Chest Radiology
Participants
Han Na Lee, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Mi Young Kim, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review chemotherapeutic drugs that typically results in pulmonary infiltrates (both classic and new targeted chemotherapy)
2. To illustrate various CT imaging of pulmonary drug toxicity and classify these into five patterns, based on histopathologic process
3. To review and suggest diagnostic criteria of chemotherapy-induced toxicity
4. To demonstrate mimickers of chemotherapy-induced pulmonary toxicity during CT interpretation

TABLE OF CONTENTS/OUTLINE
1. Chemotherapeutic drugs - Demonstrate agents that commonly have toxic effect on lung - Mechanism of classic and new targeted drugs
2. CT patterns, based on histopathologic process
   1) Nonspecific interstitial pneumonia
   2) Organizing pneumonia
   3) Diffuse alveolar damage
   4) Eosinophilic infiltrates
   5) Alveolar hemorrhage
3. When radiologists need to consider chemotherapy-induced toxicity preferentially than the other disease? - Suggest diagnostic criteria, taking into account of clinical and radiologic manifestations
4. Long-term follow-up of chemotherapy-induced toxicity - Reversibility of pulmonary infiltration on follow-up CT
5. Availability of pattern approach, associated with prognosis of patients
6. Mimics of pulmonary chemotherapy-induced toxicity
   - Atypical pneumonia
   - Idiopathic interstitial pneumonia with or without exacerbation
Magnetic Resonance Imaging of the Aorta and its Application in Aortic Pathologies: Current Standards, Recent Advances and Future Trends

All Day Location: CH Community, Learning Center

Participants
Fabian Rengier, MD, Heidelberg, Germany (Presenter) Nothing to Disclose
Michael Wehrmeister, Heidelberg, Germany (Abstract Co-Author) Nothing to Disclose
Christian Weis, Heidelberg, Germany (Abstract Co-Author) Nothing to Disclose
Tilman Leidenberger, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
Sasan Partovi, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Matthias Muller-Eschner, Heidelberg, Germany (Abstract Co-Author) Nothing to Disclose
Rolf Vosshenrich, MD, Goettingen, Germany (Abstract Co-Author) Nothing to Disclose
Hans-Ulrich Kauczor, MD, Heidelberg, Germany (Abstract Co-Author) Research Grant, Siemens AG; Research Grant, Bayer AG; Speakers Bureau, Boehringer Ingelheim GmbH; Speakers Bureau, Siemens AG; Speakers Bureau, Novartis AG; Speakers Bureau, GlaxoSmithKline plc; Speakers Bureau, Almirall SA

TEACHING POINTS
To illustrate current state-of-the-art magnetic resonance (MR) imaging of the aorta including standard protocols, recent advances and future trends. To discuss its application in aortic pathologies in every day clinical practice including discussion of the additional value of recent technological developments in certain patient populations.

TABLE OF CONTENTS/OUTLINE
Participants
Davis Rierson, MD, Charlottesville, VA (Presenter) Nothing to Disclose
Juliana M. Bueno, MD, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
After reviewing our exhibit, the learner will be able to: Understand the vital role of supine chest radiographs in the detection of pneumothorax in trauma and critically ill patients. Understand the anatomy of the pleural space and how it influences the collection of air based on positioning. Remember and recognize the subtle radiographic findings and classic signs associated with pneumothorax on a supine view, illustrated by representative cases. Understand the importance of recognizing this entity in a plain film in the era of cross-sectional imaging.

TABLE OF CONTENTS/OUTLINE
Outline: Anatomic illustration of the pleural space and its normal recesses Radiographic illustration and review of imaging findings of most common types of supine pneumothoraces Anteromedial pneumothorax Subpulmonic pneumothorax Posteromedial pneumothorax Apicolateral pneumothorax 3. Pitfalls and mimics of supine pneumothorax 4. Teaching points and Summary
Lung Cancer Associated With Cystic Air Spaces and Its Differential Diagnosis: Multimodality Imaging Findings and Follow-up

All Day Location: CH Community, Learning Center

Participants
Youkyung Lee, MD, Guri, Korea, Republic Of (Presenter) Nothing to Disclose
Choong-Ki Park, MD, Kuri, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Lung cancer can present unevenly thickened wall of cystic air space. Lung cancer associated with cystic air spaces is one of causes of missed lung cancer. The purpose of this exhibit is 1. To present CT and FDG PET findings of lung cancers associated with cystic air spaces and their serial imaging findings 2. To differentiate lung cancers associated with cystic air spaces from benign disease associated with cystic air spaces, and cavitary lung cancer

