical history.
CONTENT ORGANIZATION
Daily radiologists encounter images with chest devices which depend on correct spatial positioning to function properly. This study discusses images from a cardiovascular hospital that include: cardiac conduction devices, pacemakers, catheters, stents, chest tubes, sternotomy wires, valve replacements and ventricular assist devices. Elaborate description of device appearance in chest x-ray will allow proper device identification. Comparison of in place and misplaced devices in chest x-rays will portray appropriate device anatomic location.
SUMMARY
Chest devices are widely seen in clinical practice. Radiologists should be able to determine correct positioning and understand common complications associated to medical devices to accurately interpret chest x-rays. This educational exhibit intends to provide a pictorial review of chest X-rays that display a variety of chest devices by including abundant descriptions of correctly and incorrectly placed devices.

Various Abnormal Air-containing Lesions in the Thorax around the Tracheobronchial Tree

LL-CHE4323
Young-Seon Kim
Mi-Jin Kang , MD
Jae Hyung Kim
Myeong Ja Jeong
Jihae Lee
Han Bee Lee , MD
Kyung-Eun Bae , MD
Tae Kyung Kang

PURPOSE/AIM
1. To show various abnormal air containing lesion from thoracic inlet level to diaphragm level
2. To present differential point between pneumomediastinum and other small air cysts
3. To present clue to detect origin of pneumomediastinum
CONTENT ORGANIZATION
1. Thoracic inlet level
- Subcutaneous emphysema
- Pneumomediastinum
- Paratracheal air cyst
- Esophageal diverticulum
2. Carina level
- Pneumomediastinum
- by bronchial injury
- by esophageal injury
- by alveolar rupture
- differentiate pneumomediastinum from benign air cyst around airway
- Subcarinal air cyst
3. Diaphragm level
- Hiatal hernia
- Tracheoesophageal fistula
SUMMARY
Pneumomediastinum is a condition in which air is present in the mediastinum. The diagnosis can be confirmed via CT, lucent streaks or bubbles of gas in that ouline mediastinal structures. However, various other abnormal air containing lesions in thorax can mimick pneumomediastinum. In this exhibit we present: 1) abnormal air containing lesion from thoracic inlet level to diaphragm level; 2) differential point between pneumomediastinum and other small air cysts; 3) clue to detect origin of pneumomediastinum.
Knowledege with various air containing lesions around the tracheobronchial tree and differential point from pneumomediastinum may help accurate diagnosis of pneumomediastinum.

Typical and Atypical CT Manifestations of Lung Cancer: A Pictorial Review in the Era of Lung Cancer Screening

LL-CHE4324
Anne S Chin , MD
Masahiro Yanagawa , MD, PhD
Henry Guo
Ann N Leung , MD

PURPOSE/AIM
The National Lung Screening Trial (NLST) recently showed that lung cancer screening using low-dose CT resulted in a 20% reduction in mortality from lung cancer. While the practical implementation of screening is still being debated, lung cancer screening has already begun in many institutions, and is likely to increase in the next few years. Our aim is to review typical and atypical CT manifestations of lung cancer in light of increasing lung cancer screening programs.
CONTENT ORGANIZATION
Misinterpretation of CT findings may be of concern with high volumes of chest CT performed for lung cancer screening. We will provide an illustrated review of (A) typical features of lung cancer, and (B) emphasize atypical or less common manifestations that are noteworthy. CT manifestations of lung cancer can broadly be categorized as (1) Solid nodules or masses, (2) Ground-glass or mixed nodules, (3) Cystic lesions, (4) Consolidation, (5) Airway/Endobronchial lesions and (6) Lymphadenopathy. We will also suggest an approach for imaging follow-up or further evaluation of some of these non-specific findings.
SUMMARY
This timely and systematic pictorial review of typical and atypical CT manifestations of lung cancer will assist the general radiologist in this new era of lung cancer screening.

Use of Model-based Iterative Reconstruction on CT Imaging of Cystic Fibrosis

LL-CHE4325
Kenneth K Lau
Dana Jackson , RT
Nicholas D Ardley

PURPOSE/AIM
Chest radiography (CXR) has been the main imaging tool in cystic fibrosis (CF) assessment, but often lacks a precise correlation with clinical status. Computed tomography (CT) of chest is more sensitive and specific. Its conventionally higher radiation exposure prevents its routine use. Recent advent of the model-based iterative reconstruction (MBIR) technique enables CT image with increased resolution and fewer artifacts at lower radiation dose. This educational exhibit is to demonstrate the usefulness of the MBIR technique in the CT assessment of CF.
CONTENT ORGANIZATION
CT of chest at 100kVp and 10mAs were performed on 42 consecutive CF patients. Multi-planar reformats were produced using MBIR. CT demonstrated different types, degrees and precise locations of bronchiectasis and peribrochial thickening in all patients. Mucous plugging in 73.8%, consolidation in 19%, tree-in-bud appearances in 33.3%, collapse in 6%, scarring in 76.1%, pneumothorax in 2.3% and pulmonary abscess in 2.3% were seen.
The radiation dose ranged between 0.045 to 0.07mSv which was similar to that of CXR. Image qualities were of diagnostic quality.
SUMMARY
As gene therapy is being developed for CF, there is a need for detailed lung and airway evaluation. With the advent of MBIR, CT may become the preferred imaging tool in future CF assessment.

Organized Thrombus in Pulmonary Arteries in Patients with CTEPH Using ECG-gated Contrast CT

LL-CHE4326
Yoshihiro Sanda
Tetsuya Fukuda
Munehiro Sugiyama
Kumi Ozaki
Yoshiaki Morita
Masahiro Higashi , MD
Tsuyoshi Ogo
Akihiro Tsuji
Norifumi Nakanishi
Hiroaki Naito , MD, PhD

PURPOSE/AIM
To evaluate the diagnostic value of ECG-gated Contrast CT in patients with chronic thromboembolic pulmonary hypertension (CTEPH), that cannot be treated surgically.
CONTENT ORGANIZATION
10 patients with CTEPH before balloon pulmonary angioplasty (BPA) were included. A 320-row ADCT was employed. The timing bolus method was used to determine the pulmonary arterial phases, and ECG-gated scanning was performed according to the phases. Image reconstruction function was used a lung field reconstruction function. We evaluated as follows: (1) detectability of web or band-like lesions in the pulmonary artery, (2) classified representative forms of organized thrombus into 4 types as follows: type 1: webs, type 2: web and slits, type 3: slits, type 4: narrowing or complete occlusion.
SUMMARY
(1) With the lung field reconstruction function, diagnosis of subsegmental branches, and subsubsegmental branches improved using ECG-gating method. (2) Type 1 lesions were most frequently observed in both segmental and subsegmental branches. Type 2 lesions were not frequent than type 1, but subsegmental branches were frequently involved. Type 3 lesions observed as a thin flap in subsegmental branches. ECG-gated contrast CT with 320-row ADCT can be used to evaluate the organized thrombus in patients with CTEPH, and is helpful for the treatment BPA distal to segmental arteries.

Hyperdense Pulmonary Opacities on CT: A Schematic Approach to More Effective Reporting

LL-CHE4327
Jose Gutierrez , MD
Marcelo Sanchez , MD
Pedro Arguis , MD
Daniel Barnes
Mariana N Benegas Urteaga , MD
Teresa Maria De Carlat , MD
Rosario J Perea , MD

PURPOSE/AIM
To show the common and uncommon pulmonary conditions that can appear hyperdense in CT-scan
To Provide a schematic diagnostic approach, based on morphology, distribution, and clinical history
CONTENT ORGANIZATION
Introduction
Micronodules:
Infections (TBC, hystoplasm, chicken pox)
Metastatic calcifications (hyperparathiroidismo, IRC, Sarcoidosis, myeloma, tumoral osheolisis)
Chronic hemorragic (primary and secundary hemosiderosis)
Occupational diseases (silicosis, siderosis, baritosis)
Iodine aspiration
Cyanoacrylate thromboembolism
Alveolar microlithiasis
Nodules and masses
Tumoral
-Benign (hamartoma, carcinoid, chondroma)
-Malignant (bronchogenic carcinoma, sarcomas, thyroid carcinoma)
Non-tumoral (amyloidosis, hyalinizing granulomas, progressive massive fibrosis, amiodarone)
Lineal o reticular abnormalities
Pulmonary ossification (idiopathic, secondary)
Endobronchial calcification (ABPA)
Schematic diagnostic approach
Conclusions
SUMMARY
The diseases and conditions that manifest with increased lung attenuation on CT are diverse, heterogeneous and respond to deposit hyperdense materials
To classify these lesions, it is necessary to take into account their morphology, distribution and medical history
A schematic approach narrows the differential diagnosis and, in some cases, allows establishing a definitive diagnosis

The A,B,C,D, and E's of Thoracic Trauma

LL-CHE4328
Neelmini B Emmanuel , MD
Zaihleen S Keller , MD
Alison Wilcox , MD *
Ana Maliglig , MD, MPH

PURPOSE/AIM
Familiarize the participant with the spectrum of CT and radiography findings in patients presenting with acute chest injuries at a level 1-trauma center.
CONTENT ORGANIZATION
Pictorial essay depicting the "ABCDE's" of acute thoracic trauma to include: 1. Aorta: indirect radiographic signs, direct signs of aortic injury seen on CT (penetrating and shearing forces), active bleeding/pseudoaneurysms, and pitfalls in interpretation. 2. Airways: Tracheal-bronchial lacerations and ruptures 3. Bones: Sternal fractures, flail chest, and thoracic spine injuries 4. Cardiac: Hemopericardium, pneumopericardium, 5. Diaphragmatic rupture 6. Esophagus: blunt and penetrating trauma
SUMMARY
Most radiographs and CTs of the chest are obtained to evaluate for acute aorta injury in a patient presenting with chest trauma. However, many other types of injuries can be discerned and should be looked for.

Desmoid Tumor of the Pleura: A Possible Imaging Diagnosis?

LL-CHE4329
Laure Rivail , MD
Francois Jausset
Valerie Laurent , MD
Jean Michel Vignaud
Denis M Regent , MD

PURPOSE/AIM
The purpose of this exhibit is: To review the pathophysiology of desmoid tumors of the pleura To distinguish the nuances between demoid tumors of the pleura and localized fibrous tumors of the pleura To show helpful imaging finding allowing for more accurate diagnosis which affects surgical and therapeutic management.
CONTENT ORGANIZATION
Physiopathology of desmoid tumors of the pleural Literature review : clinical and radiologic findings of demoid tumors of the pleura What elements can assist in the diagnosis of fibrous tumors of the chest wall ? What is the most helpful imaging finding to differenciate desmoid tumor to localized fibrous tumor?
SUMMARY
The differential diagnosis between DTP and LFTP is mainly based on pathology. Nevertheless, a working diagnosis preoperatively by imaging is very useful given the high risk of recurrence and therefore the need for complete resection in the DTP . Desmoid tumor more frequently involve the parietal pleura and have a broad base of attachement, so present a fixed character unlike the fibrous tumor of the pleura. But the most helpful imaging finding is the infiltration of desmoid tumors into adjacent chest wall, seen with gadolinium enhanced MRI that seems to be the best technique of imaging to clarify the relationship with the adjacent structures.

Dynamic 4-dimensional CT Assessment of Functional Expiratory Tracheal Narrowing

LL-CHE4330
Kenneth K Lau
Paul Leong , MBBS
Theodore Lau

PURPOSE/AIM
Functional expiratory tracheal narrowing is poorly understood and can be seen in 23% of adults. Tracheomalacia, tracheobronchomalacia (TBM), dynamic airway collapse (DAC) and excessive dynamic airway collapse (EDAC) have been used indiscriminately to describe it. It may cause symptomatic airflow limitation and be mistreated as asthma or COPD. This exhibit is to demonstrate the use of 4-dimensional CT (4D-CT) in assessing various types of functional tracheal narrowing that have distinct aetiological, therapeutic and prognostic implications.
CONTENT ORGANIZATION
DAC is a physiological process with no tracheal cartilage deformation and EDAC occurs when tracheal area is reduced by >50% on expiration due to exaggerated posterior membrane movement. It may be a transient phenomenon during acute dyspnoea and responds to positive pressure ventilation.
TBM indicates abnormality of the cartilage rings that may be associated with relapsing polychondritis and can be focal, segmental or diffuse. It can be of 'saber', 'crescentic', 'lunate' and 'circumferential' shape.
SUMMARY
4D-CT allows the non-invasive assessment of these airway conditions, helps disease monitoring and therapy guidance. It may become a valuable research tool for better understanding of the underlying pathophysiology.

New View of Old Art: Challenges in Interpretation, Common Pathologies, and Instrumentation Associated with Portable Chest Radiographs from ICU

LL-CHE4331
Diana Kaya , MD
Iclal Ocak , MD
Jin Hong Wang , MD
Haresh V Naringrekar , MD
Kyongtae T Bae , MD, PhD *

PURPOSE/AIM
1. To present and discuss challenges in the interpretation of portable chest radiographs from critically ill patients.
2. To provide imaging interpretation strategies for common lung pathologies of ICU patients in association with various pathophysiologies and clinical presentations.
3. To describe correct and incorrect placements of monitoring devices, lines, and tube along with associated complications from instrumentations.
CONTENT ORGANIZATION
1. Describe factors affecting interpretation and misinterpretation of chest radiographs from ICU
a. Field of view, patient's position
b. Exposure
c. Artifacts
d. Labeling

2. Common lung pathologies with illustrative image findings (including CT imaging confirmation): pulmonary edema, ARDS, pneumonia, pulmonary embolism, aspiration
3. Common instrumentations:correct and incorrect placements of monitoring devices, lines, tubes
4. Common complications from instrumentations: pneumothorax, hemothorax, pneumomediastinum, pneumopericardium, pericardial effusion, abscess
SUMMARY
Although portable chest radiograph is an old art, it provides time-sensitive, crucial information for managing ICU patients. This exhibitionenhances radiologists' knowledge in the interpretation of ICU chest radiographs and awareness of complications that should be critically communicated with clinical management team.

Another Patient with Hemoptysis! Image Guided Diagnosis and IR Guided Management of Common and Uncommon Causes of Hemoptysis

Back to Top

LL-CHE4332

Ammar A Chaudhry , MD
Vadim Grechushkin , MD
Maryam Gul
Kevin S Baker , MD
Choo-Won Kim , MD
Abbas A Chaudhry , BSc
William H Moore , MD *
John A Ferretti , MD

PURPOSE/AIM
1. Pictorial review of bronchial anatomy and discussion of common variants. 2. Case based review highlighting common and uncommon causes of hemoptysis. 3. Discuss different interventional radiology guided treatment options/techniques and prognosis of the above entities.
CONTENT ORGANIZATION
We will present case based review of clinical presentation, imaging findings and interventional radiology guided management of common causes of hemoptysis include bronchitis, bronchogenic carcinoma, bronchiectasis and trauma. The less common causes of hemoptysis include aspergilloma, cystic fibrosis, Hugh-Stoven syndrome, Idiopathic pulmonary artery aneurysm, pulmonary sequestration, Racemose aneurysm, Rassmussen's aneurysm, etc.
SUMMARY
1. Understanding of bronchial anatomy and the various entities that result in hemorrhage will aid in quicker diagnosis and treatment, thereby improving patient morbidity and mortality. 2. By the conclusion of this presentation, viewer should have a better understanding of various causes of hemoptysis, what the radiologist needs to know and what should be recommended to the clinician. Viewer should also be able to narrow the differential diagnosis, aid in the workup, guide any potential biopsy, treatment and imaging follow-up. 3. Chart of salient features for quick reference will be presented.

Intrathoracic Transposition of Muscle and Other Soft Tissue Flaps: A Review of Clinical Indications and Imaging Features

Back to Top

LL-CHE4333

Carolina S Carcano , MD
Howard Mann , MD
Jacobo Kirsch , MD
Jeffrey P Kanne , MD *

PURPOSE/AIM
• To review common indications for intrathoracic soft tissue transpositions
• To review the muscular and non-muscular tissue flaps commonly used in these procedures
• To explicate the associated imaging findings on post-surgical chest radiographic and computed tomography examinations
CONTENT ORGANIZATION
• Review of common surgical indications for soft tissue transpositions.
• Itemization of commonly applied muscular and non-muscular transpositions
• Depiction of the imaging appearance of resultant anatomic structural findings on chest imaging examinations using clinical case material
SUMMARY
Intrathoracic transposition of muscular or other vascularized tissue flaps is performed during a variety of procedures in thoracic surgical practice. Common indications include reinforcement of the closure of various pulmonary and extra-pulmonary fistulas; buttressing of bronchial stumps and airway anastamoses; obliteration of intrathoracic cavities; and for closure of chest wall defects. Imaging findings on chest radiography and computed tomography may be misinterpreted when details about the underlying pathology and transposition procedure are not known to the radiologist.

The ABC of the Aortic Artery: From Normal Variants to Everything Else

Back to Top

LL-CHE4334

Rosana G Santos , MD
Cecilia I Leal
Hugo M Marques , MD
Nuno V Costa
Marta O Simoes , MD
Pedro Ananias
Rui Simoes Santos
Otilia Fernandes
Luisa Figueiredo

PURPOSE/AIM
To describe and present an iconographic selection of the spectrum of aortic variants and pathology, outlining the state-of-the-art principles in cross-sectional imaging evaluation of the aorta.
CONTENT ORGANIZATION
Aortic pathology includes a wide spectrum of diseases, which can present with broad clinical scenarios and are associated with high morbidity and mortality. The authors present a comprehensive review on aortic variants and pathologic conditions, from congenital to acquired anomalies, such as coartation; acute aortic syndromes, including intramural hematoma, penetrating atherosclerotic ulcer and dissection; post-traumatic injuries, including post-traumatic pseudoaneurysm; obstructive arterio-aortopathies and also inflammatory /Takayasu arteritis and neoplastic processes.
SUMMARY
Knowledge of the spectrum of aortic pathology and awareness of optimal technical acquisition parameters, enabling patient-tailored examinations, is essential for consistent acquisition of diagnostic images, thus improving diagnostic accuracy, providing pre-interventional guidance and favoring optimal therapeutical management.

Thoracic MR Lymphography: To a Better Approach of the Mystery of Lymphatic Ducts

LL-CHE4335
Sanaa El Mouhadi , MD
Sarah Derhy
Laurence Monnier Cholley
Corinne Becker
Yves M Menu , MD
Lionel Arrive , MD

PURPOSE/AIM
-To detail MR lymphography techniques and to emphasize on non Contrast MR lymphography
-To describe normal MR lymphography appearance of thoracic lymphatic vessels
-To highlight the diagnostic role of MR lymphography in several thoracic lymphatic disorders
CONTENT ORGANIZATION
MR lymphography sequences will be illustrated
Thoracic duct and its affluents will be described, so as the more common variants of thoracic lymphatic vessels
Chest lymphatic pathological conditions will be listed and the diagnostic role of MR lymphography will be emphasized
SUMMARY
Thoracic MR lymphography is a non invasive technique based on 3D acquisition and very heavily T2-weighted MR sequences. No contrast agent is used.
MR lymphography allows a good visualization of the thoracic duct and the accessory lymph channels. Thoracic lymphatic anatomy is complex and variations are frequent
In both secondary and congenital chylothorax, MR lymphography is a useful technique to identify the leak sites, to elucidate the cause and to select the optimal therapy (i.e. level of ligation of thoracic duct)
It is also a non invasive imaging modality to explore lung lymphangiectasis and to show dysplasic and dilated lymphatic ducts associated with lymphedema
MR lymphography gives a unique cartography of lymphatic dysplasia and malformation in several complex lymphatic disorders

Idiopathic Interstitial Pneumonias: A Radiology-Pathology Correlation

LL-CHE4336
Michael A Kadoch , MD
Thomas J Ward , MD
Maria Padilla
Mary Beth Beasley
Adam Jacobi , MD
Matthew D Cham , MD

PURPOSE/AIM
Idiopathic interstitial pneumonias encompass a broad range of diffuse parenchymal lung diseases with varying treatment and prognostic implications. This exhibit will review the imaging features of various idiopathic interstitial pneumonias, demonstrating how pathologic abnormalities are manifested on CT.
CONTENT ORGANIZATION
This exhibit will present a pictorial essay illustrating both common and uncommon CT manifestations of the following entities and their respective pathologic correlates:
• Usual interstitial pneumonia (UIP)
• Non-specific interstitial pneumonia (NSIP)
• Respiratory bronchiolitis interstitial lung disease (RB-ILD)
• Desquamative Interstitial pneumonia (DIP)
• Lymphocystic Intertitial pneumonia (LIP)
• Acute Interstitial pneumonia (AIP)
• Cryptogenic organizing pneumonia (COP)
SUMMARY
The accurate classification of idiopathic interstitial pneumonias is complex and best done with a collaborative approach between clinicians, radiologists, and pathologists. The treatment and prognosis varies greatly between entities. The unique imaging features used to differentiate between these diseases will be reviewed in this pictorial essay.

Repairing the Pipes: Surgical Repair of Tracheal Stenosis and Tracheomalacia - Role of Imaging before and after Repair

LL-CHE4337
Cylen Javidan-Nejad , MD
Daniel Vargas , MD
Elham Najafpour , MD
Varun Puri , MD

PURPOSE/AIM

1. Describe CT imaging features of tracheal stenosis and tracheobronchiomalacia before and after repair
2. Review the surgical techniques and selection criteria for surgery
3. Discuss the CT technique from optimal imaging of the airways

CONTENT ORGANIZATION

1. Causes and clinical manifestations of tracheal stenosis and tracheomalacia
2. CT imaging technique and methods of post-processing for optimal interpretation
3. Clinical and imaging diagnostic criteria
4. Surgical repair:

   • Criteria for surgical candidacy
   • What the surgeon needs to know from the radiologist prior to intervention
   • The various surgical techniques (e.g. stent, balloon tracheoplasty, open tracheoplasty, open resection)
   • Post-repair complications with focus on the role of CT in diagnosis of complications

SUMMARY
Diseases of the trachea and main bronchi can be a cause of chronic cough or misdiagnosed as asthma and are easily missed by clinicians and radiologists alike. Knowing the imaging technique and diagnostic criteria on imaging before and after surgery will help the radiologist play a critical role in managing such patients.

Chest Imaging in the Elderly: What Every Radiologist Should Know About

LL-CHE4338

Manuela Mereu , MD
Francesco D'Alessandro , MD
Massimo Verdecchia
Rosa Lucia Patea , MD
Brunella Cerasa
Antonio R Cotroneo , MD

PURPOSE/AIM
1) To describe chest imaging findings in elderly patients
2) To differentiate between paraphysiological findings related to the aging process and pathological findings, initial onset of a disease
CONTENT ORGANIZATION
The aging process engaging the rib cage, mediastinum, airways and parenchyma can make difficult the differentiation between normal and pathologic chest findings. We describe the most frequent chest imaging findings related to aging modifications such as apparent increase in pulmonary transparency caused by atrophy of the muscles of the thoracic wall, false nodules substained by arthrosis of the costo-vertebral joint, vertebral fracture due to reduction of the calcium content. We also consider airways's calcifications and variations in caliber. We illustrate also imaging findings related to modifications of the cardiovascular system: increase in vessel calibers, cardiac enlargement, vascular and valves calcifications. The knowledge of these chest findings is essential for a correct interpretation of chest plain film.
SUMMARY
Chest X-ray in the elderly is more frequently performed due to a progressive increase in life expentancy so radiologists have to be familiar with the paraphysiological chest imaging findings related to the aging process in order to reduce misinterpretations.

Bell-Clapper Lesions in Thoracic Aorta: Diagnosis and Management of Floating Thrombus

LL-CHE4339

Maria C Ageitos Casais , MD
Anxo Martinez-De-Alegria , MD
Gabriela Tirapu , MEd
Miguel Dominguez Robla , MD
Sandra Baleato Gonzalez , MD

PURPOSE/AIM
The purpouse of this exhibit is:
1) To review underlying pathophysiology of floating thrombus in thoracic aorta
2) To illustrate the features of this rare condition in different imaging modalities
3) To discuss its complications and treatment
CONTENT ORGANIZATION
Floating thrombi in the thoracic aorta are an uncommon condition, specially in the absence of atherosclerotic disease or hypercoagulable state, and they are a potential source of systemic embolisms. We describe the characteristic imaging features of this disease on echography, CT and MR, review their potential complications, and discuss the different therapeutic options from anticoagulation to endovascular treatment and surgery.
SUMMARY
Imaging techniques, specially MDCT angiography, are valuable noninvasive diagnostic tools for the assessment of patients with floating thrombus in thoracic aorta. Radiologists should be able to:
1) Recognize the imaging clues of this rare entity, in order to ensure timely treatment.
2) Avoid potencial pitfalls in interpretation.

It Is More than Just an Air Crescent: Pulmonary Fungal Infections

LL-CHE4340

Jayashree R Jadhav , MBBS, DMRD
Palak B Popat , MBBS, MD
Karuna Agawane
Monika S Bapat , MBBS
Priya Hira , MBBS, DMRD
Namrata D Naik

PURPOSE/AIM
1.To discuss imaging features of pulmonary fungal infections.
2.To emphasise on the variation in spectrum between immunocompromised versus immunocompetent individuals.
CONTENT ORGANIZATION
Fungal Infections of lungs are important infective entities being encountered more frequently in the current clinical scenario. fungal infection is a major cause of morbidity and mortality in patients with immunocompromised status. Hence, it is essential to identify these diseases on imaging in order to instill appropriate treatment.
Symptoms of these patients need to be correlated with the immune status on a background of diabetes, malignancies, AIDS and post transplant status. **Classification**-a. Primary and Secondary
b.Non invasive and Invasive
c. In immunocompetent and immunpcompromised status.
Imaging features on CT-
Consloidation-patchy or lobar
Ground glass opacities- halo, reverse halo
Nodules- Peribronchiolar or centrilobular
Others -fungal ball
SUMMARY
1. Clinico-radiological correlation for evaluation of pulmonary fungal infections.
2. Characteristic Radiological features to suggest prognosis and guide further management.

Pearls of CT Perfusion

LL-CHE4341

Shaun M Nordeck , MS, RRA *
Lori M Watumull , MD *
Hythem A Omar , MD
Edward J Stehel , MD
Gary Arbique , PhD *
Cecelia Brewington , MD *

PURPOSE/AIM
Review and provide insights for imagers entering the arena of CT Perfusion imaging.
CONTENT ORGANIZATION
Overview of principles behind CT Perfusion (Anatomy and Physiology) Currently available equipment / software

- Review available CT acquisition methods (shuttle jog, cine volumetric), associated benefits / drawbacks
- Review body registration techniques (deformable, ridged, etc.)
- Assessment methods (Single input maximum slope, dual input, Patlak, etc.)

Review current practice protocols for CT Perfusion (Pulmonary, solid organs, brain, etc.)

- Low dose techniques
- Use of iterative reconstruction.
- Importance of bolus contrast administration
- Minimizing motion
- ROI placements and rationale
- Lesion location / size when imaging neoplasm

Review artifacts that degrade images or prevent perfusion assessment Lessons learned
SUMMARY
CT Perfusion is an evolving technology with several promising new applications. Learning from prior experience will minimize erroneous data, increase consistency, and improve accuracy when initiating CT Perfusion clinical protocols. Consistency and accuracy are essential in the translation of CT Perfusion into valuable clinical practice.

CT-scan Lung Parenchyma Elementary Signs with Model-based Iterative Reconstruction Technique. A Pictorial Review

LL-CHE4342
Antoine Khalil , MD
Marie-Pierre Debray , MD
Paul Ayestaran , DiplEng, PhD *
Jean-Noel Foulquier
Marie F Carette , MD

PURPOSE/AIM
The purpose of this exhibition is to explain the different reconstruction techniques using in lung CT-scan, and to show CT-scan lung parenchyma elementary signs with an equivalent Chest-X-ray dose.
CONTENT ORGANIZATION
A- Problematic of irradiation in lung parenchyma exploration with CT-scan
B- Reconstruction techniques of CT-scan commercially available
C- Model-based Iterative reconstruction technique
D- MBIR and ground glass opacities
E- MBIR and parenchyma consolidation
F- MBIR and Bronchiectasis
G- MBIR and emphysema
H- Limitations of MBIR in lung parenchyma analysis
SUMMARY
Irradiation is a major problem in monitoring patients with chronic pulmonary parenchymal diseases especially chronic interstitial lung diseases. This monitoring is currently done with chest radiography during scheduled visits. CT-scans were reserved for biannual following or during exacerbations.
It is difficult to monitor the appearance or the evolution of lesions and the date of onset due to the poor resolution of chest radiography compared with CT-scan. The possibility of having CT scans which the irradiation is equivalent to a chest X-ray providing better monitoring.

Chest Case of the Day

LL-EDE3003
Moderator
Eric T Goodman , MD
Andrew C Yen , MD
Sharon S Brouha , MD, MPH
Masoud Shiehmorteza , MD
Michael E Hahn , MD, PhD
David S Heister , MD
Quinn C Meisinger , MD
Gregory A Shaw , MD

PURPOSE/AIM
1) To analyze interesting chest cases. 2) To understand appropriate differential diagnosis. 3) To understand the clinicial signnificance of the diagnosis presented.

Chest Case of the Day

Chest Case of the Day

Michael E Hahn , MD, PhD
David S Heister , MD
Quinn C Meisinger , MD
Gregory A Shaw , MD

PURPOSE/AIM
1) To analyze interesting chest cases. 2) To understand appropriate differential diagnosis. 3) To understand the clinicial signnificance of the diagnosis presented.

Chest Case of the Day

LL-EDE3003
Moderator
Eric T Goodman , MD
Andrew C Yen , MD
Sharon S Brouha , MD, MPH
Masoud Shiehmorteza , MD
Michael E Hahn , MD, PhD
David S Heister , MD
Quinn C Meisinger , MD
Gregory A Shaw , MD

PURPOSE/AIM
1) To analyze interesting chest cases. 2) To understand appropriate differential diagnosis. 3) To understand the clinicial signnificance of the diagnosis presented.

Chest (Vascular)

Sunday, 10:45 AM - 12:15 PM ● S404CD

IR CT CH

SSA04 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5
Moderator
Phillip M Boiselle , MD
Moderator
Smita Patel , MBBS

SSA04-01 ● Value of Echocardiography in Patients with Acute Pulmonary Embolism with a Normal CT-derived Right-to-Left Ventricular Diameter Ratio

Kanako K Kumamaru MD, PhD (Presenter) ; **Elizabeth George** MBBS ; **Nina Ghosh** ; **Carlos J Gonzalez Quesada** MD ; **Marie Gerhard-Herman** ; **Frank J Rybicki** MD, PhD * ; **Nicole Wake** MS ; **Arash Bedayat** MD

PURPOSE
Decision criteria for subsequent transthoracic echocardiography (TTE) after acute pulmonary embolism (PE) are needed when the CT-derived right-to-left ventricular (RV/LV) diameter ratio does not suggest RV dysfunction. The purpose of this study is to develop a clinical prediction rule for low probability of incremental prognostic benefit from subsequent TTE after acute PE.

METHOD AND MATERIALS
A single institution retrospective cohort study included 579 consecutive patients diagnosed with acute PE by CT pulmonary angiography between August 2003 and March 2010 with a normal RV/LV diameter ratio (
RESULTS
RV strain was detected in 21.6% (51/236) of the patients who underwent TTE. The final prediction model of the �TTE-Benefit� group (n=55) included 5 variables: congestive heart failure (adjusted odds ratio (OR):4.32, 95% confidence interval (CI):1.88-9.92), RV diameter on CT >45mm (OR:3.07, 95%CI:1.56-6.03), age >60 years (OR:2.59, 95%CI:1.41-4.77), central embolus (OR:1.96, 95%CI:1.01-3.79), and stage 4 cancer (OR:1.94, 95%CI:0.99-3.78). If these five factors were all absent (corresponding to 37.1% of the population), the probability of �no incremental benefit from TTE� was 0.97 (95%CI=0.95-0.99). The model had a good discrimination (c-statistic=0.758) and was internally validated (over-fitting bias=2.52%).

CONCLUSION
RV diameter >45mm on CT, congestive heart failure, age >60 years, central embolus, and stage 4 cancer are useful factors in guiding decision making regarding which patients with acute PE and normal RV/LV diameter ratio may benefit from subsequent TTE. If all factors are negative, the incremental benefit from TTE within 14 days is minimal in terms of RV function assessment and short-term PE-related mortality prediction.

CLINICAL RELEVANCE/APPLICATION
Age, RV diameter, embolus size, congestive heart failure, and cancer are useful factors in making decision regarding which patients with acute PE and normal RV/LV ratio may benefit from subsequent TTE

SSA04-02 ● CT Pulmonary Angiography with Ultra Low-dose of Contrast and Radiation- Evaluation of Image Quality and Radiation Dose

Prabhakar Rajiah MD, FRCR (Presenter) ; **Calen Frolkis** BA ; **Luis A Landeras** MD ; **Jennifer Paczak** ; **Leslie Ciancibello** RT ; **Robert C Gilkeson** MD *

PURPOSE
Iodinated contrast has been associated with renal and thyroid dysfunction. Recent literature suggests that the presence or iodinated contrast amplifies DNA radiation damage following CT. Hence, an ideal CT scan protocol should involve the least amount of radiation dose and contrast. The purpose of this study is to evaluate if image quality is preserved in a CT pulmonary angiographic (CTPA) protocol with an ultra-low dose contrast and radiation dose.

METHOD AND MATERIALS
Retrospective analysis revealed 99 patients who underwent CTPA using an ultra low-dose technique. All the scans were performed on a 128-slice Dual-source Siemens Definition FLASH scanner. Images were acquired following intravenous injection of 30 ml of iodinated contrast (Optiray 350) at 4 ml/sec. Images were acquired in high-pitch helical mode (3.2), with kv of 80-120 (BMI dependent) and mAs of 130. The scan length, CTDIvol and DLP were recorded. Images were independently reviewed by 2 readers and graded on a 1 to 5 scale (1- non diagnostic, 2- probably non diagnostic, 3- probably diagnostic, 4-diagnostic, 5- excellent image quality). Signal, noise and Signal-to-noise ratio (SNR) were also recorded in main, right and left pulmonary arteries.

RESULTS
The study had 67 men and 32 women with age range of 19-84 years (57.97 ± 16; Mean, std dev). 76 had a history of neoplasm. BMI ranged from 16 to 40 (25.2 ± 4.8). Embolism was present in 22 patients. Contrast enhancement was excellent in the pulmonary arteries

(MPA- 327.4 ± 24.2, LPA 329.0 ± 24.2, RPA- 335.4 ± 26.1). SNR was good in all the pulmonary arteries (MPA 14.6 ± 6.8, LPA 14.3 ± 5.8, RPA- 13.9 ± 6.6). Image quality was considered excellent by both the readers (Reader 1, 4.3 ± 1.0, Reader 2, 4.4 ± 0.9), with no significant difference between the readers (p value, 0.7). Only 4 studies were considered non diagnostic, which is less than the non diagnostic rate described in the current literature. The DLP is 157.8 ± 66 with effective dose of 2.2 ± 0.9 mSv

CONCLUSION
Using a helical acquisition technique, CTPA images with good diagnostic quality can be obtained using a very low dose of iodinated contrast and low radiation dose. There is also potential for further reduction in the contrast and radiation doses and cost savings.

CLINICAL RELEVANCE/APPLICATION
Diagnostic CTPA can be performed with ultra-low contrast dose techniques while reducing potential toxicities associated with the administration of iodinated contrast.

SSA04-03 ● Diagnostic Accuracy of Low-dose CT Pulmonary Angiography: Results of a Prospective Randomized Trial (REDOPED)

Zsolt Szucs-Farkas MD, PhD (Presenter) ; **Andreas Christe** ; **Boglarka Megyeri** MD ; **Martin Rohacek** ; **Peter Vock** MD ; **Endre V Nagy** ; **Johannes T Heverhagen** MD, PhD * ; **Sebastian T Schindera** MD *

PURPOSE
To compare diagnostic accuracy of low-dose computed tomography pulmonary angiography (CTPA), with both reduced radiation and reduced contrast material (CM) dose with a normal-dose protocol in detecting acute pulmonary embolism (PE).

METHOD AND MATERIALS
The Reduced Dose in Pulmonary Embolism Detection (REDOPED) trial was a single-centre, single-blinded, HIPAA-compliant, prospective randomized study. Five hundred and one patients with body weights of
RESULTS
The reference diagnosis was equivocal in 20 of 501 patients. CTPA diagnosis was correct in 240 patients and incorrect in 5 in the normal-dose group. CTPA was correct in 230 cases and incorrect in 6 in the low-dose group (odds ratio 1.25, 95% confidence interval, 0.38 to 4.16; P=0.77). Sensitivity was 96.9% and 100% and specificity was 98.1% and 97.1% in the normal-dose and low-dose groups, respectively. No PE or PE-related death occurred during 90-day follow-up. The mean estimated effective dose was 3.28 mSv in the normal-dose group and 2.25 mSv in the low-dose group, corresponding to a reduction by 31% (P
CONCLUSION
The accuracy of low-dose CTPA with reduced radiation and reduced CM dose is not significantly different from that of normal-dose CTPA in detecting or excluding acute PE in patients weighing
CLINICAL RELEVANCE/APPLICATION
CTPA with 80 kVp tube voltage provides high accuracy at reduced radiation and reduced CM dose and can be recommended for routine PE diagnosis in patients weighing

SSA04-04 ● Sub-mSv CT Imaging of Pulmonary Arteries Using an Iterative Model Reconstruction Algorithm

Daniela Muenzel MD (Presenter) ; **Thomas Koehler** PhD * ; **Bernhard Brendel** * ; **Kevin M Brown** MS * ; **Stanislav Zabic** PhD * ; **Alexander A Fingerle** MD ; **Ernst J Rummeny** MD ; **Martin Dobritz** MD ; **Peter B Noel** PhD

PURPOSE
To investigate the improvement in diagnostic quality of iterative model reconstruction (IMR) algorithm for sub-mSv computed tomography angiography of the pulmonary arteries (CTA).

METHOD AND MATERIALS
Eighteen patients (single-center, IRB approved) were imaged on a Philips Brilliance iCT (Philips, Cleveland, OH) for visualization of the pulmonary arteries, 8 with and 10 without pulmonary artery embolism. All scans were performed at 120 kVp (average effective doses 4.34±1.99mSv). Acquisitions with reduced radiation exposure were simulated from the original CT data to 15% of the tube current, resulting in a sub-mSv average dose of 0.65±0.30mSv. Filtered backprojection (FBP) was used to reconstruct the original data (protocol A); sub-mSv data were reconstructed using FBP (protocol B) and IMR (protocol C). The performance of IMR was assessed with respect to the image quality metrics image noise and contrast-to-noise ratio (CNR) and with respect to effective dose of each protocol. Two blinded readers determined subjective image quality and assessed the detectability of pulmonary artery embolism, where ground truth was obtained from protocol A.

RESULTS
With IMR noise could be subjectively removed, while the image texture (look and feel) of these images differed from FBP reconstructions. Specifically, with IMR, the noise is significantly reduced by a factor up to 20 (B vs. C). This is reflected by an improvement in the contrast-to-noise ratio and improved image quality with a median image quality score of 3 (IMR, B) vs. 1 (FBP, C), p < 0.05. With respect to diagnostics the angiographic datasets protocol A and C were identical, while B was worse: To detect pulmonary artery embolism in IMR and FBP low dose images, the sensitivity was 100% for IMR and 62.5% for FBP while specificity was 100% for both protocols.

CONCLUSION
This simulation study indicates that by using IMR for reconstruction, pulmonary artery embolism can be detected accurately in scans with sub-mSv dose levels.

CLINICAL RELEVANCE/APPLICATION
IMR has the potential to reduce patient dose and improve image quality in clinical day-to-day routine.

SSA04-05 ● Impact of Perfusion Imaging on the Assessment of Peripheral Chronic Pulmonary Thromboembolism: Clinical Experience in 62 Patients

Francesco Molinari MD (Presenter) ; **Julien Le Faivre** MD ; **Francois Pontana** MD ; **Kanna Yasunaga** MD ; **Jacques Remy** MD * ; **Martine J Remy-Jardin** MD, PhD *

PURPOSE
To evaluate the impact of perfusion imaging on the detection of peripheral chronic pulmonary thomboembolism (CPTE).

METHOD AND MATERIALS
62 patients (30 males; 32 females; mean age: 60 yr) with chronic thromboembolic disease underwent a dual-source, dual-energy chest CT angiographic examination with (a) reconstruction of diagnostic (i.e., averaged images from both tubes) and pulmonary blood volume (PBV) images; (b) enabling separate depiction of peripheral CPTE on diagnostic images (i.e., cross-sectional images viewed on lung and mediastinal window settings for analysis of segmental arteries, completed by maximum intensity projections for the subsegmental level) and perfusion defects on MPRs of PBV images. On diagnostic scans, the CT features of CPTE included stenosed arterial branches and/or endoluminal filling defects within segmental and subsegmental arteries. On PBV images, embolic type defects consisted of triangular, pleural-based and sharply marginated hypoattenuated areas which recorded at a segmental level (20 segments/patient; total: 1240 segments). The readings of diagnostic and perfusion images were independently performed by two readers.

RESULTS
On diagnostic images: (a) the analysis of segmental arteries depicted CT features of CPTE within 476 segments; (b) the analysis of both segmental and subsegmental arteries depicted CT features of CPTE within 872 segments. PBV imaging depicted: (a) 313 segments with perfusion defects at the level of which segmental arteries had not been diagnosed with CPTE, increasing the number of segments affected by CPTE by 66% (313/476); (b) 66 segments with perfusion defects at the level of which subsegmental arteries had not been diagnosed with CPTE, increasing the number of segments affected by CPTE by 7.5% (66/872).

CONCLUSION
The reading of PBV images enables depiction of a greater number of segments involved in peripheral CPTE.

CLINICAL RELEVANCE/APPLICATION
Depiction of CT features of CPTE at the level of the segmental and subsegmental pulmonary arterial bed is improved by the reading of PBV images.

SSA04-06 ● Detection of Pulmonary Hypertension in Patients with Cystic Fibrosis (CF) Using Magnetic Resonance (MR) Flow Measurements

Nino Kiria MD (Presenter) ; **Jutta Hammermann** ; **Bernhard Schulte-Hubbert** ; **Michael Laniado** MD ; **Nasreddin Abolmaali** MD

PURPOSE
Pulmonary arterial hypertension (PAH) is a severe complication of a cystic fibrosis lung disease. The aim of this study was to evaluate MR based flow measurements in the pulmonary trunk to detect evolving signs of PAH in patients suffering from CF.

METHOD AND MATERIALS
23 patients (median age: 25 years, age range: 11-39 years, 10 female, 13 male) suffering from CF of different severity were examined using MRI based flow measurements. The examinations were performed at 1,5 Tesla scanner using body matrix coils and were the part of an annual follow-up. In addition to the standard CF-lung protocol an ECG-triggered phase-contrast flow measurement was acquired over the entire cardiac cycle with a temporal resolution of 12 ms. The assessed data, especially the acceleration times (AT,[ms]) and the average diameter of the pulmonary trunk were evaluated and the blood flow graphs in the pulmonary trunk during the heart cycle were analysed.

RESULTS
The comparison of means revealed significant differences for AT and average diameter of pulmonary trunk as well as the double peak increase of pulmonary flow during the heart cycle. It was possible to identify 5 patients demonstrating definite signs of PAH, such as shortened AT and enlarged diameter of pulmonary trunk and its restricted distensibility during systole/diastole as well as slow/double peak increase of the blood flow in pulmonary trunk. In patients with clinically no signs of pulmonary hypertension mean AT was 149 +- 25 ms and the mean diameter of the pulmonary trunk was 4,1 +- 1 cm. The CF-patients with suspected PAH showed a mean AT of 131+-25,9 ms and a mean diameter of the pulmonary trunk of 5,1+-1,2 cm.

CONCLUSION
Signs for the development of a PAH (i.e. reduction of AT) are detectable using MRI based flow measurements. This technique could be a valuable screening tool for CF patients to identify the development of a PAH. Correlation to the echocardiographic results of the respective five patients will be presented.

CLINICAL RELEVANCE/APPLICATION
As PAH is a crucial complication of CF, MRI based flow measurements in pulmonary trunk can be helpful for detection, follow-up and control of therapy of PAH in CF patients.

SSA04-07 ● Evaluation of Pulmonary Hypertension (PH) by Pulmonary Artery (PA) Tortuosity Measurements: Correlations with Mean Pulmonary Artery Pressure (mPAP) and Pulmonary Vascular Resistance (PVR)

Seyed Ameli-Renani MBBS,FRCR (Presenter) ; **Jenny L Bacon** MRCP * ; **Sarah L Sheard** MBBS, FRCR ; **Anand Devaraj** MBBS ; **Brendan P Madden** MBBCh, MD ; **Ioannis Vlahos** MRCP, FRCR *

PURPOSE
To evaluate whether PA automated curved multiplanar reformat (cMPR) measurements correlate with mPAP or PVR and whether these can discriminate patients with PH.

METHOD AND MATERIALS
57 patients (22 male), suspected of PH, who underwent CT pulmonary angiography (CTPA) with contemporaneous (2 or PVR>3 WU patient subsets was evaluated (Mann-Whitney U).

RESULTS
cMPRs were successful in 100/114 (88%) of vessels. Moderate correlations were demonstrated between right, left and mean cPA with mPAP (r=0.41, 0.46, 0.47, all p

CONCLUSION
PA tortuosity, quantified by limited automated artery measurements, is feasible, correlates with mPAP, and may identify patients with PH.

CLINICAL RELEVANCE/APPLICATION
Automated pulmonary arterial tortuosity measurement may be an indicator of pulmonary artery pressure and PH, however, relationships to PVR are more complex, requiring correction for lung expansion.

SSA04-08 ● Incidence of Repeat CT Pulmonary Angiography for Suspected Pulmonary Embolism and Clinical Factors Associated with Repeat Testing

Daniel M Adams MD (Presenter) ; **Scott Woller** MD ; **Scott Stevens** MD * ; **Scott Evans** PhD ; **Greg Snow** PhD ; **Joseph Bledsoe** MD ; **Jim Lloyd** BS ; **Todd D Lovelace** MD ; **Valerie Aston** RT ; **C. Gregory Elliott** MD

PURPOSE
CT pulmonary angiography (CTPA) for suspected pulmonary embolism (PE) is a frequently performed exam that bears inherent risks. We measured the proportion of exams performed for patients who undergo repeat CTPA and identified differences in characteristics for those patients.

METHOD AND MATERIALS
This retrospective study was performed at Intermountain Medical Center and LDS Hospital in the Salt Lake City, Utah area. Consecutive CTPA exams for suspected PE ordered from the emergency department from May 22, 2009 to June 30, 2010 were identified. Data for patient characteristics were extracted from the medical record electronically and by manual review. Pretest probability was calculated with the Revised Geneva Score (RGS), d-dimer values were collected, and the final interpretation of each CTPA was recorded. Guideline concordant use was defined as CTPA being ordered for 'PE Likely' (RGS >10) patients or following a d-dimer that was positive among �PE Unlikely� (RGS = 10) patients. All patients who underwent multiple examinations were identified, and comparisons of patient characteristics from CTPA encounters were made based on whether a single exam or multiple exams were performed during the study period.

RESULTS
3500 CTPA exams for suspected PE were performed during the study period for 3279 individual patients. 3090 patients had 1 exam, 164 patients had 2 exams, 19 patients had 3 exams, 5 patients had 4 exams, and 1 patient had 5 exams. Repeat examinations were associated with younger mean age (50 vs. 53 years); a higher incidence of prior venous thromboembolism (48.0% vs. 15.7%), trauma (6.6% vs. 2.9%), and signs and symptoms of deep vein thrombosis (unilateral leg pain 10.5% vs. 6.7%, signs of DVT 9.5% vs. 6.2%); and a higher mean pretest probability for PE (RGS 6.3 vs. 5.0). Repeat exams also had a higher yield of positive interpretations (14.4% vs. 9.1%); and were less frequently performed in concordance with evidence-based guidelines (39.5% vs. 46.3%).

CONCLUSION

Repeat CTPA exams are commonly performed. Patients receiving multiple exams have a higher clinical pretest probability and incidence of PE than patients receiving single CTPA exams. Repeat CTPA exams are less likely to be performed in concordance with evidence-based guidelines.

CLINICAL RELEVANCE/APPLICATION
In these settings, repeat CTPA exams were common and often show acute PE although they were less likely to be performed in concordance with evidence-based guidelines.

SSA04-09 ● 70 kV CT Pulmonary Angiography - Advantages of a Dual-source Protocol with Reduced Iodine Load

Ralf W Bauer MD (Presenter) * ; **Claudia Frellesen** ; **Firas Al-Butmeh** ; **Boris Bodelle** MD ; **Julian L Wichmann** MD ; **Josef Matthias Kerl** MD * ; **Martin Beeres** MD ; **Boris Schulz** MD ; **Thomas Lehnert** MD ; **Thomas J Vogl** MD, PhD

PURPOSE
Lower kV settings go along with higher iodine attenuation, but also with increased noise, if mA are not adapted accordingly. Low kV scanning opens the door for the application of low iodine content contrast agents with potential benefits for patients with reduced kidney function. We investigated the potential of a novel 70 kV dual-source CTPA protocol (DS70) with low iodine load in comparison to a single-source 70 kV (SS70) and 100 kV (SS100) protocol with standard iodine load in terms of image quality and radiation exposure.

METHOD AND MATERIALS
Each 20 consecutive patients with suspected pulmonary embolism underwent CTPA either with a standard single-source 100 kV (120 mAs; group 1), a single-source 70 kV (208 mAs; group 2) or a novel dual-source 70 kV protocol (416 mAs; group 3). A dual-source protocol can overcome tube output restrictions that occur at 70 kV by using both X-ray tubes of the scanner simultaneously. Contrast enhancement was achieved with 70 ml of a contrast agent with 400 mgI/ml in group 1 and 2, whereas in group 3 the same volume was injected but with a lower iodine concentration of 300 mgI/ml. Injection rate was constant at 4 ml/s and bolus tracking was used for automated scan start. CTDIvol, DLP, noise, signal intensity in the pulmonary trunk and segmental arteries and corresponding SNR values were compared.

RESULTS
Chest diameter was not statistically significantly (p>0.05) different between the groups. CTDIvol (median: 5.86 vs. 2.49 vs. 5.79 mGy) and DLP (167 vs. 68 vs. 156 mGycm) were statistically significantly lower in group 2 with no such difference between group 1 and 3. Vascular attenuation was significantly higher (segmental arteries, 332 HU vs. 647 HU vs. 521 HU) with both 70 kV protocols. Image noise was significantly reduced with the DS70 protocol compared to the SS70 protocol and was at the level of the SS100 protocol. This resulted in a significantly higher SNR in group 3 compared to group 1 (56.0 vs. 60.1 vs. 64.3).

CONCLUSION
70 kV DS CTPA can achieve better SNR at similar dose values than a standard single-source 100 kV protocol, but with 25% less iodine load. The 70 kV single-source protocol showed lowest dose values, but has a demand for a high iodine contrast material in order to achieve equivalent image quality.

CLINICAL RELEVANCE/APPLICATION
The introduced 70 kV DS CTPA protocol holds potential for reducing iodine load in patients at risk for developing contrast-induced nephropathy.

Emergency Radiology (Imaging Chest Emergencies)

Sunday, 10:45 AM - 12:15 PM ● N228

ER CT VA CH   Back to Top

SSA05 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5
Moderator
Sanjeev Bhalla , MD
Moderator
Michael N Patlas , MD

SSA05-01 ● Detection of Intramural Hematoma: Is a Non-contrast Phase Really Necessary?

Christopher A Potter MD (Presenter) ; **Daniel S Hippe** MS * ; **Elan D Bomsztyk** MD ; **Guy E Johnson** MD ; **Bruce E Lehnert** MD ; **Lorenzo Mannelli** MD, PhD ; **Claire K Sandstrom** MD ; **Martin L Gunn** MBChB *

PURPOSE
CT angiography is sensitive and specific for diagnosis of intramural hematoma (IMH), aortic dissection (AD) and penetrating atherosclerotic ulcer (PAU). Most acute aortic syndrome (AAS) protocols use a pre-contrast phase to detect IMH, as contrast-enhanced phase alone is believed insufficiently sensitive for IMH, but there is little supporting data.

METHOD AND MATERIALS
We retrospectively reviewed images of patients who presented to our Emergency Department with suspected AAS and received pre- and post-contrast CTA from 2/1/2005 to 2/1/2010 for isolated acute IMH, defined as IMH without visible intimal flap. 423 studies were reviewed. 11 cases of IMH were identified. 22 normal controls and 12 abnormal controls (AD or PAU) were age and sex matched and added. The 45 studies were randomized. Only contrast-enhanced images were evaluated by three blinded, independent fellowship-trained radiologists. Reviewers rated their confidence for IMH using a 5-point modified Likert scale, also indicating if they recommended a non-contrast study to exclude IMH. Inverse probability weighting was used to extrapolate ordering rates from the matched case-control sample to the original sample.

RESULTS
423 patients underwent CTA for AAS. 11 patients were diagnosed with IMH (incidence of 2.6%). On independent case review, overall rater sensitivity for IMH on contrast-enhanced images alone was 94% (CI 74-99%) and specificity 97% (CI 88-99%). For all false negative cases, confidence rating for exclusion was low and delayed non-contrast examination was recommended. If delayed CT were ordered due to suspicious findings on contrast-enhanced images, 7.1% of patients (CI 3.3-14%) would undergo a delayed CT to exclude IMH. More conservatively, if delayed CT were ordered when confidence rating of 1 or 5 (definitely not present or definitely present) cannot be assigned, only 14% (CI 7.5-25%) of patients would undergo additional delayed CT. While the present sample was not large enough to be definitive, no IMH cases would be missed using this approach.

CONCLUSION
Acute IMH is a very uncommon diagnosis in patients with suspected AAS. A pre-contrast examination is unnecessary for diagnosis of acute IMH. Dose and time savings may be achieved by eliminating the pre-contrast phase.

CLINICAL RELEVANCE/APPLICATION
Exclusion of non-contrast phase on CTA for acute aortic syndrome, used in most ED protocols, may result in overall patient time and radiation dose savings.

SSA05-02 ● Is the Precontrast CT Series Necessary for Ruling Out Acute Aortic Intramural Hematoma?

Elie Portnoy MD (Presenter) ; **Maria C Shiau** MD ; **James S Babb** PhD ; **Rose Weiner** BS ; **Francis G Girvin** MBChB ; **Jane P Ko**

MD ; **Derek M Mason** MD ; **Maj L Wickstrom** MD

PURPOSE
To assess the need for pre-contrast imaging when evaluating for Acute Aortic Intramural Hematoma (IMH). The current gold standard for the detection of Aortic Dissection (AD) is CT angiography. However, along the disease spectrum of AD, lie several related pathologies with near identical clinical presentations. IMH, one such disease, lacks an intraluminal flap or discernible communication between the luminal blood and the intramural hematoma. It has long been posited that concern for this pathology alone necessitated pre-contrast images (in addition to post contrast images) to conclusively rule out IMH (in addition to AD.) This study seeks to demonstrate non-inferiority to post-contrast imaging alone in comparison to pre- and post-contrast studies.

METHOD AND MATERIALS
Study group of 23 patients (10M;13F;age 57-93;mean:78.5y) who underwent Pre- and Post-Contrast CT series and were diagnosed with IMH via official radiology report at a tertiary care hospital between 2007 � 2011. 23 gender and age controlled subjects were selected with no remarkable findings on CT. Five independently operating thoracic radiologists (dedicated experience in specialty 5-14 years) were presented with randomized, anonymized post-contrast imaging alone of the 46 above patients, aware of suspected acute aortic injury, and asked to comment on the absence or presence of IMH, AD, and/or penetrating ulceration. They were then presented with both the Pre- and Post-Contrast series for these patients and asked for their diagnoses yet again.

RESULTS
Within the post-contrast group, the readers were diagnostically accurate for IMH 72.8% of the time, as opposed to the combined pre- and post-contrast group, where they were accurate 76.8%. (p-value .340). (95% CI -2.2?8.8.) Since the difference between the 2 groups was statistically insignificant and it can be asserted with 95% confidence that no greater than 8.8% of cases of IMH would be missed with post-contrast imaging alone, post-contrast imaging alone was statistically non-inferior to combined pre- and post-contrast imaging. .

CONCLUSION
IMH is radiographically evident on post contrast imaging alone and it is statistically non-inferior to combined pre- and post-contrast sequences.

CLINICAL RELEVANCE/APPLICATION
In clinical practice, when evaluating for possible aortic syndromes (Dissection, IMH, etc.) we contend that post-contrast angiography alone may suffice. Broader/confirmatory study may be warranted.

SSA05-03 ● Reduced Z Axis CTPA in Pregnant Women for Pulmonary Embolism - Do We Really Miss Any Important Diagnoses? How Much Is the Resultant Dose Reduction?

Kaushik S Shahir MD (Presenter) ; **Luis A Sosa** MD ; **Jonathan M McCrea** MD ; **Lawrence R Goodman** MD

PURPOSE
To evaluate the feasibility for applying reduced z axis coverage in CTPA in pregnant women. Were important diagnoses missed? What dose reduction resulted?

METHOD AND MATERIALS
In this IRB-approved retrospective study, 84 pregnant patients underwent CTPA for pulmonary embolism during 2004-2012. New axial, sagittal and coronal series were created with a reduced anatomic coverage extending from aortic arch to the base of the heart. These were read individually by 2 experienced blinded readers on the PACS workstation. The scans were evaluated for PE, incidental and pertinent findings. The readers had access to most recent chest radiograph. These results were compared with original report by the 3rd reader. In case of missed abnormality, 3rd reader checked whether the finding was a known abnormality or whether it influenced the clinical outcome. Additionally, we estimated dose length product (along z axis) for 40 patients as a quality control project.

RESULTS
Two out of 84 patients had PE and were successfully identified by both readers. 32 patients had normal exams. Rest of the patients had 57 pertinent and 20 incidental findings. 4 incidental findings including 3 benign thyroid nodules and one benign splenic calcification were missed. One pertinent but a benign lung nodule was missed, but this was a known abnormality based on prior CT. None of these missed findings affected further clinical outcome or management. Radiation dose was reduced by a mean of 69%.

CONCLUSION
No PE or any important diagnosis are missed using the reduced anatomic coverage CTPA for PE in pregnant women. The radiation dose is reduced by approximately 69%. Hence we highly recommend this technique in pregnant women.

CLINICAL RELEVANCE/APPLICATION
The study helps solve any doubts as regards to using a reduced z-axis CTPA technique for PE in pregnant women.

SSA05-04 ● Feasibility Study of Low Dose Chest CT for Initial Evaluation of Blunt Chest Trauma Patients

Jae Yong Cho MD (Presenter) ; **Joo Sung Sun** MD ; **Sung Jung Kim** ; **Kyu-Sung Kwack** MD, PhD ; **Sung Hoon Park** MD ; **Kyung Joo Park** MD ; **Young Gi Min** MD

PURPOSE
To evaluate the feasibility of low dose chest CT (LDCT) for initial evaluation of blunt chest trauma.

METHOD AND MATERIALS
A total of 71 patients who met criteria indicative of major trauma (76% male; age range, 16-85) were included. All patients underwent LDCT without IV contrast and standard CT with IV contrast using parameters as followings: LDCT, 40mAs with ATCM and 100kVp or 120kVp (based on BMI); standard post-contrast CT, 180mAs with ATCM and 120kVp. Transverse, coronal, saggital images were reconstructed with 3-mm slice thickness without gap. Reference standard images were reconstructed using standard CT data (1-mm slice thickness without gap). Reference standard was established by 2 radiologist by consensus. Four readers independently evaluated chest injury (fractures of bony thoracic cage, aortic injury, tracheobonchial injury, esophageal injury, hemothorax, pneumothorax, pulmonary contusion). Four investigators recorded results with 4 confidence scale (0-3 point). Comparison of radiation dose was done.

RESULTS
Radiation doses (CTDIvol) of LDCT (average 2.67mGy) was significantly lower than those of standard CT (average 13.4mGy)(78% dose reduction). ROC analysis and intraclass correlation coefficient ICC measurement demonstrated that LDCT was comparable to standard dose CT for evaluation of chest injury. ROC comparison analysis revealed no significant difference of diagnostic performance between LDCT and standard dose CT for the diagnosis of bony thoracic cage fracture, pulmonary contusion, hemothorax ,pneumothorax, chest wall injury (p>0.05). ICC was measured for inter-observer consistency and revealed that there was good inter-observer consistency in each examination of LDCT and standard dose CT for evaluation of chest injury (0.83~0.94). Aortic injury could not be appropriately compared due to LDCT underwent without using contrast materials and this was limitation of this study.

CONCLUSION
Our conclusion is that there is a great potential benefit to use LDCT for initial evaluation of blunt chest trauma because LDCT could maintain diagnostic image quality as standard dose MDCT and provide significant radiation dose reduction. Further study of LDCT with IV contrast for evaluation of aortic injury is needed.

CLINICAL RELEVANCE/APPLICATION
This preliminary study suggest LDCT could be adequate initial imaging modality for blunt chest trauma patients with maintaining

diagnostic image quality and reducing radiation dose.

SSA05-05 • Usefulness of Ultra Low-dose (sub mSv) Chest CT Using iDose4 Iterative Reconstruction for Initial Evaluation of Sharp Fish-bone Esophageal Foreign Body

Boram Yi MD (Presenter) ; **Joo Sung Sun** MD ; **Young Gi Min** MD ; **Kyung Joo Park** MD

PURPOSE
To evaluate the usefulness of ultra low dose chest CT (uLDCT) as initial imaging study for sharp fish-bone esophageal foreign body (EFB).

METHOD AND MATERIALS
A total of 38 subjects who visited emergency room with an obvious history and symptoms of sharp fish-bone EFB were included in this study.uLDCT were acquired at 20mAs with ATCM and 100kVp or 120kVp on a 64 MDCT scanner (Based on BMI). All uLDCT data were reconstructed twice, once with FBP and once with iDose4 IR, then 2 sets of CT data were randomly arranged and reviewed by 3 readers who were blinded to the result. Readers independently reviewed 3-mm thickness transverse and coronal images. Readers also scored subjective image quality (4 point scale). One reader measured objective image noise (SD of circular ROI, 10 pixels in diameter at the following level: right common carotid artery of the thoracic inlet; pulmonary trunk; D-aorta of lug base). Positive findings were defined as identification of high-density foreign body, secondary findings (soft tissue swelling, pneumomediastinum). ROC analysis was used to evaluate diagnostic performance of uLDCT. Intraclass correlation coefficient (ICC) was measured for analysis of inter-observer consistency.

RESULTS
Thirty-three fish bone EFBs were identified and removed by 31 esophagogastroscopy, and 2 operations. Among 5 cases of true negative, false positive lesions were frequently recorded as the cervical EFB when reviewing CT data using FBP than CT data using iDose4 IR. uLDCT provided radiation dose reduction by average 0.82 mGy of CTDIvol and 32.7 mGy*cm of DLP (0.46mSv). Significant noise reduction (objective and subjective) of mediastinum was achieved using iDose4 IR technique (p
CONCLUSION
Very low dose CT using iDose4 provided satisfactory diagnostic image quality for identifying fish-bone EFB with reduced radiation dose, therefore uLDCT would be adequate as first imaging modality for sharp fish-bone EFB. iDose4 IR would be useful to reduce image noise of mediastinum mimicking EFB.

CLINICAL RELEVANCE/APPLICATION
Very low dose chest CT using iDose4 IR would be first imaging modality for initial evaluation of sharp fish bone esophageal foreign body before flexible endoscopic removal.

SSA05-06 • Increased Referral-rate for Investigation, and Increased Incidence of Symptomatic Radiologically-diagnosed Pulmonary Embolus in a Large Teaching Hospital, over a 10 Year Period

Kenneth Muir (Presenter) ; **Nicholas C Morley** MA, FRCR ; **Edwin J Van Beek** MD, PhD * ; **John Murchison** MBCHB

PURPOSE
To measure the rate of referral for radiological investigation of suspected acute Pulmonary Embolism (PE) and the incidence of PE detected in these scans, in a large teaching hospital. To observe changes in these measurements over the recent decade.

METHOD AND MATERIALS
Retrospective review of radiology records for Computed Tomography Pulmonary Angiograms (CTPA) and Perfusion Scans (Q-scans) for suspected acute PE, between 1st April 2002 and 1st April 2012. Graphical and statistical analyses were performed with Microsoft Excel and Graphpad Prism. Some of the data for the earlier years in this study was published previously (O'Neill et al., 2004). Our local research ethics service approved this project.

RESULTS
111% increase in total VTE investigations over 10 years, from 996 to 2111. Substantial increase in referral for CTPA, incrementaly from 706 to 2020 scans per year. We also saw a decline in Q-scans from 290 to 91 per year. Increase in total number of PEs diagnosed, with annual incidence rising from 147 (15% positive-scan rate) to 426 (20% positive-scan rate), an increase of 190%. We observed an older population of PE patients, with mean age at diagnosis of PE going up from 62.2 to 65.4 (p= 0.03) and a 6-fold increase in PEs diagnosed in the 85-94 age group, from 9 to 57 per year.

CONCLUSION
There has been a major increase in the total number of investigations for suspected acute PE, accounted for by an increased use of CTPA with a corresponding decrease in the use of Q scans. In spite of what is generally assumed, the positive diagnosis rate increased, which may be a reflection of changed patient demographics combined with greater sensitivity of CTPA with newer CT scanners.

CLINICAL RELEVANCE/APPLICATION
The current rate of investigation for suspected acute PE is justified by a high rate of relevant diagnoses. Analysis of PE severity in these cohorts is warranted and is ongoing.

SSA05-07 • Cost and Risk Analysis of CT Pulmonary Angiography to Rule Out Pulmonary Embolism in Low and Very Low Risk Emergency Department Patients

Scott A Atkins MD (Presenter) ; **Steven Munson** MD ; **J. Paul Jacobson** MD * ; **Thomas J Kelly** MD

PURPOSE
A recent study has shown that approximately one third of CT pulmonary angiograms (CTPAs) performed to rule out pulmonary embolism (PE) in the emergency department (ED) are in low risk or very low risk patients based on Wells criteria and D-dimer, resulting in potentially avoidable cost to our healthcare system and risk to patients. The purpose of this study is to evaluate the cost effectiveness of CTPA in diagnosing PE in low risk patients and to quantify potentially avoidable cost and patient risk with the current medical practice pattern. Other studies have been done showing that CTPA is a cost effective method to diagnose PE when used in conjunction with Wells criteria and D-dimer. However, no studies have quantified the additional cost and patient risk when this standard of care is not followed and potentially avoidable imaging is performed.

METHOD AND MATERIALS
A literature search was performed and data on the current use of CTPA in the diagnosis of PE was reviewed. A decision model was constructed for evaluating low and very low risk patients for PE with and without the use of CTPA. The costs and patient utilities for each outcome were plotted to determine the dominant strategy. Strategies are dominant if they have lower costs and better outcomes compared to other strategies based on quality adjusted life years (QALYs). Sensitivity analyses were performed to test the stability of the results over a wide range of clinically relevant values.

RESULTS
The strategy of ED observation, not performing CTPA, dominated the strategy of performing CTPA to rule out PE in low and very low risk ED patients. ED observation dominated over a wide range of clinically relevant values, showing cost savings to the medical system and better patient outcomes when compared to performing CTPA in this population.

CONCLUSION
Ruling out pulmonary embolism in ED patients should begin with an assessment of risk based on clinical factors (Wells criteria) and a D-dimer to ensure that CTPA is not performed on patients who are low or very low risk. The potentially avoidable CTPAs performed on low risk patients add significant cost to the medical system without improving patient care. In fact, potentially avoidable imaging poses significant risk to these patients.

Performing CTPA to rule out PE in low and very low risk ED patients increases medical costs and increases patient risk, worsening patient outcomes.

SSA05-08 ● Variation in Utilization and Positivity Rates of CTPA among Emergency Physicians at an Academic Tertiary Emergency Department

Yingming Amy Chen MD (Presenter) ; **Bruce G Gray** MD ; **Glen Bandiera** MD ; **David Mackinnon** ; **Djeven P Deva** MBBCh

PURPOSE
This project examines the utilization and diagnostic yield patterns for CT pulmonary angiography (CTPA) ordered by individual Emergency Physicians (EPs) at an academic tertiary care center. The study is part of the institution�s quality improvement initiative aimed at establishing quantitative parameters for assessing individual EP�s image utilization.

METHOD AND MATERIALS
A cross-sectional retrospective study was conducted on 850 consecutive ED patients with suspected pulmonary embolism (PE) who underwent CTPA. Radiology report data was extracted from our institution�s RIS PACS software (syngo Imaging, Siemens) based on a targeted search of all CTPA reports from January 2010 to December 2012. Positivity rate for PE as well as nonthrombotic clinically significant findings were calculated. Utilization rates and positivity rates for individual physicians were calculated and correlated with both years of experience and certification.

RESULTS
Acute PE was diagnosed in 142 of the 850 patients evaluated by CTPA (16.7%). A further 25.2% of scans were negative for PE but had other clinically significant findings: 11.2% infection, 2.7% pulmonary edema, 2.9% effusion, 3.1% tumour, and 4.9% other. EPs ordered an average of 0.5 CTPA scans per 100 patients seen, with a significant variation across EPs in utilization (0.2 to 1 scans per 100 patients). Considerable variation also existed in the positivity rate for PE, ranging between 6.5% and 38.9%. There was no significant correlation between EP years of experience and utilization rate (linear regression r = - 0.27; ANOVA p = 0.36 for 20 years) or positivity rate (r = -0.32; ANOVA p = 0.39). Furthermore, utilization and positivity rates were not significantly different between EPs with emergency medicine certification by the Royal College (FRCP) vs by the College of Family Physicians of Canada (CCFP-EM) (student t-test p = 0.34 for utilization rate, p = 0.56 for positivity rate).

CONCLUSION
While average utilization and positivity rates of CTPA for ED patients with suspected PE at our institution are comparable to those in the literature, considerable interphysician variability exists for both metrics. Utilization and positivity rates for CTPA did not correlate with either the physicians� years of experience or specialty certification.

CLINICAL RELEVANCE/APPLICATION
Results of the study suggest an opportunity for a more standardized approach to the of use of CTPA among EPs.

SSA05-09 ● Comparison between CT Angiography of the Bronchial and Non-bronchial Systemic Arteries vs. Conventional Angiography in Patients Undergoing Endovascular Treatment of Hemoptysis

Hosny M Hamza MD, FRCR (Presenter) ; **Yasser Ragab** MBBCh, MSc ; **Magdy Abdelsalam** MD

PURPOSE
To compare bronchial and nonbronchial systemic CT angiography at 320 multi-detector row computed tomography with conventional angiography in patients undergoing endovascular treatment of hemoptysis.

METHOD AND MATERIALS
A retrospective study including 50 ptients (37men, 13women) with hemoptysis of bronchial and nonbronchial systemic artery origins underwent 320 multi-detector CT angiography of the thorax prior to embolization. Findings on CT angiograms, including CT scans, maximum intensity projections, and three-dimensional volume-rendered images, were used to evaluate the depiction of bronchial and nonbronchial systemic arteries. Retrospective analysis of the ostium and the course of bronchial and/or nonbronchial systemic arteries on CT angiograms enabled evaluation of the accuracy of this technique in identification of the relevant vasculature.

RESULTS
Among the 50 patients initially treated with bronchial artery embolization, 56 bronchial arteries were identified at CT angiography. In 94% of cases, concordant findings were observed with both modalities. In five 6% cases, CT could not be used to identify the ostia of bronchial arteries. In 5% cases, CT depicted bronchial arteries that could not be selectively catheterized. Three-dimensional images were found to be superior to2 D CT angiogrphic in depicting the ectopic origin of the bronchial arteries, which enabled the interventional radiologists to perform successful embolization after direct catherization of the ectopic vessel in every case. In 10 % of patients, the nonbronchial systemic origin of bronchial bleeding was identified on CT angiograms.

CONCLUSION
CT angiography using 320 Multi-detector systems provides more accurate depiction of bronchial and nonbronchial systemic arteries than does conventional angiography.

CLINICAL RELEVANCE/APPLICATION
The routine use of 320 CT scan in patients with hemoptysis can help identifying the origin of the bleeding vessels and can improve the efficeincy of the the treatment by identifying unexpected vessels

Radiation Oncology and Radiobiology (Lung I)

Sunday, 10:45 AM - 12:15 PM ● S104A

RO CH

SSA22 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5
   Moderator
   Zhongxing Liao , MD
   Moderator
   Matthew M Harkenrider , MD

SSA22-01 ● Increased Risk of Chest Wall and Rib Toxicity in Lung SBRT Patients Treated with RTOG-0813 Protocol and Monte Carlo Based Planning

Supriya Jain MS, BA (Presenter) ; **Anil Sethi** PhD ; **Edward Melian** MD ; **Bahman Emami** MD

PURPOSE
To evaluate Monte Carlo (MC) based lung stereotactic body radiotherapy (SBRT) plans for dosimetric parameters correlated with the development of chest wall pain and rib fracture.

METHOD AND MATERIALS
Twenty consecutive lung SBRT patients treated from 2010-2012 with heterogeneity corrected Pencil Beam (PB) plans were selected.

Chest wall (CW) was contoured as a 3 cm expansion of the ipsilateral lung. Treatment plans were normalized to deliver 50 Gy PTV dose in 5 fractions using 7-12 non-coplanar, conformal, 6 MV fields. Using MC dose algorithm, each plan was optimized for PTV dose coverage as per RTOG-0813 protocol. Patients were classified based on PTV location: island tumors (8), adjacent to CW (9), or mixed (3); and PTV size (cc): small (< 25), medium (25-60), or large (> 60). Treatment plans were evaluated for toxicity risk based on four dosimetric thresholds - CW: Dmax < 50 Gy, V30 < 30 cc, V40 < 5 cc and Ribs: Dmax

RESULTS
Tumor size and location were strong predictors of risk of toxicity to CW and ribs. With MC planning, 0% (0/6) of small, 50% (4/8) of medium, and 100% (6/6) of large tumors exceeded all four CW and ribs toxicity thresholds. 78% (7/9) of tumors located adjacent to CW surpassed every CW / ribs threshold vs. 67% (2/3) of mixed and 25% (2/8) of island tumors. Mean Dmax for ribs was significantly higher for tumors adjacent to CW than for island tumors (61.6±11.7 Gy vs. 45.00±11.7 Gy, p = .007). Transitioning from PB to MC planning resulted in a higher overall risk of toxicity. Mean relative dose increases from PB to MC plans were 32.4±12.7%, 24.8±10.4%, and 20.3±6.4% for small, medium, and large tumors, respectively, and 32.5±11.6%, 26.6%±8.8%, and 19.5±7.2% for island, mixed, and chest wall tumors respectively.

CONCLUSION
MC based lung SBRT plans that satisfy RTOG-0813 criteria for PTV dose coverage result in an increased risk of chest wall and rib toxicity. Large tumor size and proximity to CW predict highest absolute dose to CW and ribs. However, relative increase in CW / rib dose from PB to MC planning is directly proportional to tumor distance from CW and inversely proportional to tumor size. Low-risk small island tumors experience the greatest increase in CW/rib dose when planned with MC algorithm.

CLINICAL RELEVANCE/APPLICATION
With Monte Carlo based planning, revision of RTOG-0813 guidelines for PTV dose coverage may be necessary to prevent chest wall pain and rib fractures.

SSA22-02 ● Prospective Study Evaluating the Use of IV Contrast on IMRT Treatment Planning for Lung Cancer

Hua Li PhD (Presenter) ; **Beth Bottani** ; **Todd DeWees** ; **Daniel A Low** PhD * ; **Jeff M Michalski** MD ; **Sasa Mutic** MS * ; **Jeffrey D Bradley** MD ; **Cliff G Robinson** MD

SSA22-03 ● Lung Injuries after Stereotactic Body Radiotherapy in Patients with Emphysema Who Had Stage I Non-small Cell Lung Cancer

Moeko Ishijima (Presenter) ; **Hidetsugu Nakayama** ; **Yu Tajima** ; **Sachika Nogi** ; **Ryuji Mikami** ; **Koichi Tokuuye** MD, PhD ; **Soichi Akata** MD

SSA22-04 ● Incidence of Radiation Pneumonitis after Stereotactic Body Radiation Therapy for Lung Cancer Patients with Pulmonary Interstitial Changes

Tadamasa Yoshitake MD (Presenter) ; **Katsumasa Nakamura** MD, PhD ; **Tomonari Sasaki** MD, PhD ; **Saiji Ohga** MD ; **Kotaro Terashima** ; **Kaori Asai** ; **Yoshio Matsuo** ; **Takeshi Kamitani** MD ; **Hideki Hirata** ; **Hiroshi Honda** MD

SSA22-05 ● Stereotactic Body Radiation Therapy for Stage I Non-small Cell Lung Cancer: A Community Hospital Experience

Charles C Vu BSE (Presenter) ; **Janna Z Andrews** MD ; **Karen Episcopia** MS ; **Jeffrey G Schneider** MD ; **Scott L Schubach** MD ; **Jonathan A Haas** MD *

ABSTRACT
Purpose/Objective(s): Stereotactic body radiation therapy (SBRT) has been shown to have increased local control and overall survival relative to conventional external beam radiation therapy in patients with medically inoperable stage I non-small cell lung cancer (NSCLC). Excellent rates of local control have been demonstrated both in clinical trials as well as in single-center studies at academic institutions. However, there is limited data on the experiences of community hospitals with SBRT for Stage I NSCLC. The purpose of this study is to report the local control and overall survival rates in patients treated with SBRT for Stage I NSCLC at Winthrop-University Hospital (WUH), a community hospital.
Materials/Methods: This is a retrospective review of 78 Stage I central and peripheral NSCLC tumors treated between December 2006 and July 2012 with SBRT at WUH. Treatment was given utilizing fiducials and a respiratory tracking system. If the fiducials were not trackable, a spine tracking system was used for tumor localization. CT-based planning was performed using the ray trace algorithm. Treatment was delivered over consecutive days. The Kaplan-Meier method was used to calculate local control and overall survival.
Results: The median age was 77.4 years. 53% of the patient population was female. 67% of the tumors were Stage IA (T1N0M0), and 33% of the tumors were Stage IB (T2N0M0). 53% of the tumors were adenocarcinomas and 29% were squamous cell carcinomas, with the remainder being of unknown histology or NSCLC, not otherwise specified. Median dose prescribed was 48Gy given in 4 fractions with a median follow-up time of 11.0 months. The 2-year local control rate was 86.6%, and the two-year overall survival was 63.8%.
Conclusions: Our findings support that local control and overall survival at WUH, a community hospital, are comparable to that of academic institutions' published experiences with stereotactic body radiation therapy for Stage I NSCLC.

SSA22-06 ● Intensity-modulated Radiation Therapy Following Extrapleural Pneumonectomy for Malignant Pleural Mesothelioma: A Single Institution Experience

Sameer Jhavar MD, PhD (Presenter) ; **Mehul Patel** ; **Divya Patel** ; **Nitika Thawani** MD ; **Dharanipathy Rangaraj** ; **Philip Rascoe** ; **Scott Reznik** ; **Alan Gowan** ; **W Roy Smythe** ; **Subhakar Mutyala** MD

SSA22-07 ● Volumetric-modulated Arc Therapy for Lung Tumors: A Dosimetric Comparison with 3d Technique

Shino Kobayashi-Shibata (Presenter) ; **Akihiro Haga** ; **Hideomi Yamashita** ; **Keiichi Nakagawa** MD, PhD

ABSTRACT
Purpose/Objective(s): We compared a dose volume histgram (DVH) in stereotactic body radiotherapy (SBRT) and volumetric-modulated arc therapy (VMAT) and 3D conformal method.
Materials/Methods: The investigation period was from July 2010 to Januart 2013. The solitary lung nodule was 20 cases. SBRT was performed by 11 ports using non-coplanner beams. VMAT used a single arc. The prescription dose was 50Gy/4fr in 95% of PTV. The aspiration suprression was performed by abdominal pressure. We created repiratory curves using ANZAI belt and devided 10 phases by respiratory phase. ITV was made by the sum of 10 GTVs in each 10 respiratory phase. PTV-ITV margin was 5 mm. Leaf-PTV margin was 5 mm in 3D conformal and SBRT.
Results: The mean of GTV, CTV, and PTV were 2.7cc, 4.2cc, and 18.5cc. The mean of homogeneity index (HI) was 1.34 +/- 0.10 in multi-potrs, 1.20 +/- 0.09 in VMAT, and 1.41 +/- 0.12 in 3D-conformal. The mean lung dose was 356.5 cGy in multi-potrs, 373.3 cGy in VMAT, and 380.3 cGy in 3D-conformal. The mean of lung V20 (%) was 5.1%, 5.6%, and 4.8%. V15% was 7.1%, 7.9%, and 7.0%. V10% was 10.7%, 11.0%, and 10.3%. V5(cc) was 632.4cc, 553.2cc, and 703.5cc.
Conclusions: Lung VMAT SBRT was not inferior to multi-ports SBRT or 3D-conformal SBRT not only in the homogeneity but in lung low dose volume.

SSA22-08 ● Are There Computed Tomography Features Predictive of Local Recurrence in Patients with Early Stage Non-small Cell Lung Cancer Treated with Stereotactic Body Radiation Therapy?

Darragh Halpenny MBBCh, MRCPI (Presenter) ; **Carole A Ridge** MD ; **Sara A Hayes** MBBCh ; **Junting Zheng** ; **Chaya Moskowitz** ; **Andreas Rimner** MD * ; **Michelle S Ginsberg** MD

PURPOSE
Stereotactic body radiation therapy (SBRT) is a therapeutic option for patients with stage I non-small cell lung cancer who may not be surgical candidates. SBRT delivers highly targeted, high dose radiation. The post-treatment radiological appearance is different compared with conventional radiotherapy (CRT). The objective of this study is to identify computed tomography (CT) features predictive of local recurrence after SBRT

METHOD AND MATERIALS
The institutional review board approved this study. 218 consecutive patients underwent SBRT (4000-6000 cGy, 3-5 fractions over 1-2 weeks) for local control of lung cancer from Jan 1, 2006-Mar 1, 2011. CT images were retrospectively, independently reviewed by 2 radiologists. CT studies prior to SBRT and at 6, 12 + 24 months after SBRT were evaluated. Signs of local recurrence recorded were: opacity with a new bulging margin, opacification of air bronchograms, new or enlarging pleural effusion, new or enlarging mass and increase in lung density at the treatment site. End points assessed were local recurrence (biopsy proven or on PET/CT) and death. Landmark analyses at 6 months, 12 months and 24 months were performed to examine the association between CT features and local recurrence free survival (LRFS).

RESULTS
89 of the 218 treated patients were included as they had radiologic follow-up of at least 24 months. 10 (11.2%) patients had local recurrence. 31 (34.8%) patients died within the period of follow up. None of the 5 morphological features usually associated with CRT were significantly associated with LRFS after SBRT (p>0.05). Nodal recurrence at 12 and 24 months was significantly associated with LRFS. Nodal recurrence at 12 months conferred a 50% (95%CI: 19%-100%) chance of being event free at 36 months compared to those with no nodal recurrence (66%, 95%CI: 54%-79%, p = 0.023 both readers, kappa=1.00). Patients had a higher chance of local recurrence or death at 36 months when they had nodal recurrence at 24 months (47% vs 29%, p=0.026, and 64% vs 26%, p

CONCLUSION
No local recurrence features identified on CT associated with CRT were associated with SBRT. Nodal recurrence was significantly associated with local recurrence free survival.

CLINICAL RELEVANCE/APPLICATION
Radiological patterns of local recurrence associated with CRT may not be predictive of local recurrence in patients receiving SBRT for early stage lung cancer

SSA22-09 • Stereotactic Body Radiation Therapy for Unbiopsied Early Stage Lung Cancer - A Multi-institutional Analysis

Matthew M Harkenrider MD (Presenter)

ABSTRACT
Purpose/Objectives: Medically inoperable lung cancer patients often have comorbidities that preclude pathologic diagnosis from being attained. We perform a multi-institutional analysis to determine if unbiopsied early stage lung carcinoma can be safely and effectively treated with SBRT.
Material/Methods: 34 patients with unbiopsied lung cancer treated with SBRT at the University of Louisville or University of Virginia. Patients had CT and PET imaging clinically consistent with lung malignancy. Median SBRT dose was 50 Gy (range 30-55 Gy) in a median of 5 fractions (range 3-10 fractions) with static field SBRT or VMAT.
Results: Median follow up is 16.7 months. Primary tumors had a median longest dimension on the original CT of 1.6 cm (range 0.5-3.3 cm) and post-treatment CT scan of 1.25 cm (range 0.0-4.5 cm) (p=0.025). Median pretreatment SUV on initial PET scan is 4.6 (range 0.0-16.2) and at a median of 7.6 months after SBRT, decreased to 2.25 (range 0.0-10.9) on post-treatment PET (p=0.002). Crude local control is 97.1%. The estimated 2 year regional control is 80%, distant control 85%, and overall survival 85%. There were no Grade 3 or greater acute toxicities and only three Grade 3 chronic treatment-related toxicities.
Conclusions: In medically inoperable patients with unbiopsied lung cancer, local control can be achieved in with minimal toxicity with the use of SBRT. The use of SBRT for unbiopsied early stage lung cancer patients should be performed in a multidisciplinary setting and after detailed discussion with the patient about risks and benefits of SBRT.

Chest - Sunday Posters and Exhibits (12:30pm - 1:00pm)

Sunday, 12:30 PM - 01:00 PM • Lakeside Learning Center

CH

LL-CHS-SUA • *AMA PRA Category 1 Credit* ™:0.5
  Host
  Brett W Carter , MD *

LL-CHS-SU1A • Classification of T1 Lung Adenocarcinoma by the Size of Solid Components on Thin-section CT: Correlation with Pathological Findings

Yukihiro Ogihara (Presenter) ; **Kazuto Ashizawa** MD ; **Hideyuki Hayashi** ; **Akihumi Nishida** ; **Naoya Yamasaki** ; **Tomoshi Tsuchiya** ; **Keitaro Matsumoto** ; **Takeshi Nagayasu** ; **Tomayoshi Hayashi** ; **Sumihisa Honda** ; **Masataka Uetani** MD

PURPOSE
A statement from the Fleischer Society suggests that the size of the solid component in lung adenocarcinoma is best measured in its largest dimension visible on axial thin-sections with a mediastinal window setting (WS). Tsutani Y et al. stated that the pathologic lymph node (LN) negative status criteria of a size of the solid component were less than 8mm in its maximum dimension with a lung WS.. The purpose of our study was to correlate the size of solid components on thin-section CT (TS-CT) with pathological findings (LN metastasis and local invasion such as lymphatic or vascular invasion) in T1 lung adenocarcinoma, and to evaluate the predictive value of the size of solid components for pathological status.

METHOD AND MATERIALS
From January 2008 to August 2012, 192 patients with surgical resected T1 lung adenocarcinoma were retrospectively analyzed. Two chest radiologists, who were blinded to the results of pathological findings, measured long and short dimensions of the solid components with a lung (WW 1600, WL -600) and/or a mediastinal (WW 320, WL 30) WS. The average sizes of the solid components measured by the two radiologists were correlated with the pathological findings.

RESULTS
7 out of 192 patients (3.6%) had pathological LN metastasis. Patients with a long axis of solid component of less than 5 mm with a mediastinal WS or 8 mm with a lung WS, were observed to have no LN metastasis, resulting in positive predictive value (PPV) for predicting pathologic LN-negative status of 100% with each WS. 62 out of 192 patients (32%) had pathological local invasion. In patients with a long axis of solid component of less than 5 mm with a mediastinal WS or 8 mm with a lung WS, PPV for predicting pathological local invasion-negative status was 91% (40/44) and 90% (55/61), respectively.

CONCLUSION
The long axis of the solid component with a mediastinal WS bounded by 5mm (Fleischer Society), or that with a lung WS bounded by 8mm was valid for prediction of pathologic LN-negative metastasis.

CLINICAL RELEVANCE/APPLICATION
The patients who meet these predictive criteria may be optimal candidates for limited resection without the systemic LN dissection.

LL-CHS-SU2A • Volumetric FDG PET-CT in the Preoperative Assessment of Patients with Thymic Epithelial Malignancies

Marcelo K Benveniste MD (Presenter) ; **Cesar Moran** MD ; **Osama R Mawlawi** PhD ; **Patricia S Fox** MS ; **Stephen G Swisher** MD * ; **Edith M Marom** MD

PURPOSE
Metabolic tumor volume assessment using positron-emission tomography (PET)◇CT has a role for monitoring response to therapy in

oncologic patients. Assessment of tumor volume above a specific SUV threshold has a potential promise to distinguish between early (Stage I and II) and advanced thymoma (stage III and IV) as well as high risk thymoma (Type B3) from low risk according to WHO Classification. It is important to differentiate these neoplasms before surgery, as patients with a worst histological type or locally advanced tumors require neoadjuvant chemotherapy that enables effective resection. Thus, tumor volumetric assessment could be used to direct those patients. This study assessed whether the volumetric standardized uptake value (SUV) measurements can predict advanced thymoma and whether it can separate type B3 thymoma from low risk thymoma.

METHOD AND MATERIALS
We retrospectively reviewed FDG positron emission tomography (PET)-CT scans of 51 consecutive newly diagnosed patients with thymic epithelial malignancy. PET-CT findings documented were focal FDG activity: SUVbwmax, SUVbwmean, SUVbwpeak and total body volumetric standardized uptake value (SUV) measurements. These were correlated with Masaoka-Koga staging and WHO classification. Wilcoxon rank-sum tests were used to assess association between SUV and pathological stage, cancer type, and classification.

RESULTS
Among the study patients, 37 had thymoma, 12 thymic carcinoma, and 2 thymic carcinoid. Higher total tumor volume above SUV 3.5 was seen in patients with type B3 thymoma than in those with type A, AB, B1, or B2 thymoma (p=0.04). Total tumor volume above SUV 3.5 was higher in patients with advanced stage than in early stage disease (p=0.0008). Additionally, patients with thymic carcinoma or carcinoid demonstrated a higher total tumor volume above SUV 3.5 than in those with thymoma (p=0.02).

CONCLUSION
Metabolic tumor volume assessment is helpful in distinguishing early from advanced stage thymoma, low-risk thymoma from more aggressive thymoma (type B3) and thymic carcinoma/carcinoid tumors from thymoma.

CLINICAL RELEVANCE/APPLICATION
Metabolic tumor volume assessment has a potential to differentiate between early and invasive thymomas and help in clinical decisions.

LL-CHS-SU3A ● The Utility of Routine Pelvic Imaging during CT Staging of Primary Lung Cancer

Nasser F Alamri MBBS (Presenter) ; **Hadas Moshonov** PhD ; **Greg Korpanty** MD ; **Natasha Leighl** MD ; **Narinder S Paul** MD *

PURPOSE
The purpose of this study is to investigate whether routine pelvic CT has a role in the baseline staging of lung cancer patients.

METHOD AND MATERIALS
A retrospective review of an institutional lung cancer database containing 970 patients registered from 1/2002-1/2012. Inclusion criteria for the study required the following; a diagnosis of primary lung cancer established at our Institution, pelvic CT performed on initial staging CT and the availability of all images including subsequent MRI, CT-PET, Tc-99m bone scans and surveillance CT if performed. Histological confirmation of disease stage was also required. 225 patients satisfied the inclusion criteria. The primary study aims were to determine whether: a) the initial staging CT demonstrated evidence of pelvic metastases, b) if the presence of pelvic metastases changed the disease stage and / or c) if the presence of pelvic metastases changed patient management compared to review of the chest and abdominal images alone. Secondary study aims included the detection of occult pelvic metastases on MRI, bone scan or CT: PET and the detection of incidental abnormalities on the initial pelvic CT.

RESULTS
Of 225 lung cancer patients; 138 (61.6%) had disease limited to the thorax, 35 (15.6%) patients had abdominal and pelvis metastasis, and 5 (2.2%) patients had isolated pelvic metastasis. Of the 40 (17.8%) patients that had pelvic disease, 33 (82.5%) had metastases to the bony pelvis, and 5 (12.5%) had lymph node metastasis demonstrated on staging CT. Overall, the findings on pelvic CT did not change the disease stage in any patient. However, the findings on pelvic CT influenced patient management in 14/225 (6.2%) patients, compared to review of the chest and abdominal images alone, as these patients were referred for radiotherapy to treat the metastatic pelvic disease. Pelvic MRI or CT: PET images demonstrated occult pelvic metastases in an additional 2/225 (0.9%) of patients. Staging pelvic CT demonstrated incidental abnormalities in 15/225 (6.7%) patients.

CONCLUSION
Pelvic CT performed routinely during baseline staging for lung carcinoma does not result in a change in disease stage but does influence patient management in 6% of patients.

CLINICAL RELEVANCE/APPLICATION
Accurate baseline staging of lung cancer determines prognosis and patient management. Addition of routine pelvic CT to the staging protocol does not appear to provide additional prognostic information

LL-CHS-SU4A ● Effectiveness of Pulmonary MRA for the Primary Diagnosis of Pulmonary Embolism: Outcomes Analysis of 578 Consecutive Symptomatic Patients

Mark L Schiebler MD (Presenter) * ; **Christopher J Francois** MD ; **Michael D Repplinger** MD ; **Karl Vigen** PhD ; **Scott B Reeder** MD, PhD ; **Harald Kramer** MD ; **Thomas M Grist** MD * ; **Alejandro Munoz Del Rio** PhD ; **Azita Hamedani** MD ; **Scott K Nagle** MD, PhD *

PURPOSE
Determine the effectiveness of using pulmonary magnetic resonance imaging as the primary test for the determination of pulmonary embolism (MRA-PE) in a symptomatic population.

METHOD AND MATERIALS
We performed a retrospective review of our experience with 578 consecutive symptomatic patients studied over a five year period with MRA-PE for the primary diagnosis of pulmonary embolism (PE). Contrast enhanced MRA images were performed in a single breath hold at 1.5 Tesla. The negative predictive value at three months and Kaplan-Meier analysis were calculated from the available time to venous thromboembolism (VTE) follow up data obtained from the electronic medical record.

RESULTS
There were 578 consecutive symptomatic patients who underwent pulmonary MRA as their primary examination for the determination of PE. There were 467 females (average age ± 1S.D: 36.6 years, ± 16), and 111 males (average age ± 1S.D: 44.9 years± 19.5). Out of 578 MRA exams, 25 were non-diagnostic due to motion. Of the remaining 553 patients, 53 were positive and treated on the basis of MRA findings alone. Of the 500 negative MRA�s, 76 were lost to 3-month follow up, leaving 424 patients with an initial negative MRA and 3 months of complete EMR follow up. Of these, 8 were found to have VTE during F/U. The negative predictive value for MRA-PE at three months was 98% (97-99, 95% CI). Kaplan-Meier estimate values, for time to VTE at one year, was found to be 0.98 (97-0.99, 95% C.I).

CONCLUSION
In this single site retrospective study, MRA-PE was found to be effective as a primary imaging modality for the diagnosis of PE in symptomatic patients with a high rate of technical success. At those sites with sufficient technical expertise in performing pulmonary MRA, and knowledgeable of the artifacts associated with this technique, should consider use of this modality where appropriate clinical settings warrant.

CLINICAL RELEVANCE/APPLICATION
MRA-PE can be safely used for the primary diagnosis of pulmonary embolism in symptomatic patients. This test should be considered as an acceptable alternative to CTA-PE for vulnerable patients.

LL-CHE-SU5A ● Non Resolving Lung Consolidation: Pandora's Box

Archana T Laroia MD (Presenter) ; **Sandeep T Laroia** MD

PURPOSE/AIM
To review the radiological diagnosis of subacute or chronic lung consolidation.

CONTENT ORGANIZATION
A pictorial assay of non resolving lung consolidation will be presented. A wide variety etiologies include benign entities like atypical infections (fungal),sarcoisdosis, cryptogenic organising pneumonia (COP), eosinophilic pneumonia, Wegeners, pulmonary infarcts, alveolar protienosis, lipoid and radiation pneumonia and drug reaction. Lung cancer with lepidic growth and lymphoma are dangerous mimics of the benign causes.

SUMMARY
Non resolving lung consolidation has a broad differential diagnosis ranging from infection, inflammatory and vascular etiology to rare benign causes like COP, wegners, lipoid pneumoia etc. Slow growing cancer is a dangeous mimic that can be missed if not suspected.

Chest - Sunday Posters and Exhibits (1:00pm - 1:30pm)

Sunday, 01:00 PM - 01:30 PM ● Lakeside Learning Center

`CH`

LL-CHS-SUB ● *AMA PRA Category 1 Credit* ™:0.5

LL-CHS-SU1B ● Accuracy of Diffusion-weighted (DW) Magnetic Resonance (MR) Imaging with Background Signal Suppression (MR-DWIBS) in Diagnosis of Mediastinal Lymph Node Metastasis of Non-small Cell Lung Cancer (NSCLC)

Liang Xu (Presenter) ; **Yuhui Liu** ; **Yong Huang**

PURPOSE
To prospectively evaluate the accuracy of diffusion-weighted (DW) magnetic resonance (MR) imaging with background signal suppression (MR-DWIBS) for detecting mediastinal lymph node metastasis of non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS
MR-DWIBS was performed in 42 consecutive patients (27 men, 15 women; age range, 42� 78 years; median age, 55 years) with pathologically proven NSCLC. The visualization rate of metastatic lymph node (MLN) and benign lymph node (BLN) of all size and normal size (less than 1cm in diameter) was compared by using Fisher's exact test on a per-nodal basis. By manually drawing regions-of-interest (ROIs), signal intensity (SI) and apparent diffusion coefficient (ADC) of MLN and BLN was measured and compared by using two-tailed unpaired student t-test. Receiver operating characteristic (ROC) analysis was used to assess the overall diagnostic accuracy of SI and ADC. The optimal cut-off value was determined and the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy was calculated.

RESULTS

CONCLUSION
MR-DWIBS with SI and ADC measurement appears to be clinically helpful to determine mediastinal lymph node metastasis of NSCLC without reference to nodal size.

CLINICAL RELEVANCE/APPLICATION
MR-DWIBS might be a practical technique of clinical significance in determination of mediastinal lymphnode metastasis of NSCLC.

LL-CHS-SU2B ● Thymic Epithelial Tumors: Prognostic Determinants among Clinical, Histopathologic, and Imaging Findings

Jung Won Moon (Presenter) ; **Kyung S Lee** MD, PhD ; **Yo Won Choi** MD ; **Dong-Wook Sung** MD ; **Myung-Hee Shin** ; **Joungho Han** ; **Geewon Lee** MD

PURPOSE
To evaluate the value of imaging modality in predicting patient prognosis in thymic epithelial tumors stratified with WHO classification and Masaoka-Koga staging schemes.

METHOD AND MATERIALS
From 1994 to 2011, 544 patients (M:F = 301:243; mean age, 51.4 years) were diagnosed to have a thymic epithelial tumor (A, AB, B1, B2, B3 and C series) with core biopsy or surgical resection. All patients underwent contrast-enhanced CT at the presentation. Two observers reviewed CT findings retrospectively in terms of tumor shape, margin, the presence of necrosis or calcification, internal characteristics (homogeneous vs. heterogeneous, degree of enhancement [Hounsfield Unit on pre-, and post-contrast enhancement images for net enhancement], invasion of surrounding structures, and the presence of pleural or pericardial seeding and nodal or extra-thoracic metastasis. Final decisions on the findings were reached by consensus. Pathologic results were subcategorized by using WHO classification and disease extents by the use of Masaoka-Koga staging system. The presence of myasthenia gravis (MG) was evaluated, and overall survivals were assessed. And then, CT findings, histologic classification and prognosis were correlated from each other.

RESULTS
Analysis using Cox-proportional hazards model was performed. Of CT findings, tumor size, shape (hazard ratio [HR] = 1.352), margin (HR = 1.364), the presence of calcification (HR = 1.585), net enhancement, findings of seeding and metastasis (HR = 1.374) were significantly correlated with overall survival (P < .05), while heterogeneity of tumor, the presence of necrosis or invasion of surrounding structures were not. Masaoka-Koga staging system appeared as an independent prognostic factor (HR = 1.018 - 1.392, P < 0.001) for survival. Higher B series tumors of WHO classification (HR = 1.090 - 1.322, P < 0.05) were also survival determinant. The presence of MG was also a bad prognostic factor for survival (P = .021, HR = 2.467).

CONCLUSION
This study provided a rough information for the possibility of CT findings as predictor of overall survival, and also revealed stratification of clinico-pathologic correlation.

CLINICAL RELEVANCE/APPLICATION
Because CT findings, WHO classification and Masaoka-Koga staging schemes are prognostic determinants, the integration of all information is mandatory for patient prognosis prediction.

LL-CHS-SU3B ● Accuracy of CT-guided Percutaneous Transthoracic Needle Biopsy for Diagnosis of Anterior Mediastinal Lesions

Milena Petranovic MD (Presenter) ; **Carol C Wu** MD * ; **Subba R Digumarthy** MD ; **Victorine V Muse** MD ; **Amita Sharma** MBBS ; **Jo-Anne O Shepard** MD * ; **Ashok Muniappan** MD ; **Robert P Hasserjian** MD ; **Matthew D Gilman** MD

PURPOSE
To determine the clinical role and accuracy of CT-guided percutaneous needle biopsy in diagnosis of anterior mediastinal lesions.

METHOD AND MATERIALS

A review of CT-guided needle biopsies of anterior mediastinal lesions performed at our institution between January 2003 and December 2012 was conducted. All biopsies were performed by dedicated thoracic interventionalists. Data were collected on characteristics of the lesions, patient demographics, tumor markers, complications, and subsequent surgical intervention and/or other treatment. Both cytology and core biopsy results were reviewed. Surgical pathology results were recorded if available.

RESULTS
The study cohort consisted of 52 patients (M:F 32:20, mean age 49y) with mean diameter of mediastinal mass = 9.1 ± 3.7cm. 34/52 (65%) patients also had subsequent surgical biopsy or resection. CT-guided biopsy was accurate in 40/52 (77%) patients: 11/11 (100%) thymic neoplasms, 13/22 (59%) lymphomas, 2/3 (67%) germ cell tumors, 4/5 (80%) metastatic lesions, 6/7 (86%) primary lung neoplasms, 2/2 (100%) sarcomas, 1/1 (100%) mesothelioma and 1/1 (100%) thyroid goiter. Non diagnostic results were seen in 12/52 (23%) patients, consisting of lymphoma (9), germ cell tumor (1), primary lung neoplasm (1) and metastasis (1). FNA alone made the correct diagnosis in 31/52 (60%) patients, and provided a discordant diagnosis with final pathology in 4/52 (7.7%). Core biopsy had a 36/47 (77%) diagnostic rate and none of the core biopsies were discordant with final pathology. Of the 5 patients who did not have core biopsy performed, 3/5 (60%) had a non-diagnostic FNA. Flow cytometry was performed in 33/52 (63%) patients. There was no statistically significant difference between the diagnostic and the non-diagnostic groups in patients� age, lesion size, and presence of necrosis or cystic region in the lesion. Complication rate was 2/52 (3.8%), compromised of small self resolving pneumothoraces.

CONCLUSION
CT-guided needle biopsy of anterior mediastinal lesions is a safe and well-tolerated diagnostic procedure. The sensitivity of needle biopsy is better for thymic neoplasms than for lymphoma and germ cell tumors. Core biopsy improves the diagnostic accuracy compared to FNA alone.

CLINICAL RELEVANCE/APPLICATION
Our study highlights differences in diagnostic accuracy of CT-guided percutaneous needle biopsy depending on the pathology. It also raises the importance of providing core biopsy samples for analysis.

LL-CHS-SU4B ● Dual-energy CT for Differentiating Acute and Chronic Pulmonary Thromboembolism: An Initial Experience

Seung-Seob Kim MD (Presenter) ; **Jin Hur** MD ; **Young Jin Kim** MD ; **Hye-Jeong Lee** MD ; **Yoo Jin Hong** MD ; **Byoung Wook Choi** MD

PURPOSE
The purpose of this study was to evaluate the diagnostic capability of dual-energy CT in differentiating acute and chronic pulmonary thromboembolism (APTE and CPTE).

METHOD AND MATERIALS
We prospectively enrolled 22 patients (8 males, 14 females; mean age: 67.3 years old) with a filling defect larger than 5mm in diameter in the pulmonary artery (PA). All patients underwent dual-energy CT using gemstone spectral imaging (GSI) mode (GE HD750). For quantitative analysis, two investigators measured the following parameters for emboli: CT attenuation density (HU values), iodine concentration (mg/ml), and iodine-related HU values (IHU). Statistical analysis included calculation of means and standard deviations, the t-test and ROC analysis.

RESULTS
Among 22 patients, 14 were categorized with APTE and 8 with CPTE. The mean HU values of emboli were significantly different between the APTE and CPTE groups (24.5 ± 16.4 vs 60.3 ± 19.8 HU; p = 0.008). The mean iodine concentration and IHU values were significantly different between the two groups (0.61 ± 0.26 vs 1.79 ± 0.42; p = 0.0001 and 6.4 ± 3.1 vs 29.0 ± 8.7 HU; p = 0.0001). The area under the ROC curve (AUC) for differentiating APTE and CPTE using HU, iodine concentration, and IHU values were 0.911 (95% CI: 0.710, 0.976), 0.997 (95% CI: 0.844, 1.000), and 0.997 (95% CI: 0.844, 1.000), respectively.

CONCLUSION
Dual-energy CT using a quantitative analytic methodology can be used to differentiate between APTE and CPTE.

CLINICAL RELEVANCE/APPLICATION
Radiologists can help patients to avoid unnecessary treatment by differentiating APTE and CPTE on initial CT scan, since the therapeutic management between APTE and CPTE is completely distinct.

LL-CHE3110-SUB ● Recent Advances in Computed Tomography of the Aorta and Their Application in Aortic Pathologies in Every Day Clinical Practice

Fabian Rengier MD (Presenter) ; **Matthias Muller-Eschner** MD ; **Paul Schoenhagen** MD ; **Hendrik Von Tengg-Kobligk** MD * ; **Rolf Vosshenrich** MD ; **Hans-Ulrich Kauczor** MD * ; **Sasan Partovi** BS *

PURPOSE/AIM
1. Illustrate current state-of-the-art computed tomography (CT) of the aorta including recent advances and technological developments.
2. Discuss their application in aortic pathologies in every day clinical practice.

CONTENT ORGANIZATION
1. State-of-the-art CT of the aorta: A. Non-ECG-gated CT angiography. B. ECG-gated CT angiography. C. Dual-energy CT of the aorta including virtual non-contrast. D. Three-dimensional image processing for advanced preoperative planning of endovascular repair. 2. Application to aortic pathologies: A. Aortic dissections Stanford Type A and B. B. Intramural hematoma. C. Penetrating atherosclerotic ulcers. D. Thoracic aortic aneurysms. E. Abdominal aortic aneurysms. 3. Conclusions.

SUMMARY
This exhibit gives recommendations for CT imaging protocols in every day clinical practice. It is also shown how recent technological developments such as dual-energy CT and three-dimensional image processing can be effectively integrated into the clinical workflow. The reviewer of this exhibit will learn the value and application of different imaging protocols, contrast media phases and image processing techniques with regards to the most common aortic pathologies.

Lung Cancer Screening: How I Do It

Sunday, 02:00 PM - 03:30 PM ● E451B

OI CH

RC101 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5

RC101A ● Current Data Summary and Recommendations

Ella A Kazerooni MD (Presenter)

LEARNING OBJECTIVES
1) To understand the current guidelines for lung cancer screening with CT from major professional societies. 2) To learn what the current position is of the U.S. Preventative Services Task Force on screening for lung cancer. 3) To understand options for reimbursement, from self pay to third party payors.

ABSTRACT
Since the results of the NLST were published in 2011, demonstrating a 20% reduction in lung cancer specific mortality in high risk current and former smokers, many professional organizations have developed guidelines that recommend screening CT in that same population: 55-74 year olds with a 30 or more pack year history of smoking who ar current smokers or who quit in the last 15 years. Some professional organizations have somewhat controversially extended favorable recommendations to younger and older individuals, and those at moderate risk of developing lung cancer basedon other risk factors. The last words from the US Preventative Task Force on this issue were a non favorable receoemnendation in 2004, 'The U.S. Preventive Services Task Force (USPSTF) concludes that the evidence is insufficient to recommend for or against screening asymptomatic persons for lung cancer with either low dose computerized tomography (LDCT), chest x-ray (CXR), sputum cytology, or a combination of these tests' followed by similar lack of endorsement in a 2009 USPSTF publication of making decisions in the setting of 'insufficient evidence.' The latter addressed the question in 4 domains: potential preventable burden, potential harm of the intervention, costs (both monetary and opportunity), and current practice. While an increasing but small number of third party payors cover screening CT today, and nost self pay programs are seeing little uptake of individuals, Medicare has not issued a statement. Like some other organizations, the cost effectiveness analysis may be very important in their decision. Circustances that coudl lead Medicare to cover screening CT for lung cancer if there is a favorable USPSTF recommendation or if federal legislation is passed, similar to what was done with MQSA and breast cancer screening with mammography.

RC101B ● Starting a Screening Program

Reginald F Munden MD, DMD (Presenter) *

LEARNING OBJECTIVES
1) Understand important issues to be addressed in planning a lung cancer screening program. 2) Appreciate the need to have a multidisciplinary approach to lung cancer screening. 3) Determine the resources to undertake lung cancer screening program.

ABSTRACT
Launching a lung cancer screening program is not simply a matter of opening the doors and offering low-dose CT to anyone who wishes to be screened. There are many decisions that need to be resolved prior to launching a screening program such as the criteria for screening ◆ NLST, NCCN or one based on previous screening trials. A system of registration, recording and follow-up of patients will need to be established. Other considerations include whether the radiologist is responsible for follow up of patients or whether a physician of record is required. Is self-referral allowed? What about structured reporting? It is extremely important to develop a protocol to manage positive findings for patients that the physicians who will ultimately treat the patient agree upon. This session will discuss many of the fundamental issues related to establishing a lung cancer screening program.

RC101C ● Management Strategies for Screen-Detected Nodules

Thomas E Hartman MD (Presenter) *

LEARNING OBJECTIVES
1) Identify imaging findings and tools that can aid in the management of screen detected pulmonary nodules.

ABSTRACT
In order to optimize CT screening for lung cancer, appropriate management of screen detected pulmonary nodules is essential. Various criteria from initial size, attenuation and margin to growth rate on subsequent exams can be used to help stratify risk and determine appropriate management. Evolving computer aided diagnostic applications may improve our ability to manage screen detected nodules.

RC101D ● Biopsy of Screen-Detected Nodules

David F Yankelevitz MD (Presenter) *

LEARNING OBJECTIVES
1) To understand indications for biopsy of screen-detected nodules. 2) To develop an approach to optimize small specimen evaluation. 3) To improve communication between the radiologist and the cytologist to optimize diagnosis.

RC101E ● Other Findings: What Do I Do?

Caroline Chiles MD (Presenter)

LEARNING OBJECTIVES
1) Suggest management guidelines for incidental findings discovered at the time of lung cancer screening, with special emphasis on COPD, coronary artery disease, and other cancers.

ABSTRACT

Sports Injuries in the Chest and Abdominal Wall: A Core Curriculum of the Body's Core

Sunday, 02:00 PM - 03:30 PM ● E353C

MK GU GI CH

Back to Top

RC104 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5
David A Rubin , MD *
Jonathan C Baker , MD *
William E Palmer , MD

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.

Thoracic Aorta: Key Concepts (An Interactive Session)

Sunday, 02:00 PM - 03:30 PM ● S105AB

[VA] [CH]

RC112 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5

RC112A ● Transcatheter Aortic Valve Replacement (TARV)

Paul Schoenhagen MD (Presenter)

LEARNING OBJECTIVES
1) Discuss Pathophysiology and Prevalence of Symptomatic Severe Aortic Stenosis. 2) Discuss Transcatheter Treatment Options (TAVR).
3) Discuss Critical Role of Imaging in the Context of TAVR.

RC112B ● The Spectrum of Type A Dissections

Anne S Chin MD (Presenter)

LEARNING OBJECTIVES
1) Review the pathology, epidemiology, and natural history of acute type A aortic dissection. 2) Describe the imaging strategies and diagnostic information sought in patients with acute aortic syndromes. 3) Review the recent classification of acute aortic dissection. 4) Illustrate imaging findings of the spectrum of acute type A aortic dissection, with a focus on recognizing subtle CT angiographic findings related to the lesser known 'Class 3' aortic intimal tear or 'limited dissection.'

ABSTRACT
The traditional Stanford classification distinguishes between dissections involving the ascending aorta (Type A) from those that do not involve the ascending aorta (Type B). Type A aortic dissection is rare, but remains the most lethal of aortic disorders requiring prompt surgical intervention. The common pathologic denominator in patients with acute dissection is an abnormal aortic media ('cystic medial necrosis') which can be found in genetic/inherited diseases (e.g. Marfan's) but also in patients with severe hypertension. The CT imaging strategy of suspected acute aortic syndrome should always include (i) non-enhanced images to assess for intramural hematoma (IMH); when the index of suspicion for aortic dissection is high, also consider (ii) EKG-gating for motion-free evaluation of the aortic root/ascending aorta, and (iii) including common femoral arteries in the CTA scan range to assess lesion extent and identify a percutaneous access route. The spectrum of aortic dissection has recently been classified as the following: Class 1 classic dissection with true and false lumen separated by an intimal flap; Class 2 IMH; Class 3 discrete or limited dissection; Class 4 penetrating atherosclerotic ulcer (PAU); and Class 5 iatrogenic/traumatic. A clarification and modified conceptual classification of aortic dissection will be provided, along with illustrative examples of these aortic lesions. Particular focus will be given to the lesser known Class 3 'limited dissection' which is described as a subtle and eccentric bulge of the aortic wall. While it has been reported to elude current imaging techniques, emphasis will be made on recognizing subtle CTA imaging findings characteristic of this uncommon but important dissection variant.

RC112C ● Surgical Procedures and Complications

Terri J Vrtiska MD (Presenter)

LEARNING OBJECTIVES
1) Describe common indications for surgical intervention in aortic disease including aneurysm, vasculitis, infection, trauma and connective tissue disorders. 2) Identify key CTA features of the normal postoperative aorta. 3) Present the characteristic CTA findings for complications of postoperative aortic repair including disease progression, thrombosis, stenosis, infection, pseudoaneurysm, aorto-enteric fistula and aortic rupture.

ABSTRACT

Hot Topic Session: Therapies for Early Stage I Lung Cancer: Options and Controversies

Monday, 07:15 AM - 08:15 AM ● E353A

[RO] [OI] [CH]

SPSH21 ● *AMA PRA Category 1 Credit* ™:1 ● ARRT Category A+ Credit:1
Moderator
Zhongxing Liao , MD
Joseph K Salama , MD
Damian E Dupuy , MD *
Jessica S Donington , MD *

LEARNING OBJECTIVES
1) To understand the role, benefits and risks of stereotactic radiation in the treatment of early-stage lung cancer. 2) To understand interventional oncology and surgical options in the treatment of early-stage lung cancer. 3) To gain a critical appraisal of all three options and risks and benefits of each for personalized care in challenging patients population with common multi-morbidity.
ABSTRACT
URL

Practical Issues in Chest Imaging: Case-based Approach (An Interactive Session)

Monday, 08:30 AM - 10:00 AM ● E353C

[OI] [CT] [CH]

RC201 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5

RC201A ● Pulmonary Infection

Lacey Washington MD (Presenter)

LEARNING OBJECTIVES
1) Recognize a broad range of potential radiographic findings of acute infection. 2) Recognize clinically relevant features in infection imaging. 3) Recognize findings that are not characteristic of community-acquired pneumonia and that suggest an alternate diagnosis.

RC201B ● Lung Cancer: Hiding in Plain Sight

Eric J Stern MD (Presenter)

LEARNING OBJECTIVES

1) Understand characteristics of missed lung cancers on CXR. 2) Understand how we visually search. 3) Be aware of common observer errors. 4) Know CXR hiding spots. 5) Be aware of some ancillary diagnostic tools.

ABSTRACT
Have you ever missed a lung cancer on CXR? Missed lung cancer is one of most frequent causes for malpractice lawsuits in radiology in USA This lecture: Focus on detecting smaller cancers -Opportunities for earlier detection
-Potentially better survival?
-Characteristics of missed lung cancers
-Visual searching pitfalls Common Observer errors: -Scanning error
(failing to look at the abnormality)
-Recognition error
(looking at the abnormality but not identifying it)
-Attention error
(distractions)
-Decision making:
identifying abnormality but deciding to ignore it -Satisfaction of search Contributing factors: -Lesion Characteristics
-Density, margins, etc
-Other distractors Eg. Superimposed diseases, artifacts, etc.
-History
-Technical considerations
Recognize common hiding spots Other Diagnostic Tools

RC201C ● Management of Sub-Solid Lung Nodules: How I Do It...

Myrna C Godoy MD, PhD (Presenter)

LEARNING OBJECTIVES
1) To comprehend the new IASLC/ATS/ERS classification of lung adenocarcinomas and its correlation with subsolid nodules. 2) To review the current approach to diagnosis and management of subsolid pulmonary nodules.

ABSTRACT
The term subsolid nodule includes pure ground-glass nodules (GGNs) and part-solid nodules (PSNs), which are mixed ground-glass/solid lesions. Strong correlation has been demonstrated between the histologic findings of lung adenocarcinoma with lepidic growth pattern and the CT appearance of persistent subsolid nodules. Radiologists should be familiar with the new classification of lung adenocarcinoma that has been recently proposed by the International Association for the Study of Lung Cancer, American Thoracic Society and European Respiratory Society. Serial CT imaging has demonstrated stepwise progression of these nodules in a subset of patients, characterized by increase in size and density of GGNs and development of a solid component. Given the slow growth rate of GGNs, standardized guidelines with long-term (= 3 years) CT follow-up have been proposed using low-dose CT technique.

RC201D ● Post-Operative Chest Imaging

Jo-Anne O Shepard MD (Presenter) *

LEARNING OBJECTIVES
1) To demonstrate the radiologic appearance of expected and unexpected complications of thoracic surgical appearances through a case-based approach. 2) An understanding of the surgical procedures and expected findings will facilitate the recognition of complications. 3) Prompt identification of post-operative complications in a timely and accurate way will improve post-operative morbidity.

Quantitative Imaging: Diffuse Lung Disease Assessment Using CT

Monday, 08:30 AM - 10:00 AM ● N229

PH CT BQ CH

RC225 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5
Director
Michael F McNitt-Gray , PhD *

RC225A ● The Role of Quantitative CT in the Assessment of Diffuse Lung Disease

Jonathan G Goldin MBChB, PhD (Presenter)

LEARNING OBJECTIVES
1) Identify the application of quantitative imaging principles in the assessment of patients with Diffuse Lung Disease. 2) Identify conditions required for successful application of quantitative imaging principles. 3) Analyze quantitative imaging techniques and apply this knowledge to protocol development and patient management in the setting of both clinical workup and clinical trials involving patients with Diffuse Lung Disease.

RC225B ● Quantitation in the Assessment of COPD

David A Lynch MBBCh (Presenter) *

LEARNING OBJECTIVES
1) Describe the methodology and limitations of non-invasive imaging in quantifying lung structure. 2) Describe the opportunities for non-invasive imaging in understanding the structure of the lung, and how that relates to phenotyping subjects for clinical trials and longitudinal studies. 3) Understand the clinical relevance of quantitative imaging of COPD. 4) Learn how to interpret quantitative CT results in the lung.

ABSTRACT
COPD is characterized on CT by emphysema, bronchial wall thickening, and small airway abnormalities. These morphologic findings may be quantified and grouped into phenotypes, with different clinical presentations and prognosis. Clinicians are increasingly using these quantitative imaging techniques to study COPD. This course will provide information on the results of large-scale clinical trials ongoing in COPD. The limitations and sources of variation of current quantitative imaging methods will be discussed. Relationships between quantitative CT measures, genetic markers, and clinical abnormalities will be stressed.

RC225C ● Standardization of Imaging and Measurement Protocols

Matthew S Brown PhD (Presenter) *

LEARNING OBJECTIVES
1) Understand sources of quantitative lung CT measurement variation including technical, physiologic, and algorithmic. 2) Review strategies for standardization across multiple sites and imaging platforms. 3) Assess the impact on sample size in multicenter clinical trials.

OI CH

SSC04 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5
    Moderator
    James G Ravenel , MD
    Moderator
    Alexander A Bankier , MD, PhD *

SSC04-01 ● Chest Keynote Speaker
James G Ravenel MD (Presenter)

SSC04-02 ● Lung Cancer Probability in Subjects with CT-detected Pulmonary Nodules

Nanda Horeweg MD (Presenter) ; **Joost Van Rosmalen** PhD ; **Marjolein A Heuvelmans** BSc ; **Carlijn Van Der Aalst** PhD ; **Harry De Koning** * ; **Matthys Oudkerk** MD, PhD ; **Rozemarijn Vliegenthart** MD, PhD ; **Ernst T Scholten** MD ; **Kristiaan Nackaerts** MD, PhD * ; **Jan-Willem J Lammers** MD, PhD ; **Harry Groen** ; **Carla Weenink** MD, PhD ; **Erik Thunnissen** MD, PhD ; **Peter M Van Ooijen** ; **Willem P Mali** MD, PhD

PURPOSE
The main challenge in computed tomography (CT) screening for lung cancer is the high prevalence of pulmonary nodules and the relatively low incidence of lung cancer. Thresholds for nodule size and growth rate, which determine which nodules require additional diagnostic measures, should be based on the lung cancer probability of the individual.

METHOD AND MATERIALS
The diameter, volume and volume-doubling time (VDT) of 9,681 non-calcified nodules detected in 7,135 participants in the Dutch-Belgian lung cancer screening trial were used to quantify their lung cancer probability. Complete coverage on all lung cancer diagnoses was obtained by linkages with the national cancer registry, for a follow-up of eight years. The probabilities were used to propose and evaluate optimized thresholds for CT-detected nodules.

RESULTS
Lung cancer probability was low in subjects with a nodule volume 600days, 4.0% for VDTs 400-600days and 6.7-25.0% for VDTs
CONCLUSION
Subjects with nodules
CLINICAL RELEVANCE/APPLICATION
This study provides detailed and reliable data on the lung cancer probability of subjects with CT-detected nodules stratified by nodule diameter, volume and growth rate. This information can be valuab

SSC04-03 ● Lung Nodule Detectability on Computed Tomography at Ultra-low Dose Scanning with Adaptive Iterative Dose Reduction Using Three Dimensional Processing (AIDR3D): Comparison with Low-dose Scanning by Receiver-operating Characteristic Analysis

Yukihiro Nagatani MD (Presenter) ; **Masashi Takahashi** MD ; **Kiyoshi Murata** MD ; **Mitsuru Ikeda** MD ; **Tsuneo Yamashiro** MD ; **Tetsuhiro Miyara** ; **Hisanobu Koyama** MD ; **Mitsuhiro Koyama** MD ; **Yukihisa Satoh**

PURPOSE
To compare lung nodule detectability (LND) on computed tomography (CT) with adaptive iterative dose reduction using three dimensional processing (AIDR3D) between ultra-low dose CT scanning (ULDS) and low dose CT scanning (LDS)

METHOD AND MATERIALS
This was part of the Area-detector Computed Tomography for the Investigation of Thoracic Diseases (ACTIve) Study, a multicenter research project being conducted in Japan. The Institutional Review Board of each institution approved this study and written informed consent was obtained. In a single visit each, 83 subjects underwent chest CT (64-row helical mode) using identical multi-detector CT scanners at a gantry rotation speed of 0.35 second with three different tube currents: 240,120 and 20 mA (2.51, 1.26 and 0.21mSv, respectively). Axial CT images with 2-mm thickness and increment were reconstructed using AIDR3D. Standard of reference (SOR) was determined on the basis of CT images at 240mA by consensus reading of two board-certificated radiologists with regard to the presence of nodule with the longest diameter of more than 3mm. Five radiologists independently assessed and recorded presence/absence of lung nodules and their locations by continuously-distributed rating in CT images at 20mA (ULDS) and 120mA (LDS). Receiver-operating characteristic (ROC) analysis by jackknife method was used to evaluate LND of both methods in total and also in subgroups classified by nodular longest diameter (>4, 6 and 8mm) and characteristics (solid and non-solid).

RESULTS
For SOR, 160 solid and 61 non-solid lung nodules were totally identified. No significant difference in LND for nodules with the longest diameter of more than 6mm was shown between both methods, as area under ROC curve was 0.932±0.020 in ULDS and 0.948±0.020 in LDS. Similarly, for the entire solid nodules, LND was quite similar between both methods, as area under ROC curve was 0.844±0.017 in ULDS and 0.876±0.026 in LDS.

CONCLUSION
It was demonstrated that ULDS with AIDR3D could have comparable LND to LDS with AIDR3D except for smaller non-solid nodules.

CLINICAL RELEVANCE/APPLICATION
ULDS with AIDR3D has a sufficient potential to be used for lung cancer screening.

SSC04-04 ● Coronary Artery Calcification as a Predictor of Mortality in the National Lung Screening Trial - American College of Radiology Imaging Network

Caroline Chiles MD (Presenter) ; **Fenghai Duan** PhD * ; **Gregory W Gladish** MD ; **James G Ravenel** MD ; **Scott Baginski** MD ; **Bradley J Snyder** MD ; **Sarah Baum** MS ; **Stephanie M Smith** BA ; **Reginald F Munden** MD, DMD *

PURPOSE
Low dose CT (LDCT) screening for lung cancer offers an opportunity to evaluate coronary artery calcification (CAC), a predictor of cardiovascular events strongly associated with age and smoking history. This study examines mortality in NLST participants with quantitative and qualitative CAC scores.

METHOD AND MATERIALS
We conducted a retrospective, randomly selected, case-control study to analyze the relationship between baseline LDCT CAC, coronary heart disease (CHD) and all-cause (AC) mortality . Five cardiothoracic radiologists evaluated a total of 1,570 LDCTs from 3 groups: group 1 included 210 CHD deaths; group 2 included 314 AC deaths (excluding CHD); a control group included 1046 participants alive at conclusion of the trial. Of these, 133 were excluded for clinical/technical reasons. Readers performed quantitative analysis of CAC (Agatston scoring), as well as qualitative analysis, based on both an overall and a per-vessel visual assessment (none/0, mild/1, moderate/2, heavy/3), using a set of standard reference CT images.

RESULTS
A CAC Agatston score of 0 was present in 34% of controls, 12% of patients with CHD death and 18% of patients with ACM (p1,000 (reference 0) were associated with hazard ratios (HRs) of 1.3 (p=.40), 3.5 (p

CONCLUSION
A visual assessment of CAC can be used for risk prediction of CHD death and ACM using non-gated LDCT for lung cancer screening, and is comparable to Agatston scoring. ACRIN receives funding from the National Cancer Institute through the grants U01 CA079778 and U01CA 080098.

CLINICAL RELEVANCE/APPLICATION
CAC, a significant cause of mortality in the lung cancer screening population, can be evaluated by a simple visual assessment.

SSC04-05 • Diagnostic Accuracy of Digital Tomosynthesis of the Chest for Nodules Detection in Lung Cancer Screening Program

Maurizo Grosso MD (Presenter) ; **Liliana Comello** ; **Roberto Priotto** MD ; **Emanuele Roberto** ; **Luca Bertolaccini** ; **Alberto Terzi** ; **Stephane Chauvie** PhD *

PURPOSE

METHOD AND MATERIALS
Accrual of study participants started in December 2010 and ended in December 2011. Smokers or former smokers aged from 45 to 75 years, with a smoking history of at least 20 pack-years, without malignancy in the 5 years before the start of the study were eligible for the study. DTS were performed at baseline and at 1 year follow up. Subjects with lung nodules were addressed to other radiological examination (CT, contrast enhanced CT or PET/CT).

RESULTS
Of the 1919 candidates assessed, 1843 (96%) were enrolled into the study. The mean age was 61 years (ranging 48-73). A total of 1843 DTS studies were performed. Pulmonary abnormalities were detected in 268 (14.5%) subjects. First-line basal computed tomography (CT) was subsequently carried out in 132 (7.2%) subjects, 68 (4.9%) of which were referred for follow-up CT; PET/CT was performed in 27 (1.46%), and lung cancer was detected in 18 (0.98%) individuals.

CONCLUSION
The detection rate of non-calcified lung nodules for DTS was comparable to rates reported for CT. A small subgroup underwent low-dose CT and entered a follow-up program. Overall, lung cancer was detected in about 1% of cases. Chest DTS holds promise as a first-line lung cancer screening tool. With a low-dose protocol effective dose could be kept as low 0.1 mSv/exam.

CLINICAL RELEVANCE/APPLICATION
Tomosynthesi could find a role in lung caner screening screening program

SSC04-06 • CT Screening for Lung Cancer: Current Practice Patterns at Leading Academic Medical Centers

Phillip M Boiselle MD (Presenter) ; **Charles S White** MD ; **James G Ravenel** MD

PURPOSE
Evidence-based guidelines recommend that lung cancer screening be conducted at academic medical centers similar to the NLST sites, but several aspects of CT screening are not addressed by clinical guidelines. Thus, our purpose was to determine current practice patterns for CT screening at leading academic medical centers.

METHOD AND MATERIALS
An electronic survey was emailed in March 2013 to thoracic radiologists at 21 leading academic medical centers, which were identified from the 2012-2013 US News and World Report listings of top hospitals, cancer centers, and pulmonary medicine centers. Participants who reported that they currently offer lung cancer screening were asked additional questions about patient selection, referral requirements, self-pay charges, dose, number of patients screened, nodule management guidelines, use of CAD and volumetric analysis software, and inclusion of a smoking cessation program.

RESULTS
Of the 18 survey respondents (86% response rate), 15 (83%) currently have a CT screening program and 3 (17%) are planning one. Among the 15 respondents with an active screening program, almost all included a smoking cessation program (n=14, 93%) and did not employ CAD (n=13, 87%) or nodule volumetry software (n=14, 93%). Less uniformity was reported for: patient selection criteria (NLST criteria most common, n=11, 73%); required referral from a patient�s clinician (n=11, 73%); rate of self-pay charges ($300-$400 most common, n=10, 67%); choice of guidelines for nodule management (Fleischner Society guidelines most common, n=10, 67%); and estimated scan dose (1-2 mSv most common, n=7, 47%). One to 5 patients are scanned per week at 13 of the 15 sites, which is the same or fewer than 6 months ago.

CONCLUSION
Screening programs at leading academic medical centers routinely include a smoking cessation program and only infrequently employ CAD or volumetric analysis software. However, there is less uniformity in patient selection criteria, referral requirements, self-pay charges, scan dose, and choice of nodule management guidelines.

CLINICAL RELEVANCE/APPLICATION
The variability in screening practices at leading academic medical centers suggests the need for formalized radiology guidelines for CT screening for lung cancer.

SSC04-07 • Solitary Pulmonary Nodule: Which Parameters Would Be Better to Assess for Quantitative Diagnosis on Diffusion-weighted MR Imaging with Multiple b-Values?

Hisanobu Koyama MD (Presenter) ; **Yoshiharu Ohno** MD, PhD * ; **Shinichiro Seki** ; **Mizuho Nishio** MD * ; **Sumiaki Matsumoto** MD, PhD * ; **Takeshi Yoshikawa** MD * ; **Nobukazu Aoyama** RT ; **Kazuro Sugimura** MD, PhD * ; **Masakazu Kanzawa** RT

PURPOSE
To determine the appropriate parameter for quantitative differentiation of solitary pulmonary nodules (SPNs) by means of diffusion weighted MR imaging (DWI) with multiple b values.

METHOD AND MATERIALS
Thirty-two subjects (24 men and 12 women, mean age 68.2 years) with 36 SPNs (range; 5-30mm) underwent DWI with multiple b values (b=0, 50, 100, 150, 300, 500, and 1000 s/mm2). According to the results from pathological and/ or more than 2 year�s follow-up examinations, all SPNs were divided into two groups: malignant SPNs (n=27) and benign SPNs (n=9). Then, five quantitative parameters were determined from region of interest (ROI) drawn over each SPN as follows: apparent diffusion coefficient (ADC), true diffusion coefficient (D) and perfusion fraction (PF) from all b-value data, and the signal intensity ratio between SPN and spinal cord on DWI with b-value at 1000 s/mm2 (LSR1000) and 500 s/mm2 (LSR500). To compare the quantitative parameter difference between malignant SPNs and benign SPNs, all parameters were compared by using Mann-Whitney�s U-test. To determine the each feasible threshold value, ROC-based positive test was performed. Finally, sensitivity, specificity and accuracy were compared each other by means of McNemar's test.

RESULTS
On comparison of each parameter between malignant and benign SPNs, both LSRs had significant difference between two groups (p

CONCLUSION
For quantitative differentiation of SPNs on chest DWI, LSR evaluation is more useful and practical method than ADC, D, and PF

assessment in routine clinical practice. In addition, b-value at 500 s/mm2 would be better to choose than b values at 1,000 s/mm2 in this setting.

CLINICAL RELEVANCE/APPLICATION
For quantitative differentiation of SPNs on chest DWI, LSR evaluation is more useful and practical method than ADC, D, and PF assessment in routine clinical practice.

SSC04-08 • A Multicenter, Community Based Chart Review of the Management of Small (8-15 mm) Nodules by Pulmonologists

James G Ravenel MD (Presenter) ; **Nichole Tanner** * ; **Anil Vachani** * ; **Gregory B Diette** * ; **Jyoti Aggarwal** ; **Charles Mathews** ; **Paul Kearney** ; **Kenneth Fang** ; **Gerard Silvestri** MD

PURPOSE
Increased utilization of CT along with a growth in lung cancer screening will result in the detection of many new small nodules. While there are defined algorithms for the management of small nodules in screening trials, little is known as to how small nodules are managed in the private practice setting. The purpose of this chart abstraction is to understand what diagnostic pathways are utilized to diagnose small pulmonary nodules in community practice.

METHOD AND MATERIALS
A chart review was conducted of ten community practice pulmonology clinics across the United States. This study was approved with a waiver of consent from the IRB and charts were reviewed and findings documented in a HIPAA compliant manner. Consecutive charts from patients with newly detected pulmonary nodules between 8 and 20 mm with either a confirmed diagnosis or two-years follow-up were included. Nodules >8 and
RESULTS
One hundred ninety-five charts from 10 practices were abstracted. The average age was 64.7 years. 46% were male and 87% were white. Never smokers, former smokers, and current smokers accounted for 28%, 41%, 31%, respectively. A total of 159 nodules 8-15 mm in size were reviewed. A final diagnosis of malignancy was made in 30 (18.8%) by 24 major and 6 minor procedures. There were 129 (82.1%) benign nodules. This was confirmed by histopathology in 48 cases (30.3%) (14 major and 34 minor procedures). The remaining 81 (50.9%) were followed radiographically and considered indeterminate or benign at the end of two years. Of those monitored, 4 underwent non diagnostic minor procedures, 74 had a least one CT follow-up (range 0-7) and 20 had a FDG PET scan.