TABLE OF CONTENTS/OUTLINE
1. Definition of lung cancers associated with cystic air spaces 2. Differential from cavitary lung cancer 3. Illustration of teaching points including cases of lung cancers associated with cystic air spaces with their previous or follow-up CT and FDG-PET finding 4. Benign lesions mimicking lung cancers associated with cystic air spaces 5. Lung cancer associated with honeycombing lesion of usual interstitial pneumonia
Cracking the Core of the Lateral Chest: A Case Based Study of Abnormalities and Anatomy and the Center of the Lateral Radiograph

Awards
Certificate of Merit

Participants
Lindsey Minshew, MD, Jacksonville Beach, FL (Presenter) Nothing to Disclose
Barbara L. McComb, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The identification of an abnormality in the center of the lateral radiograph in and around the bilateral hila can be particularly challenging; however, the recognition of deviation from normal is invaluable in confirming pathology. We have collected a series of cases where pathology not necessarily obvious on the PA view is recognized by a subtle alteration from normal on the lateral view. The intended audience is residents, fellows and even general radiologists. Teaching Points: 1. To review normal anatomy centrally on the lateral radiograph. 2. To improve recognition of difficult to detect abnormalities through cases that depict subtle alterations from normal.

TABLE OF CONTENTS/OUTLINE
1. Value of the lateral radiograph.
2. Review of normal anatomy in the approximate center through diagraming and sample normal radiographs. Highlights left main-upper lobe bronchus continuum, LLL bronchus, RUL bronchus, RML bronchus, carina, LPA, right hilar composite, and inferior hilar window.
3. Cases depicting subtle deviations from normal due to lesions. Some examples include anterior displacement of the BI posterior wall, increased opacity over LPA, obscured LLL bronchus anterior wall, increased opacity in the inferior hilar window, increased opacity of the right hilar composite. Will include accompanying PA view, cross sectional images, and discussion.
TEACHING POINTS

1. HRCT patterns of pulmonary fibrosis can be categorized into definite UIP, possible UIP, and inconsistent with UIP classes.
2. Honeycombing on HRCT is the main differentiator between definite and possible UIP.
3. In addition to UIP, there are other types of pulmonary fibrosis that can be confidently diagnosed on HRCT.

TABLE OF CONTENTS/OUTLINE

We have created a free, personalized, simulation-based, online training program in the interpretation of HRCT with a specific focus on UIP diagnosis (www.hrcteducation.org). Novel educational methodologies which are leveraged in this program include unsuccessful retrieval, immediate feedback, and deliberate practice. Based on pre-test scores, the learner will be placed into 1 of 2 tracks. The learner will be guided through 2 sets of 5 cases of complete dataset CT scans in interstitial lung disease and quizzed in an algorithmic method to show the learner a basic approach to pulmonary fibrosis on HRCT. Based on the 1st 10 cases, the learner will be shown 10 more cases which specifically address their areas of weakness (distribution of fibrosis, honeycombing, UIP diagnosis). Case answers will be presented in a video format to simulate the verbal feedback, apprenticeship model of training common to residencies/fellowship. Immediate and 3-month post-tests will be administered to assess the degree of retention.

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Jonathan H. Chung, MD - 2013 Honored Educator
Radiofrequency ablation (RFA) is a thermal ablation technique that is increasingly used in the management of early stage inoperable localised non-small cell lung cancer. It is an image-guided technique that destroys cancer cells via coagulative necrosis. This exhibit will describe:

- Indications for the use of lung RFA
- Lung RFA technique, emphasizing the advantages of conscious sedation in low FEV1 patients
- A gold-standard algorithm for patient evaluation prior to thermal ablation
- Guidelines for lesion selection using MDCT examples
- Evidence for effectiveness and advantages of RFA versus stereotactic ablative radiotherapy (SABR)
- A consensus follow-up imaging protocol post RFA, thereby allowing prompt detection and re-ablation of early recurrence
- Potential RFA side effects, including pneumothorax and under-recognised post-ablation neural injury (e.g. to the brachial plexus, phrenic nerve)

We will highlight the key radiological findings post lung RFA, including usual expected MDCT temporal evolution as well as potential pitfalls in post RFA imaging interpretation.