CONCLUSION
Over one third of benign nodules between 8 and 15 mm in our chart review underwent an invasive procedure for diagnosis. Education and improved pathways are needed in the community to limit costs and potential morbidity related to small nodule management.

CLINICAL RELEVANCE/APPLICATION
Over 1/3 of benign nodules referred to community pulmonologists undergo an invasive procedure for diagnosis. Better pathways are needed to avoid invasive diagnosis of benign lesions.

SSC04-09 • Discrimination of Pulmonary Benign from Malignant Nodules Using a Computerized Three-dimensional Shape Analysis

Won Chang MD (Presenter) ; **Chang Min Park** MD, PhD ; **Sang Joon Park** ; **Sang Min Lee** MD ; **Jin Mo Goo** MD, PhD *

PURPOSE
To retrospectively investigate the differentiating value of computerized three-dimensional (3D) shape analysis between pulmonary benign and malignant nodules

METHOD AND MATERIALS
Between January 2010 and June 2012, we identified 113 patients (59 men and 54 women; mean age, 58.7 ± 13.0 years) with 113 pathologically-confirmed pulmonary nodules = 2cm in size (mean size, 1.45 ± 0.40 cm; 62 malignant and 51 benign nodules) on thin-section chest CT. Each lung nodule was manually-segmented from the surrounding lung parenchyma on axial CT images and 3D shape features of each nodule were calculated using an in-house software program. To evaluate the differentiating value of these 3D shape features between benign and malignant nodules, comparison statistics and receiver-operating characteristics curve (ROC) analysis was performed.

RESULTS
Between benign and malignant nodules, there were significant differences in nodule�s sphericity, discrete compactness and 3D roundness. Compared with malignant nodules, benign nodules showed significantly higher sphericity (0.767 vs. 0.653, p
CONCLUSION
Computerized 3D shape analysis such as nodule�s sphericity has a potential as a differentiating tool between pulmonary benign from malignant ones.

CLINICAL RELEVANCE/APPLICATION
(dealing with thin section chest CT); Computerized 3D shape analysis of lung nodules can differentiate benign from malignant ones ;and is recommended as part of initial evaluation prior to the biopsy.

Radiation Oncology and Radiobiology (Lung II)

Monday, 10:30 AM - 12:00 PM • S104A

| RO | CT | CH |

SSC15 • *AMA PRA Category 1 Credit* ™:1.5 • ARRT Category A+ Credit:1.5
　Moderator
　Allen G Meek , MD
　Moderator
　Zhongxing Liao , MD

SSC15-01 • Assessing Response to Radiochemotherapy Treatment on 18F-FDG PET in Non-small Cell Lung Cancer Using Approaches of Histogram and Gray Level Co-occurrence Matrix

Changsheng Ma MS (Presenter) ; **Yong Yin**

ABSTRACT
Purpose: The aim of this study was to propose and investigate gray level histogram and texture features information provided by 18F-FDG PET to assess patient's imaging response to radiochemotherapy in non-small cell lung cancer (NSCLC).
Methods: Twelve patients with newly diagnosed NSCLC treated with combined radiochemotherapy were involved in this study. Patients were categorized under three headings (non-responders, partial responders and complete responders) by experienced radiologists on the basis of RECIST according PET scans changes between pretreatment and 1 month after treatment. We analyzed the percentage variation of PET density using histogram analysis approach which characterizes global change of tumor region on PET. Texture parameters variation between pretreatment and 1 month after treatment completion which describe local voxel spatial distribution were extracted from Gray Level Co-occurrence Matrix (GLCM). Correlation between characteristics' variation and three type response status were analyzed.
Results: The uniformity of gray level histogram on the whole and the maximum percentage decrease in histogram was well associated

with tumor shrinkage and response status. The above indices derived from histogram were capable to differentiate three groups tumor response to radiochemotherapy. Texture parameters' variation (ASM, ENT and IDM) were able to differentiate the 3 response groups considering a high correlation with response status.

Conclusion: We demonstrated that histogram and texture analysis methods on baseline ^{18}F-FDG PET scans provided robust, discriminative stratification in assessing response to combined radiochemotherapy and may have a good application prospect in clinical practice.

SSC15-02 ● SPECT-based Functional Lung Imaging for the Prediction of Radiation Pneumonitis: A Clinical and Dosimetric Correlation

Douglas Hoover (Presenter) ; Robert Reid ; Eugene Wong PhD ; Eric Sabondjian ; George Rodrigues ; Brain P Yaremko

SSC15-03 ● Pleural Invasion by Lung Cancer: Evaluation with 3 Dimensional CT

Yoshiyuki Takahashi (Presenter) ; Shodayu Takashima ; Hodaka Numasaki PhD ; Daisuke Morimoto ; Binghu Jiang

PURPOSE
We studied the value of computer-aided 3 dimensional (3D) CT for diagnosing pleural invasion by lung cancer.

METHOD AND MATERIALS
This series included 207 peripheral lung cancer of 3 cm or smaller in 205 consecutive patients (mean age, 67±9 years; 125 men and 86 women) who had contrast enhanced 16-slice MDCT with 1-mm collimation before surgery. All nodules were in contact with the pleura on CT images. Greatest transverse and vertical diameters of nodules, greatest contact length and contact areas between nodules and pleura, and incidence of pleural thickening, angle patterns (acute or obtuse) of nodules and pleura, and our originally classified 4 3D rendering patterns of the pleura (flat, skirt-like, rectangular solid, and waving) were compared between nodules with and without pleural invasion and statistically significant factors were assessed with stepwise logistic modeling to study the most significant factor for predicting pleural invasion and then its diagnostic statistics were calculated.

RESULTS
Pleural invasion was pathologically verified in 61 (29%) of 207 nodules. Greatest transverse diameters of nodules (p
CONCLUSION
Computer-aided 3D rendering analysis of the pleura was useful for diagnosing pleural invasion by lung cancer.

CLINICAL RELEVANCE/APPLICATION
3D rendering analysis of the pleura may provide useful information on staging of lung cancer and therefore may contribute to management of patients with peripheral lung cancer.

SSC15-04 ● Rate of 18FDG-PET Parameter Decline Early During Radiotherapy Predicts Clinical Outcomes in Locally-advanced Non-small Cell Lung Cancer (LA-NSCLC)

Victor Mangona MD (Presenter) ; Larry L Kestin MD ; Dan Ionascu PhD ; Ovidiu Marina ; Bor-Tau Hung ; Mackenzie C McGee MD ; Ching-Yee O Wong MD, PHD ; Di Yan ; Inga Grills MD

PURPOSE
To determine on-treatment (OT) 18FDG PET-CT parameters predictive of clinical outcomes for response-based adaptive radiotherapy (RT).

METHOD AND MATERIALS
16 consecutive patients from 2009-11 with node+ cstage IIIA (n=9) and IIIB (n=7) NSCLC received1.5 Gy BID RT with concurrent chemotherapy on a prospective phase I/II protocol. RT dose was 60-72 Gy (n=12) (54 Gy if neoadjuvant, n=4) using IMRT with daily online CBCT. 4D dual-phase PET-CTs were obtained weekly during RT. Actual and %baseline max dimension (cm), bidimensional product (BDP, cm2), SUVmean, SUVmax, PET volume (vol), and total glycolytic activity (TGA=SUVmean x PETvol) were assessed. Rate of change was estimated with slope of linear regression. All PET vols were measured with the PET edge tool (MIM softwareTM) = 25 times (average reported) attempting coverage of 50% SUVmax. Clinical outcome groupings were compared with the Mann-Whitney U test (medians listed) and Cox proportional hazards.

RESULTS
Overall and potential FU was 19.4m (30.4 in living pts) and 33m (25-42) , age 66y, dose 65Gy, max dim. 6.2 cm, vol 40cc, and 4 OT PETs per pt (66 total). At 2y, 7 of 16 had locoregional recurrence (tumor/LNs, LRR); 5 distant metastasis (DM); 8 death, and 5 death of disease (DOD). Time until LRR, DM, death, and DOD events were 10.8, 7.6, 11.4, and 11.8 mos, respectively. Despite higher baseline SUVmean (7.3 v 5.5) and SUVmax (13.8 v 10.2) (p
CONCLUSION
Rates of decline of multiple metabolic parameters within the first 3 wks of treatment carry potential for predicting long-term outcomes after RT for NSCLC. In this sample, TGA was most predictive for LRR, DM, and DOD. During-treatment response-based adaptation of dose is worthy of investigation.

CLINICAL RELEVANCE/APPLICATION
Early PET response parameters during RT, particularly total glycolytic activity (TGA), predict long-term clinical outcomes. Such parameters may facilitate a treatment response-based dose modification.

SSC15-05 ● SUVmax and GLUT-1 Expression Correlate with Treatment Failure in Stage I Lung Adenocarcinoma

Todd Aguilera MD, PhD (Presenter) * ; Maximilian Diehn MD, PhD * ; David Shultz MD, PhD ; Nicholas Trakul MD, PhD ; Viswam S Nair MD ; Robert West MD, PhD ; Billy W Loo MD, PhD *

PURPOSE
Stage I non-small cell lung cancer (NSCLC) can be treated with surgery or stereotactic ablative radiotherapy (SABR) and predictors of treatment failure may enable selection of patients for adjuvant treatment. Glycolytic metabolism, as assessed by SUVmax in 18F-fluorodeoxyglucose PET, glucose transporter type I (GLUT-1 or SLC2A1) protein or mRNA expression, may correlate with outcome in Stage I NSCLC. We set out to explore if FDG uptake, and SLC2A1 protein or RNA expression correlate with outcomes in Stage I NSCLC patients treated with SABR or surgery.

METHOD AND MATERIALS
To determine disease free survival (DFS) We examined the records of 100 adenocarcinoma (AC) and 78 squamous cell carcinoma (SCC) Stage I NSCLC patients treated at Stanford. Thirty-five AC and 16 SCC tumors received SABR and 65 AC and 62 SCC received surgery. SUVmax was determined for SABR patients, and GLUT1 protein was evaluated in surgical patients. Lastly, we examined the association of SLC2A1 mRNA expression with outcomes in 778 NSCLC surgically treated patients.

RESULTS
Among radiotherapy patients, 11 AC and 3 SCC, failed treatment locally, regionally or distantly. The median SUVmax for AC of 7.8 (range 1.4-31.8) was significantly associated with 5-year DFS (Hazard Ratio [HR] 1.12, Confidence Interval [CI] 1.01-1.24) while the median SUVmax for SCC of 14.3 (range 3.1-25.4) did not associate with 5-year DFS (HR 1.06, CI 0.87-1.29). In surgical patients GLUT-1 was high in 23% and 62%, intermediate in 37% and 24%, and low in 40% and 13% in AC and SCC patients respectively. There were 10 AC and 15 SCC failures and GLUT-1 staining significantly associated with 5-year DFS for AC (HR 2.39, CI 1.07-5.33) but not SCC (HR 0.74, CI 0.39-1.41). SLC2A1 expression in 778 NSCLCs profiled using DNA microarrays confirmed association of SLC2A1 expression with outcome in AC and non-SCC patients (HR 1.44, CI 1.25-1.66), but not for SCC patients (HR 1.07, CI 0.84-1.37).

CONCLUSION
SUVmax in SABR patients, and SLC2A1 expression in surgical patients strongly associate with outcomes in stage I lung AC but not SCC.

Therefore, SUVmax and/or SLC2A1 expression may be useful biomarkers for identifying stage I AC patients at highest risk for disease recurrence.

CLINICAL RELEVANCE/APPLICATION
In the assessment of curable early stage lung cancer risk stratification based on imaging characteristics can guide clinical management. FDG-PET will play an important role in this assessment.

SSC15-06 • Comparison of Auto-segmented PET Volumes in Lung Tumors with CT Based Manual Contours: Implications in Radiotherapy Planning

Madhava Kanakamedala MD (Presenter) ; **Shankar P Giri** MD ; **William N Duggar** ; **Srinivasan Vijayakumar** MD

ABSTRACT
Purpose/Objective(s):
The aim of this study was to compare GTV volumes drawn manually on CT scans with GTV delineation on FDG PET scans utilizing an automatic threshold (SUV 3) and gradient-based (PET Edge) auto-segmentation methods in lung tumors and discuss implications in radiation planning.
Materials/Methods:
Nineteen patients with lung carcinoma treated with radiation therapy, whose PET scans were done within 30 days of simulation CT were enrolled. FDG-PET/CT and planning CT were transferred to the MIM software (MIM Vista Corp,Cleveland,OH) and fused using a deformable registration algorithm. For each patient three GTV's were defined. GTV for CT was manually contoured on CT scans using lung window for lesions well within the lung parenchyma and a mediastinal window when it was adjacent to mediastinum or chest wall. For GTV SUV3, a circle of interest was created with a margin around the lesion, excluding blood pool(heart) and auto segmented with SUV value of 3. The GTV-PET Edge was auto segmented using a PET Edge tool centered on the hyper metabolic area. *Statistical Methods:* Spearman correlation coefficients were constructed to view relationships between variables, and sign tests were used for inference.
Results:
Among 19 patients 3 were small cell, 16 were with non-small cell carcinomas (9 squamous cell and 6 adenocarcinoma). As per the AJCC 7th Ed, 7- they had 3 stage I, 8 stage II and 8 were stage IIIA. Only two patients had associated consolidation and atelectasis. Median CT volume for all lesions was 18.96 (range 0.82-630.9), PET Edge median 8.9(range 0.74-507.610), SUVs 3 median 26.93 (058-723.15). Correlation between CT and SUV 3, SUV 3 and PET edge, CT and PET Edge were 0.9474, 0.9526 and 0.9211 respectively. No significant differences between CT and SUV 3 volumes (p=0.648). But PET edge volumes were significantly less compared to CT volumes (p=0.032). On average PET edge volumes were 10.06 cc less than the CT volumes.
Conclusions:
CT overestimates GTV volume in lung tumors with no additional or negative margins required to create CTV (Chan et al). Surgical pathologic studies determined CTV margins of 6mm for SCC and 8mm for ADC, beyond gross pathological tumor. In phantom studies auto segmentation using PET edge tool was shown to be superior to other methods and better correlated with pathology.
In our study the GTV based on CT and SUV 3 was similar while the GTV based on PET edge was consistently smaller. PET SUV 3 is valuable when contouring a GTV using PET/CT fusion as it could include tumor and microscopic extensions . The use of PET edge tool needs to be studied clinically to assess if the smaller volume maybe useful in small low risk tumors suitable for SBRT.
Surgical pathological studies with larger number of patients are required to further confirm the CTV margins based on the GTV volumes generated on CT and PET auto segmented tools.

SSC15-07 • To Investigate 4D CT Images in Defining Contours Using QUASUR Programmable Respiratory Motion Simulation Platform and Lung Phantom

Changsheng Ma MS (Presenter)

PURPOSE
To analyze 4D CT images in defining contours of lung phantom using Programmable Respiratory Motion Platform.

METHOD AND MATERIALS
Acquiring 4D CT images of the respiratory motion lung phantom using varian Real-time Position Management (PRM) system. The lung portion from the Computerized Imaging Reference Systems (CIRS) phantom (Computerized Imaging Reference Systems, Inc., Norfolk, VA), was scanned using a CT scanner (Philips Big core CT) to obtain a CT HU-density table as for baseline dose calculation and stability comparison.The Quality Assurance System for Advanced Radiotherapy(QUASARTM) supports the testing of a wide variety of dosimetric and nondosimetric functions of Radiation Therapy Planning Systems and CT Simulators using a set of innovative quality assurance(QA) tools. The phantom was performed followed by a 4D CT scan of simulating free breathing phantom on a 16-slice CT scanner (Philips Brilliance Bores CT).The Translation Stage amplitude is fixed at 40mm peak to peak for the moving chest wall platform.The Dispiay shows the speed of motion in breaths per minute 20 BPM and seconds per breath 3 SPB.

RESULTS
Compared to the actual movement, lung density phantom geometry center displacement for X axis is 1mm, 2mm for Y axis and 1mm for Z axis in 4D CT reconstruction image.

CONCLUSION
4D CT of PRM system in aquring the respiroty motion images is accurate, easy to use, and fast. It allows for clean imaging and treatment of lung sites which affected by the respiratory motion.

CLINICAL RELEVANCE/APPLICATION
No

SSC15-08 • Radiation-induced Fibrosis after Lung Stereotactic Body Radiation Therapy (SBRT) Is Correlated with Radiation Treatment Parameters: A Timeline of Computed Tomography (CT) Changes

Mary M Salvatore MD (Presenter) ; **Miriam Knoll** MD ; **Ren-Dih Sheu** PhD ; **Sarah L Kerns** PhD, MPH ; **Abraham Knoll** MD ; **Yeh-Chi Lo** PhD ; **Kenneth E Rosenzweig** MD *

PURPOSE
Patients treated with stereotactic body radiation therapy (SBRT) for lung cancer are followed by computed tomography (CT) and most patients are found to have evidence of radiation-induced fibrosis (RIF) surrounding the treated tumor. There is no consensus regarding the size and anatomic pattern of RIF and we investigated whether treatment isodose levels could predict RIF.

METHOD AND MATERIALS
We selected 37 lung lesions in 32 patients who were treated with SBRT and had received post-treatment follow up CTs (FU-CT). Each FU-CT was fused with the patient�s original simulation CT, and treatment isodose levels were overlaid onto the CT. The RIF surrounding the treated lesion was contoured. The fibrosis extension index (FEI) was defined as the volume of RIF extending outside a given isodose level relative to the total volume of RIF on FU-CT and was expressed as a percentage.

RESULTS
32 patients underwent SBRT to the planned target volume (PTV) to a total dose of 45-54 Gy in 3-5 fractions. The 1st, 2nd, and 3rd FU-CT were at a median of 6 (n= 36), 10 (n=26), and 16.5 (n=6) months. The mean RIF volume at 1st , 2nd, and 3rd FU-CT was 69, 47,and 42 cc. Univariate analysis using Pearson�s correlation revealed that the PTV was positively correlated with RIF volume (correlation coefficient [CC]=0.628 and p < 0.0001 at 1st FU; CC=0.401 and p=0.021 at 2nd FU; CC=0.265 and p=0.306 at 3rd FU). FEI_{40} Gy at 1st FU was significantly positively correlated with FEI_{40} Gy at subsequent FU�s (CC=0.689 and pst and 2nd FU; 0.901 and p=0.020 comparing 2nd and 3rd FU). A similar trend was seen for FEI_{20} Gy, FEI_{30} Gy and FEI_{35} Gy, where 1st FU positively correlated with 2nd FU and 2nd FU positively correlated with 3rd FU. 96% and 94% of the RIF was found within the 20 Gy isodose line at the 1st and 2nd FU, respectively. 65% of patients were found to have a decrease in RIF at 2nd FU.

CONCLUSION
We have shown that radiation-induced fibrosis evolves over time and 1st FU-CT correlates well with subsequent CTs. 96% of the RIF can be found to occur within the 20 Gy isodose line, which may prove beneficial to radiologists attempting to distinguish recurrence vs. RIF.

CLINICAL RELEVANCE/APPLICATION
Communication of treatment isodose information to radiologists may improve the accuracy of reporting CTs after SBRT, and may aid with distinguishing recurrence vs. RIF.

SSC15-09 ● Application of Bone Suppression Technique to Real-time Tracking Radiotherapy

Rie Tanaka PhD (Presenter) ; **Shigeru Sanada** PhD * ; **Makoto Oda** ; **Mitsutaka Suzuki** ; **Keita Sakuta** RT ; **Hiroki Kawashima** MS

PURPOSE
A recently developed image processing methodology, the bone suppression technique, can suppress the conspicuity of bones on chest radiographs, creating sort of soft-tissue images obtained by the dual-energy subtraction technique. This study was performed to evaluate the usefulness of bone suppression fluoroscopy in real-time tracking radiation therapy.

METHOD AND MATERIALS
Dynamic chest radiographs of 9 patients with lung nodules during respiration were obtained using a flat panel detector (FPD) system (CXDI-50RF; Canon Inc.) (120 kV, 0.1 mAs/pulse, 5 fps, SID = 1.0 m). Commercial bone suppression image-processing software (SoftView version 2.0; Riverain Medical) was applied to the dynamic chest radiographs to create corresponding bone suppression images. Region of interests (ROIs) were manually located on lung nodules and automatic target tracking was conducted with in-house software based on the template matching technique (MATLAB ver. 2012b; MathWorks). The size of the ROI and its search area were determined to achieve the greatest accuracy. To evaluate the accuracy of target tracking, the maximum tracking error in the resulting images was compared between bone suppression and conventional fluoroscopic images.

RESULTS
The accuracy of target tracking was significantly improved in 8 of 9 cases. For better accuracy, the ROIs and search area were set to a larger size than for conventional images. The average maximum tracking errors in bone suppression and conventional fluoroscopic images were 1.3 ± 1.0 mm and 3.3 ± 3.3 mm, respectively. The bone suppression technique was especially effective in the lower lung area where pulmonary vessels, bronchi, and ribs showed complex movements (Fig. 1). In contrast, there was no significant improvement in a patient with severe interstitial pattern that resulted in a faint shadow of ribs on the original images.

CONCLUSION
The bone suppression technique improves tracking accuracy without special equipment and additional patient dose in real-time tracking radiation therapy. Our results indicated its usefulness especially in the lower lung area with complex movements of lung structures and ribs.

CLINICAL RELEVANCE/APPLICATION
Bone suppression fluoroscopy is a useful new technique for respiratory displacement of the target. Automatic target tracking can be conducted without rib shadows.

Chest - Monday Posters and Exhibits (12:15pm - 12:45pm)

Monday, 12:15 PM - 12:45 PM ● Lakeside Learning Center

CH

LL-CHS-MOA ● *AMA PRA Category 1 Credit* ™:0.5
Host
Jane P Ko , MD

LL-CHS-MO1A ● Acute COPD Exacerbation: 3 Tesla MRI Evaluation of Pulmonary Regional Perfusion

Amedeo Taglieri (Presenter) ; **Gian Luigi N Sergiacomi** MD ; **Antonio Chiaravalloti** MD ; **Eros Calabria** MD ; **Daniele Citraro** MD ; **Giovanni Simonetti** MD

PURPOSE
To compare pulmonary perfusion MR parameters in patients affected by COPD during acute clinical phase with hypercapnic syndrome and during clinical stabilization phase.

METHOD AND MATERIALS
29 patients with acute exacerbation of chronic obstructive pulmonary disease were evaluated by perfusional MRI during acute and clinical stabilization phase. Inclusion criteria: PaCO2 >45 mmHg and respiratory acidosis (pH
RESULTS

CONCLUSION
MRI allows quantitative evaluation of pulmonary regional perfusion in patients with COPD. Our results suggests vasospastic component as the main responsible of pulmonary hypoperfusion due to acute hypercapnia.

CLINICAL RELEVANCE/APPLICATION
MRI allow identification of patients needing vasodilators therapy alone from those requiring also anticoagulants therapy for prevention of pulmonary hypertension AND heart failure.

LL-CHS-MO2A ● Commercial Implementation of the Parametric Response Map for Clinical COPD Phenotyping

Craig J Galban PhD (Presenter) * ; **Ryan Chamberlain** PhD * ; **Jennifer Boes** ; **Ella A Kazerooni** MD ; **Alnawaz Rehemtulla** PhD * ; **Brian D Ross** PhD *

PURPOSE
COPD is a complex disease where patients comprise of varying severity of emphysema and small airways disease. An unmet clinical need is a biomarker capable of accurately quantifying small airways disease, which is considered the reversible component and thus treatable. University of Michigan investigators have developed a voxel-based CT imaging biomarker, referred to as the Parametric Response Map (PRM), that is capable of diagnosing the two major phenotypes in COPD: functional small airways disease (fSAD) and emphysema. For this technology to be fully realized, a commercial grade and regulatory-approved diagnostic analysis and reporting software must be developed. We describe the initial development of a commercial version of the PRM diagnostic software application, and our evaluation of this platform against published results performed on CT data acquired as part of the COPDGene study.

METHOD AND MATERIALS
CT scans of 194 COPD patients were acquired from the COPDGene Study. PRM consisted of spatially aligning parenchymal tissue from inspiratory and expiratory CT scans. Relative volumes of the three components were quantified by summing like-classified voxels and normalizing to the total lung volume. All PRM analyses were performed using the commercial platform and results were compared to previously generated PRM result.

RESULTS
We have implemented a fully integrated and automated diagnostic platform that completes PRM on inspiration and expiration CT scans (Figure 1). We compared the resulting PRM values from the commercial version of the algorithm to those used in the recently published Nature Medicine article1 and found excellent correlation (R^2 = 0.93).

CONCLUSION
The unique property of our PRM implementation is that it is implemented in a cloud computing platform that will allow users to upload the original CT image data, execute the PRM algorithm, then download the results without needing to install software locally. Thus, users can run PRM without purchasing expensive hardware required for this computationally intensive algorithm. It is anticipated that cloud-based access to PRM can be integrated seamlessly into clinical workflow.

CLINICAL RELEVANCE/APPLICATION
PRM provides an objective quantitative assessment of lung disease extent and progression. A commercial grade and regulatory-approved diagnostic analysis will allow PRM to be fully realized.

LL-CHS-MO3A ● Impact of the Hybrid Iterative Reconstruction Technique on Image Quality in Ultra Low Dose 80 kilovoltage Computed Tomographic Pulmonary Angiography (CTPA)

Azien Laqmani (Presenter) ; **Marc Regier** ; **Simon Veldhoen** MD ; **Alexandra Backhaus** ; **Felicia Wassenberg** ; **Gerhard B Adam** MD ; **Hans Dieter Nagel** * ; **Frank Oliver G Henes** MD

PURPOSE
To determine whether an iterative reconstruction (IR) technique (iDose, Philips Healthcare) can reduce image noise and improve image quality in ultra low dose CTPA.

METHOD AND MATERIALS
40 patients (mean body weight, < 80 kg; mean BMI, 23.1) with suspected pulmonary embolism (PE) underwent CTPA with an ultra low dose 80 kV protocol (Brilliance iCT; means: CTDIvol , 2.34 mGy; DLP, 76.45 mGy*cm; effective dose, 1.07mSv). The raw data were reconstructed using filtered back projection (FBP) and three IR level (2, 4 and 6). Two radiologists in consensus assessed subjective image quality and image noise on a scale of 1 (very poor) to 5 (excellent). Conspicuity of PE was assessed in central, segmental and subsegmental arteries using a three-point scale (1, subtle; 2, sufficient; 3, excellent). CT-Attenuation, objective image noise (OIN) and background signal (SIbackgr.) were measured, contrast-to-noise ratios (CNR) and signal-to-noise ratios (SNR) were calculated. Statistical analysis was performed using an unpaired t-test and 1-way analysis of variance (ANOVA).

RESULTS
With each IR level a significant and progressive decrease in subjective and objective image noise was achieved. By implication, SNR and CNR were significantly increased with IR 4 and 6 compared to FBP (p 2 (p
CONCLUSION
The hybrid IR technique with level 4 and 6 significantly reduces image noise and improves image quality in 80kV CTPA protocols.

CLINICAL RELEVANCE/APPLICATION
By the use of IR low dose CTPA with effective doses close to 1mSv are feasible in patients weighing less than 80 kg.

LL-CHS-MO4A ● Percutaneous Cryoablation of Lung Tumors: One Year Follow-up

Claudio Pusceddu MD (Presenter) ; **Barbara Sotgia** ; **Luca Melis** ; **Rosa Maria Fele** ; **Francesco Meloni** ; **Giovanni Battista Meloni**

PURPOSE
To report the data of one year follow-up with CT-guided percutaneous cryoablation (PCA) in patients with primary and secondary pulmonary tumors.

METHOD AND MATERIALS
CT-guided PCA was performed on 46 lung masses (18 NSCLC = 39%; 28 secondary lung malignancies = 61%) in 40 consecutive patients (28 men and 12 women; mean age 65 ± 10 years) not suitable for surgical resection. Lung masses were treated using three types of cryoprobes: IceRod, IceSfere and IceSeed capable of obtaining different size of iceball. The number of probes used ranged from 1 to 5 depending on the size of the tumor. After insertion of the cryoprobes into the lesion, the PCA were performed with two cycles each of 12 min of freezing followed by a 4 minutes active thawing phase and a 4 minutes passive thawing phase for each one for all treatments.

RESULTS
All cryoablation sessions were successfully completed. All tumors were ablated. No procedure-related deaths occurred. Morbidity consisted of 20% (8 of 40) pneumothorax, 7% (3 of 40) pleural effusion and 3% (1 of 40) cases asymptomatic small pulmonary hemorrhage, respectively, all of CTCAE grade 1 (Common Terminology Criteria for Adverse Events). Low density of entire lesion, central necrosis and solid mass appearance were identify in 32 (70%), 8 (17%) and 6 (13%) of cryoablated tumors, respectively. Technical success (complete lack of enhancement) was achieved in 80%, 95%, 91% and 85% of treated lesions at 1-, 3-, 6-, and 12-months CT follow-up scan, respectively. Comparing the tumor longest diameter between the baseline and at 6 and 12 months CT images, technical success was revealed in 91% and 83% cases, respectively.

CONCLUSION
Our preliminary experience suggests that PCA is a feasible and safe treatment option. Well-designed clinical trials with a larger patient population are necessary to further investigate the long-term results and prognostic factors.

CLINICAL RELEVANCE/APPLICATION
Cryoablation of the lung tumors is a safe and effective procedure capable of obtaining complete ablation of the tumor in a high number of patients after one year follow-up.

LL-CHS-MO5A ● Towards a Real-time Diaphragm Positioning System for Aiding in Needle Interventions Targeting Small Thoracic Lesions

Maarten Kroes MSc (Presenter) * ; **Frank De Lange** PhD ; **Yvonne Hoogeveen** PhD ; **Knut Brabrand** MD * ; **Lars Hoff** ; **Leo Schultze Kool** MD

PURPOSE
As breath-holds often cannot be reliably reproduced respiratory motion may compromise image guided needle interventions. Commercially available breath-hold monitors use indirect measures for respiratory motion, e.g. chest wall or abdominal deformation. Purpose of this study was to assess the applicability of a novel motion sensor in monitoring diaphragm movement directly.

METHOD AND MATERIALS
The motion sensor consists of a set of 4 independent 3.5 MHz ultrasound transducers each consisting of 8 piezoelectric elements and mounted in a soft rubber housing, small enough to be fitted between ribs. The difference in acoustic impedance of air relative to tissue provides a strong reflective interface. The reflection may be exploited to monitor the position of the moving diaphragm.
The position sensitive signal of the sensor was sampled every 100 ms and correlated to the position of the diaphragm as derived from simultaneously recorded images from a diagnostic ultrasound system (GE Vivid 5, 30 fr/s) in healthy volunteers. Measurements were taken from more than 30 breathing cycles. For every 500 ms the relative distance to the position of maximal expiration was determined as derived from both monitoring techniques.

RESULTS
In the figure the relative difference in position of the diaphragm as derived from the ultrasound images is compared to the signal derived from the motion sensor over time. The median difference between the two monitoring techniques was 3 mm (range 0-9 mm).

CONCLUSION
We found a strong correlation between the motion sensor signal and diaphragm movement as derived from ultrasound imaging. Future work is to develop a feedback system for the patient to allow self monitoring aiding in reproducible diaphragm positioning.

CLINICAL RELEVANCE/APPLICATION
We developed a motion sensor providing direct feedback on the position of the moving diaphragm, complemented with a feedback system this will allow patients to accurately reproduce breath-holds.

LL-CHE3097-MOA ● Multimodality Imaging Analysis and Diagnostic Algorithm of Congenital and Acquired Cystic Masses of the Mediastinum in the Adult

Francisco Garcia-Morales MD (Presenter) ; **Pramod K Gupta** MD ; **Gregg D Rice** MD

PURPOSE/AIM
1)The purpose of this exhibit is to illustrate with multiple imaging modalities the cystic pathology of the mediastinum as well as imaging pitfalls and the imaging approach based on anatomical localization. 2.To explain with cases the utility of MRI with contrast, the use of diffusion-weighted imaging of the chest in the evaluation of atypical lesions. 3. To discuss the use of trans-esophageal endoscopic ultrasonography (EUS) in selected cases not showing the typical featureas of non complicated cysts and its potential use for diagnosis and tissue sampling.

CONTENT ORGANIZATION
37 cases of mediastinal were reviewed with a combination of imaging tecniques including plain radiographies, computed tomography, magnetic resonance, endoscopic ultrasound and a single case with PET. The lesions were classified as: 1)Mesothelial cysts: pericardial and pleural cysts 2)Foregut cysts: Bronchogenic and esophageal duplication cysts 3)Lymphatic cyst 4)Thymic cysts 5) Mimics

SUMMARY
The imaging findings of the congenital and acquired cystic lesions of the mediastinum and mimics will be illustrated particularly with Computed tomography and the use of Magnetic Resonance Imaging and Endoscopic Ultrasound (EUS) in selected atypical cases. The diagnostic approach based on anatomical location will be discussed.

Chest - Monday Posters and Exhibits (12:45pm - 1:15pm)

Monday, 12:45 PM - 01:15 PM ● Lakeside Learning Center

CH

LL-CHS-MOB ● *AMA PRA Category 1 Credit* ™:0.5

LL-CHS-MO1B ● Pulmonary Abnormal Perfusion Detection Using the Iodine and Air Distributions in Spectral CT Imaging

Yu M Meng MD (Presenter) ; **Wang Dan** MD ; **Bai X Dong** ; **Shen Baozhong** MD, PhD

PURPOSE
To explore the feasibility of evaluating pulmonary perfusion disorders with different pathological changes using the distributions of iodine and air in spectral CT.

METHOD AND MATERIALS
47 patients underwent spectral CT pulmonary angiography (CTPA) imaging on GE Discovery CT750HD scanner. Lung window and Min IP were used to evaluate the air content in pulmonary tissue. Combined iodine-based material decomposition images and monochromatic CTPA images were used to detect the abnormal perfusion location, types and to measure iodine content.Based on the data to analyze the morphology and aeration in abnormal lung parenchyma.

RESULTS
18 patients with no pulmonary embolism (PE)on CTPA had even iodine distribution for the left and right parts of the lung parenchyma (P>0.05), and homogeneous air distribution in Min IP. The iodine contents (IC, in mg/ml) in posterior, mediastinum, bilateral for the lung parenchyma were 1.03, 1.30, and 1.52, presenting gradient distribution from ventral to dorsal. In 12 patients with PE, a total of 186 emboli (56 occlusive and 130 non-occlusive) were found. 92 in 130 showed reduced perfusion(IC,0.62).The air content presented no obvious increment. Perfusion exhibited noticeable reduction in all occlusive clots, (IC,0.13). The air content increased in Min IP(Figure 1). 7 patients with pulmonary infection with 4 ground-glass opacification cases (IC,2.56) and 3 consolidation cases (IC,3.84). Reduced aeration was seen on the Min IP in the areas of hyper-perfusion. The iodine showed diffuse perfusion defect in 6 patients with pulmonary hypertension but normal CTPA. A marked reduction of the pulmonary parenchyma density of 0.48mg/ml and corresponded to increased content of air. In 2 cases of diffuse emphysema, the IC is 0.20. Markedly reduced density in the Min IP matched the areas with reduction of perfusion in the iodine maps. In 2 cases of Interstitial fibrosis, reduced perfusion (IC,-0.07) of the pulmonary parenchyma was found in both cases together with reduced aeration in Min IP(Figure 2).

CONCLUSION
Spectral CT Imaging is able to quantitative measure the content of iodine and the distribution of gas in lungs with different pathological changes, which can be used as a new effective way to detect the pulmonary blood flow / ventilation changes.

CLINICAL RELEVANCE/APPLICATION
lung perfusion with Spectral CT can be evaluated under different pathological conditions, changes in lung function.

LL-CHS-MO2B ● *Individually Optimized Uniform Enhancement in CT Angiography for the Diagnosis of Pulmonary Thromboembolic Disease-A Simulation Study*

Ming Xue (Presenter) ; **Hao H Zhang** ; **Seth J Kligerman** MD * ; **Paul Klahr** PhD * ; **Warren D D'Souza** PhD ; **Wei Lu**

PURPOSE
To improve the diagnostic quality of CT angiography (CTPA) for pulmonary thromboembolic disease by individually optimizing a bi-phasic contrast injection function to achieve targeted uniform contrast enhancement. To compare the results against a previously reported discrete Fourier transform (DFT) approach in a simulation study.

METHOD AND MATERIALS
This study uses a retrospective dataset of 27 consecutive patients. We developed an optimization approach consists of two steps: 1. Compute the impulse enhancement function (IEF) based on the test bolus scan; 2. Optimize the contrast injection function using the IEF in order to achieve uniform target enhancement. We chose a bi-phasic contrast injection function in which the injection rates and durations are optimized by minimizing the difference between its contrast enhancement curve and the uniform target enhancement curve. The optimization method we propose here searches the optimal bi-phasic injection function that conforms to the constraints on injection rate and contrast volume. The contrast volume is limited firstly to the clinical standard of 65 mL and then to the same amount used in the DFT approach. The optimization approach is compared against the DFT approaches in terms of the average root mean square errors (RMSE) from the uniform target contrast enhancement curve and the average contrast volume used.

RESULTS
When the contrast volume is limited to 65 mL, the optimization approach produces contrast enhancement significantly (p

CONCLUSION
The optimization approach generates individually optimized bi-phasic injection functions yielding significantly improved contrast enhancement than the DFT approach. Its implementation in clinic has great potential to improve the diagnostic quality of CTPA.

CLINICAL RELEVANCE/APPLICATION
With limited contrast volume, our proposed method can produce optimal uniform or plateau-like enhancement pattern to help the diagnosis of pulmonary thromboembolic disease (PE).

LL-CHS-MO3B ● MRI Derived Cardiac Mass Is Decreased in Bronchiolitis Obliterans Syndrome (BOS) after Lung Transplantation: A Novel Biomarker for Early Detection of Transplant Failure?

Jan Hinrichs (Presenter) ; **Jens Gottlieb** ; **Julius Renne** MD ; **Christian Schoenfeld** ; **Sajoscha A Sorrentino** MD ; **Marcel Gutberlet** DiplPhys ; **Daniela Wenzel** ; **Tobias Welte** MD ; **Frank K Wacker** MD * ; **Jens Vogel-Claussen** MD

PURPOSE
Bronchiolitis obliterans syndrome (BOS) represents a severe complication following lung transplantation (LTx) and is associated with small airway fibrosis. Currently lung function tests are used as a clinical marker to diagnose BOS with limited sensitivity for early graft failure. This study was undertaken to assess if MRI derived biventricular cardiac mass and function parameters may predict BOS.

METHOD AND MATERIALS
Using 1.5T cardiac MRI, measurements of myocardial structure and function were performed in 51 patients (age and sex matched): 25 women with a mean age of 49 ± 13 years (13 without BOS; 12 with BOS) and 26 men with a mean age of 44 ± 13 years (12 without BOS; 14 with BOS) were examined. Multiple step wise regression analysis was implemented to estimate the relationship of biventricular cardiac mass and function parameters for BOS. T-test and Spearman rho correlation were used.

RESULTS
In a multiple regression analysis including age, sex, days after LTx, mean blood pressure, history of ischemic heart disease, CI, RV and LV EF, EDV/BSA, ESV/BSA and mass/BSA as parameters only LV mass/BSA remained as an independent parameter to predict the presence of BOS (p=0.04, OR=1.19, 95%-CI=[1.036;1.477]). In an ordinal logistic regression model predicting various stages of BOS (BOS 0, BOS1, BOS2 and BOS 3) using the same parameters LV mass/BSA (p=0.03,OR=1.167, 95%- CI=[1.037;1.398]) and days after LTx (p=0,007, OR=0.998, 95%-CI=[0.997;0.999]) were both independent predictors for increasing BOS severity. Patients without BOS showed a significantly higher LV, RV and global myocardial mass compared to patients with BOS (p

CONCLUSION
Reduced LV cardiac mass may serve a novel biomarker for BOS and the severity of BOS in our cohort of lung transplant patients. Further research should evaluate if cardiac mass can predict survival.

CLINICAL RELEVANCE/APPLICATION
LV mass may serve as MRI derived biomarker for detection of lung transplant failure due to BOS.

LL-CHS-MO4B ● Breast Density: Comparison of Chest CT with Mammography

Mary M Salvatore MD (Presenter) ; **Laurie R Margolies** MD ; **Minal Kale** MD ; **Juan Winivesky** MD ; **Claudia I Henschke** MD, PhD ; **David F Yankelevitz** MD * ; **Sean Kotkin**

PURPOSE
Women with dense breast tissue on mammograms have an increased risk of breast cancer. CT scans of the chest allow for evaluation of breast density and could provide important information.

METHOD AND MATERIALS
Institutional Review Board (HIPPA compliant) approval was obtained to perform a retrospective review of the mammogram and chest CT scan of 206 women performed within 1 year of each other. Two board certified radiologists with expertise in mammography and CT scan interpretation independently reviewed the mammograms and CT scans and classified each case into one of the four breast density grades defined by the American College of Radiology Breast Imaging Reporting and Data System (BIRADS).Inter-reader agreements for the mammographic and CT density grades were determined using Cohen�s weighted kappa statistics. The intra-reader correlation coefficient was determined on a subset of CT images.

RESULTS
The inter-reader agreement was higher for the CT than for the mammogram density grades (0.79; 95% CI 0.73 -0.85 vs. 0.62; 95% CI 0.54 � 0.71). The intra-reader reliability of breast density readings on CT was 0.88, at the high end of reliability.

CONCLUSION
Preliminary results suggest that breast density readings on CT are reliable, and may provide important additional risk information on all CT scans of the chest.

CLINICAL RELEVANCE/APPLICATION
CT breast density readings represent an opportunity to provide additional information about the risk of breast cancer that is currently not being used in a standardized manner.

LL-CHS-MO5B ● Development of a Simulation Model for Lung Cancer Screening by Low-dose Computed Tomography: A Validation Study

Marjolein A Heuvelmans BSc (Presenter) ; **Marcel Greuter** PhD ; **Roland Snijder** ; **Harry Groen** ; **Matthys Oudkerk** MD, PhD ; **Geertruida H De Bock**

PURPOSE
The purpose of this study is to develop a lung cancer screening model which can be used for a valid prediction of the outcome of lung cancer screening trials, in order to optimize scenarios for lung cancer screening.

METHOD AND MATERIALS
Included in the lung cancer screening simulation model were the risk to develop lung cancer during life, the sensitivity of low-dose CT, preclinical tumor growth, tumor induction, lung cancer mortality, and mortality due to other reasons. The simulation model was validated by comparing the outcome data of the model with the available data from two recently published lung cancer screening studies, the American National Lung Cancer Screening Trial (NLST) and the Dutch-Belgian Lung Cancer Screening Trial (acronym NELSON).

RESULTS
No significant differences were found by comparing the number of tumors predicted by the model and the number of tumors found in both lung cancer screening studies. Although the model overestimated the mortality rate for the NLST study, it predicted a mortality reduction for lung cancer screening of 22.1% (95%CI: 14.8%-28.9%), which was not significantly different from the published mortality reduction of 20.0% (95%CI: 6.8%-26.7%).

CONCLUSION
The new model can be used for further optimization of different scenarios in lung cancer screening.

CLINICAL RELEVANCE/APPLICATION

Using the developed model, the outcome of lung cancer screening trials in terms of lung cancer mortality reduction can be predicted.

ISP: Chest (Intervention)

Monday, 03:00 PM - 04:00 PM ● S404CD

`IR` `CT` `CH`

SSE05 ● *AMA PRA Category 1 Credit* ™:1 ● ARRT Category A+ Credit:1
Moderator
Jo-Anne O Shepard , MD *
Moderator
David F Yankelevitz , MD *

SSE05-01 ● Chest Keynote Speaker
Jo-Anne O Shepard MD (Presenter) *

SSE05-02 ● Needlescopic Resection of Small Pulmonary Nodule after CT Fluoroscopy-guided Dual Localization with Radiotracer and Hookwire

Jiyoon Park MD (Presenter) ; **Hwan Seok Yong** MD ; **Kyung Won Doo** ; **Hyun Koo Kim** ; **Eun-Young Kang** MD

PURPOSE
The aim of this study was to evaluate the feasibility of a dual localization with radiotracer and hookwire before needlescopic resection for small pulmonary nodule.

METHOD AND MATERIALS
CT fluoroscopy-guided dual marking with hookwire and ^{99m}Tc-phytate was performed on 36 pulmonary nodules of 34 patients just before the needlescopic procedure. This method was carried out through one introducer needle after and initial single-puncture. After detection of the hookwire-marked site through needlescopy, the precise lesion was confirmed using laparoscopic gamma probe by calculating the highest radioactivity. The pulmonary nodule was resected and diagnosed by pathologic examination.

RESULTS
The mean size of the nodules was 12.5±7.4 mm (range, 3~40). Their mean distance from the pleural surface was 5.6±5.8 mm (range, 0~18.7). There were 8 pure ground glass opacity lesions, 7 semisolid lesions and 21 solid lesions. The time of the dual localization procedure was 10.8±3.6 minutes (range 5~18). Pneumothorax was developed in 6 of 34 patients (17.6%) after preoperative localization, but it needed no treatment. Seven hookwires dislodged during the operation. Nevertheless, radiotracer markings detected on a gamma probe guided a successful wedge resection without difficulty in all 7 cases. All nodules were successfully resected under needlescopy except conversion to the 5mm-sized thoracoscopy in 4 patients due to pleural adhesion.

CONCLUSION
Dual marking with radiotracer and hookwire under CT fluoroscopy is a safe and no time consuming procedure, and it has made needlescopy assisted lung resection for small nodules or GGO lesions easier, more convenient, and less hazard in relatively superficial lesions.

CLINICAL RELEVANCE/APPLICATION
Dual localization method is quick and precise technique and recommended for preoperative localization of small nodules or GGO lesions in relatively superficial location.

SSE05-03 ● Pulmonary Hemorrhage Complicating CT-guided Biopsy of Pulmonary Nodules: Risk Factor Analysis in 650 Patients

Mohammed A Alsubhi BMBS (Presenter) ; **Nour-Eldin A Nour-Eldin** MD, MSc ; **Ahmed F Emam** MBBCh ; **Nagy N Nagib** MSc ; **Thomas J Vogl** MD, PhD

PURPOSE
To evaluate the significant risk factors involved in the development of pulmonary hemorrhage during CT-guided Lung of pulmonary Nodules.

METHOD AND MATERIALS
Institutional board approval for the current retrospective study. Patients provided an informed consent for CT-guided biopsy and the anonymous use of the data for research purposes. The study included 650 paients (221 females and 429 males with mean age 56.2 years SD: 5.2) who underwent CT-guided biopsy of pulmonary lesions in the period between january 2008 and January 2013. Factors associated with the development of pulmonary hemorrhage were analyzed including: Age , lesion size, lesion position, coaxial versus non coaxial system, fine needle vs trucut needle. Univariate analysis was performed. P value of < 0.05 was considered as statistically significant. Exclusion criteria for biopsy were abnormal bleeding profile and pulmonary hypertension.

RESULTS
Significant risk factors involved in the development of pulmonary hemorrhage were: lesion size < 1 cm (p=0.03), central lesions (5 cm (p=0.04), basal pulmonary lesions versus apical lesions (p=0.01) and traversing pulmonary vessels in the needle track (p=0.02). No significant correlation for development of pneumothorax was detected in coaxial versus no-coaxial technique. The incidence of pulmonary hemorrhage was 5.8% (38 out of 650). Treatment was only conservative.

CONCLUSION
Significant risk factors involved in the development of pulmonary hemorrhage including small central or basal lesions, long intrapulmonary needle track and traversing pulmonary vessels in the needle track. The management of such condition is only conservative.

CLINICAL RELEVANCE/APPLICATION
The incidence of pulmonary hemorrhage is is associated with certain factors that make certain cases of higher risk.

SSE05-04 ● Detecting Pneumothorax at Very Low Dose MDCT after Intervention. How Low Can We Go?

Adeel R Seyal MD (Presenter) * ; **Marcos P Botelho** MD * ; **Carla B Harmath** MD ; **Fernanda D Gonzalez Guindalini** MD * ; **Mauricio S Galizia** MD ; **Vahid Yaghmai** MD

PURPOSE
To evaluate the effect of different kVp and mAs on MDCT detection of small pneumothorax using different reconstruction algorithms.

METHOD AND MATERIALS
An anthropomorphic chest phantom containing pneumothorax was scanned 15 times, with 80, 100 and 120 kVp and with 10, 20, 40, 75 and 110 mAs. The images were reconstructed with 3-mm slice thickness, using both Filtered Back Projection (FBP) and Sinogram Affirmed Iterative Reconstruction (SAFIRE). Two blinded radiologists evaluated three regions with small pneumothorax (pneumothorax thickness between 1.0 and 2.0 mm) and also a region without pneumothorax. Radiologistsscored each area independently, as 0 (certainly no pneumothorax); 1 (equivocal for pneumothorax) or 2 (certainly a pneumothorax). CTDIvol was recorded to measure radiation dose. Statistical analyses were assessed by frequency and kappa statistics.

RESULTS
Both radiologists scored correctly all 30 cases without pneumothorax, regardless of acquisition settings or reconstruction algorithm. Six out of 90 (6.7%) pneumothoraces were called equivocal by reader 1 and 8 out of 90 (8.9%) by reader 2. Overall agreement between both readers was very good (k=0.85). The two thinnest pneumothorax regions were called equivocal by either one radiologist or the other at the lowest radiation dose settings (80 kVp/10mAs and 80kVp/20mAs), regardless reconstruction kernel. The lowest acquisition parameters that none of the readers had equivocal interpretations were 100kVp/20mAs (0.89mGy).

CONCLUSION
Acquisition settings as low as 100kVp/20mAs (0.89mGy) may be suitable to confidently detect the presence of very small pneumothoraces after intervention, regardless of reconstruction algorithm.

CLINICAL RELEVANCE/APPLICATION
Evaluation of small pneumothorax with MDCT may be confidently performed with very low acquisition parameters. This may help reduce radiation dose for detecting pneumothorax after intervention.

SSE05-05 ● Analysis of Risk Factors Influencing Local Tumor Control in Patients with Pulmonary Nodules after Microwave Ablation (MWA)

Thomas J Vogl MD, PhD (Presenter) ; **Thomas Worst** ; **Nagy N Naguib** MSc ; **Nour-Eldin A Nour-Eldin** MD, MSc

PURPOSE
To evaluate the risk factors predicting local tumor control after microwave ablation (MWA) of primary and secondary lung malignancies $\leq$3 cm in maximum diameter.

METHOD AND MATERIALS
In this retrospective study 91 index tumors (ITs) in 57 patients were treated with single antenna MWA. Time to local progression was monitored using CT over a median follow-up of 10.2 months ± 6.2 (range, 6.0 - 29.2). An overall estimated time to local tumor progression was performed via Cox regression model. Factors hypothesized to correlate with ablation response included tumor diameter (15.5mm), tumor shape (round/oval vs. irregular), clear vs. ill-defined tumor margin, adjacency to the pleura, adjacency to bronchi, vessels of $\geq$ 3 mm in diameter located at a maximum of 5 mm from the IT, energy applied to IT (26.7 J/mm³) and occurrence of cavernous formations after ablation. A logistic regression model was used to correlate the data.

RESULTS
Local tumor progression occurred in 30/91 (33%) ITs, seen in 21/57 (36.8%) patients. Mean time to local tumor progression was 8.3 months (± 5.5; range, 2.1 - 25.2) (median, 22.6 months ± 12.4 months). Risk factors significantly correlating with local tumor progression were >15.5 mm (p
CONCLUSION
Independent predicting factors for local tumor progression in primary and secondary lung neoplasms $\leq$3cm in diameter are irrgular IT shape and
CLINICAL RELEVANCE/APPLICATION
Irregular IT shape and <3cm in diameter.

SSE05-06 ● Percutaneous Computed Tomography (CT)-guided Transthoracic Needle Lung Biopsy (TTNLB) in Patients with Hematologic Malignancies: Diagnostic Yield, Safety and Clinical Outcomes

Ruth M Dunne MBBCh (Presenter) ; **Gowri Satyanarayana** ; **Driele Peixoto** ; **Francisco M Marty** MD ; **Ritu R Gill** MBBS *

PURPOSE
To evaluate the diagnostic utility and safety of CT-guided TTNLB in patients with hematologic malignancies and impact on clinical outcomes.

METHOD AND MATERIALS
This IRB-approved HIPAA-compliant study included consecutive patients with hematological malignancies who underwent TTNLB procedures between July 1, 2007 and June 30, 2012. Demographic, clinical and pathological data were collected. Both cyto-pathologic and microbiologic results were also assessed. Complications and hospital admission stays were recorded. Primary outcome measures were diagnostic efficacy, defined by number of procedures, which provided a specific diagnosis of either malignancy or infection; and safety defined, by number and type of complications per procedure. Secondary outcome measure was change in therapy based on the diagnostic yield. Statistical analysis were performed to determine univariate and multivariate predictors of diagnostic efficacy and frequency and severity of complications.

RESULTS
108 patients underwent 114 TTNLB procedures, resulting in established specific diagnoses in 37.7% (43/114) of procedures: 26 (22.8%) lesions were consistent with malignancy and 17 (15%) were infective etiologies. The most common underlying malignancy was non-Hodgkin lymphoma in 39% (42/108) of patients. Biopsied lesion median diameter was 3.1cm (range, 0.7-14.2 cm; interquartile range, 2.1-5.5cm), lesions were most frequently located in the left lower lobe (31/114 [27.2%]); were pleural-based in (73/114 [64%]); had surrounding ground glass opacification in (59/114 [51.8%]). Complications occurred in 31 (27%) of 114 procedures: small volume hemoptysis in 4 (3.5%) procedures and pneumothorax in 28 (24.5%) procedures, three requiring chest tube placement. Pneumothorax incidence was significantly associated with larger (18-G) biopsy needle use and longer lesion distance from pleura (p>0.05). The results of TTNLB led to changes in antimicrobial or oncological therapy in 46(44.7%) of the 103 patients with adequate follow-up.

CONCLUSION
TTNLB is a safe diagnostic procedure in patients with hematologic malignancies with the potential of making specific diagnoses with minimal morbidity and can positively affect patient management.

CLINICAL RELEVANCE/APPLICATION
TTNLB in patients with hematologic malignancies is useful as it may establish specific diagnoses for which targeted treatments are available and can be performed safely with minimal morbidity.

RSNA Diagnosis Live™: Chest and Abdomen

Monday, 04:30 PM - 06:00 PM ● E450A

GI CH

SPDL21 ● *AMA PRA Category 1 Credit* ™:1.5
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.
ABSTRACT
URL

Hot Topic Session: Lung Adenocarcinoma - Evolving Concepts

Tuesday, 07:15 AM - 08:15 AM ● E351

`OI` `CH`

SPSH30 ● *AMA PRA Category 1 Credit* ™:1 ● ARRT Category A+ Credit:1
Moderator
Ella A Kazerooni , MD

LEARNING OBJECTIVES
1) To become familiar with the revised lung adenocarcinoma classification scheme. 2) To learn the appropriate imaging technique for detection and characterization of lung adenocarcinomas, particularly part solid and ground glass nodules. 3) To learn appropriate strategies for managing nodules with a ground glass component, including the recommendations from the Fleischner Society.
ABSTRACT
With advances in CT technnology, thinner slices of the whole lungs in a single breath hold has become routine. With the improved resolution, more small nodules, and increasingly more nodules that are partly or entirely ground glass in opacity are detected that ever before. This has become particularly evidennt through the many single are lung cancer screening with low dose CT cohort studies, and the NLST. As nodules have been resected internationally, the need to redefine these largely adenocarcinomas are was needed, resulting in a multisociety effort published in 2011; the details of this revised pathologic classification with imaging correlation be discussed and illustrated. In addition, it has been recognized that part solid nodules (mixed ground glass and solid components) carry a higher risk than pure ground glass nodules, and the latter higher risk than the more ubiquitious solid nodules. Managing these part solid and non solid nodules, together referred to as 'subsolid nodules' should therefore be different. In early 2013 the Fleischner Socity published new recommendations for how to manage solitary and multiple subsolid nodules detected on CT as a complement to their earlier recommendations for managing indeterminate lung nodules which dealt with solid nodules, The details of the subsolid nodule management recommendations will also be discussed. Recommended reading: 1) Recommendations for the Management of Subsolid Pulmonary Nodules Detected at CT: A Statement from the Fleischner Society. Radiology. 2013 Jan;266(1):304-17 http://radiology.rsna.org/content/early/2012/10/10/radiol.12120628.full 2) International Association for the Study of Lung Cancer/American Thoracic Society/European Respiratory Society International Multidisciplinary Classification of Lung Adenocarcinoma. J Thorac Oncol. 2011 Feb;6(2):244-85 http://www.ncbi.nlm.nih.gov/pubmed/21252716
URL
http://radiology.rsna.org/content/early/2012/10/10/radiol.12120628.full http://www.ncbi.nlm.nih.gov/pubmed/21252716

SPSH30A ● The Revised Lung Adenocarcinoma Classification: Justification and Radiologic-Pathologic Correlation

William D Travis (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSH30B ● The Radiologist Approach to Lung Adenocarcinomas: Imaging Technique, Reporting, and Management Recommendations

David P Naidich MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

High-Resolution CT: A Pattern-based Approach (An Interactive Session)

Tuesday, 08:30 AM - 10:00 AM ● E450A

`CT` `CH`

RC301 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5

RC301A ● High-Resolution CT: Principles and Anatomic Considerations

Gerald F Abbott MD (Presenter) *

LEARNING OBJECTIVES
1) To define and illustrate the anatomic structures that form the basis of high resolution CT (HRCT) imaging of the lung. 2) To define and illustrate the anatomic basis of the most common imaging patterns detected on HRCT.

RC301B ● High-Resolution CT: Patterns and Differential Diagnoses

Brett M Elicker MD (Presenter)

LEARNING OBJECTIVES
1) Identify common findings and patterns on high resolution CT of the lung. 2) Give focused differential diagnoses based on a combination of HRCT findings and clinical information. 3) Understand the role of HRCT in diagnosis in relation to clinical and pathologic results.

RC301C ● High-Resolution CT: Unknown Cases

Sujal R Desai MBBS (Presenter)

LEARNING OBJECTIVES
1) To understand the key relationship between high-resolution CT (HRCT) patterns and macroscopic histopathologic changes in diffuse interstitial lung diseases (DILD). 2) To learn the characteristic HRCT appearances of DILDs in which a confident (and accurate) radiologic diagnosis can be made. 3) To appreciate the importance of atypical and overlapping HRCT features in many DILDs.

Pediatric Radiology Series: Chest/Cardiovascular Imaging I

Tuesday, 08:30 AM - 12:00 PM ● S102AB

VSPD31 • *AMA PRA Category 1 Credit* ™:3.25 • ARRT Category A+ Credit:3.5
    Moderator
    Shreyas S Vasanawala , MD, PhD *
    Moderator
    Taylor Chung , MD
    Moderator
    Daniel W Young , MD

VSPD31-01 ● State of the Art MRI and MRI of Congenital Heart Disease

Frandics P Chan MD, PhD (Presenter) *

LEARNING OBJECTIVES
1) To review the MRI environment and anethesia requirements for pediatric patients with congenital heart disease. 2) To understand what MRI can do that echocardiography or catheter angiography cannot, and how this is used to advantage in congenital heart disease. 3) To explore advanced techniques, such as four-dimensional phase contrast imaging, real-time imaging, and non-contrast coronary angiography, that can expedite and increase the capability of cardiac MRI studies.

ABSTRACT
Cardiac MRI is an established imaging tool for the assessment of congenital heart disease in children and adults. The lack of oncogenic radiation makes MRI the preferred tool over CT. However, in young patients who require general anesthesia, the imager should be familiar with the risks involved. While usually safe, general anesthesia has heightened risk in patients with aortic obstruction, pulmonary hypertension, arrhythmia, and ventricular failure. In current clinical practice, the three-dimensional capability of cardiac MRI is used to accurately assess ventricular volume and function. Flow measurement by two-dimensional phase contrast is used to assess shunt ratio, cardiac output, and valvular regurgitation. Comprehensive cardiac MRI examination for a patient with complex congenital heart disease can be time-consuming, and it requires an MRI operator with considerable skill and knowledge of cardiac anatomy. Four-dimensional phase contrast imaging capture a volume of the cardiac anatomy and flow physiology, which can be analyzed by post-processing, thereby simplifying the scan protocol and shortening the study time. Other advanced MRI techniques include real-time and pseudo-gated imaging for fetal studies, delayed-enhancement of myocardium for endocardial fibroelastosis, and MR coronary angiography for coronary anomalies.

VSPD31-02 ● Clinical Validation of Free Breathing Navigator Triggered Retrospectively Cardiac Gated Cine Steady-state Free Precession (NAV-SSFP) Imaging in Sedated Children

Lamya A Atweh MD (Presenter) ; **Amol Pednekar** PhD * ; **Siddharth P Jadhav** MD ; **Esben S Vogelius** MD ; **Raja Muthupillai** PhD * ; **Rajesh Krishnamurthy** MD *

PURPOSE
The cine steady-state free precession (SSFP) is the preferred sequence for ventricular function evaluation, however it requires suspended respiration which is difficult in sedated children. Many groups perform multi-NSA acquisitions (MN) during free breathing. In this work, we validate a navigator triggered SSFP (NAV-SSFP) sequence that drives the magnetization to steady-state before cardiac gated cine acquisition in the sedated free-breathing pediatric population.

METHOD AND MATERIALS
This prospective study was performed with IRB approval on 20 sedated children with congenital heart disease (age: 7±6 yrs, HR: 97±22 bpm, RespR: 22±9 bpm). The cine SSFP sequence was modified to include respiratory triggering with Navigator [1]. Imaging was performed on a 1.5T MR scanner. Identical imaging parameters were used for MN (4 NSA) and NAV sequences, covering both ventricles in short-axis orientation (TR/TE/flip angle: 3/1.5/60�; acquired voxel size: 1.3-1.6 x 1.3-1.8 x 4-9.5 mm3; SENSE acceleration factor: 2; temporal resolution: 30-45 ms). Image quality assessment (Figure 1) and quantitative volumetric analysis was performed by a single blinded user. One-sided Wilcoxon signed rank test and Box plot analysis were performed to compare the clinical scores. Bland-Altman (BA) analysis was performed on LV and RV volumes.

RESULTS
The clinical scores for NAV-SSFP were consistently better than MN-SSFP (Table 1). Total score with equal weights to each clinical score category was significantly better for NAV compared to MN. EDef scores were significantly better for NAV-SSFP than MN-SSFP. ISA scores were identical. The BMC scores were not significantly different. BA analysis for LV volumes indicates that variability between NAV and MN acquisitions is comparable to inter and intra-observer variability reported in the literature (Table 2) [2]. Total scan duration for NAV-SSFP (4.1±1.6 min) was shorter than MN-SSFP (5.2±0.8 min).

CONCLUSION
Modifying the cardiac gated cine SSFP sequence for free-breathing and navigator triggering allows clinically diagnostic images in sedated patients without penalty for contrast, spatio-temporal resolution, or total scan time while significantly decreasing RF duty cycle and improving spatial detail. 1 ISMRM 3938, 2012 2 JMRI 28(39-50), 2008

CLINICAL RELEVANCE/APPLICATION
Free-breathing navigator triggered cine SSFP allows diagnostic images in sedated patients with improved spacial resolution and shorter scan times.

VSPD31-03 ● Noninvasive 4D Pressure Difference Mapping Derived from 4D Flow MRI in Patients with Repaired Aortic Coarctation: Comparison with Young Healthy Volunteers

Fabian Rengier MD (Presenter) ; **Michael Delles** DiplEng ; **Joachim Eichhorn** MD ; **Hendrik Von Tengg-Kobligk** MD * ; **Hans-Ulrich Kauczor** MD * ; **Roland Unterhinninghofen** PhD ; **Sebastian Ley** MD

PURPOSE
In patients with aortic coarctation, pressure measurements before and after repair currently are obtained by invasive catheterization or by echocardiography using the Bernoulli equation. Purpose of this study was to assess spatial and temporal pressure changes in patients with repaired aortic coarctation compared to young healthy volunteers using 4D flow MRI and derived 4D pressure difference maps.

METHOD AND MATERIALS
4D flow MRI of the thoracic aorta was performed at 1.5T in 13 patients after aortic coarctation repair without recoarctation (mean age 18.8 years, 5 female, 8 male) and 13 healthy volunteers (mean age 22.9 years, 4 female, 9 male). Spatial/temporal resolution was 1.6x1.6x2.1mm³/28ms. Using published algorithms and in-house developed image processing software, 4D pressure difference maps relative to the proximal ascending aorta were computed based on the Navier-Stokes equation. The thoracic aorta was divided into four segments: ascending aorta, aortic arch, proximal descending aorta and distal descending aorta. For each segment, spatial pressure range at mid systole and maximum slope of local pressure amplitudes were calculated.

RESULTS
Mean spatial pressure range at mid systole for patients/volunteers was (in mmHg): ascending aorta 1.8/1.6 (p=ns), arch 4.8/1.7 (p=0.02), proximal descending 8.9/1.6 (p
CONCLUSION
Noninvasive 4D pressure difference mapping derived from 4D flow MRI showed significant spatial and temporal changes in patients with repaired aortic coarctation compared to young healthy volunteers, particularly affecting aortic arch and proximal descending aorta, but also distal descending aorta. The technique can characterize such changes not only noninvasively but also in greater detail than echocardiographic pressure gradient measurements.

4D pressure difference mapping can characterize spatial and temporal changes of intraluminal aortic pressure and may evolve into a noninvasive alternative to catheterization in coarctation follow-up.

VSPD31-04 ● Assessment of Conduit Size prior to Percutaneous Pulmonary Valve Replacement: Which MR Sequence Is Best?

Ladonna J Malone MD (Presenter) ; **Jane Gralla** ; **Uyen Truong** ; **Brian Fonseca** ; **Thomas Fagan** MD ; **Lorna Browne** MD, FRCR

PURPOSE
The advent of percutaneous pulmonary valve replacement (PVR), providing a nonsurgical approach to the management of severe pulmonary regurgitation in patients with right ventricle to pulmonary artery (RV-PA) conduits, has transformed treatment of patients with repaired congenital heart disease. Cardiac MRI (CMR) is increasingly relied upon to determine candidacy for percutaneous PVR using angiographic size criteria. In order to optimize the CMR assessment, our goal was to determine which pulse sequence had the best agreement with conventional angiographic measurement of the right ventricle to pulmonary artery (RV-PA) conduit obtained during percutaneous PVR.

METHOD AND MATERIALS
15 patients had CMR performed prior to percutaneous PVR procedure. Measurements of the narrowest diameter of the RV-PA conduit were obtained on the following sequences: cine gradient echo (GE) at end-systole and at end-diastole, T1 TSE obtained in systole, 3D gadolinium enhanced MRA, and 3D SSFP. Multiplanar reformats using 3D reconstruction software were used to measure both AP and transverse dimensions on 3D sequences, but only AP diameters if an RVOT plane was obtained (cine GE and T1 TSE). These were compared to angiographic measurements using Bland Altman plots and Intraclass Correlation Coefficient (ICC).