TABLE OF CONTENTS/OUTLINE

- Lung RFA technique
- RFA versus SABR evidence base
- Lung RFA patient selection algorithm
- Lung RFA lesion selection criteria
- Imaging follow-up protocol post lung RFA
- Lung RFA complications
Participants
Carlos Capunay, MD, Buenos Aires, Argentina (Presenter) Nothing to Disclose
Patricia M. Carrascosa, MD, Buenos Aires, Argentina (Abstract Co-Author) Research Consultant, General Electric Company
Javier Vallejos, MD, MBA, Vicente Lopez, Argentina (Abstract Co-Author) Nothing to Disclose
Jimena B. Carpio, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
2- To understand the principles of dual energy CT. 1- To review the indications, diagnostic imaging, potential benefits and limitations of Dual energy CT in lung disorders.

TABLE OF CONTENTS/OUTLINE
Anastomotic Airway Complications after Lung Transplant: Clinical, Bronchoscopic and CT Correlation

All Day Location: CH Community, Learning Center

Awards
Certificate of Merit

Participants
Kyle Luecke, MD, Tampa, FL (Presenter) Nothing to Disclose
Carlos A. Rojas, MD, Tampa, FL (Abstract Co-Author) Nothing to Disclose
Andres Pelaez, MD, Tampa, FL (Abstract Co-Author) Nothing to Disclose
Tony Fattouch, MD, St Petersburg, FL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review the normal appearance of the airway anastomosis in lung transplant patients with emphasis on CT images with bronchoscopic correlation. To review the most common complications of airway anastomosis following lung transplant and their imaging appearance on CT with bronchoscopic correlation. To review the management of airway anastomosis complications.

TABLE OF CONTENTS/OUTLINE
TEACHING POINTS

1. Eligibility criteria for CT lung cancer screening.
2. LungRADS™ is a structured reporting and management tool used for the interpretation of CT lung cancer screening studies.
3. Ascending LungRADS™ categories from 1-4 have an increased risk for lung cancer, and a more escalated management strategy.

TABLE OF CONTENTS/OUTLINE

The National Lung Screening Trial (NLST) demonstrated that low dose CT (LDCT) screening significantly and cost effectively reduces lung cancer specific mortality. The Centers for Medicare and Medicaid Services (CMS) and US preventive services task force have endorsed LDCT lung cancer screening. ACR LungRADS™ is a structured reporting and management tool to help practice safe and quality lung cancer screening. The ACR Lung Cancer Screening Registry (ACR LCSR), the first CMS approved registry requires the use of LungRADS™ in order to obtain reimbursement. This exhibit will describe and illustrate LungRADS™ reporting categories, based on nodule size, consistency (solid/part solid/nonsolid) and growth. There are 5 LungRADS™ categories, 0-4 based on the highest risk finding with two modifiers, S and C. 1 and 2 are considered negative screens; 3 and 4 are positive screens. Widespread adoption of LungRADS™ can maximize the benefits of LDCT screening using standard nomenclature for reporting and ensure that safe, quality CT screening is available.

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Ella A. Kazerooni, MD - 2014 Honored Educator
Omnia Mutantur Nos Et Mutamur In Illis: A Guided Tour of Changes in Evaluation of Pulmonary Vasculature with Dual Energy CT

All Day Location: CH Community, Learning Center

Participants
Azadeh Tabari, Boston, MA (Presenter) Nothing to Disclose
Alexi Otrakji, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Shaunagh McDermott, FFR(RCSI), Boston, MA (Abstract Co-Author) Nothing to Disclose
Jo-Anne O. Shepard, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Mannudeep K. Kalra, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Subba R. Digumarthy, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Swati Goyal, Boston, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Application of dual energy CT (DECT) technology for evaluation of pulmonary arteries has induced substantial changes to scanning protocol, contrast injection technique, reconstructed images and diagnostic interpretation of DECT pulmonary angiography. Image contrast improvement with DECT help reduce number of non-diagnostic CT pulmonary angiogram with lower injection rate and lower contrast volume. Availability of maps of contrast enhancement in the lung parenchyma provides additional information on changes in regional pulmonary blood volume from ischemic and non-ischemic disease processes of the lungs. We use an innovative, case-based, interactive program (RadIQ) to take a guided tour of beneficial changes associated with application of DECT for evaluation of pulmonary vasculature.