RESULTS
Cine GE measurements at end-systole had the best agreement with angiogram with a mean difference of 0.8 mm (95% limits of agreement -3.86 to 5.46 and ICC 0.75). The AP dimension on 3D MRA also had a high ICC (0.85) and a relatively narrow 95% limits of agreement (-0.89-5.67), but demonstrated a consistent over-measurement bias with a mean difference from angiogram of 2.39 mm. The 3D SSFP measurements demonstrated the worst agreement, likely due to inherent artifacts in stenosed conduits. Slow flow artifact on T1 TSE impaired accurate measurement in irregularly calcified conduits.

CONCLUSION
RV-PA conduit measurements obtained from cine GE at end-systole and 3D MRA demonstrate strongest agreement with conventional angiographic measurements in evaluating percutaneous PVR candidacy.

CLINICAL RELEVANCE/APPLICATION
Standardization of RV-PA conduit measurements with improved angiographic agreement should decrease incidence of unsuccessful percutaneous PVR procedures related to failure to meet size criteria.

VSPD31-05 ● Noninvasive Quantification of Aortopulmonary Collateral Flow and Intracardiac Shunt Flow for the Patients who Underwent Bidirectional Glenn Shunting

Rongpin Wang MD (Presenter) ; **Qiping Deng** MD ; **Meiping Huang** MD

PURPOSE
To explore the feasibility of calculating aortopulmonary collateral flow (APCF) and intracardiac shunt flow (ICSF) in patients underwent bidirectional Glenn shunt (BGS) by using phase-contrast MRI (PC-MRI) sequence.

METHOD AND MATERIALS
Twenty-two BGS patients (patient group) and 15 healthy volunteers (control group) were performed at 3.0 tesla MR system by using PC-MRI sequence to measure the flow of great vessels of right pulmonary artery (RPA), left pulmonary artery (LPA), ascending aorta (AA), superior vena cava (SVC) and inferior vena cava (IVC). The quantity of AA (Q_S), pulmonary (Q_P) and venous return (Q_V) per minute were calculated by using Report Card software. APCF and ICSF was calculated as the formula: $APCF = Q_S - Q_V$, $ICSF = 2Q_S - (Q_V + Q_P)$. The end-diastolic volume index (EDVI) of major ventricle were performed with cine-MRI sequence, and the regurgitation area of atrioventricular valve were measured with ultrasound cardiography. The difference of Q_P, Q_S and Q_V and blood flow of great vessels intragroup were assessed by using paired samples t-test. The relationship of ICSF with EDVI of major ventricle and with the regurgitation area of atrioventricular valve was evaluated with correlation and regression analysis.

RESULTS
In control group, Q_P: Q_S: Q_V were found to be 1: 1.009: 0.974. In patient group, Q_S was found significantly higher than Q_V, and Q_V was significantly higher than Q_P. The blood flow of great vessels in patient group were found to be significantly lower than that of in control group except the flow of AA, while the regurgitation fraction of great vessels in patient group were found to be significantly higher than that of in control group. The APCF ranged from 0.23 to 1.63 l/min/m² (mean 0.88 l/min/m²), and the ICSF ranged from 0.22 to 1.29 l/min/m² (mean 0.61 l/min/m²). A positive relationship between ICSF and EDVI and the regurgitation area of atrioventricular valve were found ($r=0.685$, and $r=0.806$).

CONCLUSION
The parameters of blood flow of great vessels can be reliably measured with PC-MRI sequence on 3.0 tesla MR system. And then, the SPCF and ICSF can be calculated.

CLINICAL RELEVANCE/APPLICATION
The APCF and ICSF can be calculated simultaneously in BGS patients by using phase-contrast MRI sequence, which may play an important role for therapeutic decision-making and evaluating prognosis.

VSPD31-06 ● Evaluation of the Pulmonary Vasculature in Mouse Models of Congenital Diaphragmatic Hernias

Michael Phillips ; **Daku Siewe** BS (Presenter) ; **Joshua C Tan** ; **Scott Moore** ; **Sean McLean** ; **Yueh Z Lee** MD, PhD *

PURPOSE
Congenital diaphragmatic hernia (CDH) is a common birth defect that leads to pulmonary hypertension. Decreased arterial development in the lung contributes to the pulmonary hypertension observed in CDH. The Slit3 knockout mouse is a viable mouse model for CDH that develops pulmonary hypertension (PHtn). We sought to quantitatively assess pulmonary artery blood vessel development using specimen CT scanning of the perfused pulmonary vasculature of mouse models of CDH.

METHOD AND MATERIALS
We perfused the pulmonary vasculature of 3 month old Slit3 wild type mice (no hernia) to Slit 3 knock mice (CDH/PHtn) using a radio-opaque material (microfil) with density tailored to minimize venous contamination. Vessel overfill was determined through examination by microscope. The mouse lungs with the filled vasculature were excised and scanned on a specimen scanner (Scanco microCT 40) at 8 micron resolution. The data was transferred for offline analysis using iNtuition (Terarecon). Vessel branching, length and diameter were measured.

RESULTS
5 wildtype (Slit3) and 5 CDH (Slit3 KO) were scanned. Severe hypoplasia was evident in the lungs from the CDH mice. Total lung volume was decreased in the knockout mice, consistent with the presence of a CDH. Vessel overfill The pulmonary vasculature was also altered, reflecting the abnormal development. Branch by branch vessel quantitation analysis is ongoing.

CONCLUSION
Quantitative analysis of pulmonary vasculature specimens from mice is readily feasible, providing a powerful new tool for the evaluation of mouse models of disease that effect the lung and lung development. We hope to combine our novel methods of in-vivo and ex-vivo imaging of these mouse models of CDH to add to the armamentum of pediatric radiologists. Though the imaging and analysis approaches are demonstrated in mice, the techniques may be readily translatable to clinically relevant imaging.

CLINICAL RELEVANCE/APPLICATION
Quantitiative measures of the pulmonary vasculature are possible in mouse models of CDH, enabling a powerful tool for the evalution of treatment effects that may be translated into children with CDH.

VSPD31-07 ● High Temporal versus High Spatial Resolution in MR Quantitative Pulmonary Perfusion Imaging of 2-year Old Children after Congenital Diaphragmatic Hernia Repair

Meike Weidner (Presenter) ; **Frank G Zoellner** ; **Claudia Hagelstein** MD ; **Stefan O Schoenberg** MD, PhD * ; **Katrin Zahn** ; **Thomas Schaible** ; **Lothar R Schad** PhD ; **Wolfgang Neff** MD, PhD

PURPOSE
Congenital diaphragmatic hernia (CDH) leads to lung hypoplasia. Using dynamic contrast enhanced (DCE) MR imaging, lung perfusion can be quantified. As according to simulations absolute MR perfusion values depend on temporal resolution, we compared two different MR protocols to investigate firstly if impaired ipsilateral lung perfusion is present with both protocols in 2-year old children after CDH repair, secondly if simulation results can be confirmed and thirdly which protocol should be preferred.

METHOD AND MATERIALS
DCE-MRI was performed in 36 children after CDH repair using a 3D TWIST sequence. Two MR protocols were applied: protocol A (n=18) based on a high spatial (3.0sec;voxel size:1.25x1.25x1.25mm3) and protocol B (n=18) on a high temporal resolution (1.5sec;voxel size:2x2x2mm3). 0.05mmol/kg body weight of contrast agent (Dotarem, Guerbet, France) was administered. Pulmonary blood flow (PBF) was calculated for both lung sides by placing 6 cylindrical regions of interest (ROI), apical, middle and basal, in the ventral and the dorsal lung, respectively. Peak signal to noise ratio (PSNR) was calculated.

RESULTS

CONCLUSION
In 2-year old children after CDH repair ipsilateral lung perfusion is significantly reduced. Higher temporal resolution and increased voxel size show a gain of PSNR and significantly decrease the underestimation of PBF. Protocol B should therefore be preferred, as a 2 mm3 isotropic voxel resolution is sufficient to detect side-differences of lung perfusion.

CLINICAL RELEVANCE/APPLICATION
In the long-term follow up of children after CDH, MR-perfusion imaging can help to quantify lung impairment without ionizing radiation. A temporal resolution of 1.5 sec is advisable.

VSPD31-08 ● Translational Experience in the Treatment of Duchenne Muscular Dystrophy (DMD) by Intra-arterial Transplantation of Mesoangioblasts (MABs): From a Toxicity Study in 10 Beagle Dogs to the First, Phase-1 Study in 3 Dystrophic Children

Massimo Venturini MD (Presenter) ; **Giulio Cossu** ; **Letterio S Politi** MD ; **Michele Colombo** ; **Giulia Agostini** ; **Alessandro Del Maschio** MD

PURPOSE
Literature lacks of complete, single-center translational studies. DMD, a genetic syndrome characterized by progressive absence of dystrophin protein, causes progressive muscle degeneration, paralysis and death. Corticosteroids are not effective, while novel therapies (gene/stem cells) are on work. Our aim was to assess MABs intra-arterial infusion in Beagle dogs and, subsequently, in 3 dystrophic children, at escalating dose, to preliminarily assess the safety.

METHOD AND MATERIALS
Every 3 weeks, 10 dogs, under immunosuppressive treatment (cyclosporine-A), were submitted to 4 intra-arterial infusions each (2 in one lower limb, 2 in aorta), of either MABs (n=6) or placebo (n=4). Dogs were sacrificed to assess toxicity after 251 days. One year later, after the approval on behalf of the institutional ethical committee and obtaining written informed consent from the children�s parents, every 2 months 3 DMD children (mean age=10 years) under immunosuppressive treatment (tacrolimus) were submitted to 4 allogeneic MABs intra-arterial infusions each (2 in one lower limb, 2 multidistrict) using a 4-Fr introducer/catheter. Efficacy was assessed every 2 months by quantitative strength measurements (Kin-Com-test) and thighs/legs fibro-fatty degeneration/quantification (MRI), and after 8 months by gastrocnemius biopsies.

RESULTS
No mortality related to MABs in Beagle dogs was recorded. The 12 intra-arterial MABs infusions were regularly performed with no peri-procedural complications, except for one successfully treated vasospasm. The only relevant complication was 1 focal thalamic ischemia of 1-cm (MRI) that occurred 5 hours after the fourth infusion, after sporadic atrial fibrillation (ECG) (Atrial-fibrillation-related-thrombosis? Late vasospasm?), without consequences. Relative stabilization/decrease in disease progression was observed. At MRI, a stabilization of fibro-fatty degeneration was more evident in the child treated at an earlier disease stage.

CONCLUSION
Our translational experience about MABs intra-arterial transplantation in DMD, showed no signs of toxicity in beagle dogs and a relative safe and partial effective in dystrophic children, with encouraging future perspectives.

CLINICAL RELEVANCE/APPLICATION
In DMD, a major MABs intra-arterial concentration, transplanted exclusively in the lower limbs, at an early disease stage, could determine an improvement of dystrophin restoration and clinical impact.

VSPD31-09 ● Coronary Artery Imaging in Children

Cynthia K Rigsby MD (Presenter)

LEARNING OBJECTIVES
1) To provide an overview of the imaging modalities used to image coronary arteries in children. 2) To show examples of anomalies of coronary artery origin, course, and termination. 3) To illustrate coronary artery anomalies associated with congenital heart disease. 4) To demonstrate coronary artery findings in Kawasaki disease.

ABSTRACT
Coronary artery anomalies can be classified as anomalies of origin and course, anomalies of coronary termination, coronary anatomy with congenital heart disease and acquired coronary abnormalities. Normal coronary artery anatomy and an imaging focused discussion of each of the different type of coronary abnormalities will be presented.

VSPD31-10 ● Correlation of CT and MR findings with Surgery for Anomalous Aortic Origin of Coronary Arteries (AAOCA)

Lamya A Atweh MD (Presenter) ; **Carlos M Mery** MD ; **Prakash M Masand** MD ; **Silvana M Lawrence** MD, PhD ; **Dean E McKenzie** ; **Rajesh Krishnamurthy** MD *

PURPOSE

Anomalous aortic origin of the coronary artery (AAOCA) is commonly evaluated with magnetic resonance imaging (MRI) or computed tomography (CT) prior to surgery. Imaging targets include ostial location and morphology, intramurality, and presence of proximal stenosis. Precise description of the AAOCA morphology is important for surgical planning. Our objective is to correlate CT and or MRI with surgical findings in this high-risk population.

METHOD AND MATERIALS
IRB approval was obtained for our retrospective study. We identified all patients with AAOCA who were operated at our institution from 2003-2013. Patients who had no imaging available for review were excluded. Imaging was reviewed by a pediatric radiologist with 13 years of experience in cardiac imaging who was blinded to the results of the surgeries. Studies were assessed for the type of AAOCA, location and morphology of the anomalous ostium, right-left ostial relationship, and presence and length of intramural course. Surgical findings were reviewed for the same variables. The imaging interpretations were compared to the surgical data for concordance.

RESULTS
The patient population consisted of 16 patients (M:F = 10:6; age: 10 years ± 5), with 8 CT and 10 MR exams. 2 patients had both MRI and CT. CT was more accurate than MRI for all imaging targets (Table). MRI accurately predicted the type of coronary artery anomaly (90%) and ostial location (80%), but fared poorly in predicting type of R-L ostial relationship (60%), ostial morphology (10%) and intramurality (30%). Apart from its high accuracy for imaging targets, CT also provided virtual angioscopic views of the ostia that simulated surgical exposure.

CONCLUSION
CT is more accurate than MRI for characterization of critical imaging targets of AAOCA.

CLINICAL RELEVANCE/APPLICATION
CT is more accurate than MRI in defining ostial morphology, ostial relationship and intramural course and should be the imaging method of choice for AAOCA.

VSPD31-11 ● Compression of the Left Anterior Descending Artery during Percutaneous Pulmonary Valve Replacement: The Protective Role of Epicardial Fat?

Ladonna J Malone MD (Presenter) ; **Uyen Truong** ; **Brian Fonseca** ; **Thomas Fagan** MD ; **Lorna Browne** MD, FRCR

PURPOSE
The advent of percutaneous pulmonary valve replacement (PVR), providing a nonsurgical approach to the management of severe pulmonary regurgitation in patients with right ventricle to pulmonary artery (RV-PA) conduits, has transformed treatment of patients with repaired congenital heart disease. Extrinsic compression of the left anterior descending artery (LAD) during percutaneous PVR is a rare but potentially catastrophic complication, necessitating preoperative selective coronary angiogram with test balloon inflation to assess risk. If LAD occlusion is demonstrated, the percutaneous PVR is aborted. Cardiac MRI (CMR) is the gold standard in measuring RV size and optimal timing of PVR. Although LAD anatomy is well delineated on CMR, the minimum separation between the RV-PA conduit and LAD that would prevent LAD compression is unknown.

METHOD AND MATERIALS
16 patients underwent CMR prior to percutaneous PVR. Prior to PVR, 2 patients demonstrated extrinsic compression of the LAD during test balloon inflation while the other 14 did not. CMRs in both groups were retrospectively reviewed and the following data recorded in each: i) shortest distance between LAD and RV- PA conduit, ii) presence of circumferential epicardial fat surrounding the LAD, iii) thickness of conduit calcification, iv) proximal LAD course and v) relative position of the great vessels. Mean distance and minimum distance between LAD and RV-PA conduit were calculated in all patients and parameters in both patient groups compared.

RESULTS
In patients without extrinsic LAD compression, the mean distance from LAD to RV-PA conduit was 6.8 mm. The minimum distance was 1.6 mm. All these patients demonstrated a circumferential cuff of epicardial fat between the LAD and RV-PA conduit. Both patients with LAD compression had no measureable distance (0 mm) between the conduit wall and LAD, and a circumferential cuff of epicardial fat was absent. There was no significant difference in conduit calcification thickness between the two groups.

CONCLUSION
A circumferential cuff of epicardial fat between the LAD and RV-PA conduit decreases risk of extrinsic LAD compression during percutaneous PVR.

CLINICAL RELEVANCE/APPLICATION
The absence of a circumferential cuff of epicardial fat between the LAD and RV-PA conduit on a pre PVR CMR should raise concern for potential LAD compression during percutaneous PVR.

VSPD31-12 ● Cardiovascular CT in Neonates and Infants: Comparison of Effective Radiation Dose between Target-mode Prospective EKG-gated Volumetric CT Using 320 Detector Scanner and Ungated CT Using 64-slice Scanner

Siddharth P Jadhav MD (Presenter) ; **Prakash M Masand** MD ; **Rajesh Krishnamurthy** MD *

PURPOSE
The target mode of prospective EKG gating with the volumetric 320 detector scanner provides cardiac pulsation-related motion compensation for cardiovascular imaging without increasing radiation exposure when compared to ungated volumetric studies. The objective of this study is to compare target mode volumetric imaging (320) to ungated 64 slice imaging (64) for cardiovascular studies in neonates and infants for image quality, diagnostic efficacy and radiation exposure.

METHOD AND MATERIALS
Following IRB approval, a retrospective evaluation of our experience with CTA for cardiovascular indications in neonates and infants aged 0-6 months was performed. 29 patients who underwent ungated imaging with 64 slice scanner from 2010-2012, and 22 patients who underwent volumetric imaging with the target protocol on the 320 detector scanner in 2012-2013 were included. Parameters collected included clinical history, indication for CT, qualitative assessment of image noise and pulsation related blurring, diagnostic efficacy, and radiation dose parameters (CTDI and DLP). Comparison was made to catheterization data and surgical reports for diagnostic accuracy.

RESULTS
The distribution of clinical indications was comparable between the 64 and 320 groups, and included status of branch pulmonary arteries in Tetralogy of Fallot, evaluation of aortopulmonary collaterals or ductal dependent pulmonary flow in pulmonary atresia, anomalous pulmonary venous return, pulmonary vein stenosis, coarctation, heterotaxy, and vascular mediated airway compromise. All studies were diagnostic for the main clinical indication. Average DLP for target 320 studies was 11.6, with average effective dose of 0.75 mSv using conversion tables from ICRP publication 103. Average DLP for 64 slice studies was 63.88, with average effective dose of 4.31 mSv. The 320 studies resulted in higher image quality related to less pulsation artifact, with visualization of coronary origins in all but one case.

CONCLUSION
Volumetric imaging with the target mode offers several advantages over previous generation scanners for cardiovascular indications in infants, including a 82% reduction in effective dose, ability to perform free-breathing studies, and improved image quality.

CLINICAL RELEVANCE/APPLICATION
Volumetric imaging with target-mode of EKG gating offers improved image quality and reduced radiation dose when compared to 64 slice CT for cardiovascular imaging in neonates and infants.

VSPD31-13 ● Radiation Dose and Image Quality Comparison of Three Scan Schemes in Retrospective ECG-gated Coronary CT Angiography for Pediatric Patients

Zhiming Liu MD (Presenter) ; **Yong Li Cao** ; **Yun Peng** MD

PURPOSE
Retrospective ECG-gated coronary CT angiography (CCTA) is often used in children because of their higher heart rates. In this study, we assessed the image quality and radiation dose of three scan schemes in order to select an optimal retrospective CCTA technique for maximum dose reduction.

METHOD AND MATERIALS
60 consecutive patients (ages: 2months - 13years) were randomly assigned to three groups (20 in each group) for retrospectively ECG-gated CCTA with different tube current (mA) selection schemes. The tube voltage was 80kV, gantry rotation speed was 0.35s and helical pitches were between 0.16 and 0.20 based on patient heart rates for all groups. Group A used a fixed 350mA, group B used ECG modulated mA (350mA for 40-80% cardiac phases and 70mA for other phases), and group C also applied patient-dependent mA selection scheme for ECG modulation. The patient-dependent mA selection method was based on the CT value measurement in the scout view for individual patients. Image quality was assessed and image noise and CTDI value were measured for the three groups, and statistically compared with SPSS13.0.

RESULTS
Image noises and their standard deviations were 25.5±4.3HU, 25.0±4.8HU and 24.8±1.2HU, respectively, with no difference among the three groups (p>0.05). Group C had much less deviation in image noise than groups A and B. There were no statistical difference between image quality scores among the three groups (4.3±0.4, 4.4±0.3 and 4.5±0.4, all p>0.05). The effective doses were 4.39mSv, 3.23mSv and 2.34mSv for groups A, B and C, respectively. Dose reductions of 26% and 47% were achieved for groups B and C, respectively, compared with group A with the use of a fixed mA. Group C with the patient-dependent mA for ECG modulation had the lowest effective dose.

CONCLUSION
Patient-dependent tube current scheme in retrospective CCTA for pediatric patients allows us to achieve a desired and consistent image quality across patient population, with the lowest radiation dose to patients.

CLINICAL RELEVANCE/APPLICATION
Low kVp and patient-dependent mA in retrospective CCTA for pediatric patients allows us to achieve a consistent image quality across patient population, with the lowest radiation dose to patients.

VSPD31-14 ● Head Tracked Stereoscopic Pre-surgical Evaluation of Major Aortopulmonary Collateral Arteries in the Newborns

Frandics P Chan MD, PhD (Presenter) * ; **Sergio Aguirre** * ; **Holly Bauser-Heaton** MD, PhD ; **Frank Hanley** MD ; **Stanton B Perry** MD

PURPOSE
Children born with pulmonary atresia (PA) with major aortopulmonary collateral arteries (MAPCA) undergo early surgery to reconstruct their central pulmonary arteries. This surgery, unifocalization, requires precise mapping of all native vessels supplying the lungs and this is currently accomplished by catheter angiography (CA), with supplemental 3D information from CTA. As each patient has his unique vascular anatomy, visual comprehension can be extremely challenging. A recently developed head tracked stereoscopic system, True 3D, helps user manipulate and inspect �holographic� objects in free space. We test the hypotheses that interpretation of CTA in MAPCA cases using True 3D is faster than and as accurate as traditional tomographic readout.

METHOD AND MATERIALS
With IRB approval, newborns less than 10-days old diagnosed with PA and MAPCA, who had CA and CTA of the chest within 2 weeks, were identified between 2007 and 2011. The CA images were evaluated by an experienced cardiologist for the origins and destinations of each native pulmonary artery and MAPCA to the lung segments. The CTA images were similarly scored by a cardiac radiologist using traditional tomographic readout and True 3D in two sessions separated by 4 weeks. Using CA as the reference standard, sensitivity, specificity, accuracy, these two approaches were calculated. Interpretation times were compared using paired Student�s t-test.

RESULTS
9 newborns (mean weight 3.2kg) produced 25 traceable MAPCAs in addition to native pulmonary arteries. Using an 18-segments lung model, 774 distinct vessel-segment combinations were compared. The sensitivity, specificity, and accuracy of tomographic readout are 81%, 93% and 91% respectively. For True 3D, they are 90%, 91% and 91% respectively. The average time for interpretation is significantly shorter with True 3D, 13 +/- 4 min, than with tomographic readout, 22 +/- 7 min (P=0.0004).

CONCLUSION
This preliminary study demonstrates that head tracked stereoscopic interpretation of complex, minute pulmonary vessels in the newborn is as accurate as traditional readout.. The interpretation time is significantly faster with True 3D, and this is likely due to enhanced visual cognition using the stereoscopic approach.

CLINICAL RELEVANCE/APPLICATION
Advanced digital stereoscopy enhances visual cognition of complex anatomic relationship and is recommended for the evaluation of congenital anomalies of the pulmonary vasculature.

VSPD31-15 ● Determining the Normal Aorta Size in Infants and Children

S. Bruce Greenberg MD ; **Shilpa Hegde** MD (Presenter) ; **Shelly Lensing**

PURPOSE
No adequate standards for determining the normal range of effective diameters of the aorta or iliac arteries in children using CT or MRI exist. Our purpose is to establish normal standards for the effective diameter of the aorta at multiple levels and of the iliac artery origins.

METHOD AND MATERIALS
Chest, abdomen and pelvis computed tomography examinations with intravenous contrast performed in children without cardiovascular disease provided the data sets. Body surface area (BSA) was calculated from patient height and weight for each patient. Children age ranged from 0 to 20 years (mean 9.5 years, sd 5.7). Body surface area ranged from 0.2 to 2.5 meter^2 (mean 1.23 meter^2, sd 0.59). Chest measurements were performed on 88 children and abdomen measurements on 110 children. Double-oblique 1 mm reconstructions were used to measure aorta and iliac artery effective diameter at multiple locations by two pediatric radiologists. Pearson correlation and linear regression compared the body surface area and effective diameter measurements.

RESULTS
The results are summarized in the table. Very strong correlation between BSA and effective diameter were present at all measured levels of the aorta and the iliac arteries. The derived linear regression equations and beta standard error are included in the table. **Aorta or iliac artery level Pearson correlation Effective diameter (mm) Beta S.E.** aorta annulus 0.94 10 + (7.8) BSA 0.30 sinus of Valsalva 0.93 11.8 + (9.5) BSA 0.41 STJ 0.90 8.9 + (8.2) BSA 0.43 Ascending aorta 0.91 9.1 + (8.6) BSA 0.43 Aorta arch 0.93 6.8 + (8.2) BSA 0.35 Isthmus 0.94 6.5 + (7.1) BSA 0.29 Prox desc aorta 0.93 6.5 + (6.6) BSA 0.29 Aorta at diaphragm 0.93 6.2 + (5.2) BSA 0.24 Superior to celiac axis 0.92 5.8 + (5.2) BSA 0.22 Renal artery level 0.91 4.2 + (5.0) BSA 0.22 Distal abdominal aorta 0.91 4.0 + (4.6) BSA 0.21 Right iliac artery 0.88 2.8 + (3.2) BSA 0.17 Left iliac artery 0.89 2.9 + (3.1) BSA 0.16

CONCLUSION
The expected effective diameter for children of any expected body surface area can be calculated from the equations at 8 levels in the chest and three levels in the abdomen. The common iliac artery effective diameters can also be calculated.

CLINICAL RELEVANCE/APPLICATION
The linear regression analysis equations allow radiologists to quantitatively determine if the aorta is hypoplastic or aneurysmal in children rather than rely on subjective impression.

VSPD31-16 ● Imaging of Adolescents and Young Adults with Congenital Heart Disease

Lorna Browne MD, FRCR (Presenter)

LEARNING OBJECTIVES
1) Describe the relevant complex cardiac anatomy encountered in CHD adolescents and young adults, many of whom have undergone prior surgical repairs. 2) Describe the most likely lesions encountered in CHD adolescents and young adults. 3) Discuss some common surgical repairs and encountered complications. 4) Determine appropriate MR protocols for evaluating congenital heart disease according to the anatomic, pathologic, and hemodynamic characteristics of the defect and type of previous surgical repair. 5) Discuss the main clinical questions that are specifically posed in individual cases of pre and post operative CHD in adolescents and young adults.

Chest (Functional Lung/ Perfusion)

Tuesday, 10:30 AM - 12:00 PM ● S404CD

MR   CH

Back to Top

SSG04 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5
   Moderator
   Mark L Schiebler , MD *
   Moderator
   Martine J Remy-Jardin , MD, PhD *

SSG04-01 ● CT- PRM: A Novel Imaging Biomarker of Small Airways Disease in Asthma

Ruth Hartley MBBCh, MRCS (Presenter) ; **Sherif Gonem** ; **Jennifer Boes** ; **Maria Bule** ; **Sumit Gupta** MRCP, PhD ; **Christopher Brightling** MRCP, PhD ; **Brian D Ross** PhD * ; **Craig J Galban** PhD * ; **Salman Siddiqui** MRCP

PURPOSE
Asthma is a chronic inflammatory airway disease that is characterised by variable airflow obstruction. The parametric response map (PRM) image analysis technique has recently been utilised to differentiate functional small airway disease (fSAD) from emphysema (using image registration techniques) in patients with chronic obstructive pulmonary disease (COPD) [Galban et al, Nature Med 2012]. It is not known whether fSAD or emphysema are features of asthma, or whether they correlate with the degree of airflow obstruction.

METHOD AND MATERIALS
Fifty-two patients with asthma were recruited and underwent inspiratory and expiratory computed tomography (CT). Images were analysed using the PRM algorithm, and the relative lung volumes exhibiting fSAD and emphysema were determined, as well as the centre of mass of the voxel distribution. Lung function was measured using spirometry, and multiple breath inert gas washout (MBW), a technique for measuring ventilation heterogeneity (VH) in the conductive (Scond) and intra acinar (Sacin) small airways. Data is presented as the mean [standard deviation]

RESULTS
The relative volume of fSAD in patients with asthma was 14.3 [10.7], whereas significant emphysema was not observed in patients with asthma (2.9 [3.0]). The ratio of forced expiratory volume in one second to forced vital capacity correlated negatively with fSAD (R = -0.295, p
CONCLUSION
Functional small airway disease, but not emphysema, occurs commonly in patients with asthma, and correlates significantly with spirometric airflow obstruction. Further studies are required to determine if fSAD as measured by PRM on CT may be used to predict prognosis or response to treatment in patients with asthma.

CLINICAL RELEVANCE/APPLICATION
PRM provides an objective quantitative assessment and visualisation of lung disease extent and discriminates between emphysema and functionally impoprtant small airways disease.

SSG04-02 ● Respiratory Muscle Movement in Pompe Disease Using Cine Magnetic Resonance Imaging

Pierluigi Ciet MD (Presenter) ; **Stephan C Wens** MD ; **Adria Perez-Rovira** PhD ; **Karla M Logie** BSc ; **Piotr A Wielopolski** PhD ; **Marleen De Bruijne** PhD * ; **Ans T Van Der Ploeg** MD ; **Pieter A Van Doorn** PhD ; **Harm A Tiddens** MD

PURPOSE
Late-onset Pompe's disease is a slowly progressive proximal myopathy. Respiratory problems are the major cause of death. Up-to-date respiratory muscles in Pompe patients have never been investigated using cine-Magnetic Resonance Imaging (cine-MRI). Cine-MRI allows us to assess the contribution of each respiratory muscle during the breathing cycle. We aimed to assess the performance of respiratory muscles in a group of Pompe patients and healthy volunteers. We compared diaphragmatic displacement between the groups and correlated displacement with spirometry parameters, such as forced expiratory maneuver in 1 second (FEV_1).

METHOD AND MATERIALS
Each subject was trained to perform specific breathing maneuvers, such as FEV_1 using an MRI-compatible spirometer, which was also used for volume control during scans. Cine-MRI settings: 2 static scans (13sec) covering the entire thorax were acquired at end-inspiration and �expiration using a 3D spoiled gradient echo (SPGR) sequence (TR/TE/FA/SL=1.3/0.5/2�/3mm, sagittal acquisition) in 3T scanner. 3 dynamic-scans were performed using 3D-SPGR with TRICKS sequence (TR/TE/FA/SL=0.9/10/2�/12mm with a temporal resolution of 437ms (48 phases in 21sec). Total scan time was on average 30min. In-house developed software was used to estimate the diaphragm motion. Pearson(r) and independent T-tests were used for statistics

RESULTS
To date 10 Pompe patients (mean age 48.6 years, range 39-66 years, 5 males) and 6 volunteers (mean age 43.3 years, range 27-60 years, 3 males) performed spirometer-controlled cine-MRI. Pompe patients showed abnormal expiratory pattern with main contribution by the anterior chest wall during expiration. Vertical diaphragmatic displacement was significant different between patients and volunteers: mean displacement for volunteers 15.37±7.88 mm and 58.96±12.36 for patients; mean difference 43.58±7.02 mm; p=0.001; C.I.26.40-60.77. FEV_1 recorded during scans highly correlated with diaphragmatic displacement r=0.9; p=0.037.

CONCLUSION
Diaphragmatic function is significantly impaired in Pompe patients. In fact, in these patients movement of the anterior chest-wall is the main contributor to breathing. Cine-MRI can be a useful tool for patient�s characterization and to monitor treatment response in Pompe�s disease

CLINICAL RELEVANCE/APPLICATION
Cine-MRI is a safe and feasible technique that can provide a new insight in Pompe disease

SSG04-03 ● MRI Perfusion-weighted Fourier Decomposition (FD) Values Correlate with Pulmonary Blood Flow (PBF) Derived by Quantitative Dynamic Perfusion (DCE) MRI of the Lung in Patients with Chronic Thromboembolic Pulmonary Hypertension

(CTEPH)

Christian Schoenfeld (Presenter) ; **Marcel Gutberlet** DiplPhys ; **Jan Hinrichs** ; **Julius Renne** MD ; **Katja Hueper** ; **Steven Sourbron** PhD ; **Tobias Welte** MD ; **Marius Hoeper** ; **Frank K Wacker** MD * ; **Jens Vogel-Claussen** MD

PURPOSE
Quantification of regional lung perfusion is crucial for diagnosis and treatment response monitoring in patients with CTEPH. The hypothesis of our study is that pulmonary parenchymal blood flow can be quantified using a novel non-contrast perfusion-weighed FD method and correlates with pulmonary blood flow (PBF) derived from the clinically established DCE MRI method in patients with CTEPH.

METHOD AND MATERIALS
23 patients with suspected CTEPH underwent lung MRI at 1.5T. FD MRI: Free breathing dynamic images were acquired in serial coronal planes covering the whole lung with a 2D Fast Low Angle Shot (FLASH) sequence with a temporal resolution of 3 frames/s for one minute. After non-rigid registration FD perfusion maps were calculated. DCE MRI: After bolus administration of 0.04 mmol/kg Gd-DOTA at 5cc/sec iv the first-pass of the contrast bolus was imaged using a dynamic 3D FLASH sequence. PBF maps were calculated on a pixel by pixel basis using model-independent deconvolution. Both lungs and corresponding normal and hypo-perfused lung areas were segmented on FD perfusion-maps and on DCE PBF-maps. Also phase contrast MRI measurements were performed in the right and left pulmonary arteries (PA) with a temporal resolution of 20ms.

RESULTS
A total of 192 corresponding lung areas were evaluated. There was a significant correlation between the perfusion-weighted values of the FD method and corresponding PBF derived by DCE MRI (r=0.65, p
CONCLUSION
Our results show that regional perfusion of lung parenchyma can be assessed using the perfusion-weighted FD method in CTEPH patients. Perfusion-weighted FD values correlate well with regional PBF calculated by DCE MRI.

CLINICAL RELEVANCE/APPLICATION
Clinical relevance statement: Perfusion of lung parenchyma can be assessed visually and quantitatively with perfusion-weighted FD in patients with CTEPH.

SSG04-04 ● 3D Non-contrast-Enhanced Perfusion MRI vs. 3D Contrast-enhanced Perfusion MRI vs. Perfusion Scan: Capability for Postoperative Lung Function Prediction in Non-small Cell Lung Cancer Patients

Yoshiharu Ohno MD, PhD (Presenter) * ; **Shinichiro Seki** ; **Mizuho Nishio** MD * ; **Hisanobu Koyama** MD ; **Maho Tsubakimoto** MD ; **Takeshi Yoshikawa** MD * ; **Sumiaki Matsumoto** MD, PhD * ; **Katsusuke Kyotani** RT ; **Nobukazu Aoyama** RT ; **Akiko Kusaka** RT ; **Saori Satou** RT * ; **Yoshimori Kassai** MS * ; **Satoshi Sugiura** * ; **Kazuro Sugimura** MD, PhD *

PURPOSE
To directly the compare capability for postoperative lung function prediction among 3D non-contrast-enhanced perfusion MRI (non-CE-perfusion MRI), 3D contrast-enhanced perfusion MRI (CE-perfusion MRI) and perfusion scan (Q scan) in non-small cell lung cancer (NSCLC) patients.

METHOD AND MATERIALS
Seventeen NSCLC patients (10 men and 7 women) underwent non-CE-perfusion MRI, CE-perfusion MRI, Q scan, surgical treatment and pre- and postoperative FEV_1% measurements. All non-CE-perfusion MRIs were acquired with a 3D fresh blood imaging obtained with an ECG-gated 3D half-Fourier fast SE sequence using a 3T scanner. On non-CE- and CE-perfusion MRIs and Q scan, each regional perfusion rate in the resected lobe was determined as signal intensity or radioisotope uptake ratio between resected lobe and total lung. Then, each postoperative FEV_1% ($poFEV_1$%) was predicted from preoperative FEV_1% and regional perfusion rate in the resected lobe. To determine the capability of non-CE-perfusion MRI for regional perfusion assessment, regional perfusion rate of non-CE-perfusion MRI was statistically correlated with that of CE-perfusion MRI and Q scan. To determine the capability for prediction of postoperative lung function among three methods, each predicted $poFEV_1$% was correlated with actual $poFEV_1$%. Finally, the limits of agreement (mean difference±1.96xstandard deviation) between actual and each predicted poFEV1% was also evaluated by Bland-Altman analysis.

RESULTS
Regional perfusion rate of non-CE-perfusion MRI had significant and excellent correlations with that of CE-perfusion MRI (r=0.92, p1% and $poFEV_1$%s predicted by non-CE-perfusion MRI (r=0.91, p
CONCLUSION
Non-CE-perfusion MRI has better capability for postoperative lung function prediction than perfusion scan, and is considered at least as valuable as CE-perfusion MRI in NSCLC patients.

CLINICAL RELEVANCE/APPLICATION
Non-CE-perfusion MRI has better capability for postoperative lung function prediction than perfusion scan, and is considered at least as valuable as CE-perfusion MRI in NSCLC patients.

SSG04-05 ● Fluorine-19 MRI: A New Functional Pulmonary Imaging Modality

Marcus J Couch MSc, BSc ; **Iain K Ball** ; **Tao Li** ; **Matthew S Fox** ; **Birubi Biman** ; **Mitchell S Albert** PhD (Presenter)

PURPOSE
Fluorine-19 (^{19}F) magnetic resonance imaging (MRI) of the lungs using inhaled inert fluorinated gases can provide images that are similar in quality to hyperpolarized (HP) noble gas MRI. Inert fluorinated gases are nontoxic, abundant, inexpensive, and they have short longitudinal relaxation times. As a result, there is sufficient thermally polarized signal for imaging, and the gases do not need to be hyperpolarized prior to their use in MRI. The purpose of this study was to optimize image acquisition strategies and breathing protocols for imaging of human lungs with inert fluorinated gas MRI.

METHOD AND MATERIALS
Imaging was performed using a 3.0T Philips Achieva scanner and a flexible wrap-around quadrature transmit/receive coil (Clinical MR Solutions). Eleven healthy volunteers were enrolled in this study with no history of lung diseases. Breathing protocols were optimized for imaging with an inhaled gas mixture of 79% perfluoropropane (PFP) and 21% O $_2$. 3D ^{19}F images were acquired using ultra-short echo time (UTE) and gradient echo techniques.

RESULTS
In one representative subject, the signal-to-noise ratio (SNR) in the center slices was 37 ± 4 for UTE, and 29 ± 6 for gradient echo images. In both cases, the SNR was more than a factor of 2 larger than the SNR reported by Soher et al. (Proc. ISMRM, 2010). Overall, the SNR from UTE images was significantly different from gradient echo images (p = 0.02). UTE images had a superior SNR; however, they suffered from poor edge detail due to the nature of the data acquisition.

CONCLUSION
Overall, ^{19}F MRI using inert fluorinated gases is a new pulmonary imaging modality that can provide valuable spatially localized and functional information without the need for scarce noble gas isotopes, an expensive polarizer, or ionizing radiation. This preliminary study demonstrates the potential of ^{19}F MRI for visualizing the distribution of ventilation in human lungs, and this may be a viable clinical imaging modality that can provide useful information for the diagnosis of chronic respiratory diseases.

CLINICAL RELEVANCE/APPLICATION
Inert fluorinated gas MRI can cheaply and efficiently obtain high quality images of the lungs, and it can potentially be performed on patients with chronic respiratory diseases.

SSG04-06 • Crus Atrophy: Accuracy of CT in Diagnosis of Diaphragmatic Paralysis

Warawut Sukkasem MD (Presenter) ; **Sherine G Moftah** MD ; **Joshua O Benditt** MD ; **Sudhakar N Pipavath** MD * ; **J. D Godwin** MD ; **Eric J Stern** MD

PURPOSE
To evaluate ability of CT measurement of diaphragmatic crus thickness to distinguish a paralyzed from a non-paralyzed hemidiaphragm in patients with suspected diaphragmatic dysfunction.

METHOD AND MATERIALS
We performed a retrospective review of patients with suspected diaphragmatic dysfunction between January, 1997, and February, 2013. We identified 5,402 patients, 90 (1.7%) of whom underwent chest fluoroscopy; 72 patients (1.3%) had concurrent CT scans available for measurement of diaphragmatic crus thickness at the level of celiac and superior mesenteric arteries and the L1 vertebra. ROC analysis was performed to determine an optimal threshold for discriminating between paralyzed hemidiaphragm and non-paralyzed hemidiaphragm.

RESULTS
Of 72 patients, 11 (15.3%) had diaphragmatic paralysis by chest fluoroscopy. There was a significant difference in thickness of the crus for patients with and without diaphragmatic paralysis at the level of the celiac artery (mean$\pm$SD 1.7$\pm$0.6 mm vs. 3.6$\pm$1.3 mm, p = 0.017 on right; 1.1$\pm$0.4 mm vs. 3.0$\pm$1.4 mm, p = 0.001 on left) and the level of the L1 vertebra (mean$\pm$SD 1.5$\pm$0.7 mm vs. 4.4$\pm$1.6 mm, p = 0.018 on right; 1.5$\pm$0.6 mm vs. 3.6$\pm$1.7 mm, p = 0.017 on left). A threshold crus thickness of 2.5 mm at the celiac artery level on axial CT permitted optimal distinction and provided a sensitivity of 100% and a specificity of 86% in identifying diaphragmatic paralysis for the right hemidiaphragm, and a sensitivity of 100% and a specificity of 64% for the left. A threshold crus thickness of 2.5 mm at the L1 vertebra level on coronal CT permitted optimal distinction and provided a sensitivity of 100% and a specificity of 88% in identifying diaphragmatic paralysis for the right hemidiaphragm, and a sensitivity of 100% and a specificity of 77% for the left. There was no statistical difference between axial and coronal measurements (AUC 0.93 vs. 0.94, p = 1.000 on the right; 0.82 vs. 0.89, p = 0.570 on the left).

CONCLUSION
Diaphragmatic crus atrophy assessed by CT is a good discriminator of paralyzed vs. non-paralyzed hemidiaphragm in patients with clinically suspected diaphragmatic dysfunction.

CLINICAL RELEVANCE/APPLICATION
In patients with suspected hemidiaphragm paralysis, CT measurement of diaphragmatic crus thickness of

SSG04-07 • Reproducibility of Breath-hold and Free-breathing Quantitative Pulmonary Perfusion MRI

Daniel Maxien MD (Presenter) ; **Michael Ingrisch** ; **Felix G Meinel** MD ; **Maximilian F Reiser** MD ; **Olaf Dietrich** PhD ; **Konstantin Nikolaou** MD *

PURPOSE
Examinations in breath hold (BH) are often difficult for patients suffering from lung diseases. Recently the quantitative assessment of pulmonary perfusion using dynamic contrast-enhanced (DCE)-MRI with a measurement during free breathing (FB) was demonstrated. In this study, we compared the reproducibility of the quantitative assessment of pulmonary perfusion during FB with the reproducibility of the gold standard BH measurements.

METHOD AND MATERIALS
10 healthy, male volunteers underwent DCE-MRI on a 1.5T scanner for the assessment of pulmonary perfusion, using an accelerated 3D view sharing gradient-echo sequence. Each volunteer was examined twice at intervals of one week +/- one day. Each of these two examinations included a BH and a FB DCE-MRI acquisition, at intervals of at least 20min. Hence, 40 DCE MRI datasets were acquired in total. Pulmonary plasma flow (PPF) and pulmonary plasma volume (PPV) were determined pixel-wise, using a one-compartment model. For FP and BH measurements, the intra-class correlation coefficient (ICC) and the coefficients of variation (CV) between first and second measurement were calculated to assess test-retest reproducibility. Differences of CV between FB and BH measurements were assessed with a non-parametric, paired two-sided Wilcoxon signed rank test. Reproducibility R of PPF and PPV was calculated as root-mean-square average of CV.

RESULTS
The ICC for both measured quantitative parameters was lower during BH than in FB technique (PPF: 0.37 vs. 0.69; PPV: 0.69 vs. 0.84). Additionally, the R values of the BH measurements were higher than the corresponding R values of the FB measurements (PPF 0.32 vs. 0.16; PPV: 0.18 vs. 0.10). Overall, CV is significantly lower for the FB measurements both for PPF (p=0.008) and PPV (p=0.03). ICC values of PPF and PPV are higher for FB than for BH measurements and test-retest reproducibility is significantly better (p
CONCLUSION
A free-breathing measurement of pulmonary perfusion is suitable for the quantification of pulmonary perfusion and leads to parameter estimates with a better reproducibility than the conventionally used measurements during breath hold.

CLINICAL RELEVANCE/APPLICATION
Regarding the reproducibility, this study demonstrates that the desirable quantitative assessment of pulmonary perfusion during free breathing might be superior to the common breath hold technique.

SSG04-08 • Hyperpolarized ³He Magnetic Resonance Imaging Temporal-spatial Maps of Asthma to Guide Endobronchial Thermo-ablation

Sarah Svenningsen BSC (Presenter) ; **Miranda Kirby** PhD ; **Stephen Choy** MD ; **Andrew Wheatley** ; **David McCormack** MD ; **Grace Parraga** PhD

PURPOSE
Pulmonary functional imaging using hyperpolarized ^{3}He magnetic resonance imaging (MRI) provides a way to map heterogeneous ventilation abnormalities that are regionally and temporally persistent in asthma. Bronchial thermoplasty is a novel asthma treatment that aims to reduce smooth muscle mass in the lobar and segmental bronchi, with the goal being improved symptoms and asthma control. Currently, treatment is not guided by imaging to specific airway abnormalities. The purpose of this study was to exploit the image-guidance potential of ^{3}He MRI by developing lung function maps that spatially identify airway abnormalities in asthma.

METHOD AND MATERIALS
For a severe asthmatic, temporally persistent ventilation defects were observed on two visits 8 months apart after thermo-ablation therapy was completed. To improve the efficacy of thermoablation and decrease treatment time and cost, we investigated the potential for temporal-spatial lung function maps to guide therapy in asthmatics (n=7, 28±9 yr) who were evaluated using hyperpolarized ^{3}He MRI three times, 7±2 days apart. Temporal maps were generated from ventilation images acquired on three occasions by co-registering ^{3}He MRI after segmenting ^{3}He voxel intensities using a modified k-means cluster algorithm. Corresponding, co-registered voxels were classified as 1) persistent defect, 2) intermittent defect, 3) partial ventilation, and, 4) persistent ventilation. The temporal map was registered to thoracic CT to enable structure-function comparisons and help guide therapy to specific ventilation defects.

RESULTS
We present a ^{3}He MRI temporal-spatial lung function map co-registered to a CT-derived airway tree for a single asthmatic. Regions-of-interest (ROI) were identified with persistent and intermittent defects as appropriate targets for treatment, whereas ROI with partial or full ventilation were also identified as regions that should be avoided.

CONCLUSION

Personalized temporal-spatial lung function maps of asthma can be generated to display functional abnormalities observed over time and to guide localized therapy.

CLINICAL RELEVANCE/APPLICATION
Temporal-spatial lung function maps identified spatially and temporally persistent ventilation defects and the airways that lead to them as potential targets for thermo-ablation.

SSG04-09 • Impact of Scanning Conditions in the Evaluation of Pulmonary Blood Volume with Dual-energy CT: Results in 42 Subjects

Francesco Molinari MD (Presenter) ; **Paul Felloni** MD ; **Francois Pontana** MD ; **Nunzia Tacelli** MD ; **Teresa Santangelo** ; **Martine J Remy-Jardin** MD, PhD *

PURPOSE
To evaluate the characteristics of pulmonary blood volume (PBV) on dual-source, dual-energy chest CT examinations.

METHOD AND MATERIALS
Eligibility to this study required (a) the absence of respiratory disease after a diagnostic work-up including a dual-source, dual-energy chest CT angiographic examination; (b) rated with an excellent image quality (i.e., excellent quality of vascular opacification; no respiratory motion artifacts); and (c) obtained on the same CT unit (Definition Flash, Siemens Healthcare). Over a 2 year-period, 42 patients (mean age: 43.05 yr) fulfilled these criteria, enabling analysis of PBV in the following conditions: (a) collimation: 32x2x0.6 mm; rotation time: 0.28 s; pitch: 0.5; caudo-cranial acquisition without modulation of milliamperage; (b) administration of 80 mL of a 40% contrast agent followed by 40 mL of a diluted contrast agent (70% NaCl; 30% iodine) at a flow rate of 4mL/s,. Qualitative analysis was based on visual assessment. Quantitative analysis measured the (a) iodine concentration per lung (IPIPE software; Siemens) and (b) regional distribution of iodine after semi-automatic division of each lung into 18 areas (OSIRIX).

RESULTS

CONCLUSION
Distribution of PBV is influenced by physiological gradients and scanning conditions.

CLINICAL RELEVANCE/APPLICATION
This study provides quantitative information on lung perfusion in the conditions of standard evaluation of normal subjects.

Chest (Subsolid Nodule, Neoplasia)

Tuesday, 10:30 AM - 12:00 PM • S405AB

CT CH

SSG05 • *AMA PRA Category 1 Credit* ™:1.5 • ARRT Category A+ Credit:1.5
  Moderator
  Caroline Chiles , MD
  Moderator
  Hiroto Hatabu , MD, PhD *

SSG05-01 • Subcentimeter Lung Nodules Initially Stable for Two Years at Screening Low-dose CT: Long-term Follow-up Using Nodule Volumetry

Kyung S Lee MD, PhD ; **Kyung Eun Shin** MD (Presenter) ; **Chin A Yi** MD, PhD ; **Myung Jin Chung** MD * ; **Myung-Hee Shin**

PURPOSE
To retrospectively investigate long-term follow-up results for 2-year-stable subcentimeter nodules seen at screening low-dose CT (LDCT).

METHOD AND MATERIALS
A total of 635 subjects, who had follow-up low-dose CT (LDCT) for the initial two-year screening period and for additional three years thereafter and who had noncalcified subcentimeter nodules, were included. By using nodule volumetry software, we measured interval change of nodule volume. Positive growth was defined as an increase in volume of at least 25% between two volume measurements.

RESULTS
A total of 1107 nodules (1037 solid, 70 ground-glass opacity nodules [GGNs]) were detected at baseline CT. Of 1037 solid nodules, 1032 (99.5%) showed no growth at initial two-year follow-up CT, while of 70 GGNs, 59 (84.3%) showed no growth. Of 1032 solid subcentimeter nodules showing no growth for initial two-year follow-up period, none showed further growth during additional three-year follow-up CT, whereas of 59 GGNs stable for initial two years, two (3.4%) showed growth to be proved as adenocarcinomas. Of five solid nodules depicting growth at initial two-year follow-up CT, one (20%) proved to be adenocarcinoma, whereas of 11 GGNs demonstrating growth for the initial two-year follow-up CT, four (36.4%) showed growth and proved to be lung cancers.

CONCLUSION
All solid subcentimeter nodules having initial two-year stability at screening LDCT can be considered benign, because none shows growth at further follow-up CT. On the other hand, subcentimeter GGNs have a more chance of growth than solid nodules and need further follow-up CT for more than two years.

CLINICAL RELEVANCE/APPLICATION
This study demonstrates the two-year stability rule for subcentimeter solid nodules in LDCT using volumetry and CT follow up for more than two years seems to be mandatory for subcentimeter GGNs.

SSG05-02 • Inter-reader Variability in the Application of the 2013 Fleischner Society Recommendations on the Management of Solitary Subsolid Pulmonary Nodules

Alex C Penn MD (Presenter) ; **Mingming Ma** MD ; **Benjamin B Chou** MD ; **Jeffrey Tseng** MD ; **Peter Phan** MD

PURPOSE
To evaluate inter-reader variability in applying the 2013 Fleischner Society recommendations when presented with a potential solitary subsolid nodule identified on CT.

METHOD AND MATERIALS
Potential subsolid lung nodules were identified through a systematic retrospective review of CT studies that reported a �ground glass� lesion over a one-year period. Three radiologists decided whether the potential subsolid nodules merited application of the Fleischner Society guidelines. They then determined if a solid component was present, measured each component in two dimensions, and issued management. Inter-reader variability for management was determined based on comparing all possible reader pairs and Fleiss� kappa was used to determine significance. Fisher�s exact determined whether management was contingent on each decision. A Bland-Altman plot determined the limits of agreement for measurement within a 95% confidence interval.

RESULTS
Forty-four nodules with mean diameter 9.4 mm were evaluated by three radiologists with a measurement variability of -2.5 to +2.7 mm

(95% C.I.). Management recommendations between two readers were in agreement for 85 out of 132 cases (64.4%, kappa = 0.43) (Figure 1). The remaining 47 cases of inter-reader variability in management recommendation were contingent on disagreement over whether a potential subsolid nodule met Fleischner criteria for 24 cases (51.1%, p 0.05), and greater than one of these factors for four cases (8.5%).

CONCLUSION
Our data shows moderate inter-reader variability in applying the 2013 Fleischner Society recommendations. Significant contributors of variability include determining whether the potential subsolid nodules fit criteria and whether there was a solid component. Although measurement variability was present, it did not significantly affect the final management decisions.

CLINICAL RELEVANCE/APPLICATION
Moderate interreader variability when applying the 2013 Fleischner recommendations for subsolid nodules was largely due to differences in categorization rather than in measurement.

SSG05-03 ● Solitary Pure Ground-glass Nodules ≤5 mm: Incidence of Growth

Ryutaro Kakinuma MD, PhD (Presenter) ; **Yukio Muramatsu** MD ; **Masahiko Kusumoto** MD ; **Akiko Maeshima** ; **Hisao Asamura** ; **Noriyuki Moriyama** MD, PhD

PURPOSE
A statement from the Fleischner Society suggests that solitary pure ground-glass nodules (SGGNs)
METHOD AND MATERIALS

RESULTS
A total of 354 SGGNs
CONCLUSION
Overall, 8.7% (31/355) of SGGNs
CLINICAL RELEVANCE/APPLICATION
SGGNs

SSG05-04 ● Subsolid Pulmonary Nodules Detected during Lung Cancer Screening: Results of a Close Follow-up Approach

Hester Gietema MD (Presenter) ; **Ernst T Scholten** MD ; **Rozemarijn Vliegenthart** MD, PhD ; **Harry De Koning** * ; **Willem P Mali** MD, PhD ; **Matthys Oudkerk** MD, PhD ; **Rob Van Klaveren** ; **Mathias Prokop** MD, PhD * ; **Pim A De Jong** MD, PhD

PURPOSE
Pulmonary Subsolid nodules (SSNs) have a high likelihood of malignancy, but they are often indolent with slow growth and a low propensity for distant spread. Aim of the current analysis was to show that close follow-up of SSNs is safe and that only growing SSNs and SSNs with a new or growing solid component need further evaluation and treatment.

METHOD AND MATERIALS
The study population consisted of participants of the Dutch-Belgian lung cancer screening trial (NELSON). All detected SSNs were included in this analysis. Retrospectively, all persistent SSNs (visible on at least two computed tomography (CT) exams) and SSNs that were resected after first detection were segmented with dedicated software and maximum diameter, volume and mass were assessed. Volume doubling time (VDT) and mass doubling time (MDT) was calculated. SSNs that showed significant change were referred to a pulmonologist.

RESULTS
In total 7156 volunteers received up to four rounds of CT-screening. Two hundred sixty-four SSNs in 234 (3.3%) participants were detected during the trial. Hundred forty-seven (63%) SSNs in 126 participants disappeared at follow-up, leaving 117 persistent SSNs found in 108 (1.5%) participants available for analysis. Median follow-up duration was 1094 days (range 38 � 2380). Thirty-three (28%) SSNs were resected, and 28 SSNs were (minimally) invasive. None of the 84 (72%) non-resected SSNs developed into a clinical relevant malignancy.

CONCLUSION
Persistent SSNs have a high malignancy rate according to pathological analysis, but they rarely develop into clinical manifest malignancies unexpectedly. Our data suggest that long-term follow-up with CT may be a safe option to monitor changes in persistent SSNs. Resection should be considered only in SSNs that show rapid growth or appearance or growth of a solid component.

CLINICAL RELEVANCE/APPLICATION
Follow-up with CT may be a safe option to monitor changes in persistent SSNs, while resection should be considered only in SSNs that show rapid growth or appearance or growth of a solid component.

SSG05-05 ● Pulmonary Pure Ground-glass Opacity Nodules: Added Value of Quantitative Dual Energy CT Analysis for Distinguishing Invasive Adenocarcinoma from Non- or Minimally Invasive Adenocarcinoma

Ji Ye Son (Presenter) ; **Ho Yun Lee** MD ; **Jae-Hun Kim** PhD ; **Joungho Han** ; **Ji Yun Jeong** ; **Kyung S Lee** MD, PhD ; **O. Jung Kwon** ; **Young Mog Shim** MD

PURPOSE
To determine whether quantitative analysis of iodine-enhanced Images generated from Dual-energy CT (DECT) have added value in distinguishing invasive adenocarcinoma from non- or minimally invasive adenocarcinoma (MIA), showing pure ground-glass nodule (GGN).

METHOD AND MATERIALS

RESULTS

CONCLUSION
Volumetric quantification using iodine-enhanced imaging metrics was more accurate for distinguishing IA from AIS or MIA than that of nonenhanced imaging metrics.

CLINICAL RELEVANCE/APPLICATION
Quantitative analysis of DECT imaging can help predict pathologic classification of pure GGN, which can better assist in surgical planning to select the candidate for limited resection.

SSG05-06 ● Impact of Section Thickness on Classification of Pulmonary Nodules into Solid, Part-solid, and Non-solid: An Observer Study

Sarah J Van Riel MD (Presenter) ; **Cornelia M Schaefer-Prokop** MD * ; **Eva M Van Rikxoort** PhD ; **Bram Van Ginneken** PhD ; **Mathias Prokop** MD, PhD * ; **Steven Schalekamp** MD * ; **Colin Jacobs** MSc * ; **Pim A De Jong** MD, PhD ; **Hester Gietema** MD ; **Ernst T Scholten** MD

PURPOSE
Recently published recommendations by the Fleischner Society differentiate between solid, part-solid, and non-solid nodules. A section thickness of 1mm is recommended for evaluation. It is, however, common practice to reconstruct thicker (3mm or 5mm) sections to reduce the number of sections to evaluate. Purpose of this study was to evaluate the impact of section thickness on nodule classification

agreement.

METHOD AND MATERIALS
20 part-solid, 10 non-solid and 10 solid nodular lesions were randomly selected from the NELSON screening trial. A reference standard was established using the consensus reading of two experienced chest radiologists. Data had been acquired using a low dose (16x0.75mm, 120-140 kVp, 30 mAs) protocol. Complete CTs were shown with axial and coronal projections with either 1mm, 3mm or 5mm section thickness, the latter two with 1mm overlap. Readers could interactively scroll through the scans, use magnification, windowing and manual calibre measurements as warranted. Four readers of varying experience were asked to classify the lesions as solid (1), part-solid (2), or non-solid (3). All readings were done twice in six sessions, in which all permutations of nodules and section thicknesses were presented in different random orders. We report percentage agreement between observers and the consensus reference. All results stated are averaged over all reading sessions.

RESULTS
Mean agreement rate with the reference standard decreased from 85% (range 78-95%) to 77% (range 68-84%) and 75% (range 68-84%), for 1mm, 3mm, and 5mm section thickness, respectively. Readers were affected differently by increasing section thickness. The most experienced reader was influenced the least (agreement = 84-82-80%). Two readers demonstrated a major decrease in performance already for 3mm (81-72-70% and 91-78-81%). One reader showed a stepwise performance decline (86-77-69%).

CONCLUSION
Nodule classification is affected by section thickness. The degree of loss of accuracy appears to be reader dependent.

CLINICAL RELEVANCE/APPLICATION
Nodule classification is impaired by increasing section thickness which may have consequences for patient management. Visual classification therefore requires acquisition and storage of 1mm sections.

SSG05-07 ● Newly Developed Early Lung Cancer during Follow-up of Idiopathic Interstitial Pneumonia: Serial HRCT Observations

Mi Young Kim (Presenter) ; **Ji-Eun Kim** MD ; **Sang Young Oh** MD ; **Chang-Min Choi** ; **Tae Sun Shim** ; **Dong Soon Kim** MD

PURPOSE
To describe HRCT findings of newly developed peripheral T1 lung cancer in idiopathic interstitial pneumonia (IIP) during IIP follow-up

METHOD AND MATERIALS
Between November 2001 and October 2012, 66 consecutive patients (62men, 4 women; median age 64, range 40~85 years) who were diagnosed as IIP, fulfilled the American Thoracic Society diagnostic criteria and new cancer (including fourteen small cell) simultaneously, were included. Two radiologists independently reviewed 132 serial CT scans of 66 patients, determined the earliest scan showing lung cancer, and evaluated tumor size (mm), lobar location, axial location on transverse image, shape, and density of tumor. The median interval between null-IIP to new cancer-IIP was measured. Delay in diagnosis was measured from the time of the earliest scan showing lung cancer and the subsequent clinical diagnosis. Formal radiologic reports as �first choice� before diagnosis of cancer were reviewed.

RESULTS
The inter-observer agreement was good (Kappa value > 0.77). The median smallest tumor size on axial scan at presentation was 17mm (± 6.57, range, 5-30mm) with T1a/T1b (48/18). Tumor was most commonly located in right lower lobe (29/66, 43.9%), followed by left lower lobe (13, 19.7%). Thirty five tumors (53.0%) were in the interface between normal and fibrotic lung cysts such as honeycomb cysts, twenty two (33.3%) were in the midst of fibrotic lung cysts, and nine (13.6%) were in the normal lung. Fifty nine (83.3%) tumors had round or oval shape, seven (10.6%) tumors had a stellate shape, and two had a band-like shape. Most of the tumors (90.3%) presented as solid density rather than part solid, ground-glass opacity or consolidation. Lung cancers were found during the mean follow-up CT period of 513 days. The median delay in diagnosis was 440 days. Most of the lesions (70%) were interpreted as lung cancer, but nine were interpreted as pneumonia or fungal infection and seven were missed (10.6%) on HRCT.

CONCLUSION
About one third of the tumors were misdiagnosed including missed in ten percents. Over fifty percent of the cancers are located at the interface between normal lung and fibrotic cysts. New lung cancers usually show as tumor with a round or oval shape and solid density.

CLINICAL RELEVANCE/APPLICATION
It is important to acknowledge �CT characteristics of new early cancer in IIP patients�, because it is easily missed or confused with pneumonia or fungal infection.

SSG05-08 ● Quantitative Measurement of Part-solid Nodule Size on CT in a Chest Phantom: Effect of Dose on Accuracy

Ann L Scherzinger PhD (Presenter) * ; **Kavita Garg** MD ; **Grace Kim** MD ; **Nayana U Patel** MD ; **Samuel Chang** MD ; **Paul R Garrett** MD ; **Luduan Zhang** PhD ; **Nicholas Petrick** PhD ; **Michael F McNitt-Gray** PhD *

PURPOSE
To assess the effect of dose on the accuracy of part-solid compared to solid nodule size measurements obtained from CT images of the chest.

METHOD AND MATERIALS
Twelve synthetic nodules, four solid (spherical) and eight part solid (spherical and lobular) (CIRS, Norfolk, VA) were imbedded in the lungs of an anthropomorphic torso phantom (LUNGMAN, Kyoto Kagaku Co., Ltd., Kyoto, Japan). The thorax phantom was imaged on a Sensation 64 (Siemens Medical Solutions USA, Malvern, PA) CT using a modified version of the QIBA recommended solid nodule protocol to include imaging at 40mAs (CTDIvol = 3.06mGy) and 200mAs (15.32mGy). Images were independently segmented by four experienced radiologists, at two sittings, using the INTIO ClearStart�SVMTM Segmentation and Volumetric Measurement System (Lung research version; INTIO, Inc, Broomfield, CO). Nodule diameter and volume measures were obtained from these segmentations (n=256 part-solid, n=128 solid).

RESULTS
The relative bias estimates for part-solid nodules were 13.8% (16.1) for the longest diameter (1D) measure and15.5% (20.4) for the volume (3D) measure with the 200mAs acquisition, and 13.6% (16.9) for 1D and 14.6% (23.7) for 3D at 40mAs. For solid nodules the relative bias estimates were 1.4%(5.4) for 1D and 31.6%(17.2) for 3D at 200mAs and 3.6%(6.5) for 1D and 36.6%(33.7) for 3D at 40mAs. Although the relative bias of solid nodule 3D volume measurements were significantly higher (p .05) interaction between solidity and dose.

CONCLUSION
Although the segmentation utilizing this semi-automatic technique consistently over estimated the size of both solid and part-solid nodules, this study showed that the bias in any of the morphometric measures, regardless of lesion solidity, was not influenced by changes in CT dose.

CLINICAL RELEVANCE/APPLICATION
The accurate measurement of part-solid lung nodule size change while minimizing cumulative radiation dose is important for the management of patients with suspected or proven lung cancer.

SSG05-09 ● Stratification of Early Stage Lung Adenocarcinoma by Using Quantitative Analysis of Dual Energy CT Imaging

Jungmin Bae (Presenter) ; **Ho Yun Lee** MD ; **Ji Yun Jeong** ; **Jae-Hun Kim** PhD ; **Kyung S Lee** MD, PhD ; **Joungho Han** ; **Ji Ye Son** ; **O. Jung Kwon** ; **Byung-Tae Kim** MD ; **Young Mog Shim** MD

PURPOSE
To evaluate the usefulness of quantitative analysis of dual energy CT (DECT) imaging metrics as predictors of histopathologic tumor grade and invasiveness in early stage lung adenocarcinoma in an attempt for treatment stratification.

METHOD AND MATERIALS
Patients in stage 1 or 2 with lung adenocarcinoma were prospectively included. All patients underwent DECT and PET/CT followed by complete tumor resection. Quantitative imaging parameters were assessed both from iodine map and non-contrast image of DECT datasets. Histologic tumor grades and subtypes of adenocarcinoma in situ (AIS), minimally invasive adenocarcinoma (MIA), and invasive adenocarcinoma (IA) were also evaluated. Clinico-demographic, DECT, and PET data were investigated by univariate and multivariate analyses to identify features that helped distinguish high-grade adenocarcinoma or invasive tumor.

RESULTS
Enrolled 60 patients included 48 in 1A stage (80%), 10 in 1B (17%), and 2 in2A (3%). Of 71 tumors of 60 patients, 6 were AIS (8%), 11 were MIA (16%), and 54 (76%) were IA. In terms of tumor grade, 20 were low-grade (28%), 43 were intermediate grade (61%), and 8 were high-grade (11%). Multivariate analysis showed that presence of solid component, uniformity on iodine map (= 0.01), and tumor density (= 0.55 g) and the 75th percentile CT attenuation value (= -400 HU) on non-contrast image were statistically significant independent predictors of pathologic invasiveness. Independent predictors of high-grade adenocarcinoma consisted of tumor density on iodine map (= 0.73 g), and the 75th percentile CT attenuation values on non-contrast image (= -40 HU). Using these characteristic features, the performance of the logistic regression model showed excellent differentiating accuracy (AUC, 0.973 for invasiveness, 0.972 for high-grade).

CONCLUSION
Quantification using preoperative DECT imaging metrics can help to predict pathologic aggressiveness and invasiveness, which may help select the candidate for limited resection or adjuvant therapy.

CLINICAL RELEVANCE/APPLICATION
Quantitative analysis of DECT imaging metrics can help predict pathologic classification of lung adenocarcinoma and help establish treatment strategy.

Chest - Tuesday Posters and Exhibits (12:15pm - 12:45pm)

Tuesday, 12:15 PM - 12:45 PM ● Lakeside Learning Center

CH

LL-CHS-TUA ● *AMA PRA Category 1 Credit* ™:0.5
   Host
   Mannudeep K Kalra , MD *

LL-CHS-TU1A ● From Genotype to Phenotype: Are There Imaging Characteristics Associated with Lung Adenocarcinomas Harboring ALK Rearrangements?

Darragh Halpenny MBBCh, MRCPI (Presenter) ; **Gregory J Riely** * ; **Sara A Hayes** MBBCh ; **Helena Yu** ; **Junting Zheng** ; **Chaya Moskowitz** ; **Michelle S Ginsberg** MD

PURPOSE
Rearrangements of the anaplastic lymphoma kinase (ALK) gene are found in ~5% of lung adenocarcinomas and are associated with responsiveness to Crizotinib, an FDA-approved ALK inhibitor. The purpose of this study is to identify computed tomography (CT) imaging features associated with ALK rearrangements.

METHOD AND MATERIALS
The institutional review board approved this study. 37 patients presenting sequentially from Nov 2005 - June 2012 with lung adenocarcinoma positive for ALK rearrangements were studied. 101 patients with lung adenocarcinoma and Epidermal Growth Factor Receptor (EGFR) mutations were used as controls. Thoracic CTs, performed at presentation, were independently and retrospectively reviewed by two radiologists. Features assessed were: the size and location of thoracic adenopathy and the size, contour, consistency and location of the primary tumor. The presence of pleural effusion, pleural metastases and lymphangitic carcinomatosis were also recorded. Lesion size on CT was summarized using median and interquartile range, and compared between ALK lesions and EGFR lesions using the Wilcoxon rank-sum test. Categorical features were examined using Fisher�s exact test.

RESULTS
144 lung adenocarcinomas were identified. 38 (26%) tumors in 37 patients harbored ALK rearrangements, 106 (74%) in 101 patients harbored EGFR mutations. ALK tumors had significantly larger thoracic adenopathy than the control group. 6 (16%) ALK tumors and 1 (1%) EGFR tumor had lymph nodes >3cm in short axis (p=0.001) (kappa 0.709, 95% CI 0.561 - 0.858), while 6 (16%) ALK tumors and 32 (30%) EGFR tumors had lymph nodes 1-1.5cm in short axis (p=0.001) (kappa 0.818, 95% CI 0.724 - 0.912). ALK tumors were more likely to have multifocal adenopathy, 26 (68%) of ALK tumors versus 35 (33%) of EGFR tumors (p
CONCLUSION
On CT evaluation, ALK positive lung adenocarcinomas are more likely to be associated with larger volume, multifocal thoracic adenopathy than seen in EGFR mutant lung adenocarcinomas. While routine testing for ALK should be standard, presence of such characteristics could further prompt testing for ALK rearrangements.

CLINICAL RELEVANCE/APPLICATION
Detecting the presence of multifocal large volume lymphadenopathy in patients with lung adenocarcinoma could help identify patients at risk for harboring ALK rearrangements.

LL-CHS-TU2A ● Evaluation of CT Pulmonary Angiography and Transthoracic Echocardiography for Correlation of Imaging Findings and Prognosis in 785 Patients with Acute Pulmonary Embolism

Elizabeth George MBBS (Presenter) ; **Nicole Wake** MS ; **Kanako K Kumamaru** MD, PhD ; **Nina Ghosh** ; **Marie Gerhard-Herman** ; **Frank J Rybicki** MD, PhD * ; **Andetta R Hunsaker** MD ; **Carlos J Gonzalez Quesada** MD ; **Arash Bedayat** MD ; **Ruth M Dunne** MBBCh ; **Sachin S Saboo** FRCR, MD ; **Ashish R Khandelwal** MD

PURPOSE
To compare CT Pulmonary Angiography (CTPA) and transthoracic echocardiography (TTE) in the assessment of right ventricular (RV) size and the prognosis of 30-day PE-related mortality in patients with acute pulmonary embolism (PE).

METHOD AND MATERIALS
From all consecutive CTPAs with acute PE performed between Aug 2003 and May 2010 (n=1744) at a single, urban teaching hospital, 785 patients had TTE performed within 48 hours of the diagnostic CTPA and formed the study cohort. The CT RV/LV diameter ratio (4-chamber reformations) was correlated with qualitatively assessed RV size on TTE. The association of CT RV/LV diameter ratio and RV strain detected by TTE (defined as the presence of RV enlargement, RV hypokinesis, or elevated pulmonary arterial pressure) with PE-related 30-day mortality was assessed using multivariate logistic regression. The predictive ability (Area under the Curve; AUC) was compared between the model including CT RV/LV and that including TTE RV strain.

RESULTS
There was good correlation (Spearman's rank coefficient=0.54, p

CONCLUSION
There is good correlation between CT and echocardiography determined RV enlargement. RV strain on TTE and increase in CT RV/LV diameter ratio are independent predictors of PE-related 30-day mortality with similar prognostic ability.

CLINICAL RELEVANCE/APPLICATION
In patients with acute PE, both CT and echocardiographic assessment of RV enlargement are well correlated, and the two modalities have similar prognostic significance.

LL-CHS-TU3A ● Negative CT Pulmonary Angiography Reports: What Factors Contribute to a Definitive versus Limited Impression?

Shun Yu BS ; **Gopi Nayak** MD (Presenter) ; **Jeffrey M Levsky** MD, PhD ; **Linda B Haramati** MD, MS *

PURPOSE
It is unclear which patient or radiologist-related variables are associated with limitations in a radiologist�s ability to exclude pulmonary embolism (PE) on CT. The present study examines factors and outcomes associated with qualification of negative PE reports as �limited.�

METHOD AND MATERIALS
Reports of all CTs performed in 2011-2012 at our inner city hospital were reviewed and categorized based on report impression as: 1) positive, 2) definitive negative, 3) limited negative or 4) non-diagnostic. Limited negative reports excluded PE only to the central or segmental level, or had a limitation mentioned in the impression. We evaluated the relationship of the report impression to radiologist subspecialty (cardiothoracic vs. other), inpatient status, age, gender, ethnicity, BMI, Charlson score, other comorbidities, and vital signs, using univariate and multivariate analysis.

RESULTS
CTs were performed on 2652 patients (mean age 55yrs, 66% W): 269 (10%) were positive, 1459 (55%) definitive negative, 269 (33%) limited negative, and 56 (2%) non-diagnostic for PE. The most common limitations reported were motion (45%) and poor opacification (32%). Patients with limited negatives were more likely to be obese (p
CONCLUSION
Limited negative impressions on CT reports are strongly associated with patient-related factors such as obesity, tachypnea, mechanical ventilation and higher comorbidity status, but not with radiologist subspecialization. Patients with limited negative CTs are more likely to receive anticoagulation and undergo additional V/Q scans.

CLINICAL RELEVANCE/APPLICATION
Limited negative CT reports for PE have a false negative rate similar to definitive negative reports. The clinical value of these patients� higher anticoagulation rates should be explored.

LL-CHS-TU4A ● Is a Chest Radiograph Necessary after Percutaneous Lung Biopsy When Pneumothorax Is Absent on the Immediate Post Procedure CT Scan?

Michael G Johnson MD (Presenter) ; **Lawrence Pan** MD ; **Turgut Berkmen**

PURPOSE
To determine if a chest radiograph following CT guided lung biopsy has an impact on patient management when no pneumothorax is present on immediate post biopsy CT images.

METHOD AND MATERIALS
We retrospectively reviewed 754 CT guided lung biopsies. Six hundred thirty five patients met our inclusion criteria. Immediate post-biopsy CT scans were followed by CXRs obtained 1 - 2 hours after the biopsy. Medical records were reviewed to determine if the CXR changed management in the absence of a pneumothorax on immediate post-biopsy CT. Characteristics such as age, gender, needle gauge, core versus aspiration biopsy, emphysema, lesion location, size and depth were analyzed.

RESULTS
Two hundred thirty three (36.7%) patients developed pneumothorax. Forty two (18.0%) required a chest tube. Two hundred twenty four (96.2%) pneumothoraces were detected on immediate post-biopsy CT scan. Four patients (0.6%) who did not have a pneumothorax on CT scan or CXR subsequently developed symptomatic pneumothoraces between 5 hours and 5 days post procedure and required a chest tube. Five pneumothoraces were detected only on CXR; none of these required a chest tube. Four hundred eleven patients without pneumothorax received 446 CXRs and spent an average of 116 minutes in the hospital. Statistically significant risk factors for pneumothorax were female gender, smaller needle gauge, increased lesion depth and smaller lesion size.

CONCLUSION
Following transthoracic needle biopsy of the lung, the risk of missing a pneumothorax on CT that requires an intervention is extremely low and is not associated with significant morbidity or mortality.

CLINICAL RELEVANCE/APPLICATION
Patients without a pneumothorax on immediate post-biopsy CT may be discharged without a post biopsy CXR, which will decrease the cost and clinical time associated with a majority of the procedures.

LL-CHS-TU5A ● The Implementation of a Lung Nodule Registry to Manage and Track Lung Nodules

Debra S Dyer MD (Presenter) ; **Elizabeth Kern** MD, MS ; **David A Lynch** MBBCh *

PURPOSE
Compliance with Fleischner Society Guidelines is variable among radiologists, reported between 35 - 61% (Eisenberg et al, Radiology 2010). A Lung Nodule Registry was implemented to improve consistency in lung nodule management, facilitate utilization of Fleischner Society Guidelines and as a quality safety net to track patient follow-up.

METHOD AND MATERIALS
Cryptic "tracker" phrases describing nodule character and need for follow-up were developed in accordance with Fleischner Society Guidelines. In July 2011, the institution's 6 radiologists began adding the tracker phrases to the end of their radiology reports on patients with lung nodules. The reports were automatically entered into the institution's EMR and Lung Nodule Registry. Through data mining in the EMR of lung cancer risk factors, patients were determined to be "high risk" or "not high risk." Using the risk determination and the tracker phrase, the Lung Nodule Registry calculated the due date for the follow-up CT. Compliance with lung nodule follow-up recommendations was assessed.

RESULTS
Between July 1, 2011 - March 31, 2013, 2945 patients were identified as having a lung nodule. Median age was 64%, 56% were female, 47% deemed high risk. 91% of the nodules were solid and 9% were subsolid. Of the total patients, 646 did not require follow up due to small nodule size and not being high risk. 2089 patients were noted to need a follow-up CT. Other diagnostic work-up such as PET-CT or biopsy was recommended in 210 patients. An early audit showed that the radiologists were 96% sensitive and 100% specific in the use of the tracker phrases. Among the 2089 patients needing follow-up CT, 622 (30%) patients completed follow-up CT recommendations, 606 (29%) were identified as pending follow-up with CTs scheduled, 29 (1%) died and 832 (40%) patients were found to be overdue for their follow-up CT. A reminder letter system was initiated to notify patients and referring physicians of overdue status.

CONCLUSION
The implementation of a Lung Nodule Registry facilitates the utlization of Fleischner Society Guidelines and tracking lung nodule

follow-up. A substantial number of patients do not return for lung nodule follow-up CT on time.

CLINICAL RELEVANCE/APPLICATION
Management of lung nodules is inconsistent. Use of a Lung Nodule Registry can facilitate the use of Fleischner Society Guidelines and track lung nodule follow-up.

LL-CHS-TU6A • Digital Tomosynthesis (DTS) Pulmonary Angiography and Upper Extremity venography: Is It Feasible?

Sudhakar N Pipavath MD (Presenter) * ; **Gregory Kicska** MD, PhD * ; **J. D Godwin** MD ; **Eric J Stern** MD ; **William P Shuman** MD * ; **Gautham P Reddy** MD

PURPOSE
To evaluate DTS as a diagnostic pulmonary angiographic modality and as a venographic method for assessment of DVT.

METHOD AND MATERIALS
Prospective digital tomosynthesis (DTS) examination of 12 healthy male volunteers was performed after injecting 100cc of iodinated contrast in the antecubital vein at 5cc/sec. Female subjects were excluded by design as inclusion would entail radiation exposure to the breast tissue without any added advantage. All scans were performed on Volume Rad (GE Healthcare, Waukesha, WI). Four radiologists reviewed studies and rated the quality of enhancement on a 3-point ordered scale for each branch level of pulmonary arteries as (1) non-diagnostic, (2) diagnostic for disease other than pulmonary embolism (PE), or (3) diagnostic for PE. Veins of the upper extremity on the injected side were scored as (1) non-diagnostic, (2) diagnostic for disease other than deep vein thrombosis (DVT), or (3) diagnostic for DVT. Inter-observer agreement was evaluated using weighted Cohen�s ? and linear weights.

RESULTS
Subject ages ranged from 19 to 55 years (median: 35 years). All pulmonary artery branches were rated as diagnostic for PE in 46% of readings, and diagnostic for disease other than pulmonary embolism in 92% of the readings. The enhancement of upper extremity veins was diagnostic for DVT in 77% of readings and diagnostic for disease other than DVT in 100%. Inter-observer agreement for pulmonary artery ratings was poor (k=0.05 (95% CI: -0.02, 0.12)). However, inter-observer agreement improved when diagnostic for vascular diseases other than PE and diagnostic for PE were grouped into a single category (k=0.13 (95% CI: -0.35, 0.56)). Agreement for the assessment of upper extremity veins was moderate (k=0.47 (95% CI: 0.32, 0.60).

CONCLUSION
DTS pulmonary angiography is feasible and may be diagnostic for non-PE vascular diseases. DTS may be a potential low dose alternative to CT venography and a quicker alternative to MR venography. Further study will be required to assess DTS in patients who have pulmonary vascular disease or DVT.

CLINICAL RELEVANCE/APPLICATION
DTS pulmonary angiography can be used to evaluate pulmonary vasculature. DTS venography is a potential new way of assessing upper extremity venous system.

Chest - Tuesday Posters and Exhibits (12:45pm - 1:15pm)

Tuesday, 12:45 PM - 01:15 PM • Lakeside Learning Center

CH

LL-CHS-TUB • *AMA PRA Category 1 Credit* ™:0.5

LL-CHS-TU1B • Low kV and Low-contrast Dose CTPA: Comparison of 80 kVp/20 ml and 120 kVp/40 ml Iodixanol (370mgI/ml) Protocols

Xuemei Hu MD (Presenter) ; **Daoyu Hu** MD, PhD ; **Zhimin Jiang**

PURPOSE
To evaluate the image quality and the diagnostic value of using low kV and low contrast dose protocol in computed tomography pulmonary angiography (CTPA).

METHOD AND MATERIALS
Fifty patients with clinically suspected pulmonary embolism and with BMI=28 underwent CTPA on a 64-MDCT scanner (GE Discovery CT750 HD). The CTPA scan time was determined by using a bolus test method after injection of 20ml contrast agent. Two CTPA protocols (group A: n=20, 80 kV/20 ml, 60%FBP+40%ASiR; group B: n=30, 120 kV/40 ml, FBP) were compared. The image quality parameters [beam hardening artifacts in the superior vena cava caused by iodine contrast agent, the display level of pulmonary arterial branch, and CT value , contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) for the main pulmonary artery] and radiation dose [the weighted dose index (CTDIw), the effective dose (ED)] were evaluated.

RESULTS
Total contrast dose for CT scans was 40ml in group A, 33% less than the 60ml in group B. Pulmonary embolism was found in 17 patients (6 in group A, and 11 in group B). Forth pulmonary artery branches (sub sections) were clearly displayed in all the cases. The beam hardening artifacts in the superior vena cava were reduced in group A. There was no statistically difference for the CT value, SNR and CNR in the main pulmonary artery between the two groups (410.2±95.8HU, 32.1±12.2, 27.5±12.1 for group A and 327.8±84.5HU, 44.8±15.6, 37.1±14.9 for group B, respectively). The CTDIw and ED for group A (4.43±0.03mGy and 1.13±0.13mSv) were significantly lower than those in group B (16.8±4.42mGy and 4.22±0.78mSv) (both p
CONCLUSION
The use of low contrast dose with low tube voltage and ASIR reconstruction in CTPA provides both contrast dose and radiation dose reduction with similar or better image quality in comparison with the conventional CTPA protocol, for individuals with BMI=28.

CLINICAL RELEVANCE/APPLICATION
The low kV and low contrast dose CTPA protocol reduced radiation exposure by almost 75%and contrast media volume by 33%. It will reduce contrast-induced kidney damage and is beneficial to the patients

LL-CHS-TU2B • Indication Drift in the Setting of Improved Safety: ATS/STR 2012 Guidelines May Lead to Increased Imaging of Pregnant Patients with Suspected Pulmonary Embolism

Elizabeth R Barak MD (Presenter) ; **Saurabh Jha** MD ; **Nadav Schwartz** MD ; **Daniel Pryma** MD * ; **Eduardo J Mortani Barbosa** MD ; **Warren B Gefter** MD

PURPOSE
In early 2012, we implemented the ATS/STR 2012 guidelines for the imaging of pregnant patients with suspected pulmonary embolism(PE). The major change instituted was triage of patients with normal chest radiographs to ventilation-perfusion imaging(VQ) rather than CT pulmonary angiogram(CT) in an attempt to lower maternal radiation dose. We then tracked imaging utilization for suspected PE in pregnancy.

METHOD AND MATERIALS
All pregnant patients imaged with either CT or VQ at a tertiary care center between January 1, 2010 and December 31, 2012 were tracked. Patients up to 6 weeks post-partum were tracked as a control. Two-tailed Fisher's exact test was used for statistics.

RESULTS

Over 3 years, we performed 114 exams on 107 pregnant patients with 9 positive(7.7%). In 2012, 54 scans(36 VQ and 18 CT) were performed on 52 patients, with 1 positive(1/54, 1.9%). In 2011, 31 scans(6 VQ and 25 CT) were performed on 27 patients, with 2 positive(2/31, 6.5%). In 2010, 28 scans(5 VQ and 23 CT) were performed on 28 patients, with 4 positive(14.3%). There was a significant increase in the number of patients imaged per yearly deliveries when comparing 2012 to 2011(52/4229 vs 27/4034, p= 0.0076) and to 2010(52/4229 vs 28/4139, p=0.0054). There was a significant decrease in the percentage of positive exams when comparing 2012 to 2010(1.9% vs 14.2%, p= 0.0441) but no significant difference when comparing 2012 to 2011(1.9% vs 6.5 %, p = 0.5509) or 2011 to 2010(6.5% vs 14.2%, p= 0.4092). In comparison, over 3 years 105 exams were performed on 102 post-partum patients with 11 positive(10.7%); including 36 scans in 2012 (35 CT and 1 VQ) on 35 patients with 6 positive(16.7%); 31 CT in 2011 on 29 patients with 2 positive(6.5%); and 38 CT in 2010 with 3 positive(7.9%) with no significant change in number of exams or percentage of positive exams.

CONCLUSION

Following successful implementation of ATS/STR guidelines there was a significant increase in pregnant patients imaged for PE with a significant decrease in positive scans. We conjecture that the increase in imaging is due to the commonly seen phenomenon in medicine of indication drift, i.e. the threshold for suspecting PE is reduced as the apparent safety of the test is increased.

CLINICAL RELEVANCE/APPLICATION

Introduction of the ATS/STR guidelines for imaging suspected PE in pregnancy may potentially increase the total population radiation dose in an attempt to reduce the individual maternal dose.

LL-CHS-TU3B ● Chronic Bronchitis in Large Airways: Airway Wall Measurements on Thin-slice Low-dose CT

Marjolein A Heuvelmans BSc (Presenter) ; **Xue-Qian Xie** MD ; **Akkelies E Dijkstra** ; **Judith M Vonk** ; **Matthys Oudkerk** MD, PhD ; **Rozemarijn Vliegenthart** MD, PhD ; **Harry Groen**

PURPOSE

Chronic bronchitis (CB) is usually caused by smoking and characterized by airway wall remodeling, commonly in large airways. The purpose is to determine differences in airway wall thickness (AWT) and wall area percentage (WA%) between subjects with and without CB symptoms.

METHOD AND MATERIALS

This study was performed in the Dutch-Belgian Randomized Lung Cancer Screening Trial (acronym: NELSON trial). Fifty heavy smokers with CB symptoms (cough, mucus, dyspnea and wheezing) and 50 heavy smokers without CB symptoms were randomly selected. A 16-row multi-detector computed tomography (CT) modality (Sensation 16, Siemens, Forchheim, Germany) was utilized with a low-dose acquisition protocol. The thin slice CT images were evaluated using a dedicated software tool for airway measurement (Airway Examiner 1.0, Fraunhofer MEVIS, Bremen, Germany). AWT and WA% were measured for airways with a luminal diameter =5mm in five different bronchi in different pulmonary lobes. Differences in airway wall measurements between groups were assessed by t-testing. The association between CB symptoms and AWT and WA% was analyzed using multiple linear regression adjusted for age, body mass index, smoking, 15 percentile point of lung density, and forced expiratory volume in first second as percentage of predicted.

RESULTS

All subjects were male, with a mean age of 56.5±5.4 years (range from 50 to 69). The symptomatic group included more current smokers than the control group and had a significantly smaller Perc15, indicating more emphysema (P0.05).

CONCLUSION

Patients with symptoms of chronic bronchitis have thicker airway walls in airways with 5 to 10mm in luminal diameter, but not in airways with a larger diameter.

CLINICAL RELEVANCE/APPLICATION

In lung cancer screening trials, most persons are smokers, with high prevalence of CB. The airway wall thickening of this patient group can be assessed without additional radiation exposure and cost.

LL-CHS-TU4B ● MRI-based Morphological and Functional Scoring of Chronic Obstructive Pulmonary Disease at 1.5 Tesla

Bertram Jobst MD (Presenter) ; **Oliver Sedlaczek** MD ; **Angela Anjorin** ; **Hans-Ulrich Kauczor** MD * ; **Sebastian Ley** MD ; **Jurgen Biederer** MD ; **Mark O Wielpuetz**

PURPOSE

In times of increasing therapeutic options in chronic obstructive pulmonary disease (COPD), novel non-invasive endpoints are necessary for repeated therapy monitoring. Since MRI allows for radiation-free regional morphological and functional assessment of the lung, it was the aim of this study to develop and validate a morpho-functional MR-based scoring system for COPD patients.

METHOD AND MATERIALS

20 COPD patients (GOLDI-IV) underwent lung MRI with a protocol dedicated to morphology, respiratory mechanics and lung perfusion. Image data were independently reviewed by 3 chest radiologists with experience in lung MRI. The severity of bronchial disease, small airway disease, nodules, consolidations, parenchymal defects suggestive of emphysema, and perfusion defects were rated with a 3-point scale in a lobe-based approach (max. score 97). In addition, the extent of tracheomalacia, pulmonary trunk ectasia, right ventricular overload, and respiratory motion impairment was assessed. We compared score values in mild (GOLDI-II) vs. severe (GOLDIII-IV) COPD.

RESULTS

CONCLUSION

The proposed semiquantitative morpho-functional MRI scoring system is capable of reporting a wide range of COPD-relevant findings with excellent interobserver-reproducibility.

CLINICAL RELEVANCE/APPLICATION

MRI allows for radiation-free assessment of regional changes in lung morphology and function. The proposed score may serve as a new biomarker for interventional trials.

LL-CHS-TU5B ● Evaluation of Chronic Graft Dysfunction after Lung Transplantation Using T1 Mapping Magnetic Resonance Imaging

Julius Renne MD (Presenter) ; **Jens Gottlieb** ; **Peer Lauermann** ; **Jan Hinrichs** ; **Sajoscha A Sorrentino** MD ; **Christian Schoenfeld** ; **Marcel Gutberlet** DiplPhys ; **Peter M Jakob** PhD ; **Tobias Welte** MD ; **Frank K Wacker** MD * ; **Jens Vogel-Claussen** MD

PURPOSE

Bronchiolitis obliterans syndrome (BOS) is the main cause of chronic graft dysfunction after lung transplantation. Early detection of graft dysfunction is crucial for an effective treatment. However, currently available diagnostic methods have only limited evidence for the detection of graft dysfunction. Purpose of this study was to evaluate if oxygen-enhanced T1-mapping magnetic resonance imaging may be useful to detect BOS.

METHOD AND MATERIALS

After written informed consent 55 patients with double lung transplants were included in this study. 8 patients had to be excluded because of acute pulmonary infections. MRI scans were performed on a 1.5T scanner using an inversion recovery snapshot fast low-angle

shot (FLASH) sequence for T1 relaxation mapping while breathing room air and 100% oxygen. A minimum of 6 coronal slices (15mm slice thickness with 5mm gap) covering both lungs were acquired. After manual lung segmentation the mean T1 value and the coefficient of variation were calculated for each patient. BOS stages were determined using pulmonary function test. Statistical analysis was performed using non-parametric Kruskall-Vallis test, Mann-Whitney test and Spearmanns correlation.

RESULTS
Using pulmonary function test the following BOS levels were determined: BOS0 (n=10), BOS0p (n=11), BOS1 (n=2), BOS2 (n=8), BOS3 (n=16). The mean T1 values under room air (p=0.58) as well as under 100% oxygen (p=0.96) did not differ significantly between the different BOS levels. The coefficient of variation of T1 values acquired breathing room air differed significantly (p=0.0028) for the different BOS levels with a median of 6.3% [interquartile range 5.9%;7.2%] for BOS0 and 8.6% [7.5%;9.7%] for BOS3 (p=0.0002). Furthermore, the coefficient of variation showed a significant correlation (r=-0.58; p=0.0001) with the forced expiratory volume in 1s (FEV1) in relation to the best FEV1 after transplant.

CONCLUSION
While T1 values did not correlate with the severity of BOS, the variation of T1 values expressed by the coefficient of variation increased with progression of BOS. Furthermore, the coefficient of variation showed an inverse correlation with the ratio of FEV1 / best FEV1 after transplantation, the current clinical parameter for the determination of BOS severity.

CLINICAL RELEVANCE/APPLICATION
T1 mapping MRI may serve as a future biomarker in early detection of chronic graft dysfunction.

LL-CHS-TU6B ● Intra- and Inter-reader Variability of Pulmonary Nodule Classification according to the Fleischner Guidelines: Clinical Consequences

Sarah J Van Riel MD (Presenter) ; **Eva M Van Rikxoort** PhD ; **Colin Jacobs** MSc * ; **Steven Schalekamp** MD * ; **Mathias Prokop** MD, PhD * ; **Bram Van Ginneken** PhD ; **Pim A De Jong** MD, PhD ; **Ernst T Scholten** MD ; **Hester Gietema** MD ; **Cornelia M Schaefer-Prokop** MD *

PURPOSE
Recently published recommendations by the Fleischner Society differentiate between non-solid and part-solid nodules. For the latter follow up or invasive diagnostic procedures are recommended depending on the size of the solid core. For solid nodules, different recommendations apply. We evaluated inter- and intra-reader variability of nodule classification and the impact on patient management.

METHOD AND MATERIALS
20 part-solid, 10 non-solid and 10 solid nodular lesions were randomly selected from the NELSON screening trial. Data had been acquired using a low dose (16x0.75mm, 120-140 kVp, 30 mAs) protocol. Complete CTs were shown with axial and coronal projections with 1mm section thickness. Readers could interactively scroll through the scans, use magnification, windowing and manual calibre measurements as warranted. Four readers of varying experience were asked to classify the lesions as solid (1), part-solid with a core > 5mm and < 5mm, respectively (2 and 3), or as non-solid (4). All readings were done twice in six sessions, in which all permutations of nodules and section thicknesses were presented in different random orders. Inter- and intra-reader agreement were calculated using Cohen�s kappa statistics. To evaluate possible consequences on patient management, the number of differences between assigned scores of 1 or 2 (invasive diagnosis) and scores of 3 or 4 (follow up) were calculated. All results stated are averaged over all reading sessions.

RESULTS
Inter-reader agreement was low with mean kappa of 0.33 (range 0.02-0.58). Intra-reader agreement was moderate with mean kappa 0.54 (range 0.31-0.72). Patient management would have differed in 27% caused by interreader disagreement, and would have changed in 8% caused by intrareader variability. 28% of all nodules were uniformly classified over all reading sessions. Of these, 18% were classified as solid and 73% as non-solid.

CONCLUSION
Inter- and intra-reader agreement are low and moderate for the classification of pulmonary nodules according to Fleischner criteria if pure visual analysis is used. This may affect patient management.

CLINICAL RELEVANCE/APPLICATION
Variability in nodule classification may have consequences on patient management; use of digital analysis tools appears to be necessary to improve classification.

Interventional Oncology Series: Lung

Tuesday, 01:30 PM - 06:00 PM ● S405AB

`RO` `OI` `IR` `CH`

VSIO31 ● *AMA PRA Category 1 Credit* ™:4.25 ● ARRT Category A+ Credit:5
    Moderator
    Alison R Gillams , MBChB *

LEARNING OBJECTIVES
1) To learn the latest results of ablation in primary and secondary lung tumours. 2) To understand how to use the different ablation technologies (RF, MW and cryotherapy). 3) To learn optimal patient selection for lung ablation. 4) To understand the imaging appearances following ablation. 5) To know how to diagnose and manage possible complications following ablation.

VSIO31-01 ● Primary Lung Cancer

Robert D Suh MD (Presenter)

LEARNING OBJECTIVES
1) Discuss long term outcomes of image-guided ablation for early stage lung cancer. 2) Discuss local control rates of image-guided ablation for early stage lung cancer. 3) Understand the factors in image-guided ablation influencing survival and local control. 4) Understand treatment options and relative outcomes of image-guided ablation compared to alternative therapies for early stage lung cancer.

ABSTRACT
Thermal ablation is a safe therapeutic and effective option to provide local control for 1� lung malignancies. Thermal ablation confers survival benefits in carefully selected patients: RF ablation with encouraging mid- and long-term results. Microwave and cryoablation remain promising techniques, requiring future studies for validation.

VSIO31-02 ● Colorectal Lung Metastases

Stephen B Solomon MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

VSIO31-03 ● Sarcoma and Other Non-CR Lung Metastases

Jean Palussiere MD (Presenter)

LEARNING OBJECTIVES
View learning objective under main course title.

VSIO31-04 ● Irreversible Electroporation of Lung Metastases: Initial Experience

Thierry J De Baere MD (Presenter) * ; **Julien Joskin** ; **Antoine Hakime** MD ; **Geoffroy Farouil** ; **Lambros C Tselikas** MD ; **Frederic Deschamps**

PURPOSE
Because recurrence rate of lung RFA has been reported higher when tumor are in contact with large vessels we used Irreversible Eletroporation (IRE) used to treat such located lung metastases and reported herein our initial experience

METHOD AND MATERIALS

RESULTS

CONCLUSION
IRE is well tolerated, induces a rapid decrease in size of the treated tumor but tumor regrowth is frequent within the first year of follow-up.

CLINICAL RELEVANCE/APPLICATION
IRE of lung metastases, although inducing rapid decrease of the tumor size does not prevent later growth of the tumor. Consequently, the technique must be improved before routine clinical use.

VSIO31-05 ● What Does SBRT Contribute to the Management of Primary or Metastatic Lung Cancer?

Brian T Collins MD (Presenter) *

LEARNING OBJECTIVES
1) Review SBRT technology. 2) Review SBRT patient selection. 3) Discuss mature locoregional outcomes of SBRT for stage I NSCLC and pulmonary metastases. 4) Discuss mature survival outcomes of SBRT for stage I NSCLC and pulmonary metastases. 5) Review expected chronic toxcities of thoracic SBRT.

VSIO31-06 ● Clinical Tumour Board

Robert D Suh MD (Presenter) ; **Stephen B Solomon** MD (Presenter) * ; **Brian T Collins** MD (Presenter) * ; **Jean Palussiere** MD (Presenter)

LEARNING OBJECTIVES
1) Understand case-based information. 2) Identify treatment strategies. 3) Evaluate thoracic interventional procedures.

VSIO31-07 ● Interpretation of Follow-up Imaging

William H Moore MD (Presenter) *

LEARNING OBJECTIVES
1) Identify the findings on follow up imaging that are characteristic of post-ablation zones. 2) Identify the findings on follow up imaging that are characteristic of recurrence. 3) Compare the post ablation imaging findings between RFA, Microwave, Cryoablation and Nanoknife.

ABSTRACT

VSIO31-08 ● Why, When and How I Perform RF Ablation of Lung Tumours

Jo-Anne O Shepard MD (Presenter) *

LEARNING OBJECTIVES
1) Understand multidisciplinary patient selection and describe the indications and contraindicatons to RFA of the lung. 2) Outline the RFA procedure including sedation, appropriate approach and positioning, equipment setup and treatment and followup protocols.

VSIO31-09 ● Why, When and How I Perform MW Ablation of Lung Tumours

Thomas J Vogl MD, PhD (Presenter)

LEARNING OBJECTIVES
1) Identify indications for MWA of lung tumors. 2) Identify procedure-related risk factors. 3) Learn about tips and tricks.

ABSTRACT
Thermal ablation techniques have increasingly expanded their role in minimal invasive destruction of tumor tissue beyond the liver, especially in the lung. Both primary and secondary lung cancers are currently of interest among thermal ablation techniques such as laser therapy, radiofrequency ablation, and others. With its introduction microwave ablation (MWA) has rapidly gained its role as a precise, excellently controllable ablation technique.
In the following course different techniques of MWA of lung cancers will be presented. This includes techniques on the access, protocols for the ablation and preventive management of complications. Special focus is directed towards the daily management of risk factors at our institute in Frankfurt based on the up-do-date experience.
In the second part the indications for thermal ablation among other technologies such as radiooncology, surgery and systemic chemo-immunotherapy will be presented.
In summary, MWA of neoplastic diseases of the lung rapidly gains acceptance and provides excellent treatment results with a low rate of complications and side effects. Its current role among an armamentarium of other treatment techniques has to be searched for, documented, consolidated and expanded.

VSIO31-10 ● Evaluation of a Combined Protocol of Microwave Ablation (MWA) and Transpulmonary Chemoembolization (TPCE) versus MWA Only Protocol: Treatment of Primary and Secondary Nonresectable Lung Tumors

Thomas J Vogl MD, PhD (Presenter) ; **Thomas Dauda** BS ; **Stefan Zangos** MD ; **Emmanuel C Mbalisike** MD ; **Nour-Eldin A Nour-Eldin** MD, MSc

PURPOSE
To evaluate tumor response with volumetric assessment of tumor sizes after treating nonresectable primary and secondary lung tumors with transpulmonary chemoembolization (TPCE) combined with microwave ablation (MWA) versus MWA only protocol in palliative intention.

METHOD AND MATERIALS
Between 2007 and 2012, 23 patients (10 males, 13 females; average, 61.2 years; range, 29-83) suffering from unresectable primary

(n=3) and secondary lung tumors (n=20) were treated with TPCE (average, 4.3 sessions) followed by MWA. Another 13 patients (8 males, 5 females; average, 60.2 years; range, 28-83) suffering from unresectable primary (n=2) and secondary lung tumors (n=11) were only treated with MWA. Patients treated with a combined therapy suffered from primary lung tumors (n=3) and metastases of different origins such as colorectal carcinomas (n=6), breast cancer (n=5), urothel carcinoma (n=3), and others (n=6). Patients treated only with MWA suffered from primary lung tumors (n=2) and metastases of different origins such as colorectal carcinomas (n=6), and others (n=5). Follow-up was between 4 months and 3.7 years for primary and secondary lung tumors.

RESULTS
All patients tolerated the combined treatment and the MWA only well and without adverse effects. The rate of spontaneously resolving pneumothoraces was 5.3% in the combined protocol and 4.1% in the MWA only protocol. According to the retrospective study data, in the combined treatment protocol complete response was documented in 30.4% (n=7) of lesions, while in 21.7% (n=5) stable disease was documented and in another 47.8% (n=11) a progressive disease situation. In the group of patients treated only with MWA (n=13), complete response was documented in 38.5% (n=5), stable disease in 7.7% (n=1) and progress in 53.8% (n=7).

CONCLUSION
According to the first evaluated data the additional use of TPCE results in a slight improvement of the local response rate and a reduction of the rate of progression. Further prospective studies are, however, necessary.

CLINICAL RELEVANCE/APPLICATION
Transpulmonary chemoembolization (TPCE) and microwave ablation (MWA) are relevant palliative treatment options in patients with primary and secondary nonresectable lung tumors

VSIO31-11 ● Why, When and How I Perform Cryoablation of Lung Tumours

Peter J Littrup MD (Presenter) *

LEARNING OBJECTIVES
1) Understand the different approaches and techniques for thorough cryoablation of lung tumors (e.g., the �1-2 Rule�), emphasizing unique benefits for chest wall, pleural-based, central and para-esophageal locations. 2) Understand techniques to minimize morbidity, assessing tumor location and approach. 3) Identify major imaging follow-up criteria for ablation success and any early failures. 4) Describe the overall cost-efficacy trade-offs for cryo vs. heat-based renal ablations vs. stereotactic body radiation therapy, in relation to tumor location, complications and recurrence rates.

ABSTRACT
Cryoablation of lung tumors offers a lower pain alternative than heat-based modalities, especially for pleural and/or chest wall locations. Central locations near major bronchi locations also have low rates of pneumothorax or broncho-pleural fistulas, while paraesophageal locations are readily protected by esophageal warming balloons. Major cryoablation benefits include its excellent visualization of ablation zone extent, low procedure pain and flexible hydrodissection of chest wall ablation sites near skin. CT-guidance is the cryoablation guidance modality of choice due to circumferential visualization and ready availability. MR-guidance has little clinical benefit or cost-efficacy.
For safety, cases will be considered for choosing the most avascular approach, extent of peri-bronchial contact and chest wall involvement. Imaging outcomes of complications and their avoidance will be shown. For optimal efficacy, tumor size in relation to number and size of cryoprobes emphasize the �1-2 Rule� of at least 1 cryoprobe per cm of tumor diameter and no further than 1 cm from tumor margin, as well as cryoprobe spacing of

VSIO31-12 ● Thoracic Cryoablation: A Major Benefit for More Central and Chest Wall Locations?

Peter J Littrup MD (Presenter) * ; **Hussein D Aoun** MD ; **Barbara A Adam** MSN ; **Evan N Fletcher** MS, BA ; **Mark J Krycia** BS

PURPOSE
To assess recurrence factors for percutaneous thoracic cryoablation. Tumor and ablation size, complications, location and vessel proximity were assessed for patients with primary thoracic and metastatic tumors.

METHOD AND MATERIALS
CT and/or CT-US fluoroscopic-guided percutaneous cryoablation was used in 222 procedures on 283 tumors (75 primary, 208 metastatic tumors) in 133 patients, noting tumor and ablation volumes, location, abutting vessels >3mm, recurrences, complications, and tumor type. Primary thoracic included all lung cancer types (n=70) and pleural tumors (n=5). Complications were graded by the National Institutes of Health, Common Terminology of Complications and Adverse Events (CTCAE). Hydrodissection and esophageal warming balloon were used for tissue separation as needed (20 and 9 respectively). A minimum of 2 cryoprobes were used on all patients and for larger tumors, tumor diameter plus one was used for probe number.

RESULTS
All patients required only conscious sedation. Overall tumor and ablation median size was 2.2cm and 4.2cm, respectively. Major complication rates were significantly lower in tumors =3 cm as opposed to =3cm, 1.5% (2/134) vs. 11.8% (9/76) (p
CONCLUSION
CT guided percutaneous cryoablation in the lung provides a low morbidity alternative for complex patients, particularly for pleural/chest wall and more central tumors. Complication rates are significantly lower for tumors
CLINICAL RELEVANCE/APPLICATION
Thoracic cryoablation is not affected by vessel proximity and produces low recurrence and complication rates. Cryoablation appears superior for central and chest wall locations.

VSIO31-13 ● Complications of Lung Ablation, Preventing Them and When They Occur - Their Management

Kamran Ahrar MD (Presenter)

LEARNING OBJECTIVES
1) List potential complications of lung tumor ablation. 2) Outline steps to avoid potential complications. 3) Outline steps to manage complications.

VSIO31-14 ● Evaluating Cryoablation of Metastatic Lung/Pleura Tumors in Patients - Safety and Efficacy (ECLIPSE)

David A Woodrum MD, PhD (Presenter) ; **Thierry Debaere** ; **Fereidoun G Abtin** MD ; **Peter J Littrup** MD * ; **Frederic Deschamps** ; **Robert D Suh** MD ; **Hussein D Aoun** MD ; **Matthew R Callstrom** MD, PhD *

PURPOSE
To evaluate safety and preliminary efficacy of CT guided lung cryoablation for lung metastases =3.5cm in patients with pulmonary metastatic disease.

METHOD AND MATERIALS
Forty patients (24 males,16 females; mean age 63 years) were enrolled in a prospective single arm study to evaluate CT guided lung cryoablation(Galil Medical,Arden Hills, MN) for patients with lung metastases. Inclusion criteria were up to 3 unilaterally or a maximum of 5 metastases bilaterally. Patients were followed with serial CT imaging at 1 week, 3, 6, and 12 months. The primary endpoint for the study is local tumor control assessed by a modified RECIST. Complications were assessed using the CTCAE 4.0

RESULTS
A total of 62 tumors (40 patients) underwent 48 cryoablation procedures. The mean tumor size was 1.4 cm (range 0.3 to 3.2 cm), and 80% (n=32) of patients had unilateral disease. Sedation was general (67%;n=32), conscious/sedation in 31%(n=15), and 2% regional

sedation(n=1). Treatment time ranged from 32-272 minutes (mean=101). Nine chest tubes (18%) were placed for pneumothorax but removed in 1 day or less. With the exception of three grade 3 events (non-cardiac chest pain, pneumothorax requiring VATS, and dialysis fistula thrombosis), all other reported adverse events (95.2%) were classified as CTCAE grade 1 or 2. The most common events (48 procedures) occurring within 30 days of the procedure were pneumothorax 50% (n=24), hemorrhage 8% (n=4). All resolved with minimal to no intervention. We did not encountered major hemorrhage to the lung or the pleura. At 3 months, 28 patients (75%) followed up with 100% response rate defined as either stable disease, partial response, or complete response. At 6 months, 15 patients (38%) followed up with a 95% response rate due to one patient having a local failure.

CONCLUSION
Cryoablation of metastatic lung tumors =3.5 cm appears to be a safe. Our preliminary results demonstrate promising local tumor control within the lung.

CLINICAL RELEVANCE/APPLICATION
CT guided lung cryoablation demonstrates safety and preliminary efficacy in treating metastatic lung disease.

VSIO31-15 ● Percutaneous Cryoablation in Management of Recurrent Mesothelioma after Surgical Pleurectomy and Decortication: Efficacy and Predictors of Local Recurrence

Fereidoun G Abtin MD (Presenter) ; **Jesse K Sandberg** MD ; **Robert D Suh** MD ; **William Hsu** PhD ; **James Sayre** PhD ; **Robert Cameron** MD

PURPOSE
Percutaneous cryoablation (PCT) is an ablative technique, used to manage recurrent mesothelioma in patients following surgical lung sparing decortication and pleurectomy. The purpose of this study was to evaluate the efficacy and clinical and ablation variables that are predictive of tumor recurrence following PCT.

METHOD AND MATERIALS
IRB obtained. From a database containing surgical and radiological information, patients with recurrent mesothelioma following lung sparing pleurectomy and decortication with at least one PCT were identified. Patients were followed after PCT using CT and PET/CT scans for at least 6 months. Clinical variables included: stage at diagnosis, chemotherapy, radiation, recurrence time lag following surgery, and number of lesions at time of recurrence presentation. PCT variables included: size of the lesion, edge of ice ball beyond the tumor, number of probes, size of probes, number of cryo cycles, maximum and total freeze and thaw time. A stepwise multiple logistic regression model was used to assess predictors of local recurrence after ablation; local recurrence determined by increased regional metabolic activity or increased size of post ablation zone.

RESULTS
17 patients were identified who underwent a total of 75 outpatient cryoablations (range of 1-25). Lesions measured a mean of 37 mm (range 14-113) by 22.0 mm (range 12-55) in diameter. At 6 months 68/75 (90.7%) ablations showed no recurrence. No major, but minor complications including hematoma, small pneumothorax and hemoptysis in one patient each and erythema in 3 chest wall subcutaneous lesions (5/75 =6.6%). Late complications in 4/75 (5.3%) ablations. Considering the clinical and ablation variables, iceball beyond tumor edge less than 6.52 mm detected on CT scan during ablation was the only statistically significant predictor of recurrence (p

CONCLUSION
PCT can be used for management of recurrent mesothelioma following surgery with low recurrence rate of 9.3%, and limited early complications of 6.6%. When performing PCT, at least 6.52 mm of the edge of iceball is needed to extend beyond the edge of tumor to limit local recurrence.

CLINICAL RELEVANCE/APPLICATION
Percutaneous Cryoablation can be used in local control of recurrent mesothelioma after surgery with low recurrence rate and limited early complications.

VSIO31-16 ● Can a Biopsy Performed after Lung Radiofrequency Ablation Be Contributive?

Lambros C Tselikas MD (Presenter) ; **Julien Adam** ; **Frederic Deschamps** ; **Geoffroy Farouil** ; **Julien Joskin** ; **Christophe Teriitehau** ; **Antoine Hakime** MD ; **Thierry J De Baere** MD *

PURPOSE
To evaluate the effectiveness of a biopsy performed after lung radiofrequency ablation (RFA).

METHOD AND MATERIALS
Institutional review board approval was obtained. Eighteen patients with lung tumors, including 72% of metastases (14/18) (8 colorectal, 1 renal, 1 parathyroid, 1 melanoma, 1 osteosarcoma, 1 cholangiocarcinoma and 1 breast cancer) and 23 % of primary lung cancers (1 epidermoid and 3 adenocarcinomas) were treated with lung RFA. A biopsy was performed immediately after RFA. The biopsy was obtained through the canula used to insert the RFA probe without need for additional puncture. Pathological results including diagnostic of malignancy and morphological characteristics of tumor have been analyzed. Effectiveness was defined by ability to obtain a diagnosis of malignancy. The ability to diagnose tumor subtype, and primitive tumor location (if applicable) was determined. Procedures characteristics, recurrences and complications were also registered.

RESULTS
Mean tumor size was 17.9mm (SD: 1.5mm) at CT immediately before RFA. 89% (16/18) of biopsies were able to diagnose malignancy. Cancer subtype and origin for malignant tumors was determine in 72% (13/18) of tumors. During one-year follow-up, 1 tumor demonstrate local progression (5.5%), 5 patients presented distant lung disease progression (33%) and 11 were lung disease free (61%). Thirteen complications occurred (72%), including 5 pneumothoraxes requiring chest tube placement (27%), and 7 minor pneumothoraxes without treatment (34%), and 1 intrapulmonary hemorrhage (5%) not requiring any specific treatment. No fatal complication occurred.

CONCLUSION
A biopsy performed after RFA of lung tumor can confirm malignancy in close to 90% of cases. This diagnosis is obtained without the need for additional puncture. Such post RFA biopsy avoids the need for immediately pre-RFA biopsy, which are at risk of alveolar hemorrhage, then blurring the tumor for subsequent targeting with RFA.

CLINICAL RELEVANCE/APPLICATION
Biopsy performed after RFA through the guiding canula has a high success rate, limits the number of transthoracic punctures, and preserves the best puncture path for RFA probe placement in lung tumor.

VSIO31-17 ● IR Tumour Board

William H Moore MD (Presenter) * ; **Jo-Anne O Shepard** MD (Presenter) * ; **Thomas J Vogl** MD, PhD (Presenter) ; **Peter J Littrup** MD (Presenter) * ; **Kamran Ahrar** MD (Presenter)

LEARNING OBJECTIVES
1) Understand case-based information. 2) Identify treatment strategies. 3) Evaluate interventional procedures.

Chest (Digital Imaging)

Tuesday, 03:00 PM - 04:00 PM ● S404CD

SSJ06 • *AMA PRA Category 1 Credit* ™:1 • ARRT Category A+ Credit:1
Moderator
Heber Macmahon , MD *
Moderator
Sudhakar N Pipavath , MD *

SSJ06-01 • Multi-institution Evaluation of Digital Tomosynthesis, Dual-energy Radiography, and Conventional Chest Radiography for Detection and Actionability of Pulmonary Nodules

James T Dobbins PhD (Presenter) * ; **H. Page McAdams** MD * ; **John M Sabol** PhD * ; **Dev P Chakraborty** PhD ; **Ella A Kazerooni** MD ; **Gautham P Reddy** MD ; **Jenny Vikgren** MD, PhD *

PURPOSE
Measure sensitivity and specificity of digital tomosynthesis (DT), dual-energy radiography (DE), and conventional radiography (CXR), alone and in combination, for detection of pulmonary nodules and for determining actionability in an international, multi-institution, multi-reader study.

METHOD AND MATERIALS
This IRB-approved, HIPAA-compliant study enrolled 158 subjects (115 positive, 43 negative for CT-confirmed pulmonary nodules) at four tertiary care institutions. Subjects were imaged by chest CT, CXR (PA and lateral), DE, and DT on a flat-panel imaging device (VolumeRAD, GE Healthcare, Chalfont St. Giles, UK). Three experienced thoracic radiologists confirmed presence and location of nodule(s) by CT and determined their actionabilty using Fleishner Society guidelines. Five general radiologists, using free-response methodology and scoring on a 5-point likelihood scale, marked nodules and then determined actionablilty using CXR alone, CXR plus DE, DT alone, and DT plus DE (2193 total markings). Overall sensitivity, specificity, and JAFROC figure-of-merit (FOM; overall measure of observer performance) for various nodule size categories were determined using CT data as the reference standard.

RESULTS
516 nodules (344 of 3-5 mm, 130 of >5-8 mm, and 42 of >8-20 mm) were identified by CT. Overall detection sensitivity was 3.8%, 5.7%, 13.5%, and 13.4% for CXR, CXR+DE, DT, and DT+DE, respectively, for all nodules (3-20 mm; n=516); and 9.0%, 13.5%, 27.8%, and 28.1%, respectively, for nodules >5-mm; n=172. On a per-subject basis, sensitivity (and specificity) for actionability was 41.3% (75.0%) for CXR, 50.4% (69.4%) for CXR+DE, 60.6% (78.4%) for DT, and 52.6% (80.3%) for DT+DE. On a per-nodule basis (diam > 5 mm), JAFROC FOM was 0.453, 0.446, 0.575, and 0.573 for CXR, CXR+DE, DT, DT+DE, respectively; DT FOM was significantly better than CXR (p
CONCLUSION
DT outperformed CXR for lung nodule detection and for determination of actionability using Fleishner Society criteria. The addition of DE improved determination of actionability when paired with CXR but not when paired with DT.

CLINICAL RELEVANCE/APPLICATION
DT shows significantly improved clinical performance over CXR for pulmonary nodule detection and is recommended for imaging nodules of actionable size.

SSJ06-02 • Comparative Study between Mobile Computed Radiography and Mobile Flat-panel Radiography with and without Anti-scatter Grid for Bedside Chest Radiography: Impact on Image Quality

Thomas Lehnert MD (Presenter) ; **Nagy N Naguib** MSc ; **Josef Matthias Kerl** MD * ; **Ralf W Bauer** MD * ; **Maya C Larson** ; **Thorsten Burkhard** MD ; **Boris Schulz** MD ; **Thomas J Vogl** MD, PhD

PURPOSE
To evaluate the effect of an anti-scatter grid on perceived image quality in adult bedside chest radiographs using both a mobile digital radiography (DR) system and a conventional computed radiography (CR) system.

METHOD AND MATERIALS
We included 103 intensive-care patients (mean age: 66.4 years). Patients received bedside chest radiographs using four acquisition techniques (CR and DR with and without grid). Image quality was evaluated independently by four radiologists using a 9-point visibility scale. Evaluated were: lung parenchyma, soft tissues, thoracic spine, foreign bodies and overall image quality. Inter-observer agreement and differences between systems were tested using inter-class correlation test. Mean scores were compared by analysis of variance (ANOVA) followed by post-hoc pairwise testing (Tukey test) in case of multiple group comparison and by student�s t-test in case of single group comparison (p < 0.05 = significant).

RESULTS
The image quality of the DR images with a grid was significantly higher than that obtained without a grid (p
CONCLUSION
The use of an anti-scatter grid significantly improved the image quality of bedside DR radiographs. A similar effect was seen with CR radiographs but only for lung parenchyma, soft tissue and overall image quality. Mobile DR outperformed CR in all structures.

CLINICAL RELEVANCE/APPLICATION
In both, CR and DR, the use of grid in adult bedside radiography proved to be beneficial, and significantly improved the perceived image quality.

SSJ06-03 • Impact of Digital Scatter Correction on the Image Quality of Bedside Chest Radiographs

Sarah Poetter-Lang (Presenter) ; **Helmut Prosch** ; **Daniela Kienzl** ; **Barbara J Fueger** MD ; **Michael Weber** ; **Cornelia M Schaefer-Prokop** MD * ; **Martin Uffmann** MD

PURPOSE
The use of an anti-scatter grid for bedside chest radiographs in intensive care unit patients yields improved image quality at the cost of increased patient dose, higher demands on the acquisition technique and a heavier cassette weight. The aim of our study was to evaluate the impact on image quality of a newly developed processing method that allows for digital correction of scattered radiation.

METHOD AND MATERIALS
On consecutive days, 51 intensive care unit patients received clinically indicated bedside chest radiographs (MobileDiagnost wDR, Philips, Hamburg) with an anti-scatter grid (method A), and without an anti-scatter grid, but at a 1.6-fold reduced radiation dose (method B). The reduced-dose images were processed using scatter correction software (method C). Four readers evaluated the 153 images independently, in random order, scoring the visibility of five image quality features on a 10-point scale from 1 (very bad) to 10 (excellent), and with 4 indicating the minimum requirement for diagnostically acceptable image quality. Delineation of anatomic landmarks in high- and low-absorption areas was used as a surrogate for image quality, and thus, delineation of abnormalities.
An analysis of variance with repeated measures was used to test the significance of differences of reader ratings at a p level below 0.05.

RESULTS
For all imaging features, quality was rated significantly different (p
CONCLUSION
The scatter correction algorithm yielded significantly higher image quality for bedside chest radiographs compared to non-corrected images, but were inferior to grid images. The scatter-corrected images were comparable to grid images based on a threshold chosen to determine potentially diagnostically relevant differences.

CLINICAL RELEVANCE/APPLICATION
Scatter correction applied to bedside chest radiographs may obviate the need for anti-scatter grids, and therefore, enables a substantial radiation dose reduction.

SSJ06-04 ● Yield of Screening Chest Radiography for a Positive PPD Test in New York City

Grace C Lo MD (Presenter) ; **Michael A Kadoch** MD ; **Vivian Bishay** MD ; **Thomas J Ward** MD ; **Matthew D Cham** MD ; **Adam Jacobi** MD

PURPOSE
The Centers for Disease Control recommends that individuals with a positive PPD test undergo chest radiography to exclude a diagnosis of tuberculosis (TB). There are more reported cases of TB in New York City (NYC) each year than in any other city in the country. The purpose of this study was to review the prevalence of radiographic abnormalities of TB on chest x-rays (CXR) performed for a positive PPD in a single, urban tertiary medical center in NYC.

METHOD AND MATERIALS
Institutional review board approval was obtained. CXR reports of 904 consecutive asymptomatic individuals with a positive PPD test between January 1, 2011 and December 31, 2012 were reviewed. The prevalence of radiographic abnormalities of TB, the amount of downstream testing generated, and the results of sputum cultures, when available, were recorded.

RESULTS
Of the 904 cases reviewed (676 females, 228 males, mean age 34.74), not a single case of confirmed active TB was identified. Active TB could not be excluded based on CXR alone in 4 patients (0.4%), but all sputum cultures that were obtained in these individuals were negative. Granulomas were present in 26 patients (2.9%). No cavitary lesions were identified. A single case of lung cancer was identified (0.1%). Follow-up exams were recommended in 30 patients (3.3%), which included 15 CT scans (1.7%), 11 radiographs (1.2%), 2 echocardiograms (0.2%), 1 ultrasound (0.1%), and 1 mammogram (0.1%).

CONCLUSION
Despite the fact that there are more reported cases of TB in NYC than in any other city in the country, universal screening of asymptomatic PPD positive patients with chest radiography is still a low-yield study for the detection of active TB. It also generates a significant amount of downstream testing. These exams may also represent an unnecessary source of radiation exposure.

CLINICAL RELEVANCE/APPLICATION
Screening chest radiography among asymptomatic PPD patients appears to be a low-yield study for the detection of active TB. Therefore, it may be time to reconsider this universal recommendation.

SSJ06-05 ● Bull's Eye Imaging for the Evaluation of Pulmonary Blood Flow Using Non Enhancement Dynamic Chest X-ray: In Comparison with 99mTc-MAA Perfusion Scintigraphy

Takehiko Abe MD (Presenter) ; **Norihisa Motohashi** MD, PhD ; **Yuka Sasaki** ; **Tomomichi Izuka** ; **Naoko Koyanagi** ; **Atsuko Kurosaki** MD ; **Sumiya Nagatsuka** MS ; **Hideo Ogata** ; **Shoji Kudoh** MD, PhD

PURPOSE
To evaluate the bull�s eye imaging of pulmonary regional blood flow using non enhancement dynamic chest X-ray in comparison with 99mTc-MAA scintigraphy.

METHOD AND MATERIALS
Dynamic chest pulsed X-ray at 15 frames per second in total 10 second of tidal breathing was performed in 69 patients (mail:38, female:31 65.3years± 12.1years) with pulmonary disease. The institutional review board approval and written informed consent was obtained in all patients. Image data-sets were extracted by signal intensity pixels of blood flows by using a band-pass filter optimized for heart beats. Two trained radiologists were diagnosed and determined main vessel phase, capillary phase, and Maximum intensity projection (MIP) of each flames in one heart beat was adjustment to the bull�s eye fields and divided into 6 fields (upper, middle, lower, in right and left in every 2 hours). The signal value rate of the dynamic chest x-ray was compared with the 99mTc-MAA scintigraphy.

RESULTS
All the patients were performed technically with the total exposed dose of 0.25mGy.
The signal rate of the blood flows of main vessels in each upper, middle, lower fields was 11.9%±2.3, 23.1%±4.2, 20.7%±5.3, and 12.1%±2.8, 23.0%±5.5 and 9.2%±3.6 in the left.
The signal rate of capillary blood flow was 13.6%±2.4, 16.5%±2.8 and 23.6%±5.1 in the right, and 13.5%±3.1, 16.2%±3.4, and 16.5%±5.0 in each upper, middle, lower fields.
The rate of the MIP was 13.0%±1.4, 20.4%±2.2 and 22.4%±3.1 in the right, and 12.9%±1.9, 19.0%±2.6 and 12.4%±3.4 in the left. In those cases, The 99mTc-MAA uptake was 7.3%±2.8, 21.3%±5.6 and 27.6%±8.2 in the right and 7.3%±3.0, 18.4%±5.7 and 18.0%±7.9 in the left, respectively.
Comparison of the examinations had good correlations with R=0.59 in main vessel phase, R=0.43 in capillary phase, and R=0.67 in MIP in this study.

CONCLUSION
Bull�s eye imaging of dynamic chest X-ray blood flows had some collation with 99mTc-MAA scintigraphy. This method has potential to allow measurement and quantification of pulmonary blood flows.

CLINICAL RELEVANCE/APPLICATION
Bull�s eye imaging for the evaluation of pulmonary blood flow using non enhancement dynamic chest X-ray was shown some colleration with 99mTc-MAA scintigraphy.

SSJ06-06 ● Performance of a Next Generation Computer-aided Detection Algorithm for the Detection of Overlooked Lung Cancers on Chest Radiographs

Calen Frolkis BA (Presenter) ; **Robert C Gilkeson** MD *

PURPOSE
This retrospective study sought to evaluate a next generation CAD algorithm on the detection of previously overlooked lung cancer on prior chest radiographs.

METHOD AND MATERIALS
Institutional Review Board approval was granted for this retrospective study. Patient consent was not necessary given the retrospective nature of the data collection. Retrospective review of 606 patients presented within the last year at our institutions thoracic tumor board was performed. Clinical reports from cross-sectional imaging, pathology and prior chest radiographs were analyzed. Of this cohort, analysis revealed 41 patients whose lung cancer was inititally overlooked on a chest radiograph.A board certified chest radiologist with 15 years experience confirmed that this overlooked lesion corresponded to the site of the malignant lesion. A subtlety rating from 1-10 (1 + very subtle) was assigned to each radiograph. Anatomic distribution of nodules was recorded.All 41 images were analyzed by a next generation CAD algorithm for lung cancer detection (OnGuard 5.2 Riverain Medical). The time lapse between index CXR and eventual clinical diagnosis was recorded.

RESULTS
Overlooked lung nodules were found in 41 patients (age range 44-91yrs, average: 69yrs; 23 women, 18 men) on 41 chest radiographs. Subtlety ratings ranged from 1-9, mean of 2.39, mode of 2.Overlooked lesions were distributed in the upper lobes, 41.4% in the Right

upper lobe, and 19.5% in the Left upper lobe.The time interval between the index CXR and diagnosis ranged from 1 day to 8yrs, with an average interval of 577 days (1.5yrs).The CAD algorithm detected 28 of 41 of these lesions(sensitivity 67%). Location of the lesions detected by CAD were right upper lobe and apex (13, 31.7%), and left upper lobe and apex (8, 19.5%).The most common pathologic diagnosis in our cohort was Adenocarcinoma (24, 58.5%), Squamous cell carcinoma (14, 34.1%), and metastatic lesions (3,7%).There was a false positive average of 0.75 per image in this cohort.The majority of false positive marks were located in the upper lobes, often overlying bony structures, and pleural surfaces.

CONCLUSION
When compared to the prior literature, this CAD algorithm demonstrates marked improvement in performance in the radiologic evaluation of subtle lung cancer.

CLINICAL RELEVANCE/APPLICATION
Our study suggests that adoption of a next generation CAD system has the potential to improve time to diagnosis in patients with lung cancer.

Case-based Review of Nuclear Medicine: PET/CT Workshop-Cancers of the Thorax (In Conjunction with SNMMI) (An Interactive Session)

Tuesday, 03:30 PM - 05:00 PM ● S406A

`OI` `NM` `CT` `CH`

MSCC34 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5
Director
John A Parker , MD, PhD
Terence Z Wong , MD, PhD *

LEARNING OBJECTIVES
1) Understand the role that PET/CT can play in managing thoracic malignancies. 2) Describe the major pitfalls in interpreting thoracic PET/CT. 3) Discuss strategies for maximizing diagnostic accuracy in evaluating thoracic malignancy.
ABSTRACT
FDG-PET/CT has proven diagnostic value for evaluating primary malignancy and metastatic disease within the thorax, and can have a significant impact on patient management. Malignancies that are frequently evaluated in the thorax include primary lung cancer, esophageal cancer, lymphoma, and pleural disease. Interpretation of thoracic FDG-PET/CT scans may be complicated by the presence of benign conditions that can have high metabolic activity simulating malignancy; examples include "brown fat", sarcoidosis, granulomatous disease, post-therapeutic changes, infection, and reactive inflammation. On the other hand, some malignant disease may exhibit only modest FDG accumulation; factors include tumor histology, partial volume averaging effects, and respiratory motion. Hence, factors other than intensity of FDG uptake are often essential to distinguish benign from malignant disease. Patient history and details of prior therapy are important. Additional helpful information includes patient history, lesion distribution and symmetry, and CT imaging characteristics of the lesions. Using a case-based approach, examples of FDG-PET/CT imaging will be presented for evaluating a variety of thoracic malignancies. The approach to interpretation and strategies for distinguishing malignant from benign processes will be highlighted.

Interactive Game: The Audience Participation Game (Chest Imaging)

Tuesday, 04:30 PM - 06:00 PM ● E451A

`CT` `CH`

RC401 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5

LEARNING OBJECTIVES
1) To provide an approach to the imaging evaluation of the patient with mediastinal and lung disease. 2) To list the imaging features that allow categorization of diseases as mediastinal, airway, or interstitial. 3) To enumerate the key radiographic and CT features of these abnormalities with emphasis on providing a focused differential diagnosis. 4) To establish the role of the radiologist in the multidisciplinary approach to the management of affected patients. This interactive session will use RSNA Diagnosis Live�. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.
ABSTRACT
Diffuse lung disease is a challenging imaging finding as it is often nonspecific. Determination of potential etiologies relies on the clinical profile of the affected patient, the chronicity of symptoms, relevant laboratory findings and the distribution of disease on chest radiography. Although the above may provide clues to the diagnosis, many of these patients are evaluated with thin-section or high-resolution chest CT (HRCT). Diffuse lung diseases may affect the airways, the airspaces and/or the pulmonary interstitium.
Airways diseases may include abnormalities of airway caliber, wall thickness, and bronchiolitis (including cellular and constrictive types). Abnormalities of the airspaces may include alveolar filling with edema fluid, blood, infectious purulent material, lipoprotein and neoplastic cells, among various entities. Interstitial lung diseases are a complex group of idiopathic and secondary lung diseases (including smoking related diseases) often complicated by pulmonary fibrosis. The radiologist plays an important role in the prospective diagnosis of idiopathic interstitial fibrosis. Cystic lung diseases can also be considered within the spectrum of interstitial lung disease and may relate to abnormal cellular proliferations or may be the sequela of cigarette smoking.
This course will present a systematic approach to the imaging evaluation of patients with diffuse lung disease with emphasis on the formulation of a focused differential diagnosis, management recommendations and strategies for establishing the final diagnosis. The course will be presented as a series of case studies and enhanced by the use of the DX Live Audience Participation Game which will allow the audience to analyze the cases and make the diagnoses in a systematic fashion.

RC401A ● Interstitial Lung Disease

Laura E Heyneman MD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT

RC401B ● Mediastinal Disease

Jared D Christensen MD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

RC401C ● Airway Disease

Santiago Martinez-Jimenez MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

Chest Imaging: How Radiologic-Pathologic Correlation Informs Interpretation

Wednesday, 08:30 AM - 10:00 AM ● N228

CT CH

RC501 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5

LEARNING OBJECTIVES
1) Understand the basic structures and systems that allow the respiratory system to function. 2) Utilize the knowledge of basic respiratory structures to improve their understanding of respiratory disease and therefore improve diagnostic accuracy. 3) Improve their understanding of disease that affects the lung interstitium, small airways, pulmonary vessels and lymphatics. 4) Learn an approach to the assessment of lung nodules including new information on small ground glass opacities.

RC501A ● Interstitial Lung Disease

Jeffrey R Galvin MD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

RC501B ● Diseases of the Small Airways

Phillip M Boiselle MD (Presenter)

LEARNING OBJECTIVES
1) To understand the normal anatomy of the small airways and their relationship to the secondary pulmonary lobule. 2) To identify characteristic HRCT patterns of small airways diseases along with their clinical and pathological correlates.

RC501C ● Vascular Disease

Aletta Ann Frazier MD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

RC501D ● Lymphoid Diseases

Tomas C Franquet MD (Presenter)

LEARNING OBJECTIVES
1) To illustrate the imaging findings of some pulmonary lymphoid diseases. 2) To correlate these findings with histopathologic features. 3) To present a differential diagnosis based on pathologic-radiologic correlation.