TABLE OF CONTENTS/OUTLINE

Unique aspects of scanning protocols with DECT pulmonary angiography Welcome changes in contrast injection with DECT Recognizing image datasets obtained from DECT: Virtual monoenergetic and material decomposition images Interpretation skills for assessing DECT pulmonary angiography Recognizing matched and mismatched defects in pulmonary blood volume maps: Pearls and pitfalls Specific application of DECT for CTEPH and pulmonary arteriovenous malformation (Omnia Mutantur Nos Et Mutamur In Illis: All things change, and we change with them)

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Subba R. Digumarthy, MD - 2013 Honored Educator
Dreaming with Pirates and the Southern Seas: Classical Signs in Thoracic Radiology

All Day Location: CH Community, Learning Center

Participants
Ainhoa Viteri, MD, Bilbao, Spain (Presenter) Nothing to Disclose
Silvia Cisneros Carpio, MD, Durango, Spain (Abstract Co-Author) Nothing to Disclose
Inigo Lecumberri, Bilbao, Spain (Abstract Co-Author) Nothing to Disclose
Miguel A. Schuller Arteaga, MD, Bilbao, Spain (Abstract Co-Author) Nothing to Disclose
Berta Ruiz, MD, Bilbao, Spain (Abstract Co-Author) Nothing to Disclose
Clara Morandeira, MD, Bilbao, Spain (Abstract Co-Author) Nothing to Disclose
Domingo Grande, Bilbao, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To present all pirates- and adventures- related signs in thoracic radiology. To illustrate them through images with literary background or evocative of pirates and adventures. To help radiology residents learn these signs in a playful and original way.

TABLE OF CONTENTS/OUTLINE
BACKGROUND: The classical radiological signs are based on the phenomenon of pareidolia. The best known examples are the signs inspired by animals, plants and food. However, when looking at classic signs in the field of thoracic radiology, we are delighted by the profusion of signs that seem to be inspired by pirates’ stories and adventures in the Southern Seas. PURPOSE AND CONTENT OUTLINE: We will show radiological images of cases from our institution to illustrate the following signs:- Pirates’ ships: sail sign, spinnaker sign- Pirates’ weaponry: cannonball, dagger, scimitar, saber sheath and armored heart- Jewels in the loot: pearl (or signet) ring sign, beaded septum sign- Landscape of the Southern Seas: waves sign, atoll sign- Skies of the Southern Seas: air crescent sign, comet tail sign- The oriental jungles: bamboo, water lilies and trees in bud. We will match them with explanatory pictures in the public domain with literary background, or evocative of the novels of pirates and adventures.
TEACHING POINTS

The localization of pulmonary nodules by placing harpoon guided by computed tomography prior to surgical resection (videothorascopic); is an effective and safe option when pulmonary nodule palpation is difficult because of its size (less than 10 mm), consistency and/or distance to the pleural surface. The purpose of this exhibit is to review and explain the indications, diagnostic imaging, interventional method, contraindications and potential complications of; the location of pulmonary nodules by placing harpoon guided by computed tomography prior to surgical resection.

TABLE OF CONTENTS/OUTLINE

- Introduction
  - Anatomy
  - Types of lung nodules and management
  - Diagnostic Imaging (CT)
  - Differential Diagnosis (infectious, inflammatory, hemorrhagic, neoplastic)
- Indications
- Contraindications
- Harpoon placement guided by CT (materials and description of the technique)
- Outcomes
- Cases to illustrate the radiologic features
- Key points
Postoperative CTA/MRA of the Thoracic Aorta: What the Radiologist Needs to Know

All Day Location: CH Community, Learning Center

Participants
Joseph H. Liao, MD, New York, NY (Presenter) Nothing to Disclose
Adam Jacobi, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review thoracic aortic surgical procedures and recognize normal postoperative appearances
2. To not only discuss general thoracic surgery complications, but also cover specific complications associated with each procedure
3. To explain the pros and cons of CTA versus MRA in imaging the postoperative aorta

TABLE OF CONTENTS/OUTLINE
1. Indications for thoracic aortic surgery (aneurysm, dissection, intramural hematoma)
2. Review of various aortic procedures (Bentall, Cabrol, Ross, David valve-sparing, Elephant trunk) with interesting normal imaging findings (pitfalls)
3. Examples of general thoracic surgery postoperative complications on CTA/MRA
4. Specific complications of each procedure
5. CTA versus MRA in the postoperative setting

Conclusion
1. Familiarity with thoracic aortic procedures is imperative in preventing misdiagnoses (e.g., incorrectly calling stage 1 of the elephant trunk procedure an aortic dissection)
2. Distinguishing mediastinal abscess (requiring debridement) from postoperative fluid/blood (allowed) in deciding whether to reoperate
3. MRA with cine allows for functional evaluation of the heart and ascending aorta
Flaps and prosthetic material are used to repair thoracic defects secondary to tumor resections or complication of radiation therapy. It is important to know the radiologic appearance of flaps, because sometimes they may simulate recurrent malignancy. Regional pedicled muscular or musculocutaneous flaps are the first choice for soft tissue coverage. The muscles most commonly used for pedicle flaps are the serratus anterior, latissimus dorsi, intercostal and rectus abdominis muscles. Rigid material for chest wall reconstruction allows stability to the chest wall. Currently, polypropylene and polytetrafluoroethylene are the most commonly used material for stabilization and prevention of herniation. Complications associated with flaps and reconstruction with prosthetic material include seroma, focal infection, flap necrosis and fracture of material.