ABSTRACT

RC501E ● Lung Nodules

Seth J Kligerman MD (Presenter) *

LEARNING OBJECTIVES
1) Recognize three basic patterns of micronodularity (centrilobular, perilymphatic, random). 2) Learn differential diagnosis for each pattern. 3) Recognize additional imaging findings that will help make the correct diagnosis. 4) Understand pathologic findings which lead to each pattern.

ABSTRACT
Micronodular lung disease has three recognizable patterns which are described based on their anatomic relation to the secondary pulmonary lobule. Centrilobular nodules are the most common pattern encountered in daily practice and in most instances are related to inflammation or impaction of the respiratory bronchioles which are located in the center of the secondary pulmonary lobule. Centrilobular nodules occur in numerous pathologic processes including infection, aspiration, toxic inhalation, hypersensitivity pneumonitis, respiratory bronchiolitis, follicular bronchiolitis, and panbronchiolitis. Less commonly, centrilobular nodules can be seen due to impaction of the small arterioles in the center of the secondary pulmonary lobular due to intravenous injection of foreign substances. In contrast to centrilobular nodules, perilymphatic nodules involve the peribronchovascular interstitium, subpleural interstitium, or interlobular septae as these are the locations of lymphatic draining in the lung. Although most commonly associated with sarcoidosis, certain pneumoconioses and lymphangitic spread of tumor can lead to perilymphatic nodules. In rare instances, this pattern can be encountered with amyloidosis and lymphoid interstitial pneumonia. Random nodularity is diagnosed when numerous micronodules have no identifiable location throughout the axial distribution of the lung. Although some of the nodules in this pattern may be perilymphatic or centrilobular in location, many of the nodules are scattered throughout the secondary lobular without respect to anatomic boundaries. This is most commonly seen with hematogenous spread of infection (miliary tuberculosis or fungal infection) or metastases.

Chest (Diffuse Lung Disease)

Wednesday, 10:30 AM - 12:00 PM ● S404CD

CT CH

SSK04 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5
Moderator
David A Lynch , MBBCh *
Moderator
Cristopher A Meyer , MD *

SSK04-01 ● Dynamic Contrast-enhanced CT Quantification of Fractional Extracellular Space Correlates with Pulmonary Fibrosis Severity in a Bleomycin Mouse Model

Wilbur Wang BA (Presenter) ; **Yanjun Fu** PhD ; **Dongwei Gao** MD ; **Margaret J Wong** MENG, BS ; **Kevin Tan** ; **Hal Chapman** MD ; **Kirk D Jones** MD ; **Michael D Hope** MD ; **Benjamin M Yeh** MD *

PURPOSE
To evaluate whether dynamic contrast-enhanced CT measurements of the pulmonary fractional extracellular space (fECS) can be used to quantify the severity of pulmonary fibrosis in a mouse model.

METHOD AND MATERIALS

A range of early pulmonary fibrosis was induced in twenty-one C57BL6/N mice by intratracheal bleomycin. Mice were then scanned with dynamic contrast-enhanced CT using iohexol. Lungs were then excised and collagen was quantified using the Sircol assay in a blinded fashion. Histopathologic peribronchiolar/alveolar ductal fibrosis was graded qualitatively from 0 = none to 3 = severe. Severity of pulmonary fibrosis was graded by a thoracic radiologist from 0 = none to 2 = severe. Pulmonary fECS was calculated at each time point (every minute after contrast injection for 35 minutes) using the following equation: (postcontrast � precontrast lung attenuation) x (1 � hematocrit) / (postcontrast � precontrast blood pool attenuation). Final pulmonary fECS values for each mouse were determined as the value at which the calculated fECS reached an asymptote, representing equilibrium of the contrast material. Findings were correlated to collagen concentration and histopathological fibrosis grade.

RESULTS
Calculated fECS measurements in the mouse lungs ranged from 12.4 to 76.1%. Collagen concentrations ranged from 15.0 to 84.6 �g collagen / mg dry lung tissue. Histopathologic pulmonary fibrosis grade ranged from 0 to 3. CT measures of fECS correlated strongly with pulmonary collagen concentrations ($R^2 = 0.647$, $P < .001$) and histopathologic fibrosis grade ($R^2 = 0.578$, $P < .001$). Visual radiologic findings of lung disease correlated moderately with collagen concentration ($R^2 = 0.325$, $P < .01$) but not with histological fibrosis grade ($R^2 = 0.033$, $P = .43$). Multivariate regression analysis showed fECS and visual findings are independent predictors of collagen concentration, with an adjusted-$R^2 = 0.62$ ($P < .001$, $P < .05$, respectively).

CONCLUSION
Quantitative contrast-enhanced CT measurements of fECS more accurately estimates pulmonary fibrosis than does visual scoring of CT images in a mouse model, and complements visual scoring.

CLINICAL RELEVANCE/APPLICATION
Contrast-enhanced CT measurements of fECS may potentially be a useful quantitative marker for pulmonary fibrosis for noninvasive monitoring of pulmonary disease severity.

SSK04-02 ● Idiopathic Pulmonary Fibrosis: Comparison of a Quantitative Fibrosis Score and CT Indexes from Histogram as Biomarkers of Disease Severity and Surrogate Endpoints in Assessing Change

Hyun J Kim PhD (Presenter) ; **Matthew S Brown** PhD * ; **Daniel Chong** BS ; **Peiyun Lu** ; **Heidi Coy** ; **Jonathan G Goldin** MBChB, PhD

PURPOSE
To be a useful Quantitative Imaging Biomarker (QIB) of treatment efficacy, it should be capable of assessing severity and change of time of the disease process. CT quantitation can be based on histogram analysis of lung density or a classifier-model derived score from a set of texture features. The purpose of the study is to compare two published approaches, kurtosis of histogram analysis and the Quantitative Fibrosis Score based on a classification model to assess baseline severity and change over time in patients with idiopathic pulmonary fibrosis (IPF).

METHOD AND MATERIALS
From imaging database of standardized CT scans obtained on patients with well characterized IPF, 60 patients (29 Male with mean of Forced Vital Capacity (FVC) 63%±12) with at least baseline and paired follow-up scans were selected. After semi-automated lung segmentation, indexes of kurtosis, mean lung attenuation, variance, and skewness were derived from histogram at whole lung. Quantitative Lung Fibrosis (QLF) and Quantitative Interstitial Lung Disease (QILD) scores and volumes were calculated from a classification algorithm with denoise technique. Spearman rank correlations were used to assess associations between CT indexes and quantitative scores comparing with FVC (percent predicted) at baseline and change in FVC on follow-up.

RESULTS
At baseline, mean (±SD) of kurtosis, mean lung attenuation, variance, and skewness were 2.43 (±1.83), -760HU (±54), 44220 (±15048), and 1.48 (±0.45), respectively. Mean (±SD) of QLF and QILD were 20.7% (±13.4) and 43.3% (±20.0) for scores and were 0.71L (±0.42) and 1.52L (±0.64) in volumes. All baseline histogram indexes and QLF and QILD scores were correlated with the baseline FVC (e.g. ? =0.57; p
CONCLUSION
Kurtosis is associated with physiologic measure of baseline severity but not useful for assessing change over time. A classifier-model derived score based on a set of texture features is associated with both baseline disease extent and a sensitive measure of change over time.

CLINICAL RELEVANCE/APPLICATION
For patients� selection based on extent of disease and for meauring longitudinal changes in patients with IPF, a quantitative score derived from a classification algorithm can be used as a QIB.

SSK04-03 ● Atypical UIP: Prevalence and Genetic Associations

Jonathan H Chung MD (Presenter) * ; **Ashish Chawla** MD, MBBS ; **David Mckean** ; **Steve Groshong** MD ; **Carlyne Cool** MD ; **David A Lynch** MBBCh * ; **Anna Peljto** ; **Janet Talbert** ; **Marvin I Schwarz** MD ; **David Schwartz**

PURPOSE
To determine the frequency of atypical UIP and to evaluate whether there was an association between atypical UIP and the MUC5B promoter site SNP (rs35705950), which has been strongly associated with IPF and familial PF.

METHOD AND MATERIALS
HRCT scans of 1,764 subjects with known interstitial lung disease were scored. Of these subjects, 250 subjects had both histologic and rs35705950 SNP data (GG, GT, TT). Atypical UIP was defined as subjects in whom UIP was not considered present on the imaging differential diagnosis but was scored as definitely present on histology. Typical UIP was defined as subjects in whom UIP was considered possible, probable, or definite on imaging diagnosis and was scored as definitely present on histology. A two-tailed Fisher�s exact test and t-test were used to compare proportions and means, respectively.

RESULTS
There were 25 atypical UIP cases and 52 typical UIP cases. The rate of atypical UIP relative to all subjects in whom UIP was not considered was 22.7%. Though the total extent of fibrosis was similar in typical and atypical UIP (19.6% +/-17.7% vs 11.7% +/-12.2%, p=NS), atypical UIP cases had a significantly higher prevalence of ground-glass opacity (19.6% +/-17.7% vs 11.7% +/-12.2%, p=0.019) a lower rate of honeycombing (20% compared to 53.8%), and less subpleural preponderance (20% compared to 58%, p=
CONCLUSION
A substantial percentage of subjects with an imaging pattern inconsistent with UIP have a high-confidence diagnosis of UIP on histopathology. Atypical UIP cases most commonly mimic NSIP and chronic HP. The prevalence of the rs35705950 SNP is substantially higher in typical UIP than atypical UIP.

CLINICAL RELEVANCE/APPLICATION
Exclusion of a pathologic UIP diagnosis cannot be made accurately based purely on chest CT. Optimal treatment and prognosis may differ between atypical and typical UIP patients.

SSK04-04 ● Combined Pulmonary Fibrosis and Emphysema: What Are the Prognostic Factors of Survival in Symptomatic Subjects Compared with Asymptomatic Subjects?

Yong Seek Kim (Presenter) ; **Kum Ju Chae** ; **Gong Yong Jin** MD, PhD ; **Young Min Han** MD ; **Su Bin Chon** ; **Young Sun Lee** ; **Keun Sang Kwon**

PURPOSE

The aim of this study was to identify prognostic predictors among pulmonary function tests, clinical and CT features in symptomatic combined pulmonary fibrosis and emphysema (CPFE) compared with asymptomatic subjects.

METHOD AND MATERIALS
The study was approved by the institutional review board. We reviewed the 1,339 asymptomatic subjects (male smoker, aged 40 years or older) who performed low-dose CT from 2004 to 2010 for lung cancer screening. 4,376 respiratory symptomatic patients (male smoker, aged 40 years or older) who performed HRCT scan between 2004 and 2009 were also reviewed to find symptomatic CPFE patients. 49 asymptomatic (3.7%) and 113 symptomatic CPFE patients (2.6%) were included in this study. The extent of emphysema and honeycomb on CT was visually assessed using six and five point scale, respectively. We compared those with asymptomatic to those with symptomatic subjects for age, smoking, pulmonary function tests, and CT findings (extent of emphysema and fibrosis) using an unpaired t-test or a Chi-square with Fisher�s exact test. Multivariate Cox proportional hazards regression analysis was performed to determine the prognostic factors of symptomatic patients in pulmonary function tests and CT findings. Median survival time differences in symptomatic patients according to fibrosis scoring on CT were calculated from Kaplan-Meier analysis.

RESULTS
FVC and FEV_1/FVC of symptomatic patients were lower than those of asymptomatic subjects; 87.8 ± 16.7 vs. 95.7 ± 23.6, p=0.032, 72.2 ± 10.2 vs. 77.6 ± 4.1, p

CONCLUSION
The measure of extent of honeycomb on CT is an important to predict the median survival time in a symptomatic CPFE subject.

CLINICAL RELEVANCE/APPLICATION
Because honeycombing on CT is a prognostic factor to estimate survival rate in CPFE subjects, quantification of honeycombing on CT is useful for the prognosis prediction of a symptomatic CPFE subject.

SSK04-05 ● Performance and Interobserver Variability in Diagnosis of Idiopathic Pulmonary Fibrosis (IPF)

Hriday Shah MD (Presenter) ; **David M Naeger** MD ; **Joyce Lee** ; **Harold Collard** MD ; **Brett M Elicker** MD

PURPOSE
To determine the performance and interobserver variability of radiologists with different levels of experience for the high-resolution CT (HRCT) diagnosis of Idiopathic Pulmonary Fibrosis according to ATS/ERS/JRS/ALAT criteria.

METHOD AND MATERIALS
HRCT scans of 219 randomly selected patients from the UCSF interstitial lung disease database were analyzed by a senior attending radiologist, a junior attending radiologist and a 1st year radiology resident according to ATS/ERS/JRS/ALAT criteria. Each case was interpreted as 'definite UIP', 'possible UIP' or 'inconsistent with UIP.' In cases that were �inconsistent with UIP�, the inconsistent criteria were identified. Agreement was assessed with a Kappa statistic and a 1-tail test against the null (p-value of 0.05 considered significant).

RESULTS
33% of patients in the total cohort had a final multidisciplinary diagnosis of IPF. Overall agreement for �definite UIP� was 0.639 (p < 0.001). The overall sensitivity and specificity, respectively, of each reader for the diagnosis of IPF was as follows: senior attending radiologist (48%, 96%), junior attending radiologist (81%, 84%) and 1st year radiology resident (73%, 85%). Similar results were obtained when subset analysis only included patients with HRCT signs of fibrosis or patients =50 years of age. 6 false positive �definite UIP� interpretations were made by the senior attending radiologist whereas 22 false positive interpretations were made by the junior attending radiologist, including 14 connective tissue disease, 4 hypersensitivity pneumonitis, 1 drug toxicity and 3 idiopathic nonspecific interstitial pneumonia patients. The senior radiologist described mosaic perfusion/air trapping more often and honeycombing less often than the other two readers.

CONCLUSION
The radiologist with greater experience had a lower sensitivity and greater specificity in the HRCT diagnosis of IPF using ATS/ERS/JRS/ALAT criteria. Most false positives in the radiologists with less experience were in patients with connective tissue disease and hypersensitivity pneumonitis.

CLINICAL RELEVANCE/APPLICATION
Experience improves the specificity of a HRCT diagnosis of IPF. Since a "definite UIP" pattern on HRCT is often considered sufficient evidence for diagnosing IPF, maintaining specificity is paramount.

SSK04-06 ● Radiographic Interstitial Lung Abnormalities in Advanced NSCLC Patients during Platinum-based Chemotherapy: A Systematic Study in a Cohort with Wild-type EGFR, ALK, BRAF, and KRAS

Mizuki Nishino MD (Presenter) ; **Stephanie Cardarella** ; **Tetsuro Araki** MD ; **Christine Lydon** ; **Michael S Rabin** MD * ; **Hiroto Hatabu** MD, PhD * ; **Bruce E Johnson**

PURPOSE
Investigate the frequency of radiographic interstitial lung abnormalities (ILA) during first-line platinum-based chemotherapy in advanced NSCLC patients who are genomically characterized as wild-type for EGFR, ALK, BRAF, and KRAS, and provide reference data to assess lung toxicity of newer agents targeting specific mutations of lung cancer.

METHOD AND MATERIALS
65 advanced NSCLC patients (31 males, 34 females; age:26-76), who underwent genomic characterization between 7/09 and 7/12 and were wild type for EGFR, ALK, BRAF, and KRAS were studied. The patients were treated with first-line platinum-based chemotherapy, and had baseline CT and at least one chest CT during therapy. Baseline and all CT scans during therapy were visually scored for ILA, using a sequential reading method by 3 readers with a 4-point scale [0=no evidence of ILA, 1= equivocal for ILA, 2= suspicious for ILA, and 3=ILA], as previously published. Scores 2 and 3 were considered positive for ILA. Development of ILA was defined as score 2 or 3 on CT during therapy in patients with baseline score of 0 or 1.

RESULTS
A total of 311 chest CT scans in 65 patients were scored. On baseline CT before therapy, 9 of 65 patients (14%) were positive for ILA (score 2 in 7, score 3 in 2 patients). Six patients developed ILA during therapy (score 2 in all 6 patients), accounting for 11% of 56 patients without baseline ILA. The median time from the initiation of therapy to the first scan showing ILA was 5.0 months [range: 1.3-7.8 months]. Time from the initiation of therapy to the last CT did not differ between patients who developed ILA and those who did not (median: 7.1 vs. 5.0 months, respectively, Wilcoxon p=0.17). Clinical variables including age, gender, stage, smoking, and pathology was not associated with baseline ILA (P>0.07), or development of ILA (P>0.2).

CONCLUSION
ILA was present at baseline in 14% of the total population. 11% of the patients without baseline ILA developed ILA during platinum-based chemotherapy in genomically characterized advanced NSCLC patients. The data serve as reference for the frequency of ILA in newer anti-cancer agents developed for lung cancer.

CLINICAL RELEVANCE/APPLICATION
Frequency of ILA during chemotherapy in advanced NSCLC patients negative for 4 well-studied genomic abnormalities is reported, providing reference to assess lung toxicity of newer anti-cancer agents.

SSK04-07 ● Ultra-low-Dose (ULD) Chest CT in Immunocompromised Patients - A Prospective and Intraindividual Evaluation regarding Detection of Infiltrates

Niklas Lutzen (Presenter) ; **Tobias Baumann** MD ; **Jonas Burk** ; **Stefan Bulla** MD ; **Markus Wilhelm** ; **Isabelle Dorr** ; **Gregor**

Pache MD ; **Mathias F Langer** MD, PhD

PURPOSE
Pneumonia is a potentially fatal complication in immunocompromised patients. Therefore, low-dose (LD) CT of the chest is widely applied in these patients. It is unclear, however, to what extent radiation exposure can be lowered while still maintaining diagnostic accuracy. Thus, it was the aim of this study to evaluate the diagnostic properties of an ULD CT protocol by intraindividual comparison with an established LD CT protocol.

METHOD AND MATERIALS
102 immunocompromised patients with an hematologic disease underwent 118 paired ULD and LD CT examinations with the following scan parameters. Tube voltage 120 kV, reference tube current for LD: 75mAs, fixed tube current for ULD: 10 mAs (BMI < 25kg/m²) or 15 mAs (BMI > 25kg/m²). Four experienced radiologists, blinded to patient data and scan parameters, prospectively rated the presence of macronodules, nodules with halo-sign, grouped micronodules, ground-glass opacity, consolidations and cavities on a five-point Likert scale for each examination and side separately. Variance and mean of the four ratings were calculated for each side, patient, and dose. These values were subjected to generalized linear model (mean) and logistic regression (variance=0 or variance>0) with dose and side as fixed effects and patient as random effect.

RESULTS
Mean effective dose was 3.38±0.81 mSv for LD examinations and 0.44±0.09 mSv for the ULD approach, corresponding to dose reduction of 87% with ULD. All studies were considered as diagnostic. With an effect size of 0.09 and a t-value of 2.94 the mean rating for ground-glass opacities was slightly but significantly lower in the ULD group. Logistic regression demonstrated a significantly increased interreader variance for grouped micronodules in ULD studies. Dose settings revealed no significant effect for all other imaging criteria and parameters.

CONCLUSION
The proposed ultra-low-dose chest CT protocol allows for a considerable decrease in radiation exposure even compared to existing low-dose approaches. Despite this decrease, the diagnostic properties could largely be maintained, yet with an increased interreader variance for the detection of micronodules and a slightly lower sensitivity for ground glass opacities.

CLINICAL RELEVANCE/APPLICATION
Immunocompromised patients are commonly subjected to repeated chest CTs, Ultra-low-dose CTs might allow for a considerable decrease in radiation exposure without demise in the diagnosis of pneumonia.

SSK04-08 ● Probable UIP Is Still a Necessary Diagnostic Category on HRCT in Fibrosing Interstitial Pneumonia

Jonathan H Chung MD (Presenter) * ; **Ashish Chawla** MD, MBBS ; **Steve Groshong** MD ; **Carlyne Cool** MD ; **David Mckean** ; **David A Lynch** MBBCh * ; **Janet Talbert** ; **Anna Peljto** ; **Gregory Cosgrove** MD ; **Kevin K Brown** MD ; **Marvin Schwarz** ; **David Schwartz**

PURPOSE
Recent international guidelines support 3 classes of UIP diagnosis on CT: Definite UIP, possible UIP, and inconsistent with UIP; the probable UIP class is not included in this diagnostic scheme. The purpose of this study was to evaluate the importance of the probable UIP imaging classification, using histological correlation.

METHOD AND MATERIALS
HRCT scans from 1,764 subjects in a large multicenter database of subjects with known or suspected interstitial lung disease were scored by two thoracic radiologists. CT findings and UIP diagnosis with level of confidence (not UIP, possible, probable, definite) were recorded. Definite UIP was defined as peripheral predominant, basal predominant reticular abnormality with honeycombing. Probable UIP was defined as peripheral predominant, basal predominant reticular abnormality without honeycombing. Possible UIP was defined as reticular abnormality with features not sufficiently characteristic to reach definite or probable levels. 258 subjects had histological scoring. Histological findings and UIP diagnosis with level of confidence were recorded by two pulmonary pathologists. Two-tailed Fisher exact test was used to compare proportions of histological scores for each UIP category.

RESULTS
In those with probable UIP on CT, UIP was histologically scored as definite, possible/probable, and not considered in 48.8% (20/41), 41.5% (17/41), and 9.8% (4/41) of subjects, respectively, compared with 30.7% (23/75), 37.3% (28/75), and 32.0% (24/75) for those with possible UIP on CT (p= .0154). Corresponding histologic diagnoses for those with definite UIP on CT were 46.4% (13/28), 39.3% (11/28), and 14.3% (4/28) of subjects, respectively, very similar to the distribution of diagnoses in probable UIP (p=.883). The proportions of histological scores for probable UIP and not UIP on CT were significantly different (p
CONCLUSION
In those with probable UIP on CT, the distribution of histological diagnoses is significantly different from those with possible UIP, but very similar to those with definite UIP.

CLINICAL RELEVANCE/APPLICATION
Patients with a probable UIP diagnosis on CT should not be categorized as possible UIP.

SSK04-09 ● The Definition of Traction Bronchiectasis on CT Remains Unclear: Evaluation by 48 Observers with Various Specialties and Countries

Junya Tominaga PhD (Presenter) ; **Takeshi Johkoh** MD, PhD * ; **Kiminori Fujimoto** MD, PhD ; **Hiroaki Arakawa** MD ; **Satoshi Noma** MD, PhD ; **Kazuya Ichikado** MD, PhD ; **Masanori Akira** MD ; **Fumikazu Sakai** MD, PhD *

PURPOSE
To analyze interobserver variability in the definition of traction bronchiectasis on CT.

METHOD AND MATERIALS
Seven core members evaluated 50 CT images showing traction bronchiectasis and its mimics. They scored the probability of traction bronchiectasis using a 3-point scale (1 = low, 2 = moderate, 3 = high) as a reference standard with consensus. Forty-eight observers from various specialties and countries also independently evaluated the same images in the same manner in two sessions: first, according to �Fleischner Society: Glossary of Terms for Thoracic Imaging� criteria, and second, with additional criteria (observed exclusively in interstitial pneumonia). Weighted ? (?w) values of the scores compared to the reference standard were calculated and changes in ?w in the two sessions were evaluated by the paired t-test. The images were classified into the following 4 categories to analyze imaging features based on the mean and standard deviation (SD) of the scores: agreed presence of traction bronchiectasis (mean $\geq$ 2.5; SD $\leq$ 0.7); agreed absence of traction bronchiectasis (mean $\leq$ 1.5; SD $\leq$ 0.7); disagreement (mean, 1.5 � 2.5; SD > 0.7); and �others�.

RESULTS
In the first session, agreement for the scores varied from poor to excellent (?w: 0.06 � 0.81, median: 0.56). In the second session, agreement was fair to excellent (?w: 0.36 � 0.89, median: 0.65). The ?w increased for 41 (85%), and decreased for seven (15%) observers. A statistically significant difference in ?w was found between the two sessions (P < 0.001). In the first session, there was agreed presence for 11, agreed absence for 12, disagreement for 19, and eight �others� cases. Ten (91%) of the agreed presence cases had chronic interstitial pneumonia with reticular opacity/honeycombing. Ten (83%) of the agreed absence cases had airway disease or emphysema. Six (32%) of the disagreement cases and two (25%) �others� had acute/subacute interstitial lung diseases with airspace consolidation.

CONCLUSION
Although the definition of traction bronchiectasis in chronic interstitial pneumonia appears to be congruent between observers, disagreement is often seen in cases with acute/subacute interstitial lung diseases.

CLINICAL RELEVANCE/APPLICATION
To improve interobserver agreement, traction bronchiectasis should be used as a finding of dilated bronchi only in areas with radiological evidence of interstitial fibrosis.

Chest - Wednesday Posters and Exhibits (12:15pm - 12:45pm)

Wednesday, 12:15 PM - 12:45 PM ● Lakeside Learning Center

CH

LL-CHS-WEA ● *AMA PRA Category 1 Credit ™*:0.5
Host
Sudhakar N Pipavath , MD *

LL-CHS-WE1A ● Characterization of Pulmonary Changes in Smoke Inhalation Injury in a Sheep Model Using Contrast Enhanced CT-scans

Regina Moritz (Presenter) ; **Frank L Goerner** PhD * ; **Val M Runge** MD * ; **Osamu Fujiwara** MD ; **Gabriele A Krombach** MD ; **Matthew K Fuld** PhD * ; **Ernesto Lopez** MD ; **Donald Prough** MD ; **Perenlei Enkhbaatar** MD, PhD

PURPOSE
Annually more than 1 million burn injuries occur in the US (1). The concomitant smoke inhalation frequently causes severe pulmonary injury (ARDS) and significantly increases mortality (2, 3). The aim of this study was to characterize pulmonary changes following smoke inhalation injury (SII) in a sheep model using contrast enhanced CT.

METHOD AND MATERIALS
Six anesthetized female sheep (3 months old; 30 -45 kg) received an SII by insufflation of cold cotton smoke. Contrast enhanced (Isovue 370�, Bracco Diagnostics Inc., Princeton, NJ) CT scan (Siemens Definition Flash, Erlangen, Germany) were performed in each sheep immediately prior to injury and 24 hours post injury. Following the final CT scan the animals were euthanized and the lungs removed. The lungs were cut into slices and correlated to the CT images. Tissue histology was evaluated and correlated to CT. Two experienced chest radiologists reviewed the CT scans. Each axial slice was divided into 4 quadrants, and the presence of ground glass opacities, septal thickening, consolidation, atelectasis and bronchial wall thickness was graded (0: no changes, 1: mild changes, 2: moderate changes, 3: severe changes) and the presence of casts in the bronchial system as well as occlusion of pulmonary vessels was noted in the individual quadrants. Also the wall thickness of the trachea, the main and lobar bronchi was measured in healthy and injured animals.

RESULTS
The study revealed that the most dramatic changes occurred in the bronchial system (especially the trachea and the main and lobar bronchi). There was massive thickening of the bronchial wall caused by edema and inflammation. Cast formation within the bronchial lumen led to airway obstruction, and atelectasis of the lung was seen in all the injured animals. In 5 of the 6 sheep segmental and peripheral pulmonary arteries were occluded. There were additional changes in the lung parenchyma including peribronchial edema, atelectasis and focal inflammation. The patchy distribution of these changes appears to be very characteristic for this particular disease.

CONCLUSION
This study showed that smoke inhalation injury has a distinctive appearance on CT, allowing an early diagnosis and improved treatment.

CLINICAL RELEVANCE/APPLICATION
SII has a unique appearance on CT aiding early diagnosis and giving new insights into its pathophysiology. Pulmonary artery occlusion is shown, helping to optoptimize treatment and reduce mortality.

LL-CHS-WE2A ● Lifetime Attributable and Excess Lifetime Risk Estimates for Radiation Induced Solid Cancers Risks Based on Present Organ Doses and Age Variations in Chest CTExcess Lifetime Risk Estimates for Radiation Induced Solid Cancers Risks with Routine Chest

Sarabjeet Singh MD (Presenter) ; **Monica Ghita** PhD ; **Ranish D Khawaja** MBBS, MD ; **Sarvenaz Pourjabbar** MD ; **Atul Padole** MD ; **Mannudeep K Kalra** MD * ; **James A Brink** MD

PURPOSE
Recent data from lifespan study from Japanese Atomic Explosion estimate increased Excess Lifetime Risks (ELR) of certain radiation-induced solid cancers, when exposure occurs at middle age rather than in childhood. The purpose of our study was to assess population based estimated ELR for solid cancers following chest CT in different age groups using size adjusted CT protocols in a large tertiary health care center.

METHOD AND MATERIALS
Our IRB approved study included 2930 consecutive �routine� chest CT. Dose monitoring software (Exposure, Radimetrics) was used to obtain patient demographics, scanning parameters as well as radiation dose information (Size Specific Dose Estimate (SSDE), estimated effective doses (EED) and organ doses). Patients were stratified by age groups of 0-10, 11-20, so on, >70 years. Estimated ELR from the time of exposure from chest CT was estimated based on recently reported literature on risk estimation from radiation induced solid cancer risks published from 2007-2012.

RESULTS
SSDE for chest CT were significantly lower for patients younger than 20 years of age as compared to those 21 and above (4.5 � 6.2 mGy vs 9.7 � 10.3 mGy, p< 0.001). EED (ICRP 103) were 3 - 4 mSv and 7-8 mSv for these age groups (p
CONCLUSION
SSDE and estimated effective doses are suboptimal for cancer risk estimation and organ doses should be used for solid cancer radiation induced risk estimation, regardless of patient�s age.

CLINICAL RELEVANCE/APPLICATION
Contrary to the previously belief, dose concerns are not only important for the younger age groups (0-20) but also for older patients (30-60 years), especially for risk estimations of lung, breast, li

LL-CHS-WE3A ● 99 Patients Status-Post Lung Transplantation (LTx) for Usual Interstitial Pneumonia (UIP): CT-Pathologic Correlation

Diane C Strollo MD (Presenter) ; **Iclal Ocak** MD ; **Sonja Dacic** MD ; **Joseph M Pilewski** MD ; **Christian Bermudez** ; **Maria M Crespo** MD

PURPOSE
1. Review patient demographics and surgical procedures. 2. Assess CT-pathologic features of fibrosis, ground glass opacity (GGO), lung nodules, consolidation, lymphadenopathy, +/- thoracic malignancy.

METHOD AND MATERIALS
Patient age, gender, history of smoking and malignancy, etiology of UIP, surgical procedures, pathologic and MDCT techniques, and intervals between MDCT and LTx were recorded. MDCTs and explanted lung specimens were reviewed by 2 chest radiologists and a pulmonary pathologist, respectively.

We correlated the MDCT pattern and distribution of UIP, emphysema, GGO, lung nodules, consolidation, nodular fibrosis, lymph nodes >12mm, +/- thoracic malignancy, with pathology reports of the explanted lungs. Discordant cases were re-evaluated by our pathologist. Cancers were staged via the revised 2010 American Joint Committee on Cancer Manual.

RESULTS
99 patients (63 M:36 F) with UIP underwent LTx over a 2 year period. Mean age was 49.3 years (36.0-77.6 years). 58 (58%) had been smokers, and 6 (6%) had a history of treated malignancy (lung or breast cancer or lymphoma).
DLTx (n=61) or SLTx (n=38) was performed. Mean interval between CT and LTx was 5.0 months (0.25-15.5 mo). Etiology of UIP was idiopathic (n=68, 69%), scleroderma (n=12, 12%), or other (n=19, 19%).
CTs revealed classic (n=73, 74%) or atypical patterns of UIP (n=26, 26%); emphysema (n=31, 31%) +/- GGO (n=31, 31%); solitary (n=5, 5%) or multiple nodules (n=10, 10%), +/- consolidation (n=16, 16%); +/- mediastinal / hilar lymphadenopathy (n=68, 69%). Most nodules were not detected on pathologic evaluation.
GOO or consolidation typically represented nonspecific interstitial pneumonia (NSIP), acute pneumonia, alveolar injury, smoking-related fibrosis, aspiration or lymphoid infiltration.
Malignancy (n=7, 7%) was detected on pathologic assessment and included lung cancer (n=5) and metastases (n=2). Lung cancer was stage 1 or 2 (n=4) and stage 3A (n=1).

CONCLUSION
Pneumonia, acute lung injury and NSIP may manifest as GGO or consolidation.
7% of UIP patients had cancer in the explanted lung, typically stage 1 or 2 lung cancer that was CT-occult.
Inflammatory nodules and mediastinal lymphadenopathy are common and may mimic malignancy.

CLINICAL RELEVANCE/APPLICATION
7% of UIP patients had malignancy detected in the explanted lung, typically stage 1 or 2 lung cancer. Inflammatory nodules and lymphadenopathy are common in advanced UIP and may mimic malignancy.

LL-CHS-WE4A ● The Value of MDCT Direct-lymphangiography in Diagnostic of Diffuse Pulmonary Lymphangiomatosis

Xiaoli Sun MD, PhD (Presenter) ; **Rengui Wang** MD ; **Tingguo Wen** ; **Xiaobai Chen** ; **Lei Yang**

PURPOSE
Diffuse pulmonary lymphangiomatosis (DPL) is an uncommon entity characterized by an abnormal growth of pulmonary lymphoid tissue. The aim of this study was to evaluate the clinical value of multiple detector computed tomography (MDCT) direct-lymphangiography in the diagnosis and planning of treatment for DPL.

METHOD AND MATERIALS
This study was approved by local ethics committee, and informed consent was not required. Between August 1997 and December 2012, 23 patients with DPL (13 men and 10 women) were retrospectively reviewed for this study. Ages ranged from 2 to 48 years (mean age of 24 years). All patients had undergone MDCT direct-lymphangiography examination.

RESULTS
The findings of MDCT direct-lymphangiography were intrathoracic and extrathoracic abnormalities. Among the intrathoracic abnormalities, 100% (n=23) of patients had abnormal lymph reflux (abnormal deposition of the contrast medium), lymphangiectasia, infiltration of mediastinal soft tissue, and thickening of peribroncovascular. 82.6% (n=19) patients had interlobular septal thickening, 78.3% (n=18) patients had diffuse ground-glass opacities, 95.7% (n=22) patients had pleural effusion, 52.2% (n=12) patients had pleural thickening, 60.9% (n=14) patients had extra-pleural soft tissue thickening, 87.0% (n=20) patients had pericardial effusion, 43.5% (n=10) patients had multiple lymphadenopathy in mediastinum. The features of extrathoracic abnormalities included retroperitoneal lymphangiectasia and abnormal lymph reflux(21.7%, n=5), abdominal effusion (4.3%, n=1), retroperitoneal and splenic cystic lymphangioma (4.3%, n=1), cervical lymphangiectasia (43.5%, n=10), multiple lymphadenopathy in axilla (87.0%, n=20), and skeletal or vertebral lesions (17.4%, n=4).

CONCLUSION
MDCT direct lymphangiography is well suited to the evaluation of DPL because it is capable to show the extent of the abnormal lymphatic reflux, to clarify the dilatation and proliferation of lymphatic channels, to clearly depict the intrathoracic and extrathoracic abnormalities, and the typical images are quite helpful in diagnosis of DPL. This method provides an excellent tool for diagnosis of DPL and has high value in the determination of a treatment plan.

CLINICAL RELEVANCE/APPLICATION
MDCT direct lymphangiography provides an excellent tool for diagnosis of DPL and has high value in the determination of a treatment plan.

LL-CHS-WE5A ● Mediastinal Lymph Nodes Characterization with Diffusion Weighted Imaging with Background Suppression (DWIBS) at 3T

Caroline Mesmann MD (Presenter) ; **Francois Tronc** MD, PhD ; **Yves Berthezene** MD, PhD ; **Philippe Douek** MD, PhD ; **Loic Boussel** MD

PURPOSE
To determine whether DWIBS can differentiate between malignant and benign mediastinal lymph nodes.

METHOD AND MATERIALS
45 patients (27 to 69 years-old) scheduled for surgical lymph nodes exploration prospectively underwent a T1weighted and free breathing whole thoracic DWIBS sequences (TR/TE 6674/44; FatSat STIR with IR=260ms; Slice Thickness=5mm; b-factors=0-400-800s/mm2) on a 3T Philips Achieva MRI system. ADC maps were also calculated.
For each lymph node that have been surgically removed during the mediastinal surgical exploration, mean ADC and lymph nodes to thoracic muscles signal ratio (LNTMR) were respectively calculated on ADC maps and b800 images.
Results of mean LNTMR and ADC were compared with histopathology for each studied lymph node using Mann Whitney tests. A ROC analysis was also performed on LNTMR and ADC measurements.

RESULTS
11 lymph nodes from 9 patients (8 lung cancers, 1 Hodgkin lymphoma) were malignant and 40 lymph nodes from 36 patients were benign (14 sarcoidosis, 4 silicosis, 4 anthracosis, 4 histiocytosis, 2 tuberculosis, 8 with non-specific benign lymph nodes).
The mean LNTMR was significantly higher in malignant than in benign lymph nodes (6.18+/-2.23 vs 2.67+/-1.23; p The ROC analysis showed a highest accuracy for a threshold of 4.5 and 1171 mm²/sec for respectively the LNTMR and the ADC measurements resulting in a sensitivity of 81.8% and 72.7% and a specificity of 90% and 97.5% respectively.

CONCLUSION
Thoracic MRI with DWIBS sequence can help in differentiating benign from malignant mediastinal lymph nodes by using ADC and lymph nodes to thoracic muscles signal ratio at b800.

CLINICAL RELEVANCE/APPLICATION
Thoracic MRI with DWIBS sequence is promising to predict malignancy of mediastinal lymph nodes.

Chest - Wednesday Posters and Exhibits (12:45pm - 1:15pm)

CH

LL-CHS-WEB ● *AMA PRA Category 1 Credit* ™:0.5

LL-CHS-WE1B ● Feasibility and Utility of Xenon Ventilation CT for COPD and CPFE Patients

Masahiro Kobayashi MD (Presenter) ; **Nobuyuki Shiraga** MD ; **Kenichi Suzuki** ; **Yoshiyuki Okada** ; **Keishi Sugino** ; **Sakae Honma** MD, PhD

PURPOSE
To evaluate the usefulness of single inhalation xenon ventilation CT for patients with COPD and CPFE.

METHOD AND MATERIALS
Institutional review board approval and written informed consent were obtained. Thirty seven patients with chronic obstructive pulmonary disease (COPD, mean age: 74.1 years, range: 56-87 years) and 28 patients with combined pulmonary fibrosis and emphysema (CPFE, mean age: 74.0 years, range: 63-83 years) underwent xenon ventilation CT using dual energy technique with single inhalation of 35% xenon gas. After three dimensional reconstruction of xenon enhanced images, mean xenon enhancement values were calculated using three material decomposition methods, and correlated with pulmonary function test results. LAA% scores were also calculated and correlated with pulmonary function test results.

RESULTS
We could successfully obtain xenon enhanced images calculated by using three material decomposition methods for all subjects. No significant complications were noted with 35% xenon gas inhalation. In COPD cases, mean xenon enhancement values showed significant positive correlations with forced expiratory volume [FEV1, (r=0.45, p0.05), FEV1/FVC (r=0.13, p>0.05)], and PEF (r=0.29, p>0.05]. There were three COPD cases which had severe discrepancies between LAA% and xenon values. Those cases were thought to be airway-predominant COPD. In CPFE cases, xenon enhancement values were lower than normal lung in both emphysema and fibrosis area. Comparing with these two areas, xenon enhancement values in emphysema areas were lower than those in fibrosis areas. Thus, we could accurately evaluate the ratio of fibrosis, emphysema and normal lung parenchyma.

CONCLUSION
Xenon ventilation CT is useful to evaluate the grade and phenotype of COPD. In CPFE patients, this method can differentiate and measure each volume of fibrosis, emphysema and normal lung parenchyma correctly, which has the potential to construct a new classification and grades of this complex disease.

CLINICAL RELEVANCE/APPLICATION
Xenon enhancement CT can evaluate the regional ventilation in patients with both type of COPD. It has the potential to construct a new classification and grades of CPFE.

LL-CHS-WE2B ● Emphysema Quantification on Low-dose CT by Percentage of Low-attenuation Volume and Size Distribution Analysis of Low-attenuation Clusters: Effect of Adaptive Iterative Dose Reduction Using 3D Processing

Mizuho Nishio MD (Presenter) * ; **Sumiaki Matsumoto** MD, PhD * ; **Hisanobu Koyama** MD ; **Takeshi Yoshikawa** MD * ; **Yoshiharu Ohno** MD, PhD * ; **Yasuko Fujisawa** MS * ; **Naoki Sugihara** MENG * ; **Kazuro Sugimura** MD, PhD *

PURPOSE
To evaluate the effect of adaptive iterative dose reduction using three-dimensional processing (AIDR 3D) on two types of emphysema quantification: one using the percentage of low-attenuation volume in lungs (LAV%) and the other based on size distribution analysis of low-attenuation clusters.

METHOD AND MATERIALS
Fifty-two patients (32 men, 20 women; age, 69.2 ± 8.45 years) who had undergone standard-dose (150 mAs) and low-dose (25 mAs) CT scans were included in this retrospective study. The remaining CT parameters were: tube voltage, 120 kV; detector configuration, 160x0.5 mm; beam pitch, 0.94; gantry rotation time, 0.5 s; slice thickness, 1 mm. Emphysema quantification was performed on standard-dose CT (SDCT) images reconstructed without AIDR 3D as well as low-dose CT (LDCT) images reconstructed without and with AIDR 3D. First, LAV% was computed at 10 thresholds ranging from -990 to -900 HU. Next, at the same thresholds, the power law exponent (D) for cumulative frequency-size distribution of low-attenuation clusters was computed by means of linear regression on a log-log plot. Concerning LAV% and D, Bland-Altman analysis was used to assess whether the agreement between emphysema quantification on LDCT and that on SDCT was improved by the use of AIDR 3D.

RESULTS
When comparing at the 10 thresholds, LAV% showed mean relative differences between LDCT without AIDR 3D and SDCT ranging from 3.91% to 88.6%, and those between LDCT with AIDR 3D and SDCT ranging from -6.43% to 0.693%. Moreover, the exponent D showed mean relative differences between LDCT without AIDR 3D and SDCT ranging from 8.03% to 19.2%, and those between LDCT with AIDR 3D and SDCT ranging from 1.79% to 4.85%. When assessed by the Bland-Altman analysis at the 10 thresholds, the agreements of LAV% between LDCT and SDCT were improved at the thresholds ranging from -930 to -990 HU by using AIDR 3D. In addition, the agreements of D were improved at all of the 10 thresholds by AIDR 3D.

CONCLUSION
With regard to both LAV% and D computed at multiple thresholds, the use of AIDR 3D resulted in greater consistency of emphysema quantification on low-dose CT with quantification on standard-dose CT.

CLINICAL RELEVANCE/APPLICATION
The measurement error of emphysema quantification caused by low-dose CT can be improved by the use of AIDR 3D.

LL-CHS-WE3B ● Inappropriate Portable Chest X-ray Utilization in the MICU and Utilization of the SAPS 3 Score as a Predictor

Ronald D Novak PhD (Presenter) ; **Bahar Mansoori** MD * ; **Nicholas J Novak** ; **Rana Hejal** MD ; **Jonn-Terje Geitung** MD, PhD ; **Gunhild E Aandal** MD ; **Pablo R Ros** MD, PhD *

PURPOSE
To assess the frequency of inappropriate use of portable chest x-ray (PCXR) in the MICU for critical care patients and evaluate the Simplified Acute Physiology Score (SAPS 3) at admission to the MICU as a predictor of total and inappropriate PCXR utilization.

METHOD AND MATERIALS
As part of a larger IRB approved study, 169 MICU patients over a 3 mo. period had each portable chest x-ray performed during their term in the MICU retrospectively evaluated for inappropriate use using the ACR appropriateness criteria. The Simplified Acute Physiology Score (SAPS 3), a measure of probable ICU mortality was calculated based on data available at admission to the MICU to determine the relation of the score to measures of inappropriate PCXR utilization. The total number of PCXR, inappropriate PCXR, inappropriate/total PCXR ratio and length of stay (LOS) in MICU were also calculated. The Pearson correlation coefficient was used to determine relationships between the parameters measured. P-values less than 0.01 were considered to be significant.

RESULTS
The patient sample consisted of 92 F and 77 M, age 60 ± 15.7 yrs. Average LOS was 6.6 ± 4.4 days and the average number of PCXRs was 6.4 ± 5.8 for the duration of MICU stay. The mean number of inappropriate PCXRs was 2.1 ± 3.2 or approximately every third PCXR performed during MICU tenure and the inappropriate/total PCXR ratio was 26.4 ± 26.5 %. SAPS 3 score was significantly correlated with

age and LOS (r=0.3,P=0.0009: r=.32, P=0.0002) respectively. LOS was significantly correlated with both the total number of PCXR performed (r=0.73, P
CONCLUSION
Our results suggest that one quarter to one third of all PCXR performed in the MICU of an academic medical center are inappropriate by ACR guidelines. The likelihood that both total and inappropriate PCXRs will be performed is correlated with the length of stay in MICU. The SAPS 3 score is an easily calculated measure that may predict LOS and the likelihood of significant inappropriate use of PCXR in the MICU.

CLINICAL RELEVANCE/APPLICATION
PCXR is a frequently utilized radiological procedure in the MICU that is often used inappropriately. A SAPS 3 score may identify patients with longer LOS and greater risk of inappropriate use.

LL-CHS-WE4B ● Imaging Findings in Metastatic Melanoma Patients Following Adoptive Cell Therapy-Is It the Time to Revise Traditional RECIST Criteria?

Shai Shrot (Presenter) ; **Ronnie Shapira-Frommer** ; **Michal J Besser** ; **Jacob Schachter** ; **Sara Apter** MD

PURPOSE
Metastatic melanoma is a highly aggressive cancer. Among the current immunotherapeutic approaches, adoptive T cell therapy using infusion of autologous tumor infiltrating lymphocytes (TIL) has shown to be an effective treatment for patients with metastatic melanoma and can mediate objective response rates of 50-70%. Nowadays, response criteria for solid tumors are based mainly upon tumor burden and early increases in tumor size are classified as progression of disease. Introducing immunotherapy in oncology has led to novel patterns of imaging findings in responding patients, due to their unique mode of action. TIL induced tumor response has not been described in the literature. Our aim is to describe the novel imaging findings in metastatic melanoma patients treated with TIL.

METHOD AND MATERIALS
An IBR-approved retrospective observational study was conducted on 69 melanoma patients treated with TIL in our center (2006-2011). Each patient had pre-treatment baseline CT, follow-up CTs one month, three months after the TIL infusion and every three months thereafter. CTs were assessed according to the RECIST criteria and the radiological appearances of response were recorded.

RESULTS
Of the 69 treated patients, 48 had positive response according to RECIST criteria. Unique radiological features included: (1) appearance of post-therapy halo sign around pulmonary metastatic lesions, (2) initial post-treatment enlargement of solid metastases, followed by contraction (�pseudo-progression�) and (3) appearance of cystic changes or calcification in solid lesions. Interestingly, the kinetics of the response varied from immediate disappearance of metastatic lesions to slow-delayed decline in tumor size even years after therapy (the treatment is given only once).

CONCLUSION
Assessment of the change in tumor burden is an important component of the clinical evaluation of cancer therapeutics. The standard RECIST criteria are designed to capture the effects of chemotherapeutic agents and are dependent on tumor shrinkage to demonstrate response. Unusual response patterns, as observed in our post-TIL immunotherapy patients, emphasize the need for revise current imaging criteria to assess response following immunotherapy generally and TIL specifically.

CLINICAL RELEVANCE/APPLICATION
Radiologists working in an oncology setting should be familiar with novel response patterns after TIL infusion and apply the appropriate response criteria not based solely on tumor burden.

LL-CHS-WE5B ● The Utility of CT in Evaluation of Human Lungs after Ex-vivo Lung Perfusion (EVLP)

Saowanee Srirattanapong MD (Presenter) ; **Katherine R Birchard** MD ; **Thomas M Egan** MD ; **Will Simmons** ; **John Blackwell**

PURPOSE
The purpose of the study was to assess the utility of CT in evaluation of lungs after EVLP for transplant suitability. The pool of transplantable lungs remains well below the demand, but EVLP has emerged as a technique that can assess and possibly recondition lungs, making them potentially transplantable. However, physiologic parameters alone may be unreliable predictors of transplant suitability; CT imaging may be a valuable adjunct to assess suitability for transplant.

METHOD AND MATERIALS

RESULTS
A total of 22 lung blocks underwent EVLP and CT scan. CT showed that all had some septal thickening and ground glass opacities (probably edema). Six lung blocks were considered acceptable by clinical and physiologic parameters, but unacceptable by CT due to presence of cavitary lesions, emphysema, or consolidation. Two lung blocks were potentially transplantable by PaO2/FiO2 and clinical parameters, and potential recipients were called in for assessment, but CT findings deemed the lungs not suitable for transplant.

CONCLUSION
CT provided additional useful information in evaluating lungs after EVLP; clinical and physiologic data alone were not adequate to assess acceptability for transplant in some lungs.

CLINICAL RELEVANCE/APPLICATION
CT can increase the overall safety of transplant of conventional and NHBD lungs after EVLP, and potentially improve patient outcomes.

Essentials of Chest Imaging

Wednesday, 01:30 PM - 03:00 PM ● S100AB

CT CH

MSES43 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5

MSES43A ● Pitfalls in CT Pulmonary Angiography

Andetta R Hunsaker MD (Presenter)

LEARNING OBJECTIVES
1) Identify common pitfalls which cause the indetermiate CT Pulmonary angiogram studies including technical, physiologic and anatomic etiologies. 2) Identify pitfalls due to errors in diagnosis of filling defects in the pulmonary arteries. 3) Avoid the pitfall of satisfaction of search. 4) Identify pitfalls with dual energy CT imaging for acute PE. 5) Understand ways to either solve or get around these pitfalls.

ABSTRACT

MSES43B ● Imaging Pulmonary Edema: Elucidate Heart Lung Interaction

Diana Litmanovich MD (Presenter)

LEARNING OBJECTIVES
1) Identify typical radiological features of pulmonary edema on conventional imaging (chest radiographs and chest CT) in correlation with related pathophysiologic changes cardiac and pulmonary changes. 2) Become familiar with atypical radiologic features of pulmonary edema. 3) Become familiar with cardiac and non-cardiac causes of pulmonary edema identifiable on chest radiographs, chest CT or MRI and their influence on lung parenchyma and airways. 4) Become familiar with etiologies mimicking pulmonary edema and tools available to differentiate between those. 5) Become familiar with post-treatment appearance of pulmonary edema.

MSES43C ● Imaging of Airway Diseases: A Non-Thoracic Radiologist's Guide

Sujal R Desai MBBS (Presenter)

LEARNING OBJECTIVES
1) Have a working knowledge of key airway anatomy relevant to radiologists. 2) Understand the principal features of airways disease on HRCT and the pathophysiologic processes underlying these signs. 3) Appreciate the characteristic features of specific disease entities in which airway pathology is a dominant process.

ABSTRACT
Diseases of the airways are common in clinical practice and imaging tests have an role in evaluation. Whilst plain chest radiography is the standard investigation, there are significant limitations because of problems including anatomical superimposition and poor contrast resolution. By contrast high-resolution CT (HRCT) has significant advantages. For ease of description the bronchial tree is divided into the large (bronchi) and small (bronchioles) airways; this traditional distinction is based on airway calibre and the possession (or otherwise) of cartilage in the wall: airways greater than 1mm diameter which are reinforced by cartilage, are called bronchi whereas those of greater calibre and without cartilage are termed bronchioles. The pattern of bronchial and bronchiolar branching is ideally suited to serving the two prime functions of the respiratory tract: transport of air and gas exchange. From the radiologist's perspective, the common reason for imaging the large airways is when a diagnosis of bronchiectasis is suspected. As the reader will be aware, the term bronchiectasis refers to an irreversible dilatation of the airways usually associated with inflammation in the bronchial wall. HRCT is now the investigation of choice in patients with bronchiectasis and, for the radiologist, the cardinal feature is airway dilatation with or without of the bronchial wall thickening. Obliteration of the small airways is surprisingly common and occurs in diverse clinical settings. The cross-sectional area of individual peripheral airways is small but because of their number, the effective cross-sectional area is large. The implication is that considerable 'silent' damage will occur before symptoms of functional deficit will manifest. In reality, the two commonest patterns of small airways disease on HRCT are mosaic attenuation and a tree-in-bud pattern. These will discussed in greater detail in the presentation.

RSNA/ESR Emergency Symposium: Chest Emergencies (An Interactive Session)

Wednesday, 01:30 PM - 03:00 PM ● S402AB

ER CH

MSSR43 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5

MSSR43A ● Thoracic Injuries

Stuart E Mirvis MD (Presenter)

LEARNING OBJECTIVES
1) The learner will be able to differentiate traumatic aortic injuries from congenital varients that mimic injury, to distinguish minor from major aortic injuries and to understand how injury classification can influence management. 2) The participant will recognize the various CT appearances suggesting and verifying major airway injury. 3) The participant will understand the various CT apperances of blood/bleeding in the chest and how the location, quantity of blood/bleeding and patient clinical status determine initial treatment. 4) The learner will appreciate the spectrum of cardiac injuries that can be diagnosed on admission contrast-enhanced CT and those that require urgent intervention.

ABSTRACT

MSSR43B ● Non-Traumatic Thoracic Emergencies

Cornelia M Schaefer-Prokop MD (Presenter) *

LEARNING OBJECTIVES
1) To get familiar with protocols and diagnostic performance of comprehensive cardiothoracic CT examinations to determine the presence of vascular life threatening events such as aortic dissection, acute coronary disease and pulmonary embolism. 2) To illustrate typical but also less classic CXR and CT findings of patients with pulmonary or mediastinal diseases causing acute dyspnoea and / or requiring immediate treatment and to learn about key imaging findings in these patients allowing for a fast differential diagnosis. 3) To learn how to adapt CT protocols to CXR findings and to integrate imaging findings with lab findings, patient history and clinical information for making the diagnosis.

ABSTRACT
Pulmonary symptoms such as chest pain, shortness of breath or wheezing are common non-traumatic symptoms prompting ER visits. Because clinical symptoms are very non-specific, imaging plays a major role in differentiating life threatening from less severe diseases and forming a diagnosis. The chest radiograph remains the first imaging despite its limited sensitivity for certain diseases and being prone to inter-observer variability. Comprehensive cardiothoracic CT examinations using most modern CT equipment are well evaluated in their diagnostic accuracy to determine the presence of vascular life threatening events such aortic dissection, acute coronary disease and pulmonary embolism. Protocols, literature evidence and appropriate examples will be discussed. In addition the course will highlight nonvascular emergencies such as mediastinal diseases (e.g., esophageal perforation, mediastinitis or pericarditis) and pulmonary emergencies (e.g., pneumonia, edema, pneumothorax, exacerbation of diffuse lung diseases) for which a more comprehensive consideration of imaging findings, lab findings, patient history and clinical information is needed for making the diagnosis.

MSSR43C ● Interactive Case Discussion
Stuart E Mirvis MD (Presenter) ; **Cornelia M Schaefer-Prokop** MD (Presenter) *

Chest (Thoracic Malignancy)

Wednesday, 03:00 PM - 04:00 PM ● S404CD

OI CT CH

SSM05 ● *AMA PRA Category 1 Credit* ™:1 ● ARRT Category A+ Credit:1
   Moderator
   Kyung S Lee , MD, PhD
   Moderator
   Georgeann McGuinness , MD

SSM05-01 ● Preoperative Staging of Non-small Cell Lung Cancer with Co-registered Whole Body MR Imaging and Positron-emission Tomography (MRI-PET): Comparison with PET-CT

Chin A Yi MD, PhD ; **Kyung S Lee** MD, PhD ; **Ho Yun Lee** MD ; **Seonwoo Kim** ; **O. Jung Kwon** ; **Joon Young Choi** MD ; **Byung-Tae Kim** MD ; **Jung Won Moon** (Presenter) ; **Hee Young Lee** MD ; **Eun Young Kim** ; **Young Mog Shim** MD

PURPOSE
We compared the diagnostic accuracy of co-registered whole body (WB) MRI-PET with that of WB PET-CT in determining the preoperative stage of non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS
From January 2010 through November 2011, we prospectively enrolled 141 NSCLC patients (86 men, 55 women; mean age, 62 years) who had resectable disease on conventional staging using chest CT. They underwent whole body MRI including diffusion weighted MR imaging of the thorax and PET-CT, which were postprocessed for co-registration of MRI and PET. Two independent, blinded readers determined preoperative stage in the review of WB MRI-PET or PET-CT. Reference standards were obtained for T (n = 106) and N (n = 126) stages based on pathologic results, while M stage (n = 141) were obtained based on pathologic or follow-up imaging findings. The accurate staging, over staging, and under staging were compared by using the McNemar test.

RESULTS
The accuracy of TNM stage grouping were higher with WB MR-PET (95/141, 67%) than with PET-CT (82/141, 58%) (P =.009) and WB MR-PET significantly decreased the number of under stage (27% in PET-CT vs. 16% MR-PET, P
CONCLUSION
WB MRI-PET can be a superior diagnostic modality to PET/CT for T and M staging of NSCLC. For N staging, both MRI-PET and PET-CT show comparable results.

CLINICAL RELEVANCE/APPLICATION
The development and application of simultaneous WB MRI-PET would be advantageous for the tumor evaluation and the detection of metastasis in cancer imaging and staging.

SSM05-02 ● Comparison of Diffusion Weighted Imaging with Background Suppression (DWIBS) Sequence and Classic Spectral Diffusion Sequence (DWI) in Mediastinal Lymph Node Analysis at 3T

Caroline Mesmann MD (Presenter) ; **Adva Abergel** MD ; **Francois Tronc** MD, PhD ; **Yves Berthezene** MD, PhD ; **Philippe Douek** MD, PhD ; **Loic Boussel** MD

PURPOSE
To compare DWIBS sequence with DWI both with and without respiratory gating in mediastinal lymph node analysis at 3T.

METHOD AND MATERIALS
26 patients (27-79 years-old) scheduled for surgical lymph node analysis, prospectively undergone a whole thoracic exploration with DWIBS (TR/TE 6674/44; FatSat STIR with IR=260ms; Slice Thickness=5mm) and DWI sequences (TR/TE 1291/59.; Spectral FatSat; Slice Thickness=5mm) with and without (free breathing) respiratory gating with 0, 400 and 800 b-values at 3T.
For each of the four sequences, a qualitative analysis, defined by fat-sat homogeneity and presence of motion artefacts, rated from 0 to 4, was independently performed by two radiologists. The signal to background (STB) of mediastinal lymph nodes was also calculated as the signal of the lymph node dived by the mean signal of the thoracic muscles.
Kruskal Wallis and ANOVA tests were performed to compare respectively the qualitative and the quantitative data of DWI and DWIBS images with adapted post-hoc tests.

RESULTS
Quality of fat suppression was better for DWIBS in comparison with DWI both for the ungated (image quality score 3.9±0.33 vs 1.5±1.2, p Furthermore, motion artefacts were significantly reduced in DWIBS both for ungated (image quality score 3.13±0.55 vs 1.86±0.76, p Quantitative analysis showed a significantly higher STB in lymph nodes for DWIBS images in comparison with DWI both for the ungated (score 3.9 ±0.33 vs. 1.5± 1.2, p
CONCLUSION
DWIBS sequence improves the fat-sat homogeneity, reduce motion artefacts and increase the STB of mediastinal lymph node in comparison with DWI. Respiratory gating doesn�t improve significantly DWIBS image quality.

CLINICAL RELEVANCE/APPLICATION
DWIBS sequence improves image quality in mediastinal lymph node imaging in comparison with the standard DWI sequence.

SSM05-03 ● Lung Adenocarcinomas Presenting with Concurrent Lymphangitic Metastasis at the Initial CT: Clinical Characteristics and Prognostic Implications- Work in Progress

Hyun-Ju Lim MD (Presenter) ; **Kyung S Lee** MD, PhD ; **Myung-Ju Ahn** ; **Myung Jin Chung** MD * ; **Joonghyun Ahn**

PURPOSE
To evaluate the clinical characteristics and prognostic implications of patients with lung adenocarcinoma presenting with concurrent lymphangitic metastasis at CT

METHOD AND MATERIALS
We retrospectively reviewed the clinical data base of patients who were newly diagnosed to have non-small cell lung cancer (NSCLC) from 2007 through 2010. We searched for the cases in which radiologic report text harbored the term �lymphangitic metastasis� and clinically ensured that the findings are suggestive of lymphangitic metastasis by excluding those who were proven to have pulmonary edema on follow-up study. The extent of lymphangitic metastasis was classified into having involved the same lobe, the ipsilateral lung but the different lobe, and the different lung. Two chest radiologists reviewed CT scans and decisions were reached by consensus. We excluded the patients with non-adenocarcinoma pathology or with surgery or irradiation history.
After restaging with CT and PET/CT results by the new 7th TNM classification, CT and clinico-demographic data were investigated for those in subject group (with lymphangitic metastasis) and in control group (without lymphangitic metastasis). New clinical stage group, sex, age and history of chemotherapy were matched to assess the impact of lymphangitic metastasis on patient overall survival.

RESULTS
The subject group (n = 54) consisted of four stage IIIB (7.4%) and 50 stage IV (93.6%) lung adenocarcinoma patients (34 men, 20 women; mean age 59 ± 10 years). Of these patients, lymphangitic metastasis was depicted in the same lobe in 10, in the ipsilateral lung but different lobe in 32 and in the different lung in 12 patients. Forty two patients received chemotherapy and 12 patients did not. There was no significant difference in overall survival between lung adenocarcinoma patients with and without lymphangitic metastasis (p = .758). The extent of lymphangitic metastasis also showed no significant correlation with patient prognosis (p = .121).

CONCLUSION
Stage IIIB or IV lung adenocarcinoma patients with lymphangitic metastasis at the initial CT does not show significantly different prognosis compared with those without the condition, and the extent of lymphangitic metastasis also does not affect on patient overall survival.

CLINICAL RELEVANCE/APPLICATION
In advanced stage (IIIB and IV) lung adenocarcinoma, the presence of lymphangitic metastasis or its extent does not have any impact on patient prognosis.

SSM05-04 ● Prognostic Value of Metabolic Tumor Volume in Patients with Esophageal Carcinoma

Sonia L Betancourt Cuellar MD (Presenter) ; **Wayne L Hofstetter** ; **Arlene M Correa** PhD ; **Osama R Mawlawi** PhD ; **Diana M**

Palacio MD ; **Edith M Marom** MD

PURPOSE
To determine if ^{18}F-fluorodeoxiglucose (FDG) metabolic tumor volume (MTV) imaged by positron emission computed tomography (PET-CT) in newly diagnosed patients with esophageal carcinoma can determine overall survival.

METHOD AND MATERIALS
185 patients with esophageal carcinoma, treated with surgery alone (n=62) or multimodality therapy: neoadjuvant chemoradiotherapy followed by surgery ((n=123) were included in this study. SUVmax, volumetric metabolic measurements such as MTV and other clinical variables, including clinical staging were assessed by Cox's proportional hazards regression model to test prognostic significance.

RESULTS
Univariable Cox regression analysis of the entire group of 185 patients showed that clinical staging, and maximal tumor length as assessed by endoscopic ultrasound and all methods for assessing FDG uptake were associated with overall survival (p
CONCLUSION
Some pretreatment FDG tumor uptake measurement techniques can be useful for tailoring therapy to either surgery or multimodality therapy in patients with esophageal carcinoma.

CLINICAL RELEVANCE/APPLICATION

SSM05-05 ● Dual-energy CT in Differentiating Thymic Epithelial Tumors: An Initial Experience

Suyon Chang MD (Presenter) ; **Jin Hur** MD ; **Young Jin Kim** MD ; **Hye-Jeong Lee** MD ; **Yoo Jin Hong** MD ; **Byoung Wook Choi** MD

PURPOSE
The WHO histological classification reflects both the clinical and functional features of thymic epithelial tumors and thus contributes to the clinical assessment and treatment of patients with these tumors. The purpose of this study was to evaluate the diagnostic value of dual-energy computed tomography (DECT) in differentiating thymic epithelial tumors.

METHOD AND MATERIALS
We prospectively enrolled 14 patients (3 males; mean age: 53.3years) who were pathologically confirmed as thymic epithelial tumors. All patients underwent dual-energy CT using gemstone spectral imaging (GSI) mode (GE HD750). For quantitative analysis, two investigators measured the following parameters; CT attenuation density (HU values), iodine-related HU (IHU), and iodine concentration (mg/ml). Pathological results were used as a final diagnosis. Statistical analysis included calculation of means and standard deviations, and the t-test.

RESULTS
There were a total of 8 low-risk thymomas (6 type AB and 2 type B1) and 6 high-risk thymomas (4 type B2 and 2 type C). The mean HU values of tumors were significantly different between the low-risk and high-risk thymoma groups (90.73 ± 17.04 vs 43.09 ± 20.08 HU; p = 0.0009). The mean iodine concentration and IHU values were significantly different between the two groups (2.18 ± 0.61 vs 0.64 ± 0.32; p = 0.0001 and 42.62 ± 14.36 vs 9.31 ± 5.39 HU; p = 0.0002, respectively).

CONCLUSION
Dual-energy CT using a quantitative analytic methodology can be useful in the differentiation between low-risk thymomas and high-risk thymomas.

CLINICAL RELEVANCE/APPLICATION
Dual-energy CT with quantitative measurements could be a helpful complementary tool to differentiate low-risk thymomas and high-risk thymomas in cases in which conventional CT is inconclusive.

SSM05-06 ● Volume Perfusion Computer Tomography Monitors the "Vascular Normalization�? Effects of Antivascular Therapy in Preclinical A549 Lung Adenocarcinoma Model

Zeng Xiong (Presenter) ; **Jin-Kang Liu** ; **Hui Zhou**

PURPOSE
Numerous recent studies have shown that anti-angiogenic therapy can improve oxygenation and blood flow of aberrant tumors, thereby enhancing the efficacy of subsequent radiation and chemotherapy. This is referred to as ��normalization�� of aberrant tumor vasculature. Application of immunohistochemical techniques in quantitative evaluation of �vascular normalization� effect has always been limited by difficulties in generating reproducible data. This study demonstrates that volume perfusion computer tomography (VPCT) parameters may indicate vascular abnormality in a lung tumor model and reflect the �Vascular Normalization� effect after Bevacizumab treatment.

METHOD AND MATERIALS

RESULTS
In treated mice, BF was increased at day2 (p.0.035) and significantly increased at day4 (p.0.000) as compared to the baseline. In control mice, BF gradually decreased during treatment with significant difference on the baseline (p.0.05). Microvessel pericyte coverage index (MPI) was significantly increased and hypoxia was significantly reduced in tumors at day4-6 after Bevacizumab treatment compared to those treated with saline (p.0.000). This study clearly demonstrates the �vascular normalization� effect and it is perfectly correlated with VPCT parameters.

CONCLUSION
VPCT is a novel method for investigating lung tumor vascular architecture, and this might be considered as an innovative complementary tool for precise quantification of �vascular normalization� effect.

CLINICAL RELEVANCE/APPLICATION
VPCT might be considered as an additional complementary tool for precise quantification of Vascular Normalization effects,assessment of antitumor treatment effects.

Pediatrics (Chest)

Wednesday, 03:00 PM - 04:00 PM ● S102AB

PD CH

SSM18 ● *AMA PRA Category 1 Credit* ™:1 ● ARRT Category A+ Credit:1
  Moderator
  R. Paul Guillerman , MD
  Moderator
  Robert H Cleveland , MD *

SSM18-01 ● Structural Abnormalities of the Lung in Children Born Extremely Preterm during the Surfactant Era

Karla M Logie BSc (Presenter) ; **Conor Murray** ; **Graham L Hall** PhD ; **J. J Pillow** MD ; **Andrew C Wilson** MD

PURPOSE
The long-term structural consequences of preterm birth upon the lungs remain unclear due to improved clinical management, survival rates and survival from younger gestations. Secondary to preterm birth, many infants develop bronchopulmonary dysplasia (BPD) the lung disease attributed to impaired morbidity and lung function. The purpose of this study was to assess lung structure in a contemporary cohort of children born at = 32 weeks gestation. We hypothesised that structural abnormalities would be present in preterm children regardless of BPD status, with increased frequency and severity in the BPD cohort.

METHOD AND MATERIALS
Images of 1mm thickness were obtained from a 64-slice CT machine (Philips Brilliance 64; Philips Medical Systems, Eindhoven, Netherlands). Inspiratory images were obtained at 10mm intervals from the lung apex to the diaphragm. Three expiratory images were collected at the level of the carina and the mid-points between the carina and the lung apex, and the carina and the diaphragm, respectively. Consensus scoring using a previously published, preterm specific protocol was performed by a paediatric thoracic radiologist and paediatric respiratory physician.

RESULTS
Structural lung abnormalities were present in 94 of the 100 preterm children. The most common abnormalities were the presence of linear/triangular sub pleural opacities (n = 86), peribronchial thickening (n = 43) and pulmonary hypoattenuation on expiration (n = 43). Only hypoattenuation on inspiration and sub-segmental collapse/consolidation were more common in the BPD vs. Non-BPD cohort (45% vs. 19% and 18% vs. 0%, p = 0.01; respectively). The total chest CT score per child (sum of structural abnormalities a marker of extent of structural damage) ranged from 0 � 26 and was significantly higher in the BPD group (median total score of 8 vs. 4; p=0.01). Total score was associated with oxygen (p = 0.02) and mechanical ventilation durations (p = 0.02).

CONCLUSION
This study has shown that pulmonary structural abnormalities are present in 94% of children born preterm, regardless of neonatal diagnosis of BPD. The extent of structural damage, indicated by total chest CT score, was associated with extent of neonatal respiratory support.

CLINICAL RELEVANCE/APPLICATION
Structural abnormalities within the lungs of preterm infants remain evident at 9 � 11 years of age. Severity of lung damage is associated with, but not exclusive to, neonatal lung disease.

SSM18-02 ● Markov Model Optimization of the Imaging Screening Strategy for Cystic Pleuropulmonary Blastoma in Children with DICER1 Mutations

Divya Sabapathy (Presenter) ; **R. Paul Guillerman** MD ; **Jack Priest** MD ; **Robert Orth** MD, PhD * ; **Eugene Kim** MD ; **William Foulkes** MD ; **Ananth Annapragada** PhD *

PURPOSE
Pleuropulmonary Blastoma (PPB), the most common primary pediatric pulmonary neoplasm, is strongly associated with DICER1 gene mutations. Unresected type I (cystic) PPB may progress into more aggressive type II/III during early childhood. X-ray based screening for the disease bears the risk of radiation induced malignancies. We therefore compared the utility of chest radiography (CXR) and computed tomography (CT) screening strategies for cystic PPB in children with DICER1 mutations.

METHOD AND MATERIALS
A Markov model was used to project the outcomes of 100,000 hypothetical patients undergoing screening for PPB. Estimates of PPB risk given a DICER1 mutation, risk of progression from type I to type II/III PPB, and PPB subtype mortality were estimated from the International PPB Registry data. Scenarios included patients aged 0-3 years with annual, biannual and quarterly CXR or CT exams. Additional scenarios with only 1 or 2 CT exams during the entire 3 year period were also tested. Radiation doses were based on dosimetry estimates. Lifetime radiation-attributable risks of cancer incidence and mortality were derived from the BEIR VII report. Mortality and life expectancy loss were calculated using a life table method to evaluate lifetime detriment.

RESULTS
Patients screened with CT incur higher lifetime detriment due to radiation-induced cancer than those screened with CXR. However, CT identified virtually all cystic PPB at the first screen while CXR required multiple screening cycles. The model predicts that even for multiple (>2) CT examinations, the average loss of life expectancy is on the order of days. This is orders of magnitude lower than for undetected PPB, which results in an average loss in life expectancy of >10 years. Sensitivity analysis showed that model uncertainty was dominated by the exam radiation dose.

CONCLUSION
The model suggests that the benefits of chest CT for cystic PPB detection greatly exceed the potential risks attributable to radiation exposure.

CLINICAL RELEVANCE/APPLICATION
Markov modeling can be used to compare projected radiation-induced cancer and disease-related risks and guide optimization of imaging-based disease surveillance strategies.

SSM18-03 ● Radiological Evaluation of Neonatal Ventilator - Associated Pneumonia

Roberto Llorens Salvador (Presenter) ; **Maria Cernada Badia** MD ; **Amparo Moreno Flores** MD ; **Marta Aguar** MD

PURPOSE

1. To illustrate the radiological patterns depicted in chest radiographies in those intubated neonates diagnosed of ventilator-associated pneumonia (VAP).
2. To discuss the impact of chest imaging in neonatal VAP diagnosis.

METHOD AND MATERIALS
Following the CDC/National Nosocomial Infection Surveillance criteria, persistent radiological infiltrates or consolidation in two sequential radiographs after initiation of mechanical ventilation, in the proper clinical and microbiological scenario, are necessary to diagnose VAP. After a prospective observational cohort study conducted in our tertiary-care regional referral center for a 2-yr period,two experienced pediatric radiologists, blinded to the clinical suspicion in the moment of imaging interpretation, reviewed the radiological patterns detected in the X-rays of 202 neonates included in the study. Both radiologists,separatedly,evaluated retrospectively the chest radiographs and registered in a electronic data sheet (Excel 2010,Microsoft) the radiological findings according to their individual interpretation following the criteria mentioned before. Detailed causative microbiological agents were investigated using invasive bronchoalveolar lavage (BAL).

RESULTS
Out of 398 newborn infants a total of 202 neonates were on mechanical ventilation (MV) more than 48h,of whom 16 were diagnosed of VAP (prevalence 8.1 %). The mean age at diagnosis was 29±15 days and a mean of 21±16 days on MV had elapsed at onset of VAP. Clinical suspicion of VAP required a radiological confirmation and the most frequent radiological features associated with VAP were persistent atelectasis or consolidation on chest radiograph (88.9% of episodes). Radiological infiltrate was described in 55.6 % of cases. Both radiologists considered equally the radiographies as to be suggestive of VAP in the 100% of cases finally diagnosed as VAP. The most frequently isolated microorganism (19%) was P aeruginosa,being the Gram negative organisms responsible for 61.9 % of VAP.

CONCLUSION
There are typical radiological patterns that radiologists should be able to recognise in chest radiographies of intubated neonates in the NICU. Under clinical suspicion, radiological information is a key feature to let neonatologists perform invasive techniques as BAL to confirm VAP diagnosis.

CLINICAL RELEVANCE/APPLICATION
Recognition of determined radiological patterns is important to lead invasive diagnosis of VAP in intubated neonates in the NICU.

SSM18-04 ● Imaging for Assessing Progression in Cystic Fibrosis Lung Disease: What Is the Best Approach?

Robert H Cleveland MD (Presenter) * ; **Catherine Stamoulis** PhD ; **Gregory Sawicki** MD ; **Emma L Kelliher** MBBCh, MRCPI ; **Evan J Zucker** MD ; **Christopher Wood** BA ; **David Zurakowski** PhD ; **Edward Y Lee** MD, MPH

PURPOSE
To determine the best imaging tool in assessing longitudinal progression of Cystic Fibrosis (CF) lung disease.

METHOD AND MATERIALS
Four radiologists independently scored 211 serial chest x-rays (CXR) from 30 CF patients twice using the Brasfield and twice using the Wisconsin systems. Scores were compared to the patient's simultaneously acquired PFTs (FEV-1 and FVC). Intra- and inter-rater Pearson correlation coefficients were estimated for each system to assess respective consistency and reproducibility. Brasfield and Wisconsin scores were averaged and then converted to z-scores and compared to each other and to z-scores of the FEV-1 and FVC to determine correlation to each other and to clinical gold standards. In addition to mean scores for each reader, the coefficient of covariation were calculated to determine variability within each system's raw scores. As recently reported from the Wisconsin group, CT has not shown superiority over serial CXR for longitudinal assessment of CF lung disease. Therefore, since CT results in increased radiation dose, cost and supplemental imaging, CT was not evaluated.

RESULTS
For the 4 readers, intra-rater correlation was in the range r=0.91-0.99 for Brasfield and r=0.83� 0.99 for Wisconsin (all p
CONCLUSION
When comparing reader reliability, the Brasfield and Wisconsin systems perform almost identically. Compared to each other and to PFTs, both systems perform almost identically. More variability in scoring occurred with the Wisconsin system.

CLINICAL RELEVANCE/APPLICATION
Imaging has become recognized as a reliable outcome assessment tool in CF research. This study reveals that Brasfield and Wisconsin assessment are equally reliable as such tools.

SSM18-05 ● Low-dose CT Protocol with Post-processing Techniques in Children for Clinically Suspected Tracheobronchial Foreign Bodies

Nong Qian (Presenter) ; **Changjie Pan**

PURPOSE
The purpose of our study was to assess the sensitivity and specificity of low-dose computed tomography (CT) in children for suspected tracheobronchial foreign bodies (FBs) by using rigid bronchoscopy (RB) as the reference standard.

METHOD AND MATERIALS
A prospective study of 79 children who were admitted with suspected tracheobronchial FBs underwent non-contrast lung CT were included in the study. All studies were performed on a Dual-source CT (DSCT) with high pitch scan model (low-dose protocol), All patients performed Post-processing (PP) techniques including multiplanar reconstruction (MPR), minimum intensity projection (Min IP), and virtual bronchoscopy (VB) were performed. Two radiologists independently evaluated the characterization of the tracheobronchial FBs (location, shape and pulmonary complications). All patients underwent rigid bronchoscopy (RB) evaluation within 24 hours after foreign bodies were confirmed or highly suspected in CT. Statistical analysis was performed with 2×2 contingency tables; 95% confidence intervals (CIs) were calculated with the Blyth-Still-Casella procedure.

RESULTS
Mean patient age was 1.9 years (range, 2 months to 6 years; 58% male patients). Tracheobronchial FBs were depicted at RB in 72 of 79 patients. In 70 of 72 patients, DSCT with PP depicted a tracheobronchial FBs. Two patients with normal findings at DSCT with PP had tracheobronchial FBs at RB. Sensitivity and specificity of CT with PP were 97.2% (95% CIs: 93.4%, 100%) and 85.7% (95% CIs: 42.0%, 100%), respectively. Positive and negative predictive values were 98.6% (95% CIs: 95.8%, 100%) and 75.0% (95% CIs: 35.0%, 97.0%), respectively. Overall accuracy was 96.2% (95% CIs: 92.0%, 100%). Mean effective dose was 0.57 mSv (range, 0.17�0.77 mSv).

CONCLUSION
DSCT with a low-dose protocol with post-processing techniques had high sensitivity and positive predictive values for depiction of FBs in children. It can accurately exhibit the indirect signs and pulmonary complications.

CLINICAL RELEVANCE/APPLICATION
low-dose DSCT with PP can noninvasively depict pediatric tracheobronchial FBs. Sensitivity, and PPV are high, particularly in patients of the FBs are nonradiopaque, mean effective dose of all examina

SSM18-06 ● Comparison of Low Dose Chest CT with CR Chest Images in the Management of Pediatric Pulmonary Tuberculosis Infection

Elizabete Kadakovska (Presenter) ; **Gabriel Bartal** MD ; **Ausma Ozolina** MD ; **Evija Livcane** MD, PhD ; **Iveta Ozere** MD, PhD ; **Elina Valtere** MD

PURPOSE
Currently diagnosis of Pulmonary Tuberculosis (Tb) is based on medical history, physical examination, specific tests for Tb infection and chest computerized radiography (CR). Vast number of infected children remains undiagnosed, thus creating a reservoir for future adult disease. Diagnosis of Lung Tb in children is complex can be easily missed and chest CR does not exclude all cases of active Tb. Our purpose was to compare low dose Chest CT and chest CR in children following a course of medical treatment.

METHOD AND MATERIALS
Between January 2008 and December 2012, 61/295 children in the State Tuberculosis hospital of Latvia with clinical and laboratory signs of Tb underwent low dose Chest CT (80 kV, 90 mAs, CTDIvol (mGy) 0.68, DLP (mGy-cm) 23.12) and CR following a course of specific Anti Tuberculosis treatment. The inclusion criteria for the study were laboratory and clinical improvement. Two certified chest radiologists (EK and AO) retrospectively, independently and blindly compared chest CR and CT findings.

RESULTS
61/295 (21 %) had significantly improved bacteriology and clinical picture following the initial treatment. Comparison of radiological findings between CR and CT was performed in the following parameters Chest CR vs. CT findings were as following: air space consolidation 24 (39%) / 29 (47%), nodular lesions 16(26%) / 22(36%), lymphadenopathy 9(15%) / 25(41%), pleural effusion 9(15%) / 9(15%), cavitations with parenchymal lesions 7(11%) / 11(18%), Ghon complex 4(6%) / 13(21%), calcified lymph nodes 2(3%) / 17(28%) respectively. Cavitations with parenchymal lesions were observed in 11/61(18%) on CT only. It was possible to avoid unnecessary treatment based on CT findings.

CONCLUSION

Low dose CT can improve management of pulmonary Tb thus avoiding unnecessary and possibly harmful antibiotic treatment in pediatric population.

CLINICAL RELEVANCE/APPLICATION
Low dose chest CT is valuable tool in diagnosis and management of Tb in children

---

Controversy Session: Lung Cancer Screening: Conflict of 'Dollars and Sense?'

Wednesday, 04:30 PM - 06:00 PM ● E450A

`HP` `OI` `CH`

SPSC41 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5
Moderator
Ned Patz , MD
Ned Patz , MD
Caroline Chiles , MD

LEARNING OBJECTIVES
1) Understand the primary objectives of the NLST. 2) Describe the results of the NLST and assess their potential applications to clinical practice. 3) Assess advantages and limitations of LDCT screening. 4) Consider financial implications of widespread screening.
ABSTRACT
URL

Controversy Session: The Evolving Role of Image-guided Pulmonary, Hepatic, and Renal Mass Biopsy: Current Indications and Controversies

Wednesday, 04:30 PM - 06:00 PM ● S404AB

`GU` `GI` `CH`

SPSC44 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5
Moderator
William W Mayo-Smith , MD *

LEARNING OBJECTIVES
1) To describe the current role of receptor studies in lung biopsy specimens. 2) To report what imaging and biochemical studies are diagnostic of hepatocellular carcinoma obviating the need for biopsy. 3) To describe the current and future indications for renal mass biopsy and why many, if not all small solid masses may need to undergo biopsy.
ABSTRACT

SPSC44A ● Pulmonary Biopsy

Elizabeth H Moore MD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSC44B ● Liver Biopsy

Fred T Lee MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSC44C ● Renal Mass Biopsy

Stuart G Silverman MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

Case-based Review of Pediatric Radiology: Pediatric Thoracic Imaging (An Interactive Session)

Thursday, 08:30 AM - 10:00 AM ● S406A

`PD` `CH`

MSCP51 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5
Director
Edward Y Lee , MD, MPH

MSCP51A ● Congenital and Acquired Thoracic Vascular Disorders in Children

Lorna Browne MD, FRCR (Presenter)

LEARNING OBJECTIVES
1) Discuss 'segmental' approach to aid diagnosis of congenital cardiovascular anomalies. 2) Review imaging techniques. 3) Review clinical aspects and characteristic imaging findings of commonly encountered congenital and acquired cardiovascular diseases in children. 4) Review the common congenital heart disease surgical repairs and their most frequent complications.

MSCP51B ● Thoracic Infections in Infants and Pediatric Patients

Ricardo Restrepo MD (Presenter)

LEARNING OBJECTIVES
1) Discuss the different imaging approach of tuberculosis in pediatric patients at different ages and the differential diagnosis. 2) Discuss parenchymal lung infections that present as cavitating lesions in children and their differential diagnosis. 3) Show several examples of unusual thoracic fungal infections in children. 4) Discuss differential diagnosis of chest wall infections in children and imaging approach. 5) Discuss round pneumonia, imaging findings, work up and differential diagnosis.

MSCP51C ● Diffuse Lung Disease in Pediatric Population

Edward Y Lee MD, MPH (Presenter)

LEARNING OBJECTIVES
1) Discuss a new classification system of diffuse lung disease in pediatric population. 2) Review helpful clinical aspects and imaging findings of diffuse lung disease in children. 3) Learn characteristic HRCT imaging findings to narrow the differential diagnoses of diffuse lung disease in pediatric patients.

Chest Series: Hot Topics in Chest Imaging: Emerging Technologies and Clinical Applications

Thursday, 08:30 AM - 12:00 PM ● E351

CT BQ CH

VSCH51 ● *AMA PRA Category 1 Credit* ™:3.25 ● ARRT Category A+ Credit:3.75
  Moderator
  Jonathan G Goldin , MBChB, PhD
  Moderator
  Jens Bremerich , MD

VSCH51-01 ● Quantitative Imaging: Lung Nodule Analysis

Jane P Ko MD (Presenter)

LEARNING OBJECTIVES
1) To increase understanding of the advancements in computer-assisted quantification of lung nodule size and features. 2) To enhance knowledge of the challenges pertaining to nodule evaluation techniques and their clinical applications.

ABSTRACT

VSCH51-02 ● Quantitative Imaging: COPD and Airways

Alexander A Bankier MD, PhD (Presenter) *

LEARNING OBJECTIVES
1) To present up-to-date imaging techniques for assessing airways and lung parenchyma in patients with COPD. 2) To present quantitative imaging approaches to COPD. 3) To discuss the clinical impact of quantiattive imaging, notably for phenotyping patients with COPD.

ABSTRACT
This presentation will present current imaging techniques used to assess changes in lung parenchyma and airways in patients with COPD. It will discuss the importance of a quantitative approach to imagig COPD, notably as to phenotyping patients with this disease. Finally, potential future trends in imaging COPD will be discussed.

VSCH51-03 ● Reproducibility of Automated Three-dimensional Airway Wall Thickness Measurements in Thoracic Computed Tomography and Influence of Inspiration Depth

Michael Schmidt MSc ; **Eva M Van Rikxoort** PhD ; **Onno M Mets** MD ; **Pim A De Jong** MD, PhD ; **Jan-Martin Kuhnigk** PhD, MS (Presenter) ; **Matthys Oudkerk** MD, PhD ; **Harry De Koning** * ; **Bram Van Ginneken** PhD

PURPOSE
Pathological changes of the airways are strongly associated with lung function impairment in chronic obstructive pulmonary disease (COPD). We investigate the reproducibility of CT-based airway dimension measurements and their dependence on the level of inspiration.

METHOD AND MATERIALS
We analyzed 740 pairs of low-dose chest CT scans of male (former) smokers who were recalled for a three-month follow up scan in the NELSON lung cancer screening trial. Given the slow progression of COPD, we expect that no significant COPD-related changes in airway dimensions should exist between baseline and three month follow-up. Each scan was analyzed fully automatic using CIRRUS Lung 13.03 and airway wall thickness (Pi10) and lung volume were recorded. Subjects where processing failed for any of the two scans were excluded for analysis (n=32). First, we analyzed the differences in airway wall thickness measurements for all scan pairs. Next, we determined reproducibility in absence of significant changes in inspiration depth by repeating the analysis for the subset of scans where the difference in lung volume between baseline and follow-up was less than 200ml (n=312). Finally, we investigated the correlation between difference in inspiration depth and airway wall thickness measurements, established a linear correction model for the airway measurements and analyzed differences for corrected measurements.

RESULTS

CONCLUSION
Changes in level of inspiration are significantly associated to changes of airway wall thickness and accounted for approximately 25% of the total differences between baseline and follow-up measurements.

CLINICAL RELEVANCE/APPLICATION
Inspiration depth should be controlled or linear correction should be applied for monitoring of airway wall thickness. This may help to better differentiate COPD subtypes in chest CT scans.

VSCH51-04 ● Quantitative Imaging: Interstitial Lung Disease

Jonathan G Goldin MBChB, PhD (Presenter)

PURPOSE
The learning objectives are the following: Approaches to Quantitative Imaging in ICD, Quantitative Imaging in Clinical Trials as a Biomarker and Quantitative Imaging in Clinical Practices.

VSCH51-05 ● Phenotypes of Pulmonary Fibrosis in the MUC5B Promoter Site Polymorphism (SNP)

Jonathan H Chung MD (Presenter) * ; **Ashish Chawla** MD, MBBS ; **David Mckean** ; **Janet Talbert** ; **Anna Peljto** ; **David A Lynch** MBBCh * ; **Marvin I Schwarz** MD ; **David Schwartz**

PURPOSE
The purpose of this study was to determine the variation of phenotypic manifestations of pulmonary fibrosis with regard to the MUC5B promoter site (rs35705950) polymorphism, which has been strongly associated with IPF and familial pulmonary fibrosis.

METHOD AND MATERIALS

HRCT scans of 1,764 subjects were scored as part of a genome-wide association study. Two thoracic radiologists independently evaluated the HRCT scans. Discrepancies were resolved by a third thoracic radiologist. All patients were genotyped specifically for the rs35705950 SNP. Two-tailed Fisher exact or Chi-square tests and t-test or one-way ANOVA tests were used to compare proportions and means, respectively. A p-value of 0.05 was considered statistically significant.

RESULTS
The major and minor alleles at the rs35705950 SNP are guanine (G) and thymine (T), respectively. There were 670 GG, 958 GT, and 136 TT subjects. This distribution showed significant departure from Hardy-Weinberg equilibrium (p
CONCLUSION
Polymorphisms at the MUC5B promoter site are associated with different phenotypes of lung fibrosis on chest CT.

CLINICAL RELEVANCE/APPLICATION
Integration of imaging and genotypic information may provide valuable information regarding patient prognosis and optimal treatment in fibrotic lung disease.

VSCH51-06 ● Dual Energy CT: Emerging Applications

Ioannis Vlahos MRCP, FRCR (Presenter) *

LEARNING OBJECTIVES
1) To understand the current potential for dual energy CT in thoracic imaging. 2) To review select current literature supporting the use of dual energy imaging. 3) To highlight emerging areas of clinical evaluation.

VSCH51-07 ● Dual-energy CT with Reduced Iodine Load: A New Option for Standard Chest CTA in Patients with Superior Vena Cava Syndrome

Sofiane Bendaoud MD (Presenter) ; **Olivier Vanaerde** MD ; **Francesco Molinari** MD ; **Arianna Simeone** MD ; **Emanuela Algeri** MD ; **Martine J Remy-Jardin** MD, PhD *

PURPOSE
To evaluate the interpretive conditions for analysis of all thoracic circulations on a chest CT angiographic examination optimized for suspicion of superior vena cava syndrome (SVCS).

METHOD AND MATERIALS
41 patients with suspected SVCS underwent a dual-source, dual-energy CT angiographic examination of the chest with bi-brachial administration of a low-concentration contrast agent (160 mg iodine /mL). From each data set, 3 series of images were systematically reconstructed: (a) the 2 polychromatic series acquired at 80 and 140 kV; and (b) the fused images from both tubes, with a weighting factor of 0.6 (i.e., averaged images equivalent to images acquired at 120 kV). On each series of images, a quantitative and qualitative analysis of 3 anatomical compartments was performed, including the: (a) superior vena cava; (b) pulmonary arteries; and (c) aorta. In the quantitative evaluation: (a) ROIs were placed in each vessel-of-interest to measure mean ±SD attenuation; (b) the signal-to-noise (SNR) and contrast-to-noise (CNR) ratios were calculated. Qualitative analysis evaluated the presence and severity of streak artifacts at the level of 3 nodal stations (i.e., 2R, 4R, 10R). On a patient-by-patient basis, the number of series to-be-interpreted for optimal analysis of all anatomical regions was then assessed.

RESULTS
Averaged images provided (a) a good to excellent level of opacification within the SVC (n=40 ; 98%) without artifacts at the level of 2R (n=26 ; 63%), 4R (n=40 ; 98%) and 10 R (n=41 ; 100%) ; (b) analyzability of pulmonary arteries down to the subsegmental level (n=31 ; 76%) ; and (c) a good to excellent opacification of the aorta (n=35; 85%). In 29 patients (29/41; 71%), averaged images alone provided optimal evaluation of all vascular compartments; in 12 patients (12/41; 29%), they had to be completed by images at 140 kV (n=6) to suppress artifacts at the level of the nodal station 2R and/or images at 80 kV (n=10) to improve the CNR at the level of subsegmental pulmonary arteries and/or the aorta.

CONCLUSION
Dual-energy CT enables combination of optimal evaluation of SVCS and diagnostic image quality at the level of the other thoracic circulations.

CLINICAL RELEVANCE/APPLICATION
On dual-energy CT angiograms obtained with low-concentration contrast material, an optimal analysis of all thoracic vessels requires the reading of a single series of images in the majority of cases.

VSCH51-08 ● CT Innovations for Radiation Dose Reduction

John R Mayo MD (Presenter) *

LEARNING OBJECTIVES
1) To identify the patient factors that increase CT radiation dose risk. 2) To describe current CT radiation dose reduction techniques. 3) To outline the relationship between CT image noise and the detection of abnormalities. 4) To evaluate the impact of iterative reconstruction on CT radiation dose reduction.

VSCH51-09 ● Incidental Findings Detection on CT Pulmonary Angiography Images with Low kVp Techniques

Kanako K Kumamaru MD, PhD (Presenter) ; **Rachna Madan** MD ; **Ritu R Gill** MBBS * ; **Nicole Wake** MS ; **Frank J Rybicki** MD, PhD * ; **Andetta R Hunsaker** MD

PURPOSE
To evaluate the effect of reduced kVp on detection of incidental findings in the lungs and mediastinum in patients who underwent CT Pulmonary Angiography (CTPA) for suspected acute pulmonary embolism.

METHOD AND MATERIALS
This IRB-approved HIPAA-compliant study included consecutive CTPA studies performed from January 2008 to April 2010 which used low kVp technique (80kVp for patients weighing
RESULTS
Compared with standard kVp settings, objective/subjective noise scores were significantly greater at lower kVp, while the SNR/CNR/contrast opacification scores were not significantly different, in both weight cohorts. Confidence level of clinical interpretation tended to be lower at low kVp, with a significant decrease for mediastinal lesions interpreted by one of two readers (coefficient=-2.35, 95%CI=-2.89 to -1.82, p0.1). Multivariate analysis did not show a significant correlation between accuracy of interpretation and kVp settings for lung nodules and mediastinal nodal detection (adjusted odds ratio=0.67-1.22, p-values >0.2).

CONCLUSION
Despite the increased image noise, lower kVp techniques in CTPA studies in patients suspected of acute pulmonary embolism does not adversely affect the detection of lung nodules or mediastinal nodes.

CLINICAL RELEVANCE/APPLICATION
Lower kVp does not adversely affect the detection of lung nodules or mediastinal nodes on CTPA studies, despite the increased noise and decreased confidence in the interpretation.

VSCH51-10 ● Hyperpolarized Gas MR Imaging

Talissa A Altes MD (Presenter) *

LEARNING OBJECTIVES
1) Understand the limitations of proton lung MRI and the strengths and weaknesses of hyperpolarized gas MRI of the lung. 2) Learn about potential research and clinical applications of hyperpolarized gas lung MRI in lung diseases such as CF, asthma, and COPD.

ABSTRACT

VSCH51-11 ● Are Hyperpolarized ³He Magnetic Resonance Imaging Ventilation Defects Clinically Relevant in Ex-smokers without Airflow Limitation?

Damien Pike BSC (Presenter) ; **Miranda Kirby** PhD ; **Sarah Svenningsen** BSC ; **Harvey O Coxson** PhD * ; **David McCormack** MD ; **Grace Parraga** PhD

PURPOSE
In early or mild chronic obstructive pulmonary disease (COPD), spirometry measurements are relatively insensitive to changes in the �silent zones� of the lung in the small airways (1). However, hyperpolarized ³He magnetic resonance imaging (MRI) has provided evidence of early or very mild emphysema in never-smokers with exposure to second hand smoke (2) as well as early emphysema (3) and airways abnormalities (4) in asymptomatic ex-smokers. We recently evaluated 160 ex-smokers and 71/160 (44%) did not have spirometry measurements diagnostic for COPD. We hypothesized that ³He MRI and computed tomography (CT) measurements of airways disease and emphysema would detect a subgroup of ex-smokers without airflow limitation but with clinically relevant structure-function pulmonary abnormalities.

METHOD AND MATERIALS
Seventy-one ex-smokers (69±10yr, FEV1/FVC=.70) underwent spirometry, ³He MRI, thoracic CT and the St. George�s Respiratory Questionnaire (SGRQ). CT-derived measurements were generated for wall area percent (WA%) and lumen area (LA) of the sub-segmental lower right (RB8) airway and the relative area at -950 Hounsfield units of the CT density histogram (RA950). Hyperpolarized ³He MRI ventilation defect percent (VDP), a surrogate of airways and bullous disease, and apparent diffusion coefficients (ADC), a surrogate of emphysema was generated for whole lung (WL) and lower right lobe (LRL) pulmonary measurements.

RESULTS
Subjects were classified into two sub-groups: ex-smokers with a LRL ³He MRI defect (Defect, n=9) and ex-smokers with no LRL defect (No Defect, n=62). Subjects with a defect had significantly greater VDP, RB8 WA%, smaller RB8 LA and worse symptoms than subjects without a LRL defect.

CONCLUSION
In 9/71 (13%) ex-smokers without airflow limitation and a LRL ventilation defect, symptoms were worse and ³He MRI and CT measurements showed abnormal airway structure and function that was significantly worse than in a subgroup of ex-smokers without an LRL ventilation defect.

CLINICAL RELEVANCE/APPLICATION
In ex-smokers without airflow limitation and previously undetected but clinically relevant symptoms, lung imaging provided evidence of structure-function abnormalities that require clinical follow-up.

VSCH51-12 ● MR Imaging: Recent Advances for Chest Imaging

Jens Bremerich MD (Presenter)

LEARNING OBJECTIVES
1) Understand physical limitations specific to the chest and how to improve image quality. 2) Current applications of MR for imaging pulmonary morphology and function. 3) Oversee emerging techniques for MR imaging of the entire chest.

ABSTRACT
Introduction:
Magnetic Resonance is an attractive tool for imaging of morphology and function of the chest with ionizing radiation. Magnetic properties of the chest, however, remain unfavourable for MR because of low water proton density and considerable magnetic field inhomogeneities. Recently new imaging protocols and sequences became available that may overcome these limitations. This abstract reviews current applications and recent advances of MR of the chest. Methods:
Fast imaging techniques such as turbo spin echo or segmented gradient echo can reduce susceptibility artefacts and enable breath held acquisitions. Free breathing respiratory gated sequences may be used alternatively. Standard imaging protocols comprise T1 and T2 weighted images for morphology assessment and edema detection. Diffusion weighted MR may be added to identify diffusion restriction which may indicate malignancy. Pleural infiltration of peripheral masses may be assessed by means of cine imaging during in- and exspiration. For further characterisation of masses and inflammatory diseases T1 weighted images pre and post gadolinium may be used. Emerging techniques based on fourier decomposition for assessment of perfusion and ventilation are currently under investigation. Results: Magnetic Resonance may be used to identify and characterise pulmonary masses, monitor pulmonary perfusion and ventilation, assess chest wall motion, identify involvement of chest wall in peripheral lung tumors and to identify pulmonary embolism. Fourier decomposition may enable assessment of perfusion and ventilation and is currently under investigation. Conclusion:
Today, MR is a useful tool for assessment of pulmonary morphology, function and tissue characterisation. Recent advances in MR of the chest include fourier decomposition techniques which may enable assessment of perfusion and ventilation without injection of contrast material.

VSCH51-13 ● SUVmax Correlation between PET/MRI and PET/CT in FDG Avid Lesions of the Chest Using a Three Segment Model Attenuation Correction

Andres Kohan MD (Presenter) * ; **Christian Rubbert** MD * ; **Jose L Vercher-Conejero** MD * ; **Sasan Partovi** BS * ; **Karin A Herrmann** MD ; **Luis A Landeras** MD ; **Peter F Faulhaber** MD *

PURPOSE
PET/MRI combines the superior tissue resolution and multiparametric capabilities of the MRI with the functional capabilities of PET. It�s theorized to improve oncologic imaging in multiple areas of the body, specially: brain, liver, pelvis and bone. Nonetheless other areas are bound to benefit from this technology.
However, SUVs obtained from FDG avid lesions in PET/MRI remains a concern, mainly due to the migration from CT attenuation correction to MRI attenuation correction (MRAC). One area of major concern is the chest, where two critical tissue interfaces with very different attenuation coefficients can be found.
We studied FDG avid lesions in the chest to determine the correlation between the SUVmax from PET/MRI and PET/CT using a three segment model MRAC.

METHOD AND MATERIALS
First 47 oncologic consecutive patients from a research protocol were included. Final n was 19 due to 6 failed MRAC and 22 patients without chest lesions to analyze. All patients underwent PET/CT (Gemini TF) and PET/MRI (Ingenuity TF) with a single FDG injection. Lesions were identified by direct comparison and sub-classified as mediastinal, lung or chest wall lesions. SUVmax was determined with a spherical ROI including the lesion. Spearman Ranked correlation was performed.

RESULTS
Out of all patients (5 male, 14 female): 9 had lung cancer, 3 breast cancer, 2 head and neck cancer, 2 lymphoma, 1 melanoma, 1 pancreas and 1 colon cancer. Seventy six lesions were analyzed: 21 in the lung, 14 in the chest wall and 41 in the mediastinum. Mean

exam scan time: 18±4min (PET/CT) and 21±3 (PET/MRI). Mean time from FDG injection: 66±8min (PET/CT) and 105±20min (PET/MRI). Spearman for SUVmax was 0.93, 0.95, 0.84 and 0.96 for overall, lung, chest wall and mediastinal lesions respectively (p

CONCLUSION
Chest wall lesions had a somewhat lower correlation (0.84) than the others (>0.90), probably related to more than half of the lesions being in vertebras and ribs, whereas the MRAC cannot identify bone tissue. Nonetheless, correlation between SUVmax was very strong (rho>0.8) for all lesions in all areas which raises the question whether there is any clinical relevance to the findings seen in the chest wall.

CLINICAL RELEVANCE/APPLICATION
Reliability of SUVs in an area with air/soft tissue boundaries is vital for PET/MR to succeed in chest oncologic imaging. The high correlation to PET/CT SUVs seen here is a step into that direction.

VSCH51-14 ● Innovations in Chest Radiography

Heber Macmahon MD (Presenter) *

LEARNING OBJECTIVES
1) Understand the newer enhancements that have become available for digital chest radiography. 2) Learn how these techniques may improve diagnostic accuracy. 3) Appreciate the benefits and limitations of dual energy radiography, bone suppression, computer-aided nodule detection in clinical practice.

VSCH51-15 ● Digital Chest Tomosynthesis

Ase A Johnsson MD, PhD (Presenter)

LEARNING OBJECTIVES
1) The benefits of chest tomosynthesis in comparison to chest radiography. 2) The limitations of chest tomosynthesis in comparison to computed tomography. 3) The role of chest tomosynthesis as a problem solver in daily clinical practice.

ABSTRACT

Chest (Radiation Dose Reduction)

Thursday, 10:30 AM - 12:00 PM ● S405AB

QA CT CH

SSQ04 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5
    Moderator
    Prachi P Agarwal , MD
    Moderator
    Mannudeep K Kalra , MD *

SSQ04-01 ● Chest CT at One-Fifth of a mSv: Can Sparse Sampled Data Reconstructed with Iterative Reconstructive Technique Help Make the Cut?

Ranish D Khawaja MBBS, MD (Presenter) ; **Sarabjeet Singh** MD ; **Diego A Lira** MD ; **Synho Do** PhD * ; **Atul Padole** MD ; **Mannudeep K Kalra** MD * ; **Sarvenaz Pourjabbar** MD ; **Rolf Bippus** * ; **Thomas Koehler** PhD * ; **Kevin M Brown** MS *

PURPOSE
To compare pulmonary lesion detection, visibility of tiny structures and diagnostic acceptability in sparse-sampled CT data of sub-milli Sievert chest CT (SpS-SmSv) reconstructed with Iterative Reconstruction Technique (IRT).

METHOD AND MATERIALS
Ten non-obese patients (BMI2, age range:48-82 years) were scanned at standard-dose CT (SD) and at sub milli-sievert (SmSv at 0.9 mSv) dose on a Philips 256-slice CT scanner with double z-sampling in a prospective study. Sparse angular sampling data were reconstructed using 25% of the angular projections from the sub-mSv sinogram to reduce the number of views and radiation dose by about 4-fold (estimated ED 0.2mSv). Three image series were generated per patient (*sparse sampled reconstructed with IRT*: SpS-SmSv IRT; *fully sampled*: SmSv-FBP and SD-FBP). Two radiologists independently assessed these image series for detection of lung lesions, visibility of small structures and diagnostic acceptability. Objective noise was measured in thoracic aorta and noise spectral density (NSD) was obtained for SpS-SmSv IRT, SmSv-FBP and SD-FBP.

RESULTS
SpS-SmSv IRT resulted in 75%(0.2/0.9 mSv) and 92%(0.2/2.9 mSv) dose reduction, when compared to fully sampled submSv-FBP and SD-FBP, respectively. SpS-SmSv images displayed all 36 lesions (most < 1 cm, 31 lung nodules and 5 ground glass opacities) seen on SmSv-FBP and SD-FBP datasets. Lesion margins with sparse sampled data were deemed acceptable compared to both SmSv-FBP and SD-FBP. Overall diagnostic acceptability was maintained with SpS-SmSv IRT despite presence of minor pixilation artifacts in 3/10 cases. Interobserver agreement was statistically significant (*kappa value* 0.88; p0.05). NSD showed that SpS-SmSv IRT gives a linear decrease over frequency in the semilog plot and an exponential decrease of noise power over frequency compared to submSv FBP and SD-FBP.

CONCLUSION
It is possible to reduce chest CT dose to fifth of a mSv for sparse-sampled CT images reconstructed with IRT while retaining lesion detection and diagnostic acceptability for evaluation of pulmonary findings.

CLINICAL RELEVANCE/APPLICATION
More than 90% dose reduction could be achieved with one fourth sparse-sampled and sub millisievert chest CT examination when reconstructed with iterative reconstruction technique.

SSQ04-02 ● Lung and Nodule Perfusion Assessments on Dynamic First-pass Perfusion Area-detector CT: Capability of Adaptive Iterative Dose Reduction Using 3D Processing (AIDR 3D) for Radiation Dose Reduction as Compared with Filter Back Projection (FBP)

Yoshiharu Ohno MD, PhD (Presenter) * ; **Mizuho Nishio** MD * ; **Takeshi Yoshikawa** MD * ; **Sumiaki Matsumoto** MD, PhD * ; **Yasuko Fujisawa** MS * ; **Naoki Sugihara** MENG * ; **Hisanobu Koyama** MD ; **Shinichiro Seki** ; **Maho Tsubakimoto** MD ; **Tohru Murakami** ; **Masakazu Kanzawa** RT ; **Kazuro Sugimura** MD, PhD *

PURPOSE
To directly compare the capability for radiation dose reduction on dynamic chest perfusion area-detector CT (ADCT) aiming lung and nodule perfusion assessments between adaptive iterative dose reduction using 3D processing (AIDR 3D) and filter back projection (FBP) methods.

METHOD AND MATERIALS
36 consecutive patients (25 male, 11 female; mean age 75 years) with 36 nodules underwent standard-dose perfusion ADCT (SDCT) using the following parameters: 320×0.5 mm collimation, 80kVp, 120mA, and 0.5 sec gantry rotation time. From SDCT raw data, low-dose perfusion ADCTs (LDCTs) at 80mA, 60mA and 40mA were computationally simulated. Then, SDCT and each LDCT were reconstructed by AIDR 3D and FBP methods. From each CT data, perfusion map was computationally generated. Then, image noises of

lung parenchyma and nodule, lung and nodule perfusions were evaluated by ROI measurements. To determine the utility of AIDR 3D for radiation dose reduction, both image noises and perfusion parameters from all CT data were statistically compared each other by using Tukey's HSD test. Correlations of both perfusion parameters were evaluated between SDCT and others. Finally, to assess the radiation dose reduction capability between two methods, the limits of agreements (mean±1.96×standard deviation) of each parameter between SDCT and others was assessed by using Bland-Altman analysis.

RESULTS
When applied AIDR 3D, image noises of LDCTs at 80mA and 60mA were significantly lower than those by FBP (p
CONCLUSION
AIDR 3D method has better potential for radiation dose reduction of chest perfusion ADCT than FBP method in routine clinical practice.

CLINICAL RELEVANCE/APPLICATION
When compared with FBP method, AIDR 3D method has better potential for radiation dose reduction of perfusion ADCT for lung and nodule perfusion assessments in routine clinical practice.

SSQ04-03 ● Breast Dose Reduction during Thoracic CT: Comparison between Shielding and Low Kilovoltage for Various Breast Thicknesses

Marie-Pierre Revel (Presenter) ; **Isabelle Fitton** ; **Etienne Audureau** ; **Marie Laure Chabi** ; **Pascal Rousset** MD

PURPOSE
To compare breast dose and image noise on CT acquisitions performed with low kilovoltage or bismuth shielding, on a phantom study with different prosthetic breast thicknesses.

METHOD AND MATERIALS
Phantom study with 3 different breast thicknesses, defined as the distance perpendicular to the breast tangency line.
Five consecutive 64-detector CT acquisitions (Light-speed VCT, GE) performed for each breast thickness at 120 kVp (reference acquisition), then at 100 kVp and 120kVp with shielding. Breast dose measured using two Optically Stimulated Luminescence Dosimeters (OSLD) placed both superficially and deep within the prosthetic breast. CT number standard deviation measured within 4 central ROIs at increasing depths for image noise evaluation.

RESULTS
Intraclass correlation coefficient for dose measurements was 0.825 [95%CI: 0.726 ; 0.923]
Considering all breast thicknesses, averaged breast dose (mean of superficial and deep measurements) was reduced by 42.1 % with shielding, compared to 33.0% at 100 kVp (p=0.009). Noise increase within the 2 deepest ROIs was less with shielding (19.0% vs 32.1%, p For 1cm- breast thickness, breast dose was reduced by 46.5% and 29.7% (p=0.01) and in-depth noise increased by 19.5 % and 33.9 % (p=0.01) with shielding or at 100 kV, respectively. For 2cm- breast thickness, breast dose was reduced by 38.5% and 30.1 %, (p=0.02) and in-depth noise increased by 16.5% and 33.5% (p=0.001) with shielding or at 100 kV, respectively. For 4cm- breast thickness, breast dose was reduced by 40.6% and 40.5% (p=0.95) and in-depth noise increased by 20.7% and 29.2% (p=0.02) (with shielding or at 100 kV, respectively).

CONCLUSION
For small breast thicknesses, breast dose reduction is greater with shielding. Shielding systematically provides less in-depth noise increase.

CLINICAL RELEVANCE/APPLICATION
For an equivalent or greater breast dose reduction, shielding provides less in-depth noise increase than the 100kVp option for CT acquisitions performed on GE equipments.

SSQ04-04 ● Prospective Clinical Trial to Acquire Sub Millisievert Chest CT and Compare 4 Different Reconstruction Techniques (Filtered Back Projection, Image Based, Adaptive Statistical and Model Based Iterative Reconstruction)

Atul Padole MD (Presenter) ; **Sarabjeet Singh** MD ; **Carol C Wu** MD * ; **Jeanne B Ackman** MD ; **Jo-Anne O Shepard** MD * ; **Mannudeep K Kalra** MD * ; **Synho Do** PhD * ; **Sarvenaz Pourjabbar** MD ; **Ranish D Khawaja** MBBS, MD ; **Subba R Digumarthy** MD

PURPOSE
To assess diagnostic image quality in sub-milli-Sievert chest CT reconstructed with Filter Back Projection (FBP), SafeCT (image based), Adaptive Statistical (ASIR) and Model Based (MBIR) iterative reconstruction techniques.

METHOD AND MATERIALS
In an IRB approved, prospective clinical study, 50 patients (mean age 62 ± 10 years, M:F 33:17, undergoing routine chest CT on a 64 channel MDCT (GE Discovery CT750 HD) gave written informed consent for acquisition of an additional sub-milli-Sievert chest CT series. The latter series were acquired with reduced tube current but identical scan length compared to the routine chest CT. Sinogram data of submSv series were reconstructed with FBP, SafeCT (3 settings; Chest4, Lung1, Lung2; MedicVision Inc.), ASIR (SS50, SS70, GE Healthcare) and MBIR (GE Healthcare) and compared with FBP images at standard dose chest CT (n= 8*50=400 series). Three board certified thoracic radiologists performed independent, randomized and blinded comparison for lesion detection, lesion margin, visibility of small structures and ground glass opacities (GGO) and diagnostic acceptability. Objective measurements, noise spectral density (NSD) was obtained.

RESULTS
Mean CTDIvol were 8±4.4 and 1.8±0.2 mGy for standard and submSv CT, respectively. Of the 287 detected lesions, 196 were less than 1 cm nodules and GGO. Lesion margins were well seen on all submSv reconstruction images except MBIR where they were poorly visualized. Likewise, only submSv MBIR images were deemed suboptimal for visibility of normal structures such as lung vessels in outer 2cm, major fissures, and subsegmental bronchi. Visibility of pericardium was superior on submSv MBIR compared to the other image series. FBP, ASIR, and SafeCT showed similar NSD pattern, although SafeCT had more consistent decrease of NSD over frequency. MBIR had the lowest image noise with different and more homogeneous noise spectrum as compared to other techniques.

CONCLUSION
SafeCT, ASIR and MBIR can allow optimal lesion evaluation in chest CT acquired at CTDI vol of 2 mGy. Evaluation of lesion margins is better on SafeCT as compared to some of the other reconstruction techniques although greatest noise reduction is seen with MBIR.

CLINICAL RELEVANCE/APPLICATION
Diagnostically acceptable submSv chest CT images can be obtained when using image and model based iterative reconstructions.

SSQ04-05 ● High-pitch Low Dose Chest CT Scan for Radiation Dose Reduction Comparing Standard Low Dose Chest CT: A Pilot Study

Chanyeong Park MD (Presenter) ; **Hong-Il Ha** MD ; **Hye Sun Hwang** ; **Hye Jeon Hwang** MD ; **In Jae Lee**

PURPOSE
To assess the effectiveness of high-pitch low dose chest CT (HP-LDCT) in reducing radiation dose without deterioration of image quality compared with standard low-dose chest CT (LDCT).

METHOD AND MATERIALS
In this Institutional Review Board�approved HIPAA-compliant study, 35 patients underwent HP-LDCT and another 35 patients underwent LDCT. HP-LDCT scan parameters were as follows: pitch=3.0, 128 x 0.6 mm slice acquisition, 0.28 seconds gantry rotation time and fixed

40 mAs at 120 keV. LDCT scan parameters were as follows: pitch=1.2, 0.5 seconds gantry rotation time and other parameters were same as HP-LDCT parameters. Objective image noise was measured in five regions such as air, lung parenchyma, infraspinatus muscle, aorta, subcutaneous fat layer. Two blind radiologists independently assessed the subjective image quality of noise, artifact, sharpness and overall diagnostic acceptability with 5-point scale. Independent sample t-test, Mann-Whitney U test and kappa anlaysis were used for the statistical analyses.

RESULTS
BMI between the HP-LDCT group (24.5 ± 2.9 kg/m^2) and LDCT group (23.2 ± 3.0 kg/m^2) was no significant difference (p=0.073). The DLPs for HP-LDCT and LDCT were 90.22 ± 4.34 mGycm and 106.14 ± 6.48 mGycm, respectively ($p$pppp
CONCLUSION
HP-LDCT was achieved approximately 22% reduction of mean radiation dose with improvement of the suppression of cardiac pulsation and preserving image quality.

CLINICAL RELEVANCE/APPLICATION
High-pitch low dose chest CT reduced mean radiation dose from 1.5mSv to 1.2mSv and showed similar image noise but more motion-free images compared with standard low dose chest CT.

SSQ04-06 • How Low Can We Go: Dose Saving Potential of Model-based Iterative Image Reconstruction (MBIR) in Contrast Enhanced CT Imaging of the Chest - A Dose Finding Cadaver Study

Fabian Mueck (Presenter) ; **Zsuzsanna Deak** MD ; **Susan Notohamiprodjo** MD ; **Florian Fischer** MD ; **Jochen M Grimm** MD ; **Maximilian F Reiser** MD ; **Stefan Wirth** MD *

PURPOSE
To compare image quality (IQ) of 64-row CT scans of the chest, respectively acquired at varying dose levels and reconstructed with model based iterative reconstruction (MBIR), to standard baseline examinations at full dose and using adaptive statistical iterative image reconstruction (ASIR).

METHOD AND MATERIALS
11 human cadavers were included (79±18.5kg; 72.5±17.2y/o; BMI 26.3±5.1). Following injection of contrast media (Angiofil-Macro: Arterial=800ml; Venous=1200ml; Virtangio, Fumedica, Muri; Switzerland) a full-dose baseline reference (FBR) was acquired (CT HD750; GE Healthcare, Waukesha, IL) using a standard-of-care protocol (0.625mm helical, 0.984 pitch, 120kV, 10-400mA modulation, noise index NI=39 VS=0.625; NI = allowed procentual level of noise in a water phantom in virtual slices of varying thickness (VS in mm); raw data were reconstructed in soft tissue kernel using ASIR 50%). These baseline raw data were also reconstructed with MBIR (D0). Additionally, each cadaver was scanned with varying dose levels D1-D5 by changing NI and VS (D1: NI=35, VS=2.5; D2: NI=70, VS=0.625; D3: NI=35, VS=5; D4: NI=70, VS=2.5; D5: NI=70, VS=5; all reconstructed with MBIR). Except for NI, VS and MBIR, all other parameters were identical to the FBR, all series reformatted in 3mm axial, coronal and sagittal slices. Two radiologists, blinded to the dose level, independently compared IQ for soft tissue evaluation of D0-D5 to the full-dose FBR (IQ: -2:diagnostically inferior, -1:inferior, 0:equal, +1:superior, +2:diagnostically superior; respectively). For statistical analysis ICC and Wilcoxon�s test were used.

RESULTS
Mean values were (CTDIvol in mGy: D0 = 10.4±0.9, D1 = 7.4±2.6, D2 = 6.6±2.5, D3 = 4.3±1.8, D4 = 2.1±0.9, D5 = 1.1±0.5); (IQ: D0 = +1.9±0.2, D1 = +1.7±0.1, D2 = +1.3±0.3, D3 = +1.0±0.3, D4 = +0.4±0.3, D5 = -0.9±0.5). All values were significant different from one another; p
CONCLUSION

CLINICAL RELEVANCE/APPLICATION
For standard chest examinations of non-emergency patients, MBIR allows for diagnostic, enhanced CT scans of the chest below 1mSv without loss of image quality.

SSQ04-07 • Lung Nodule Volumetry on Low- and Ultra-low-Dose CT with Adaptive Iterative Dose Reduction (AIDR 3D): A Phantom Study

Sumiaki Matsumoto MD, PhD (Presenter) * ; **Yoshiharu Ohno** MD, PhD * ; **Tomoya Okazaki** MS * ; **Atsushi Yaguchi** MENG * ; **Tomoyuki Takeguchi** PhD * ; **Hiroyasu Inokawa** * ; **Kota Aoyagi** * ; **Hitoshi Yamagata** PhD * ; **Kazuro Sugimura** MD, PhD *

PURPOSE
To evaluate the effect of adaptive iterative dose reduction (AIDR 3D) on the accuracy and precision of lung nodule volumetry on low- and ultra-low-dose CT.

METHOD AND MATERIALS
This study employed an anthropomorphic thoracic phantom (Lungman, Kyoto Kagaku) and 24 spherical synthetic nodules of 3 density types (100, -630, and -800 HU) with each type comprised of 8 nodules ranging 5-12 mm in diameter. The nodules were placed such that each nodule was attached to either the phantom lung vasculature or mediastinum. The phantom was then scanned with an area-detector CT (Aquilion ONE, Toshiba Medical Systems) using 4 protocols consisting of different tube current settings (80, 40, 20, and 10 mA) and otherwise identical acquisition parameters, where 3 scans were obtained for each protocol. Each scanned data were reconstructed into 1-mm-thick images without and with AIDR 3D, thus resulting in two image datasets per scan. The volumes of all nodules in every image dataset were measured using newly developed software, and measurements were converted to percentage absolute biases (abs-B) and percentage inter-scan standard deviation (iSTD) relative to known volumes of nodules. Resultant values were analyzed by means of mixed effects analysis of variance in order to assess the effect of AIDR 3D on abs-B and iSTD.

RESULTS
AIDR 3D had a significant effect on reducing abs-B (p
CONCLUSION
AIDR 3D allowed volumetry of synthetic lung nodules with reduced absolute biases on low- and ultra-low-dose CT and reduced inter-scan variability on ultra-low-dose CT.

CLINICAL RELEVANCE/APPLICATION
The results of this study suggest that, by the use of AIDR 3D, lung nodule volumetry can be improved in terms of accuracy on low-dose CT and both accuracy and precision on ultra-low-dose CT.

SSQ04-08 • Comparison of Dose-length Product between Craniocaudal and Caudocranial Chest CT Scans Using Automatic Exposure Control: A Phantom Experiment with Four Different CT Machines

Yong Hwan Chung RT (Presenter) ; **Tae Hyun Nam** ; **Chang Min Dae** ; **Kwan Hong Min** ; **Kyoung Ho Lee** MD ; **Bohyoung Kim** PhD

PURPOSE
To compare dose-length product (DLP) between craniocaudal and caudocranial scan directions in scanning the chest of four humanoid phantoms with four CT scanners with automatic exposure control (AEC).

METHOD AND MATERIALS
We scanned four different humanoid phantoms of PBU-50, Norris, Wendy, and Female Rando in the two directions, with Light speed VCT (GE), Aquillion 64 (Toshiba), Somatom Definition Flash (Siemens), and Brilliance iCT (Philips) in two hospitals. The scan length was set the same for the two directions for each phantom. Other scan parameters including automatic exposure control followed the standard-of-practice in each test site. The difference in DLP between the two directions was measured in terms of (craniocaudal DLP � caudocranial DLP) / caudocranial DLP (%).

RESULTS
DLPs were higher with craniocaudal direction than with caudocranial direction for all 16 combinations of the four phantoms and four scanners. For the four phantoms, the percentage difference in DLP ranged 8.6%-10.5%, 10.3%-10.8% 5.4%-7.4%, and 5.2% -6.4% for the GE, Toshiba, Siemens, and Philips machines, respectively. No notable difference was found in the overall image quality between the two directions.

CONCLUSION
With the same other scan parameters, craniocaudal scanning had consistently higher radiation dose than caudocranial scanning by up to 10% in the four tested machines.

CLINICAL RELEVANCE/APPLICATION
We recommend the same phantom test comparing the two directions, when chest CT scan program is set up in a machine.

SSQ04-09 ● Organ-based Tube-current Modulation (OBTCM): Impact of Breast Position

Stephen Taylor MD (Presenter) ; **Diana Litmanovich** MD ; **Maryam Shahrzad** MD ; **Alexander A Bankier** MD, PhD * ; **Pierre A Gevenois** MD ; **Denis M Tack** MD, PhD

PURPOSE
To determine the location of breast tissue with respect to the zone of decreased versus increased radiation delivered by OBTCM.

METHOD AND MATERIALS
In two academic centers from the US and Europe, data were collected from 532 clinical thoracic CT examinations performed in women aged 17 to 95 years (498 supine and 34 prone scans � US=332, Europe=200). Inner and outer limits of breast tissue were determined by measuring their angles with respect to the isocenter of the gantry rotation. The percentage of women with breast tissue within and without the zone of decreased radiation (

RESULTS
In supine position, mean angles of external and of internal breasts limits were 79� (range, 75� to 86�) and 29� (range, 19� to 37�) for both breasts. In prone position, these angles were 66�(range,62� to 70�) and 21� (range, 19� to 25�). In supine and prone position, respectively, 99% and 82% of women had at least one external breast limit in the increased dose zone.14% of patients in supine position had their entire breasts in the increased dose zone. Increasing patient age was associated with increasing thoracic dimensions and with an increasingly lateral position of the breasts (r =0.198 to 0.334;P

CONCLUSION
In supine and in prone positions, respectively, 99% and 80% of women will have at least one breast in the zone of increased dose, as determined by OMBTC.

CLINICAL RELEVANCE/APPLICATION
Because most breasts are at least in their external part exposed to higher tube current, OBTCM may increase rather than decrease the radiation dose to the breast.

Chest - Thursday Posters and Exhibits (12:15pm - 12:45pm)

Thursday, 12:15 PM - 12:45 PM ● Lakeside Learning Center

CH

LL-CHS-THA ● *AMA PRA Category 1 Credit* ™:0.5
 Host
 Katherine R Birchard , MD

LL-CHS-TH1A ● Color Radiography in Lung Nodule Detection and Characterization: Comparison with Conventional Gray Scale Radiography

Hye Sun Hwang (Presenter) ; **Myung Jin Chung** MD * ; **Hyun-Hwa Oh** PhD * ; **Seoyoung Choi** PhD * ; **Kangeui Lee** PhD * ; **Younghun Sung** PhD * ; **Kyung S Lee** MD, PhD

PURPOSE
To compare the capability of lung nodule detection and characterization between Dual-energy radiography with color-representation (DCR) and conventional gray scale chest radiography (GSR)

METHOD AND MATERIALS
A total of 130 paired chest radiographs (DCR and GSR) taken from 14 normal subjects and 51 patients with pulmonary nodules were evaluated. The 51 patients had 45 non-calcified and 21 calcified nodules. DCR was obtained by adding color space within material-decomposed data (applying blue color for high attenuating component and red color for low attenuating component) and by compounding the manipulated data to one color image. Three radiologists marked suggested nodules on radiographic images and assessed the confidence of lesion presence and probability of nodule calcification by using a nine-point rating scale. The jackknife active free-response receiver operating characteristics (JAFROC) analysis was used to evaluate lesion detectability, and multi-reader multi-case receiver operating characteristics (MRMC ROC) analysis was used for the evaluation of the accuracy of nodule calcification prediction.

RESULTS
Figures of merit (FOM) from JAFROC were 0.806 for DCR and 0.811 for GSR, respectively; thus, nodule detectability was not significantly different between DCR and GSR (P = .93). Areas under curve (AUC) from MRMC ROC were 0.927 for DCR and 0.781 for GSR, respectively; thus, performance of DCR in predicting lung nodule calcification was significantly better than that of GSR (P = .04).

CONCLUSION
DCR shows similar performance in lung nodule detection compared with GSR. However, DCR does provide a significant benefit in predicting the presence of nodule calcification.

CLINICAL RELEVANCE/APPLICATION
DCR has additional value for lung nodule characterization to conventional gray scale radiography.

LL-CHS-TH2A ● Role of MDCT-virtual Lobectomy in the Prediction of Post-operative Lung Function in Patients Undergoing Surgical Lobectomy

Mariaelena Occhipinti MD (Presenter) ; **Ersilia Devicienti** ; **Anna Rita Larici** MD ; **Riccardo Inchingolo** ; **Maria Rosaria Calve** ; **Lorenzo Bonomo** MD

PURPOSE
To evaluate the reliability of multidetector computed tomography (MDCT)-virtual lobectomy in predicting post-operative forced expiratory volume in one second (poFEV1).

METHOD AND MATERIALS
Before surgical lobectomy, 31 patients with non-small cell lung cancer (15/31 with chronic obstructive pulmonary disease) underwent both clinical assessment of lung volumes by pulmonary function tests and radiological evaluation by MDCT scan. All **MDCT scans**

(obtained at full inspiration) were examined by using a software that allows semi-automated lobar segmentation and quantitative analyses of lung volumes. After manual tracing of virtual cutting planes, excluding voxels outside the identified lobe, the software automatically calculates the total volume of the lobe/lobes to be resected and the relative volume of emphysema, by applying specific density thresholds. We estimated the predicted post-operative FEV1 (**ppoFEV1**) considering pre-operative FEV1 (**preFEV1**), the number of resected lobes, resected lung volumes (RLV) and total lung volumes (TLV) calculated at MDCT. CT volumes were also adjusted according to the extent of emphysema (RLVe, TLVe). To calculate ppoFEV1 we adopted the following anatomic formula: ppoFEV1= preFEV1 x [1-(resected segments/total segments)], and we also adjusted this formula using lung volumes obtained by MDCT volumetry: ppoFEV1= preFEV1 x [1-(resected volume/total volume)]. Predicted values of both methods were correlated with post-operative measured values (**poFEV1**).

RESULTS
Linear regression analysis of **poFEV1** showed a statistically significant relationship with **ppoFEV1**, estimated by the anatomic method (R2:0.73) and by different radiological approaches considering: RLVe and TLVe (R2:0.75); RLVe and TLV (R2:0.76); RLV and TLV (R2:0.79). This correlation is even better including also the eventual presence of airflow obstruction (FEV1/FVC < 70%) and the number of days occurring between surgery and the first post-resection functional evaluation (VISITIME).

CONCLUSION
Anatomic and radiological methods to estimate poFEV1 show similar results, therefore quantitative MDCT is a valuable tool in predicting poFEV1.

CLINICAL RELEVANCE/APPLICATION
MDCT-virtual lobectomy could be a useful tool for predicting post-resection lung function and may play a role in the clinical management of patients undergoing surgical lobectomy.

LL-CHS-TH3A ● Impact of CT Scanner Capabilities on Excess Z-Axis Scan Length and Its Associated Radiation Dose

Stuart L Cohen MD (Presenter) ; **Thomas J Ward** MD ; **Mary M Salvatore** MD ; **Adam Jacobi** MD ; **Matthew D Cham** MD

PURPOSE
To determine the impact of CT Scanner capabilities on excess Z-axis scan length and radiation dose.

METHOD AND MATERIALS
Noncontrast chest CTs performed between February and July 2012 were evaluated for excess Z-axis scan length (ES). ES was defined as the scanned distance superior or inferior to the lung parenchyma and was compared across different CT scanners. Analysis was performed with ANOVA, F-test, and t-tests. Technologists were instructed to use the minimum scan length needed to include the entire lung during chest CT. These exams were performed with 4 different CT scanners: Siemens Somatom 40 slice (CT1); GE Light Speed 8 slice (CT2); GE VCT 64 slice (CT3); and GE HD750 64 slice (CT4). CT1 provides real-time visualization of the scan and a mouse-driven scan stop capability. CT2 provides real-time visualization of the scan and a keyboard-driven scan stop capability. CT3 and CT4 do not allow real-time visualization or scan stop capability.

RESULTS
1287 consecutive noncontrast CT scans were evaluated: 475 on CT1, 237 on CT2, 279 on CT3, and 296 on CT4. Mean total excess Z-axis scan length (EST) was 47 mm. CT scanner was a significant predictor EST (p

CONCLUSION
Real-time visualization of CT scans with mouse-driven scan stop capability significantly reduces ES (p
CLINICAL RELEVANCE/APPLICATION
Real-time visualization of CT scans with mouse-driven scan stop capability should be an essential feature of CT scanners to minimize Z-axis scan length and to reduce patient dose.

LL-CHS-TH4A ● Model Based Iterative Reconstruction in Chest CT: Influence to the Low-contrast High Spatial Frequency Lung Abnormalities in Diffuse Interstitial Lung Disease

Hyun-Ju Lim MD (Presenter) ; **Myung Jin Chung** MD * ; **Kyung Eun Shin** MD ; **Miyeon Yie** ; **Hye Sun Hwang** ; **Kyung S Lee** MD, PhD

PURPOSE
To compare the radiologists� performance for the evaluation of diffuse interstitial lung disease (DILD) on CT images reconstructed with Model Based Iterative Reconstruction (MBIR), Adaptive Statistical Iterative Reconstruction (ASIR), and conventional Filtered Back Projection (FBP)

METHOD AND MATERIALS
Included were 23 subjects (5 normal, 11 usual intersitial pneumonia(UIP), and 7 nonspecific interstitial pneumonia(NSIP); 13 men, 20 women; mean age, 64 ± 6 years) who underwent high dose thin section non-helical CT (HRCT, 1.25mm thickness, 100 � 300mA with dose modulation) and low dose helical CT (LDCT, 0.625mm x 64 rows with 0.984 pitch, fixed 40mA with 0.5 sec rotation). CTDI was 1.87 ± 0.01 mGy and 21.5 ± 5.5 mGy for LDCT and HRCT, respectively. LDCT was reconstructed using FBP, 50% ASIR, and MBIR. Matching images from four subsets were blinded and randomly sorted. Four board certified radiologists independently reviewed shuffled images. Semi-quantitative results for the extent of abnormalities (GGO, ground glass opacity; RET, reticular or honeycombing opacity; CON, consolidation) and confidence scores for disease status (normal vs. abnormal; UIP vs. NSIP) were compared.

RESULTS
The difference of overall diagnosis in presence of disease did not reach statistical significance (The AUCs for detection of DILD by HRCT, FBP, ASIR and MBIR were as follows: 0.978, 0.979, 0.972 and 0.963.). There was a trend of underestimation than HRCT of RET (-2.8%, -4.1%, and -5.3% in FBP, ASIR, and MBIR, respectively) and overestimation of GGO (+4.6%, +8.9%, and +8.5% in FBP, ASIR, and MBIR, respectively). However, no significant difference was found among above mentioned reconstruction methods for decision making on type of DILD (The AUCs for differentiation of UIP vs. NSIP by HRCT, FBP, ASIR and MBIR were as follows: 0.780, 0.805, 0.785 and 0.778).

CONCLUSION
LDCT with MBIR showed similar diagnostic performance to HRCT for typical DILD cases with reduced image noise in spite of much lower dose (less than 1/10). However, our study confirmed more caution is needed for comparing the disease extent especially on follow up studies reconstructed with iterative recontruction (IR) due to its possible influence on characterization of the interstitial lung disease pattern.

CLINICAL RELEVANCE/APPLICATION
IR has potential to distort the perception of extent and character of DILD. Further caution is needed for radiologists in evaluating DILD using IR.

LL-CHS-TH5A ● Comparison of 120 kV and 100 kV Scan Parameters for CT-guided Transthoracic Biopsy

Leah M Lin MD (Presenter) ; **Aysegul Solmaz Tuncer** ; **Lauren L Ihde** MD ; **Alison Wilcox** MD * ; **Farhood Saremi** MD ; **Christopher Lee** MD

PURPOSE
To compare radiation dose information, procedure duration, complication rate, and diagnostic yield for CT-guided transthoracic biopsies performed with 120 kV versus 100 kV tube voltage.

METHOD AND MATERIALS

215 consecutive CT-guided transthoracic biopsies were performed from January 2009 through January 2013 at our institution. In July 2011, a transition was made from performing biopsies with 120 kV to 100 kV tube voltage. Tube current was arbitrarily set by the technologist. All biopsies were performed without use of CT fluoroscopy. Procedure duration was calculated on the basis of the time stamps of the first and last CT images acquired during the procedure. Complications were recorded and stratified into minor and major complications. Diagnostic yield was assessed by reviewing histopathology records.

RESULTS

90 biopsies were performed with 120 kV, and 125 biopsies were performed with 100 kV. The average dose-length product (DLP) for the 100 kV biopsies was 345.1 mGy-cm, while the average DLP for the 120 kV biopsies was 842.9 mGy-cm, a dose savings of 59.1%. The average procedure duration of the 120 kV biopsies was 50 minutes, and the average duration of the 100 kV biopsies was 48 minutes. The overall complication rate for the 100 kV biopsies was 40.8%, while the complication rate for the 120 kV biopsies was 25.6%. However, after including only those biopsies performed solely by attending radiologists, the overall complication rate for the 100 kV biopsies dropped to 34.4%, while the complication rate for the 120 kV biopsies was 24.7%, which was not statistically significant. The major complication rates for the 100 kV and 120 kV biopsies in this sub-cohort were 3.2% and 4.1%, respectively. A definitive diagnosis was obtained from the 100 kV biopsies 86.4% of the time, while a definitive diagnosis was obtained from the 120 kV biopsies 83.3% of the time.

CONCLUSION

Performing CT-guided transthoracic biopsies with low tube voltage conferred a significant radiation dose savings without increased procedure duration. Although there was a trend toward increased complications at 100 kV, this was not statistically significant, and the rate of major complications was essentially the same. The rate of definitive diagnosis was, likewise, similar in both groups.

CLINICAL RELEVANCE/APPLICATION

Our results suggest that CT-guided transthoracic biopsies should be routinely performed utilizing 100 kV tube voltage.

Chest - Thursday Posters and Exhibits (12:45pm - 1:15pm)

Thursday, 12:45 PM - 01:15 PM ● Lakeside Learning Center

CH

LL-CHS-THB ● *AMA PRA Category 1 Credit* ™:0.5

LL-CHS-TH1B ● Comparison of Chest Dual-energy Subtraction Digital Tomosynthesis and Dual-energy Subtraction Radiography for Detection of Pulmonary Nodules: Initial Human Study of Clinical Cases

Tsutomu Gomi PhD (Presenter) ; **Miwako Nozaki** MD ; **Kazutoshi Takahashi** BSc ; **Masahiro Nakajima** BSc ; **Tokuo Umeda** PhD ; **Akiko Okawa** MD, RN

PURPOSE

To compare the initial evaluation of chest dual-energy subtraction digital tomosynthesis (DES-DT) and dual-energy subtraction radiography (DES-R) for detection of pulmonary nodules.

METHOD AND MATERIALS

DES-DT and DES-R systems with pulsed X-rays and rapid kV switching were used to evaluate pulmonary nodules (mean size: 5�9 mm, 7 nodules; 10�14mm, 16 nodules; >15 mm, 13 nodules). Multi-detector computed tomography images were used as reference. Low-voltage (60 kVp), high-voltage (120 kVp), and soft-tissue or bone-subtracted tomograms of the desired layer thicknesses were reconstructed from the image data acquired during a single tomographic scan using a filtered back-projection algorithm. DES-R images were processed from the low- and high-voltage images. To detect the pulmonary nodules, we used both the systems to examine 36 patients with and 36 patients without pulmonary nodules. Five thoracic radiologists (average experience, 18 years) performed receiver operating characteristic (ROC) curve analysis to evaluate the results.

RESULTS

The ROC analysis results suggested that the detection ability of DES-DT was significantly better compared with that of DES-R [P < 0.0001; 95% confidence interval: DES-DT 0.94 (0.83�0.99); DES-R 0.76 (0.68�0.85); sensitivity: DES-DT 87.7±2.9%; DES-R 53.8±3.5%; specificity: DES-DT 78.3±5.6%; DES-R 78.4±3.4%; accuracy: DES-DT 83.1±3.8%, DES-R 66.1±2.0%). When the nodules were no longer superimposed over the normal structures, their characteristics and distribution in the pulmonary nodules could be much clearly observed.

CONCLUSION

Compared with DES-R, DES-DT provided greater sensitivity for detection of pulmonary nodules, particularly for the larger ones.

CLINICAL RELEVANCE/APPLICATION

The imaging quality of DES-DT can facilitate detection of pulmonary nodules.

LL-CHS-TH2B ● Software Simulation of Small Pulmonary Nodules in Computed Tomography: Feasibility and Observer Sensitivity

Peter M Van Ooijen (Presenter) ; **Marcel Greuter** PhD ; **Rozemarijn Vliegenthart** MD, PhD ; **Xue-Qian Xie** MD ; **Matthys Oudkerk** MD, PhD

PURPOSE

Development of a software tool which simulates small pulmonary nodules in healthy human lung tissue and to determine the sensitivity of lung nodule detection in low-dose computed tomography (CT) for these simulated nodules.

METHOD AND MATERIALS

80 lobulated and spiculated nodules were simulated by an adapted software tool using ImageJ and MeVisLab. The simulated nodules were adapted from original data of real human pulmonary nodules and varied in volume from 12 to 266 mm3 and in CT density from -50 to 170 Hounsfield Units. In total 120 nodules were simulated and 1 to 9 of the nodules were randomly positioned inside 24 thoracic CT datasets of subjects with and without proven real nodules. An experienced radiologist assessed the visibility of the nodules blinded to the presence of real and simulated nodules, and if detected, indicated whether it was real or simulated.

RESULTS

88 out of 120 (73%) of the simulated nodules were considered as real. Main reason for identification of nodules as being artificial was related to the unnatural placement of the nodule. An increased sensitivity was observed at increasing nodule volume. For nodule volumes less than 45 mm3 only 28% was detected, whereas for volumes larger than 69 mm3 sensitivity increased to 100%.

CONCLUSION

A software tool was developed which can successfully simulate small pulmonary nodules in CT datasets. Observer sensitivity of artificial pulmonary nodules increases with volume to 100% at volumes larger than 69 mm3.

CLINICAL RELEVANCE/APPLICATION

The introduction of convincing software generated nodules in real patient data could overcome the lack of a ground truth in lung cancer screening validation of radiologist performance.

LL-CHS-TH3B ● Are Chest Radiographs Still a Practical Approach for Lung Lesion Detection? Performance of Microdose Chest-CT for Lung Nodule Assessment at the Same Dose Level as a Chest Radiograph

Lukas Ebner MD (Presenter) ; **Yanik Butikhofer** ; **Daniel Ott** MD ; **Adrian Huber** ; **Julia Simone Landau** MD ; **Justus E Roos** MD ; **Johannes T Heverhagen** MD, PhD * ; **Andreas Christe**

PURPOSE
The aim of our study was to investigate the feasibility of a microdose CT using the same dose as a conventional radiograph in two plains for lung nodule assessment. We hypothesize that ultra low dose chest CT with the similar dose of a chest X-ray provides superior capability of lesion detection.

METHOD AND MATERIALS
We used an anthropomorphic chest phantom with artificial lung nodules. Microdose CT parameters: 80 kV; 6 mAs. Pitch: 0.6; increment: 1.1. Iterative reconstruction algorithms were also applied for maximum dose reduction. Most recent Stellar detector geometry was used. Plain radiography in two projections was conducted in prone position for the same phantoms. A total of 20 chest phantoms were scanned. Lung nodules were randomly placed in the lung parenchyma. Five lung phantoms without lung nodules represented the control group. 3 blinded radiologists with 12, 4 and two years of experience in chest imaging conducted the read out process independently using 3 image reconstruction kernels at I30f, I50f and I70f. The read out of the chest X-rays and the CT scans was performed randomly with a pause of 3 weeks between the read-outs.

RESULTS
Nodule sensitivity of chest radiograph for reader 1,2,3 was 48.9%, 44.4% and 51.1%, respectively. Sensitivity of microdose CT (I30f) for reader 1,2,3 rose to 93.3%, 88.8% and 93.3%, respectively (all p
CONCLUSION
Microdose CT is superior to chest radiograph for the detection of solid nodules between 5 and 12mm at the same dose level of 0.05 mSv. At this dose level soft kernels allow for better sensitivities. Those preliminary results indicate, that chest radiography for lung nodule detection may be replaced by microdose CT.

CLINICAL RELEVANCE/APPLICATION
Using microdose CT, chest X-ray may be replaced for lung nodule detection with radiation dose kept to an identical minimum.

LL-CHS-TH4B ● Reproducibility of MDCT-measured Forced Expiratory Tracheal Collapse in COPD Patients: Comparison between Spirometric Monitoring and Verbal Respiratory Instructions from CT Technologists

Phillip M Boiselle MD (Presenter) ; **Stephen Loring** MD ; **Carl O'Donnell** PhD

PURPOSE
To compare the reproducibility of MDCT-measured forced expiratory tracheal collapse in COPD patients with and without the use of spirometric monitoring.

METHOD AND MATERIALS
Twelve patients meeting GOLD-criteria for COPD (7M, 5 F, mean age = 65 ± 7 years) underwent repeat CT imaging 1 and 2 years after baseline imaging of tracheal dynamics employing the same CT scanner and identical imaging parameters (64-MDCT, 40 mAs, 120 kVp, and 0.625 mm detector collimation). At baseline and year 1 (Yr1), a respiratory physiologist coordinated CT acquisitions with spirometric monitoring at both end-inspiration and during dynamic forced expiration. At year 2, verbal respiratory instructions were administered by trained CT technologists without spirometric monitoring (Yr2Tech). Cross-sectional area (CSA) of the trachea was measured 1 cm above the aortic arch at end-inspiration and dynamic expiration, and the percentage (%) expiratory reduction in tracheal lumen was calculated. Mean measurements from each time point were compared using paired sample correlations.

RESULTS
Mean tracheal measurements were similar at each time point. Mean end-inspiratory CSA was 298 ± 87 mm^2 at baseline, 297 ± 99 mm^2 at Yr1 and 310 ± 93 mm^2 at Yr2Tech; mean dynamic expiratory CSA was 135 ± 40 mm^2 at baseline, 129 ± 29 mm^2 at Yr1, and 126 ± 39 mm^2 at Yr2Tech; and mean % expiratory reduction was 54 ± 8% at baseline, 54 ± 13% at Yr1, and 55 ± 12% at Yr2Tech. Similar correlations were observed between baseline and Y1 and between Yr1 and Yr2Tech for end-inspiratory CSA (R^2 = 0.97 and 0.98, p< 0.001 for both) and dynamic expiratory CSA (R^2 = 0.70 and 0.75, p=0.001 and 0.005, respectively). For % expiratory reduction measures, a stronger correlation was observed between Yr1 and Yr2Tech (R^2 = 0.81, p=002) than between baseline and Yr1 (R^2 = 0.53, p=0.53).

CONCLUSION
MDCT measurements of tracheal dynamics performed with the commonly used method of verbal respiratory instructions from a trained CT technologist are as reproducible as those performed with the more invasive and resource-intensive technique of spirometric monitoring.

CLINICAL RELEVANCE/APPLICATION
Verbal respiratory instructions from a trained CT technologist are sufficient for dynamic expiratory CT imaging of the trachea, without the need for spirometric monitoring.

LL-CHS-TH5B ● Quantitative Ct Air Trapping in Physiological Aging: A Structure Function Analysis

Sebastien Bommart MD (Presenter) ; **Gregory Marin** ; **Arnaud Bourdin** ; **Francois Klein** MD ; **Hamid Zarqane** ; **Valerie Monnin-Bares** ; **Helene Vernhet-Kovacsik** MD, PhD

PURPOSE
To quantify the effect of aging on small airway remodeling using air trapping at computed tomography (CT)

METHOD AND MATERIALS
Eighty nine carefully phenotyped healthy volunteers, age ranging from 60 to 90 years old, mean age 72 ± 7 years, prospectively underwent spirometrically gated inspiratory and expiratory CT in this ethics committee approved study. Pulmonary function tests (PFTs) using standard plethysmography and single breath nitrogen test (SBNT) were performed on the same day. CT air trapping was quantitatively measured using automated image analysis software and its extent assessed by expiratory to inspiratory ratio (E/I). Agreement between radiologists was assessed with intra◆class correlation coefficicent (ICC). CT and PFTs were compared with age. A weighted regression equation was used to develop a diagnostic prediction for air trapping corrected by sex, weightn height and age.

RESULTS
ICC between observers ranged between 0.91 and 1 for CT air trapping quantification. E/I was correlated with age on univariate analysis (p
CONCLUSION
air trapping assessed by expiratory to inspiratory ratio on spirometrically gated CT indicates that physiologicla aging affects the distal airways.

CLINICAL RELEVANCE/APPLICATION
Our study supports the concept that CT air trapping reveals asymptomatic small airways remodeling and obstruction in healthy subjects consistently increasing with age.

Pulmonary Thromboembolism: Concepts and Controversies 2013

CT CH

RC701 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5

RC701A ● Overdiagnosis: Fact or Fiction?

Linda B Haramati MD, MS (Presenter) *

LEARNING OBJECTIVES
1) To describe the meaning of 'overdiagnosis' in the context of pulmonary embolism. 2) To develop an overview of the different types of evidence for overdiagnosis of pulmonary embolism on CT. 3) To understand why small pulmonay emboli may be physiologic. 4) To incorporate a more nuanced understanding of pulmonary emolism into the clinical practice of CT interpretation.

ABSTRACT
In 2001 CT became the most common imaging modality for suspected PE in the USA. It is unsurpassed in depicting pulmonary artery anantomy and pathology and is useful in demonstrating alternative diagnoses that explain the patients symptoms. CT is also quick and easy. However, overdiagnosis is increasingly recognized as a potential risk of CT. This is especially true when the pre test probability is low (indication creep). Overdiagnosis is defined as diagnosis of clinically unimportant disease and represents real, but clinically insignificant pathology. There is an abundance of evidence supporting the overdiagnosis of PE on CT. Since treatment for PE is based on diagnostic algorithms that preceded CT and CT demonstrates a less severe disease spectrum, randomized outcomes-based clinical trials are necessary. We anticipate that thee trials may lead to revised treatment guidelines for patients with good cardiopulmonary reserve and small PE on CT

RC701B ● CTPA: 10 Ways to Do It Better

Lawrence R Goodman MD (Presenter)

LEARNING OBJECTIVES
1) To better understand the capabilities of newer equipment in optimizing CT protocols. 2) To emphasize ways that radiation can be reduced. 3) To discuss tailored approaches to difficult to scan patients. 4) To emphasize alternative viewing strategies CTPA.

ABSTRACT
CTPA: Ten Ways to Do it Better Learning objectives:
1. To understand optimizing technique for the individual patient.
2. To review techniques for dealing with difficult patients.
3. To discuss ways to minimize radiation. Abstract:
Technique: Optimum scans are obtained by individualizing the technique for each patient. Scan parameters such as modified injection protocols, and low kV techniques provide denser vessel enhancement and diminished radiation. SVC artifacts can be minimized. Dual energy techniques provide the opportunity to visualize areas of decreased perfusion that may be the indicator of a small overlooked embolus. Difficult patient: Breathing artifacts are the most frequent cause of suboptimal scans. Numerous strategies exist to minimize the problem. Obese patients provide challenges, some of which can be overcome by adjusting contrast volume, slice thickness, and use of noise suppression software. Pregnant patients require special attention in both obtaining optimal images and minimizing radiation to both the mother and the fetus. Radiation: Dose modulation, z-axis reduction, and iterative reconstructions all lead to sizeable reductions in radiation without sacrificing image quality. The latter is particularly powerful. It allows one to reduce the radiation delivered by suppressing much of the noise during image reconstruction. Interpretation:
The use of multi-planar reconstructions and various new reading options add efficiency and certainty to the process

RC701C ● Pulmonary MRA: How I Do It

Mark L Schiebler MD (Presenter) *

LEARNING OBJECTIVES
1) Introduction to Magnetic Resonance Angiography to the Pulmonary Arteries (MRA-PE): Over 20 years of translational research with no breakthroughs in efficacy; Medical radiation risk remains for younger individuals; Nice to have an option besided CTA-PE. 2) Identify common artifacts of Pulmonary MRA and thier solutionsto improve quality and efficacy while minimizing patient risk: Maki artifact; Gibbs artifact (ringing); Wrap; Motion. 3) Overcoming barries to clinical implementation: Evidence from PIOPED III for efficacy; Effectiveness data showing high negative predictive value for MRA-PE; Treating sub segmental PE, in patients without procoagulant conditions, does not prolong life expectancy.

ABSTRACT
Pulmonary MRA (MRA-PE) has been recently shown by the PIOPED III study;to be less sensitive than CTA for the diagnosis of Pulmonary Embolism (PE).; However, it has also been shown that if performed in a technically adequate fashion, MRA-PE is highly diagnostic for this condition. Radiation dose fromCTA is an ongoing concern, especially in young patients. . There are many issues that need to be addressed technically and during scan acquistion to ensure high quality MRA-PE exams: 1. Repeat if there is respiratory motion, 2. Reduce spatial resolution to achieve shorter breath hold times, 3. Dilute contrast and deliver dose over the entire acquisition to limit, 4. Inclued entire AP chest to prevent wrap, 5. Cardaic mtion through the lingula and middle lobes, 5. Gibbs ringing artifact, 6. Bronchial proximity susceptability adjacent to pulmonary artery branches, 7. Respiratory motion, 8. Parallel imaging G factor artifact. We have reviewed all of our symptomatic patients studied with MRA-PE (used as the first line test for PE). There were 579 consecutive symptomatic patients who underwent pulmonary MRA as their primary examination for the determination of PE.; Four hundred and Thirty patients were found to be negative by MRA-PE and also had three months of EMR follow up (420/579= 72.5%) negative for VTE. We found 96.2% (557/579) of the MRA-PE exams to be of diagnostic quality- 22 cases of motion. There were 50 patients (50/579=8.6%) with at least one PE diagnosed and treated based on MRA-PE findings alone. There were 77 patients were lost to follow-up (77/579= 13.3 %). Of the 430 patients with a negative MRA-PE exam, only ten patients were found to have a subsequent VTE in the 3 month EMR period of follow up (10/430= 2.3%). The negative predictive value for MRA-PE in this series was 97.7%. Beginning a clinical MRA-PE program at major institutions, using parallel imaging with physics support, is now imminently feasible and justified for use in vulnerable patients.

RC701D ● Imaging Right Heart Dysfunction and Prognostication

U. Joseph Schoepf MD (Presenter) *

LEARNING OBJECTIVES
1) To identify suitable image acquisition strategies for right heart assessment. 2) To discuss image post-processing for quantitative imaging of right heart strain. 3) To compare the clinical usefulness of various imaging markers for patient prognostication in acute pulmonary embolism.

RC701E ● Differentiating Chronic from Acute PE

Sanjeev Bhalla MD (Presenter)

LEARNING OBJECTIVES
This portion of the course will focus on the imaging of pulmonary embolism (PE) so that the participant will leave with findings that allow the distinction of acute from subacute from chronic pe. Three types of findings will be discussed (pulmonary artery features; cardiac features and lung parenchymal features).

ABSTRACT

RC701F ● Cases: What Would You Do?

Danielle Seaman MD (Presenter)

LEARNING OBJECTIVES
1) Amplify and illustrate areas of diagnostic difficulty, controversy, and confusion in the diagnosis and intertrepation of pulmonary embolism utilizing difficult case material in an unknown case format.

Waiting to Exhale: What's the Latest with Inhalation Lung Diseases?

Friday, 08:30 AM - 10:00 AM ● N230

CT CH   Back to Top

RC801 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5

RC801A ● Smoking Related Lung Disease

Jeffrey P Kanne MD (Presenter) *

LEARNING OBJECTIVES
1) Identify immunologic reactions to cigarette smoke in the lungs. 2) Describe the histopathologic features of smoking-related lung disease. 3) Illustrate the high-resolution CT findings of smoking-related lung disease.

RC801B ● Hypersensitivity Pneumonitis

Justus E Roos MD (Presenter)

LEARNING OBJECTIVES
1) To review the most common clinical manifestations of hypersensitivity pneumonitis. 2) To demonstrate the range of histologic features of hypersensitivity pneumonitis and correlate them with radiologic findings. 3) To illustrate abnormalities indicative of hypersensitivity pneumonitis and their differential considerations at chest radiographs and CT.

ABSTRACT

RC801C ● Occupational Lung Disease

Jonathan H Chung MD (Presenter) *

LEARNING OBJECTIVES
1) List at least 3 common and 3 uncommon occupational lung diseases. 2) Briefly describe the prevalence and background of occupational lung diseases. 3) Describe and recognize the imaging manifestations of occupational lung diseases. 4) Describe the thoracic complications of occupational inhalational exposure.

ABSTRACT

RC801D ● Aspiration

Santiago E Rossi MD (Presenter) *

LEARNING OBJECTIVES
1) Discuss the most common risk factors, clinical manifestations and implications of aspiration. 2) Review the radiographic and both common and atypical CT findings of aspiration pneumonia including aspiration of solid foreign bodies and aspiration of liquids such as infectious material, gastric acid , partially digested food, lipid aspiration and chronic.

ABSTRACT
.

Emergency Radiology Case-based Countdown (An Interactive Session)

Friday, 08:30 AM - 10:00 AM ● E353C

ER MK GI CH   Back to Top

RC808 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5

RC808A ● Thoracic Top 10 Countdown

Faisal Khosa FFRRCSI, FRCPC (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.

Chest/Cardiovascular Imaging II

Friday, 08:30 AM - 10:00 AM ● N229

`PD` `CH`   Back to Top

RC813 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5

RC813A ● Pitfalls and Errors in Pediatric Thoracic Imaging

George A Taylor MD (Presenter)

LEARNING OBJECTIVES
1) Understand the common sources of error in pediatric thoracic imaging. 2) Demonstrate understanding of the influence of biases on the diagnostic process. 3) Analyze image viewing teachniques and apply them to strategies for improving image interpretation.

ABSTRACT
The goal of this presentation is to describe common patterns and potential etiologies of diagnostic error in pediatric thoracic imaging identified over a 13-year experience at a large academic children◆s hospital. Errors are defined as a diagnosis that was delayed, wrong or missed; they are classified as perceptual, cognitive, system-related or unavoidable.
Perceptual errors were the most common type of error, defined as a diagnostic finding that is noticeable but missed. Cognitive contributors to perceptual errors will be discussed, including the role of search satisfaction, visual distractors, and visual isolation. Cognitive errors were defined as faulty information processing, related to overinterpretation
of an imaging finding, misinterpretation of a finding or failure to consider a different diagnosis for a given finding [premature closure]); faulty data gathering (poorly performed imaging examination, inadequate review of patient history or lack of consideration of a patient◆s underlying condition), or insufficient knowledge base. The presentation will also discuss a number of cognitive biases that subconsciously affect our ability to effectively reach the right diagnosis. These will include examples of availability heuristics (memory of a similar case), framing effect (how data are presented), the anchoring heuristic (premature closure), the reluctance to confront authority (blind obedience), and reader overconfidence. Finally, we will review organizational errors in which systems issues such as faulty medical history and inefficient processes contribute to diagnostic errors in the chest. The presentation will suggest strategies for systematic and individual improvement.

RC813B ● Back to Basics: Radiography of the Pediatric Chest

Robert H Cleveland MD (Presenter) *

LEARNING OBJECTIVES
1) Review strategies to improve diagnostic accuracy in interpreting chest radiographs. 2) Enhance confidence for NOT obtaining follow-up CT. 3) Increase appreciation of when follow-up CT is needed.

ABSTRACT
In this session, we will review the role of the chest x-ray (CXR) in the era of high tech imaging. Specifically the need to re-establish a sense of confidence in interpreting CXR will be addressed. Situations where a confident interpretaion of the CXR obviates the need for CT will be stressed as well as those where the CXR clearly requires CT follow-up. The need to "image gently", following ALARA, guidelines is now widely accepted in pediatric radiology and is growing in acceptance in adult imaging. In our department (Boston Children's Hospital) this has lead to a 24% decrease in CT volume between 2006 and 2010. This in turn, means that a need for an increased nuanced approach to interpreting CXR is required. Specific recommendations to increase the accuracy in interpreting CXR will be discussed. As the indications for a high percentage of CXR in pediatrics are nonspecific, the need to constantly be vigilent regarding unexpected and uncommon conditions will be stressed. Particular attention will be paid to the broad range of conditions related to wheezing (or noisy breathing) and dyspnea including airway obstruction and interstitial lung disease. The increasing incidence of complications in pediatric community acquired pnuemonia and the appropriate role of CXR in that situation will also be discussed.

RC813C ● Advanced Imaging of the Pediatric Chest

Mantosh S Rattan MD (Presenter)

LEARNING OBJECTIVES
1) Introduce the ChILD (Children◆s Interstitial Lung Disease) Research Cooperative classification for pediatric diffuse lung disease. 2) Discuss imaging techniques in children with diffuse lung disease. 3) Review imaging features of specific disorders in the ChILD spectrum.

Chest (Airways, Emphysema)

Friday, 10:30 AM - 12:00 PM ● E451B

`CT` `CH`   Back to Top

SST04 ● *AMA PRA Category 1 Credit* ™:1.5 ● ARRT Category A+ Credit:1.5
Moderator
Yoshiharu Ohno , MD, PhD *
Moderator

Katherine R Birchard , MD

SST04-01 ● Assessment of Pathologic Air Trapping Using Density Mappings of Inspiration and Expiration Datasets in Multidetector Row CT: Comparison to Threshold-based Methods in Expiration and the Expiratory to Inspiratory Ratio of Mean Lung Density

Olga Solyanik MD (Presenter) ; **Sabine Dettmer** ; **Till Kaireit** ; **Tim Alten** ; **Frank K Wacker** MD * ; **Hoen-Oh Shin** MD

PURPOSE
To determine whether density mappings (DM) of HU values seen on inspiration and expiration computed tomography (CT) are more precise for the detection and quantification of pathologic air trapping (AT) than the threshold-based method (Exp) and the expiratory to inspiratory ratio of mean lung density (E/I-ratio MLD) in lung transplant patients.

METHOD AND MATERIALS
152 lung and heart-lung transplant recipients underwent paired inspiratory and expiratory CT examinations 6 months after transplantation and pulmonary function tests (PFTs) within six hours following the CT scans. The assessment of AT was performed using a threshold-based method on expiration with systematic variation of the HU range (-1000 HU to -750 HU), E/I-ratio MLD, and DM of HU values on inspiration and expiration. For Exp and DM, the ratio of the detected air trapping area (ATA) and the segmented total lung volume (TLV) seen on CT were compared to the ratio of the residual volume (RV) and the total lung capacity (TLC) on pulmonary function tests. RV/TLC beyond the 95th percentile of predicted was considered as pathologic. Detection of pAT was performed using Spearman rank correlation, receiver operating characteristic (ROC) analysis and the area under the ROC curve (AUC).

RESULTS
DM correlated significantly better with RV/TLC than other CT measures (DM: r=0.658; p
CONCLUSION
DM showed the highest correlation with RV/TLC in comparison to E/I-ratio MLD and Exp -820 to -950 HU and might to be the most suitable technique for detection of pathologic air trapping in patients after lung transplantation.

CLINICAL RELEVANCE/APPLICATION
Density mappings might be used as an imaging biomarker for the detection and quantification of pathologic air trapping.

SST04-02 ● Dynamic Oxygen-enhanced MRI: Capability for Pulmonary Functional Loss Assessment and Clinical Stage Classification in Asthmatics as Compared with Quantitative Thin-section CT

Yoshiharu Ohno MD, PhD (Presenter) * ; **Shinichiro Seki** ; **Mizuho Nishio** MD * ; **Hisanobu Koyama** MD ; **Maho Tsubakimoto** MD ; **Takeshi Yoshikawa** MD * ; **Sumiaki Matsumoto** MD, PhD * ; **Makoto Obara** * ; **Marc Van Cauteren** PhD * ; **Nobukazu Aoyama** RT ; **Akiko Kusaka** RT ; **Kazuro Sugimura** MD, PhD *

PURPOSE
To prospectively and directly compare the capability of dynamic oxygen-enhanced MR imaging (O_2-enhanced MRI) and quantitative CT for pulmonary functional loss assessment and clinical stage classification in asthmatics.

METHOD AND MATERIALS
Thirty consecutive asthmatics (17 men and 13 women; age rang 27-78 years) underwent dynamic O_2-enhanced MRI, thin-section MDCT and pulmonary function test (FEV_1% and FEV_1/FVC%). All asthmatics were classified into three stages (�Mild [n=12]�, �Moderate [n=12]� and �Severe [n=6]�) according to the Global Initiative for Asthma guideline. All dynamic O_2-enhanced MRI were obtained by using respiratory-triggered inversion-recovery 2D HASTE sequence. From signal intensity-time course curves, relative enhancement ratio and wash-in time maps in each subject were generated by pixel by pixel analyses. Then, ROIs were placed over the lung, and averaged to determine mean relative enhancement ratio (MRER) and mean wash-in time (MWIT) in each subject. On quantitative CT in each subject, ratios between wall area and total area of bronchus in right apical and anterior basal bronchi was averaged as WA%, and mean lung density (MLD) of the entire lung was also measured. To compare the capability of dynamic O_2-enhanced MRI and quantitative CT for pulmonary functional loss assessment, MRER, MWIT, MLD and WA% were correlated with FEV_1% and FEV_1/FVC%. To determine the capability of two modalities for clinical stage classification, MRER, MWIT, MLD and WA% were statistically compared among three clinical stages by means of Fischer�s PLSD test.

RESULTS
FEV_1/FVC% had significant and moderate correlations with MRER (r=0.50, p=0.005), MWIT (r=0.65, p1% also had significant and moderate correlations with MRER (r=0.60, p=0.0005), MWIT (r=0.68, p
CONCLUSION
Dynamic oxygen-enhanced MR imaging has better capability for pulmonary functional loss assessment and clinical stage classification in asthmatics than quantitative CT.

CLINICAL RELEVANCE/APPLICATION
Dynamic oxygen-enhanced MR imaging has better capability for pulmonary functional loss assessment and clinical stage classification in asthmatics than quantitative CT.

SST04-03 ● Relationship between Current Smoking, Visual CT Findings, and Emphysema Index in Cigarette Smokers

Sungshiick Jou (Presenter) ; **Kunihiro Yagihashi** MD ; **Jordan Zach** ; **David A Lynch** MBBCh *

PURPOSE
Quantitative CT (QCT) measures of emphysema are significantly lower in current smokers than in those that quit, even after adjustment for severity of COPD. The purpose of this study is to evaluate whether visual CT findings could account for the current smoker effect.

METHOD AND MATERIALS
500 current and former smokers were evaluated (50% current smokers, 53% male, 80% non-Hispanic white, mean age 62.8 ± SD 8.6). The cohort included 100 smoking controls, and 100 subjects within each of the GOLD stages 1-4. Subjects underwent high resolution volumetric CT at full inspiration. Following automated lung segmentation, extent of emphysema was defined as % voxels with attenuation values =-950 Hounsfield Units (HU) on inspiratory CT (%LAA-950HU). Each CT scan was visually scored by two radiologists for presence and extent of emphysema, ground glass opacity (GGO), centrilobular nodularity (CN), and airway wall thickening (AWT) within each lobe. Univariate analyses tested the relationship of smoking status to visual CT findings. To test whether the effect of smoking status can be attributed to visual findings, a multivariate model for %LAA-950HU was constructed containing previously described confounders in addition to the visual components associated with smoking status.

RESULTS
Current smokers displayed 23% less visual emphysema, 19% more AWT, and 188% more CN than former smokers (all p
CONCLUSION
Current smokers have less emphysema, more airway wall thickening and centrilobular nodularity than former smokers. QCT emphysema index is reduced in current smokers, even after adjustment for physiologic severity and visual findings.

CLINICAL RELEVANCE/APPLICATION
The decreased emphysema index found in current cigarette smokers is not fully explained by visual findings such as ground glass abnormality, centrilobular nodularity and airway wall thickening.

SST04-04 ● Relationships between QCT Airway Measures and Outcomes of Exacerbations

Alexander McKenzie BS (Presenter) ; **David A Lynch** MBBCh * ; **John D Newell** MD * ; **Douglas Stinson** ; **Joyce D Schroeder**

MD * ; **Douglas C Everett** PhD ; **Stephen Humphries** ; **Jordan Zach** ; **Meilan K Han** * ; **Carla G Wilson** ; **Eric A Hoffman** PhD *

PURPOSE
Volumetric CT with quantitative analysis yields numerous measures of airway lumen and airway wall. The purpose of this study was to determine which airway measures are best associated with exacerbation frequency.

METHOD AND MATERIALS
8043 inspiratory CT scans from the COPDGene study were examined. Airway measures included inner diameter, inner area, outer area and airway wall thickness, in upper and lower lobes (segmental in all cases, subsegmental and sub-subsegmental in 330 cases). Ratios of upper and lower lobe airway parameters (e.g. RB1/RB10, LB1A/LB10A) were examined. Exacerbation outcome was defined as either one severe exacerbation requiring hospitalization, or more than one mild or moderate exacerbation. Univariate logistic regression was used to determine odds associated with exacerbation. Multivariate logistic regression included age, smoking history and status, % emphysema and FEV$_1$ percent predicted.

RESULTS
On univariate analysis, measures of inner bronchial diameter and inner luminal area were consistently associated with significantly increased risk of exacerbation (odds ratios 1.05 to 3.15). Odds ratios increased as airway generation increased from the segmental to the subsegmental but remained consistent between the subsegmental and the sub-subsegmental. Multivariate regression decreased the odds ratios, but odds were consistently higher at higher generation airways (subsegmental, sub-subsegmental). Inner diameter of segmental airways in the upper lobes proved to be the most consistently high predictor of exacerbation (LB1 OR = 1.48, RB1 OR = 1.35). Exacerbations were better predicted when inner diameter measures were taken at the sub and sub-subsegmental level. Additionally, the inner diameter ratio of upper to lower lobe airways was strong predictors of exacerbation at the subsegmental level (LB1A/LB10A OR = 2.08, RB1A/RB10A OR = 2.86).

CONCLUSION
Quantitative airway measures can all be used to predict exacerbation, and odds increase in more distal airways. Upper to lower lobe ratio of airway inner diameter is a strong predictor of exacerbation at the subsegmental level.

CLINICAL RELEVANCE/APPLICATION
Quantitative evaluation of airway wall thickness may permit risk stratification and prophylaxis for COPD exacerbation, an important cause of morbidity and mortality in COPD.

SST04-05 • Is Bronchial Imaging Affected by Temporal Resolution? Comparative Evaluation at 140 and 75 ms in 90 Patients

Nunzia Tacelli MD (Presenter) ; **Antoine Hutt** MD ; **Teresa Santangelo** ; **Colm F Murphy** MD ; **Martine J Remy-Jardin** MD, PhD * ; **Jacques Remy** MD *

PURPOSE
To evaluate the influence of temporal resolution (TR) on cardiac motion artifacts at the level of bronchial walls.

METHOD AND MATERIALS
90 consecutive respiratory patients (mean age: 50.2 yr, mean heart rate: 81.2 bpm) underwent a noncontrast chest CT examination on a second-generation 128-slice dual-source CT system (Somatom Definition Flash, Siemens Healthcare, Forchheim, Germany). The examinations were obtained with dual-source, single-energy using the following parameters: collimation: 32x2x0.6 mm; rotation time: 0.28 s; weight-adapted selection of the kilovoltage (100 kVp -120 kVp); reference tube current-time product: 64 ref mAs; 4D dose modulation and a pitch of 2.0. Two series of images were systematically reconstructed using data from both tubes on a prototype workstation with a TR of 75 ms (i.e., optimized TR) (Group 1) and 140 ms (i.e., standard TR) (Group 2). Using a 4-point scale, two radiologists independently analyzed the presence and severity of cardiogenic artifacts at the level of 8 target bronchi, i.e., right (R) and left (L) B1, B5, B7 and B10 (total number of bronchi examined: n= 720).

RESULTS
Cardiogenic artifacts were significantly less frequent and less severe in Group 1 than in Group 2 (p
CONCLUSION
At 75 ms, most of bronchi can be depicted without cardiogenic artifacts.

CLINICAL RELEVANCE/APPLICATION
Quantitative estimation of bronchial morphometry should integrate the influence of cardiac motion artifacts, themselves dependent on the temporal resolution of data acquisitions.

SST04-06 • Comparison of CT Findings between Th2 Asthma and Non-Th2 Asthma: Can CT Findings Characterize Molecular Mechanism Based Phenotypes in Severe Asthma

Kwang Nam Jin MD (Presenter) ; **Chang Hyun Lee** MD, PhD ; **Hye-Ryun Kang** ; **Sujeong Kim** ; **Sang Min Lee** MD ; **Young Eun Bahn** MD ; **Kyunghee Lee** MD ; **Hyun-Ju Lee** MD, PhD ; **Jin Mo Goo** MD, PhD *

PURPOSE
Recent studies suggest that asthma can be divided into at least 2 distinct phenotypes defined by degree of T helper type 2 (Th2) cell inflammation. The purpose of this study was to compare the CT findings between Th2 (eosinophilic) and non-Th2 (non-eosinophlic) driven asthma.

METHOD AND MATERIALS
We enrolled 29 patients who have severe asthma with molecular based identification of the phenotype and underwent chest CT. Th2 type asthma was diagnosed in 21 patients and non-Th2 in 8. Two radiologists blinded to clinical information performed visual analysis in consensus for the extent and severity of bronchial wall thickening (BT), mucus plugging (MP), and the extent of bronchiectasis (BE). The extent of BT, MP, and BE was assessed as the number of involved lobes (range, 0-5) and the severity of BT and MP was evaluated as 4-point scores (range, 0-3). Quantitative analysis was available for the low lung attenuation with threshold -950 HU (LAA$_{-950HU}$), LAA$_{-856HU}$, and bronchial wall (thickness, inner luminal diameter, and wall area %; RB1, LB1+2, RB10, LB10) in 16 CT scans (13 Th2 vs 3 non-Th2).

RESULTS
In the qualitative analysis, Th2 type showed more extensive BT (Th2, 3.1 ± 2.2 vs Non-Th2, 1.1 ± 1.4, p = 0.02) and MP (Th2, 1.9 ± 1.8 vs Non-Th2, 0.5 ± 0.8, p = 0.03). BE was equally observed in both types (Th2, 1.4 ± 1.9 vs Non-Th2, 0.4 ± 0.7, p = 0.19). Severity of BT and MP between Th2 and Non-Th2 types was not significantly different (Th2, 1.3 ± 1.0 vs Non-Th2, 0.6 ± 0.7, p = 0.15; Th2, 0.8 ± 0.8 vs Non-Th2, 0.5 ± 0.8, p = 0.67) but Th2 type was given slightly higher mean severity scores. LAA-950HU was not significantly different between Th2 and Non-Th2 types (Th2, 9.9 ± 14.5 vs Non-Th2, 9.1 ± 9.1, p = 0.46), however, LAA-856HU was significantly higher in Th2 type (Th2, 43.6 ± 40.0 vs Non-Th2, 37.8 ± 20.3, p = 0.002). Quantitative analysis of the segmental bronchial wall (RB1, LB1+2, RB10, LB10) showed no significant difference in the BT, inner luminal diameter and wall area % between Th2 and Non-Th2 (p < 0.05).

CONCLUSION
In severe asthmatics, Th2 associated asthma showed more extensive bronchial wall thickening, mucus plugging, and air-trapping than non-Th2 asthma.

CLINICAL RELEVANCE/APPLICATION
The radiologic findings on CT in severe asthma differentiating between Th2 vs Non-Th2 types may enhance characterization of phenotypes and personalized and phenotype-specific therapies for asthma.

SST04-07 • 3D Lung Motion and Destruction Assessments from Inspiratory and Expiratory Thin-section MDCT: Utility for Pulmonary Functional Loss and Clinical Stage Evaluation in Smokers

Hisanobu Koyama MD (Presenter) ; **Yoshiharu Ohno** MD, PhD * ; **Yasuko Fujisawa** MS * ; **Shinichiro Seki** ; **Mizuho Nishio** MD * ; **Takeshi Yoshikawa** MD * ; **Sumiaki Matsumoto** MD, PhD * ; **Naoki Sugihara** MENG * ; **Hitoshi Yamagata** PhD * ; **Kazuro Sugimura** MD, PhD *

PURPOSE
To evaluate the utility of three-dimensional (3D) lung motion and destruction assessments from inspiratory and expiratory CT for pulmonary functional loss and clinical stage evaluation in smokers.

METHOD AND MATERIALS
Forty-four consecutive smokers (36 men and 8 women, mean age 76.6 years) underwent inspiratory and expiratory thin-section MDCTs and pulmonary function test. According to the GOLD guideline, all smokers were divided into four clinical stages as follows: �without COPD (n=6)�, �mild COPD (n=5)�, �moderate COPD (n=22)�, and �very and very severe COPD (n=11)�. 3D motion vector map was generated from inspiratory and expiratory CT in each smoker. Then, regional motion magnitudes were measured at the following three axes: horizontal, X-axis; ventraodorsal, Y-axis; and craniocaudal, Z-axis. Then, all mean magnitudes within the entire lung (MML_X, MML_Y and MML_Z) were normalized by lung volume from expiratory CT. Moreover, CT-based functional lung volume (FLV) on inspiratory CT was also assessed from total and low attenuation lung volumes in each subject. To evaluate the capability for pulmonary function loss assessment, all indexes were correlated with FEV_1% and %DL_{CO}/V_A. Then, principal component analysis (PCA) was performed for discriminating clinical stages by means of all indexes.

RESULTS
FEV_1% had significant correlation with MML_Y (r=0.67, pZ (r=0.38, pCO/V_A had significant correlation with MML_Z (r=0.40, p0.89): the first component called 'maintained structure and diaphragm motion' determined by FLV and MML_Z, the second component called 'asynchronous chest wall motion' determined from MML_X and MML_Y and the third component called 'synchronous chest wall motion' determined from MML_X and MML_Y.

CONCLUSION
3D lung motion as well as destruction assessments is considered as a useful indicator for pulmonary functional loss and clinical stage evaluation in smokers.

CLINICAL RELEVANCE/APPLICATION
3D lung motion as well as destruction assessments from inspiratory and expiratory CT data is considered as a useful indicator for pulmonary functional loss and clinical stage evaluation in smokers.

SST04-08 • Radiation-induced Lung Injury (RILI) after Stereotactic Body Radiation Therapy (SBRT) in Patients with Emphysema: A Quantitative Analysis of CT Changes

Abraham Knoll MD (Presenter) ; **Mary M Salvatore** MD ; **Miriam Knoll** MD ; **Ren-Dih Sheu** PhD ; **Sarah L Kerns** PhD, MPH ; **Yeh-Chi Lo** PhD ; **Kenneth E Rosenzweig** MD *

PURPOSE
While lung Stereotactic Body Radiation Therapy (SBRT) is the standard of care for medically inoperable patients with early stage lung cancer, there is often concern regarding the development of radiation induced lung injury (RILI) in patients with COPD due to their compromised lung volumes. We compared the volume of RILI on CT exams in patients with and without radiographic evidence of emphysema.

METHOD AND MATERIALS
A review of patients treated with lung SBRT in our department was performed and pre-treatment CT was reviewed by a Diagnostic Radiologist for evidence of emphysema. Patients were scored by number of pulmonary lobes with emphysema and severity of emphysema in each lobe (mild, moderate or severe). Each patient�s baseline smoking history was recorded. The RILI was contoured by a Diagnostic Radiologist and Radiation Oncologist and total volume of observed fibrosis was recorded.

RESULTS
37 lung lesions were treated in 15 patients with emphysema and 17 patients without. A total of 37 FU-CT�s were reviewed. At a median of 6 months after treatment (range 3 to 7 months), the mean volume of fibrosis in patients with and without emphysema was 35.4 mm^3 and 99.2 mm^3, respectively. The presence and severity of emphysema was significantly inversely proportional to the total RILI (p=0.024 and p=0.003, respectively). Age was not significantly associated with RILI (p=0.441). The number of total lung lobes with emphysema was not significantly associated with RILI (p=0.276). Smoking status was also not significantly correlated with RILI, although only 3 patients were never-smokers.

CONCLUSION
Patients with radiographic evidence of emphysema who are treated with lung SBRT have significantly decreased RILI on post-treatment FU-CT, as compared patients without emphysema. Within the subset of patients with emphysema, those with increased severity had significant decreases in RILI.

CLINICAL RELEVANCE/APPLICATION
Patients with COPD who are treated with SBRT for lung cancer have overall less RILI compared to those who do not have emphysema.

SST04-09 • Association Study between Quantitative Measurement of Diaphragm Using Volumetric CT and Pulmonary Function Tests in Patients with COPD

Sang Min Lee MD (Presenter) ; **Yongjun Chang** ; **Jangpyo Bae** MS ; **Namkug Kim** PhD ; **Joon Beom Seo** MD, PhD ; **Sang Young Oh** MD

PURPOSE
To evaluate the relationship between quantitative morphological parameters of the diaphragm with three-dimensional reconstruction using CT and pulmonary function tests in patients with COPD.

METHOD AND MATERIALS
Non-contrast, inspiration volumetric CT of thirty patients (M:F=28:2; mean age, 62.2 years) with COPD (n; mild = 3, moderate = 15, severe = 7 and very severe = 5) were included. Pulmonary function tests (PFT) were performed in all patients with in 1 week of CT imaging. Using in-house software, upper margin of diaphragm were segmented automatically. Based on initial diaphragm segmentation, quadratic 3D surface fitting was used to measure morphological parameters of the diaphragm including the diaphragm lengths on x, y, z axes (XDL, YDL, ZDL), quadratic fitting diaphragm lengths on z axis (FZDL), height from apex and base plane (H), shape index at apex (SIA), average curvature (C), curvature on apex (CA) and surface area (SA). In addition, the correlation between morphological parameters of diaphragm, emphysema index (EI) and PFT were assessed with Pearson correlation test.

RESULTS
Measured morphological parameters of diaphragm, EI and PFT were as follows: XDL=129.80±11.66mm, YDL=163.19±13.45mm, ZDL=71.27±17.52mm, FZDL=61.59±16.98mm, H=28.08±56.58mm, SIA=0.849±0.052, C=0.0081±0.0017, CA=0.0095±0.0025, SA=34381±6680mm2, EI=22.1±11.68, Dlco=15.78±5.41, FEV1=55.9±20.88 and FEV1/FVC = 47.68±16.2. Measured ZDL, SIA, C, CA, and SA were negatively correlated with EI (r = -.421, -.382, -.384, -.411, -.415, respectively). And, XDL, ZDL, FZDL, SIA, C, CA, and SA were positively correlated with DLCO (r = .489, .540, .531, .496, .415, .469, .637, respectively) and CA was positively correlated with FEV1/FVC (r = .402).

CONCLUSION
The several quantitative morphological parameters of diaphragm decrease in relation to the progression of emphysema and decrease of PFT in COPD.

CLINICAL RELEVANCE/APPLICATION
Detailed analysis of morphological diaphragm changes is possible using volumetric CT and dedicated software. It may be helpful in the understanding of diaphragm changes in COPD.

Disclosure Index

A

Abbott, G. F. - Author, Thieme Medical Publishers, Inc Author, Amirsys, Inc
Aguilera, T. - Stockholder, Avelas Biosciences, Inc
Aguirre, S. - Founder, EchoPixel, Inc Shareholder, EchoPixel, Inc
Altes, T. A. - Research Grant, Vertex Pharmaceuticals Incorporated Research Grant, Novartis AG Research support, Siemens AG
Annapragada, A. - Founder, Marval Biosciences Inc Stockholder, Marval Biosciences Inc Founder, Alzeca Biosciences LLC Stockholder, Alzeca Biosciences LLC Founder, Sensulin LLC Stockholder, Sensulin LLC Stockholder, Abbott Laboratories Stockholder, Johnson & Johnson Stockholder, Merck & Co, Inc
Antoch, G. - Speaker, Siemens AG Speaker, Bayer AG
Aoyagi, K. - Employee, Toshiba Corporation
Arbique, G. - Research Grant, Toshiba Corporation
Aviram, G. - Research Grant, Koninklijke Philips Electronics NV Consultant, Carestream Health, Inc
Ayestaran, P. - Employee, General Electric Company

B

Bacon, J. L. - Research Grant, Actelion Ltd
Bae, K. T. - Patent agreement, Covidien AG Patent agreement, Bayer AG
Baker, J. C. - Research Consultant, Biomedical Systems
Bankier, A. A. - Author with royalties, Reed Elsevier Consultant, Olympus Corporation
Bauer, R. W. - Research Consultant, Siemens AG Speakers Bureau, Siemens AG
Bippus, R. - Employee, Koninklijke Philips Electronics NV
Botelho, M. P. - Grant, Siemens AG
Brabrand, K. - Shareholder, NeoRad AS
Brendel, B. - Researcher, Koninklijke Philips Electronics NV
Brewington, C. - Research Grant, Toshiba Corporation
Brillet, P. - Consultant, Novartis AG Consultant, Takeda Pharmaceutical Company Limited
Brink, M. - Speaker, Toshiba Corporation
Brown, K. M. - Employee, Koninklijke Philips Electronics NV
Brown, M. S. - Director, MedQIA Imaging Core Laboratory

C

Callstrom, M. R. - Research Grant, Endocare, Inc Research Grant, Siemens AG
Carter, B. W. - Author, Amirsys, Inc
Chamberlain, R. - Employee, ImBio, LLC
Chan, F. P. - Research collaboration, Siemens AG Research collaboration, Echopixel, Inc
Chang, P. J. - Co-founder, Stentor/Koninklijke Philips Electronics NV Technical Advisory Board, Amirsys, Inc Medical Advisory Board, Koninklijke Philips Electronics NV Medical Advisory Board, MModal Inc Medical Advisory Board, lifeIMAGE Medical Advisory Board, Merge Healthcare Incorporated
Chauvie, S. - Stockholder, Dixit srl
Chhabra, A. - Research Grant, Siemens AG Research Consultant, Siemens AG Research Grant, Integra LifeSciences Holdings Corporation Research Grant, General Electric Company
Choi, S. - Employee, Samsung Electronics Co Ltd
Chung, J. H. - Research Grant, Siemens AG
Chung, M. - Patent agreement, General Electric Company Patent agreement, Samsung Electronics Co Ltd
Cleveland, R. H. - Research Consultant, Alexion Pharmaceuticals, Inc Editor, Springer Science+Business Media Deutschland GmbH
Collins, B. T. - Speakers Bureau, Accuray Incorporated
Coxson, H. O. - Research Grant, GlaxoSmithKline plc Contract, GlaxoSmithKline plc Contract, Olympus Corporation Steering Committee, GlaxoSmithKline plc

D

De Baere, T. J. - Consultant, Terumo Corporation Speaker, Covidien AG Speaker, Terumo Corporation Speaker, General Electric Company Consultant, General Electric Company Consultant, Guerbet SA Speaker, Guerbet SA
De Bruijne, M. - Research Grant, AstraZeneca PLC
De Koning, H. - Research Grant, F. Hoffman-La Roche Ltd Equipment support, Siemens AG Medical Advisory Board, F. Hoffman-La Roche Ltd
Diehn, M. - Research Consultant, Varian Medical Systems, Inc Research Grant, Varian Medical Systems, Inc
Diette, G. B. - Research support, Integrated Diagnostics
Do, S. - Research Grant, Koninklijke Philips Electronics NV
Dobbins, J. T. III - Research Grant, General Electric Company Research Grant, Carestream Health, Inc Patent agreement, General Electric Company
Donington, J. S. - Consultant, Olympus Corporation
Duan, F. - Consultant, WorldCare Clinical, LLC
Dupuy, D. E. - Grant, NeuWave Medical Inc Consultant, Biocompatibles International plc Board of Directors, BSD Medical Corporation Stockholder, BSD Medical Corporation

F

Faulhaber, P. F. - Speaker, Koninklijke Philips Electronics NV Grant, Koninklijke Philips Electronics NV Medical Advisor, MIM Software, Inc
Fujisawa, Y. - Employee, Toshiba Corporation
Fuld, M. K. - Researcher, Siemens AG

G

Galban, C. J. - Inventor, ImBio, LLC
Gilkeson, R. C. - Research consultant, Riverain Technologies, LLC Research support, Koninklijke Philips Electronics NV
Gill, R. R. - Scientific Advisory Board, F. Hoffmann-La Roche Ltd
Gillams, A. R. - Speaker, Covidien AG
Goerner, F. L. - Research Grant, Siemens AG Research Grant, Bayer AG Research Grant, Bracco Group
Goldszal, A. F. - Advisory Board, FUJIFILM Holdings Corporation Advisory Board, MedInformatix, Inc
Gonzalez Guindalini, F. D. - Grant, Siemens AG

Goo, J. - Research Grant, Guerbet SA Research Grant, Toshiba Corporation
Greenspan, B. S. - Consultant, CareCore National
Grist, T. M. - Research Support, General Electric Company Research Support, Bracco Group Research Support, Siemens AG Research Support, Hologic, Inc Consultant, Guerbet SA Consultant, Bayer AG Consultant, Bracco Group Stockholder, NeuWave Medical Inc Stockholder, Novelos Therapeutics, Inc
Gunn, M. L. - Medical Advisor, TransformativeMed, Inc Spouse, Consultant, Wolters Kluwer nv

H

Haas, J. A. - Speaker, Accuray Incorporated
Han, M. K. - Advisory Board, Boehringer Ingelheim GmbH Advisory Board, Pfizer Inc Advisory Board, GlaxoSmithKline plc Advisory Board, F. Hoffmann-La Roche Ltd Advisory Board, Novartis AG Advisory Board, Forest Laboratories, Inc Speakers Bureau, Boehringer Ingelheim GmbH Speakers Bureau, Pfizer Inc Speakers Bureau, GlaxoSmithKline plc Speakers Bureau, F. Hoffmann-La Roche Ltd Speakers Bureau, Novartis AG Speakers Bureau, Forest Laboratories, Inc Consultant, Novartis AG Consultant, United Biosource Corporation Royalties, UpToDate, Inc
Haramati, L. B. - Investor, OrthoSpace Ltd Investor, Kryon Systems Ltd Spouse, Board Member, Bio Protect Ltd Spouse, Board Member, OrthoSpace Ltd Spouse, Board Member, Kryon Systems Ltd
Hartman, T. E. - Author, Cambridge University Press
Hatabu, H. - Research Grant, Toshiba Corporation Research Grant, AZE, Ltd Research Grant, Canon Inc
Henry, T. S. - Travel support, Siemens AG Spouse, Employee, F. Hoffmann-La Roche Ltd
Heverhagen, J. T. - Speaker, Bracco Group
Hippe, D. S. - Research Grant, Koninklijke Philips Electronics NV Research Grant, General Electric Company Research Grant, Koninklijke Philips Electronics NV
Hoffman, E. A. - Founder, VIDA Diagnostics, Inc Shareholder, VIDA Diagnostics, Inc
Horie, M. - Grant, Toshiba Corporation

I

Inokawa, H. - Employee, Toshiba Corporation

J

Jacobs, C. - Research Grant, MeVis Medical Solutions AG
Jacobson, J. - Stockholder, Genelux Corporation
Jankharia, B. - Stockholder, Pfizer Inc Stockholder, Cipla Ltd Stockholder, Glenmark Pharmaceuticals Ltd
Johkoh, T. - Research Consultant, Bayer AG Research Consultant, F. Hoffman-La Roche Ltd

K

Kalra, M. K. - Faculty, General Electric Company
Kanne, J. P. - Research Consultant, PTC Therapeutics, Inc Research Consultant, Perceptive Informatics, Inc
Kassai, Y. - Employee, Toshiba Corporation
Katzman, G. L. - Author, Amirsys, Inc Stockholder, Amirsys, Inc
Kauczor, H. - Research Grant, Boehringer Ingelheim GmbH Research Grant, Siemens AG Speakers Bureau, Boehringer Ingelheim GmbH Speakers Bureau, Bayer AG Speakers Bureau, Siemens AG
Kerl, J. - Research Consultant, Siemens AG Speakers Bureau, Siemens AG
Kicska, G. - Research Grant, General Electric Company
Klahr, P. - Researcher, Koninklijke Philips Electronics NV
Kligerman, S. J. - Author, Amirsys, Inc Speaker, Koninklijke Philips Electronics NV
Koehler, T. - Employee, Koninklijke Philips Electronics NV
Kohan, A. - Research support , Koninklijke Philips Electronics NV
Krishnamurthy, R. - Research Consultant, Eisai Co, Ltd Research support, Koninklijke Philips Electronics NV
Kroes, M. - Grant, NeoRad AS
Kruskal, J. B. - Author, UpToDate, Inc
Kunin, J. R. - Investigator, Oncimmune LLC

L

Lee, F. T. JR - Stockholder, NeuWave Medical, Inc Patent holder, NeuWave Medical, Inc Board of Directors, NeuWave Medical, Inc Patent holder, Covidien AG Inventor, Covidien AG Royalties, Covidien AG
Lee, K. - Employee, Samsung Electronics Co Ltds
Lee, Y. Z. - Research Grant, Carestream Health, Inc
Leite, C. D. - Researcher, Guerbet SA
Littrup, P. J. - Founder, CryoMedix, LLC Research Grant, Galil Medical Ltd Research Grant, Endo Health Solutions Inc Officer, Delphinus Medical Technologies, Inc
Loo, B. W. JR - Speaker, Varian Medical Systems, Inc Speaker, General Electric Company
Low, D. A. - Scientific Advisory Board, ViewRay, Inc
Lynch, D. A. - Research support, Siemens AG Scientific Advisor, Perceptive Informatics, Inc Consultant, Actelion Ltd Consultant, InterMune, Inc Consultant, Gilead Sciences, Inc Consultant, F. Hoffmann-La Roche Ltd

M

Macmahon, H. - Shareholder, Hologic, Inc Consultant, Riverain Technologies, LLC Royalties, UCTech
Mansoori, B. - Fellow, Sectra AB
Martinez-Jimenez, S. - Author, Amyrsis, Inc
Matsumoto, S. - Research Grant, Toshiba Corporation
Mayo, J. R. - Speaker, Siemens AG
Mayo-Smith, W. W. - Royalties, Reed Elsevier Royalties, Cambridge University Press
McAdams, H. - Research Grant, General Electric Company Consultant, MedQIA Author, Reed Elsevier Author, UpToDate, Inc
McNitt-Gray, M. F. - Institutional research agreement, Siemens AG Research support, Siemens AG
Meyer, C. A. - Stockholder, Novelos Therapeutics, Inc
Moore, W. H. - Research Grant, EDDA Technology, Inc Medical Board, EDDA Technology, Inc Research Grant, Galil Medical Ltd Research Grant, Endo Health Solutions Inc
Munden, R. F. - Spouse, Research Grant, Toshiba Coporation
Muthupillai, R. - Research support, Koninklijke Philips Electronics NV
Mutic, S. - Stockholder, ViewRay, Inc Stockholder, Radialogica, LLC
Muzic, R. - Research Grant, Koninklijke Philips Electronics NV

N

Nackaerts, K. - Speaker, Pfizer Inc Speaker, Novartis AG Advisory Board, Pfizer Inc Travel support, AstraZeneca PLC Travel support, Eli Lilly and Company
Nagel, H. - Consultant, Koninklijke Philips Electronics NV
Nagle, S. K. - Stockholder, General Electric Company
Naidich, D. P. - Consultant, Siemens AG Advisory Board, VIDA Diagnostics, Inc
Newell, J. D. JR - Research Consultant, Siemens AG Research Grant, Siemens AG Consultant, WebMD Health Corp Author, Springer Science+Business Media Deutschland GmbH Consultant, VIDA Diagnostics, Inc
Nikolaou, K. - Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Nishio, M. - Research Grant, Toshiba Corporation

Nordeck, S. M. - Research Grant, Toshiba Corporation

O

Obara, M. - Employee, Koninklijke Philips Electronics NV
O'Connell, T. - President, Resolve Radiologic Ltd
Oh, H. - Employee, Samsung Electronics Co Ltd
Ohno, Y. - Research Grant, Toshiba Coporation Research Grant, Koninklijke Philips Electronics NV Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd Research Grant, Terumo Corporation Research Grant, Covidien AG Research Grant, FUJIFILM Holdings Corporation
Okazaki, T. - Employee, Toshiba Corporation
Orth, R. - 1. Investigator, Toshiba Corporation 2. AUR GE Radiology Research Academic Fellowship (GERRAF) Award, General Electric Corporation

P

Partovi, S. - Research Grant, Koninklijke Philips Electronics NV
Paul, N. S. - Research funding, Toshiba Corporation
Pednekar, A. - Employee, Koninklijke Philips Electronics NV
Peller, P. J. - Speakers Bureau, Eli Lilly and Company
Pipavath, S. N. - Research Grant, General Electric Company
Prokop, M. - Speakers Bureau, Bayer AG Speakers Bureau, Bracco Group Speakers Bureau, Toshiba Corporation Speakers Bureau, Koninklijke Philips Electronics NV Research Grant, Toshiba Corporation
Pryma, D. - Speaker, Siemens AG Research Grant, Siemens AG Research Grant, Molecular Insight Pharmaceuticals, Inc Consultant, Molecular Insight Pharmaceuticals, Inc
Pua, B. B. - Consultant, Kimberly-Clark Corporation

R

Rabin, M. S. - Advisory Board, AcuityBio Corporation
Rehemtulla, A. - Stockholder, ImBio, LLC
Remy, J. - Research Consultant, Siemens AG
Remy-Jardin, M. J. - Research Grant, Siemens AG
Riely, G. J. - Consultant, Boehringer Ingelheim GmbH Consultant, Merck & Co, Inc Consultant, F. Hoffmann-La Roche Ltd
Rimner, A. - Research Consultant, General Electric Company
Ros, P. R. - Radiology Advisory Committee, Koninklijke Philips Electronics NV Institutional research collaboration, Siemens AG Institutional research collaboration, Koninklijke Philips Electronics NV Institutional research collaboration, Toshiba Corporation Institutional research collaboration, Sectra AB
Rosado De Christenson, M. L. - Author, Thieme Medical Publishers, Inc Author, Amirsys, Inc
Rosenzweig, K. E. - Consultant, Gerson Lehrman Group, Inc Advisory Board, ViewRay, Inc
Ross, B. D. - Co-founder, ImBio, LLC Shareholder, ImBio, LLC Advisor, ImBio, LLC
Rossi, S. E. - Advisory Board, Koninklijke Philips Electronics NV
Rubbert, C. - Fellowship funded, Koninklijke Philips Electronics NV
Rubin, D. A. - Stockholder, Pfizer Inc Stockholder, Merck & Co, Inc
Runge, V. M. - Research Grant, Bayer AG Research Grant, Bracco Group
Rybicki, F. J. III - Research Grant, Toshiba Corporation Research Grant, Bracco Group

S

Sabol, J. M. - Employee, General Electric Company
Sakai, F. - Research Consultant, Bayer AG Research Consultant, F. Hoffman-La Roche Ltd Research Consultant, Takeda Pharmaceutical Company Limited Research Consultant, AstraZeneca PLC Research Consultant, Merck KGaA Research Consultant, Johnson & Johnson Research Consultant, Merck & Co, Inc Research Consultant, Kyowa-Kirin Co, Ltd Research Consultant, Bristol-Myers Squibb Company Research Consultant, Pfizer Inc Speaker, DAIICHI SANKYO Group Speaker, Eisai Co, Ltd Speaker, KYORIN Holdings, Inc Speaker, Shionogi & Co, Ltd Speaker, Dainippon Sumitomo Pharma Co, Ltd Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, LTT Bio-Pharma Co, Ltd
Sanada, S. - Stockholder, Hologic, Inc
Sanchez, J. - Research Consultant, Koninklijke Philips Electronics NV
Satou, S. - Employee, Toshiba Corporation
Schaefer-Prokop, C. M. - Advisory Board, Riverain Technologies, LLC
Schalekamp, S. - Research Grant, Riverain Technologies, LLC
Scherzinger, A. L. - Board of Directors, Touch of Life Technologies, Inc
Schiebler, M. L. - Shareholder, Novelos Therapeutics, Inc
Schindera, S. T. - Research Grant, Siemens AG
Schoenberg, S. O. - Institutional research agreement, Siemens AG
Schoepf, U. - Research Grant, Bracco Group Research Grant, General Electric Company Research Consultant, Siemens AG Research Grant, Siemens AG
Schroeder, J. D. - Research Grant, Siemens AG
Seyal, A. R. - Grant, Siemens AG
Shepard, J. O. - Consultant, Agfa-Gevaert Group
Shuman, W. P. - Research Grant, General Electric Company
Silverman, S. G. - Author, Lippincott Williams & Wilkins
Solomon, S. B. - Research Grant, General Electric Company Research Grant, AngioDynamics, Inc Consultant, Johnson & Johnson Consultant, Covidien AG Director, Devicor Medical Products, Inc Director, Aspire Bariatrics, Inc
Stevens, S. - Researcher, Iverson Genetic Diagnostics, Inc
Sugihara, N. - Employee, Toshiba Corporation
Sugimura, K. - Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips Electronics NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group
Sugiura, S. - Employee, Toshiba Corporation
Sung, Y. - Employee, Samsung Electronics Co Ltd
Swisher, S. G. - Consultant, GlaxoSmithKline plc

T

Takeguchi, T. - Employee, Toshiba Corporation
Taniguchi, H. - Research Consultant, Bayer AG Research Consultant, F. Hoffman-La Roche Ltd Research Consultant, Pfizer Inc
Tanner, N. - Research support, Integrated Diagnostics
Togashi, K. - Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd Research Grant, FUJIFILM Holdings Corporation Research Grant, Nihon Medi-Physics Co, Ltd Research Grant, Shimadzu Corporation Research Grant, Toshiba Corporation Research Grant, Covidien AG

V

Vachani, A. - Research support, Integrated Diagnostics
Van Beek, E. J. - Research support, Toshiba Corporation Research support, Siemens AG Founder and owner, QCTIS, Inc Speaker, Toshiba Corporation
Van Cauteren, M. - Employee, Koninklijke Philips Electronics NV
Vasanawala, S. S. - Research collaboration, General Electric Company Stockholder, Morpheus Medical, Inc
Vercher-Conejero, J. L. - Research Grant, Koninklijke Philips Electronics NV
Vikgren, J. - Speaker, General Electric Company Speaker, Boehringer Ingelheim GmbH
Vlahos, I. - Consultant, Siemens AG Consultant, General Electric Company

Von Tengg-Kobligk, H. - Research Grant, W. L. Gore & Associates, Inc

W

Wacker, F. K. - Research Grant, Siemens AG Research Grant, Pro Medicus Limited
Walker, C. M. - Author, Amirsys, Inc Author, Reed Elsevier
Wandtke, J. C. - Research Grant, Carestream Health, Inc
Watumull, L. M. - Research Grant, Toshiba Corporation
Wible, B. C. - RADPrimer Team Leader, Amirsys, Inc
Wilcox, A. - Speaker, Toshiba Corporation
Wirth, S. - Speaker, General Electric Company
Wong, T. Z. - Advisory Board, Eli Lilly and Company Consultant, Bayer AG
Wu, C. C. - Author, Amirsys, Inc

Y

Yaguchi, A. - Employee, Employee, Toshiba Corporation
Yamagata, H. - Employee, Toshiba Corporation
Yankelevitz, D. F. - Research Grant, AstraZeneca PLC Royalties, General Electric Company
Yeh, B. M. - Research Grant, General Electric Company Consultant, General Electric Company
Yoshikawa, T. - Research Grant, Toshiba Corporation

Z

Zabic, S. - Employee, Koninklijke Philips Electronics NV