TABLE OF CONTENTS/OUTLINE
- Indications for use of soft tissue flaps and types of flaps - Review of imaging findings: CT, FDG PET/CT
- Indications for use of rigid material for chest wall reconstructions and description of types of material - Review of imaging findings: Conventional radiograph, CT, FDG PET/CT
- Description and imaging findings associate to complications after intrathoracic soft tissue and prosthetic reconstructions.

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Sonia L. Betancourt Cuellar, MD - 2014 Honored Educator
Santiago Martinez-Jimenez, MD - 2014 Honored Educator
Santiago Martinez-Jimenez, MD - 2015 Honored Educator
Edith M. Marom, MD - 2015 Honored Educator
Brett W. Carter, MD - 2015 Honored Educator
Pneumoconioses Revisited

All Day Location: CH Community, Learning Center

Participants
Masanori Akira, MD, Sakai, Japan (Presenter) Nothing to Disclose
Tomohisa Okuma, MD, PhD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Narufumi Suganuma, MD, Nankoku, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Teaching point 1: You can learn the imaging features of many kinds of pneumoconioses.
Teaching point 2: You can learn the pathologic-radiologic correlation in pneumoconioses.

TABLE OF CONTENTS/OUTLINE

Introduction: Pneumoconiosis is a venerable word, coined from the Greek (pneuma = air and konis = dust). Specific dust exposures can result in a variety of patterns of lung injury. Imaging of pneumoconioses mainly consist of predominant nodular and predominant reticular pattern. Predominant nodular pneumoconioses must differentiate from sarcoidosis, hypersensitivity pneumonia, pulmonary Langerhans' cell histiocytosis, and other diffuse lung diseases showing nodular patterns. Predominant reticular pneumoconioses include asbestosis, hard metal pneumoconiosis, aluminum pneumoconiosis, mixed dust pneumoconiosis, and so on. The differential diagnosis includes idiopathic pulmonary fibrosis, other idiopathic interstitial pneumonias, collagen vascular disease related-interstitial pneumonia, and so on. The radiologist must understand the spectrum of expected imaging patterns related to known dust exposures.
CT Pulmonary Angiography: Technical Considerations in MDCT and Dual-Energy Imaging, Pitfalls in Interpretation, and Potential Interventional Therapy Options

All Day Location: CH Community, Learning Center

Participants
Bedros Taslakian, MD, New York, NY (Presenter) Nothing to Disclose
Jane P. Ko, MD, New York, NY (Abstract Co-Author) Speaker: Siemens AG
Larry A. Latson JR, MS, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Eric T. Aaltonen, MD, MPH, New York, NY (Abstract Co-Author) Nothing to Disclose
Mylene T. Truong, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Maria C. Shiau, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Francis G. Girvin, MBChB, New York, NY (Abstract Co-Author) Nothing to Disclose
Jeffrey B. Alpert, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Maj L. Wickstrom, MD, West Harrison, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose is to: Discuss CT pulmonary angiography (CTPA) techniques including dual energy CT, technical pitfalls, and how to overcome them via protocol optimization. Review pitfalls that can occur when interpreting CTPA, including entities that are both frequent and less commonly encountered in the adult. Identify diseases for which interventional therapies are available.

TABLE OF CONTENTS/OUTLINE

Multidetector CTPA performance - Indications CT protocol including dual-energy CT Technical pitfalls: how to overcome? Role of alternative imaging modalities Acute pulmonary thromboembolism Aneurysms and pseudoaneurysms Pulmonary hypertension Chronic thromboembolic disease Pulmonary capillary hemangiomatosis Hepatopulmonary syndrome Nonthrombotic pulmonary embolism Cement Foreign bodies Embolism to peripheral pulmonary arteries Cardiac monitoring devices in pulmonary arteries Pulmonary arterial tumors Sarcoma Metastases Pulmonary artery dissection Pulmonary artery intrasleeve hematoma Pulmonary hypoplasia Pulmonary vein varix Potential pulmonary arterial interventional therapy options Catheter-directed thrombolysis Embolization of pulmonary arteriovenous malformations, aneurysms, and pseudoaneurysms Minimally-invasive foreign-body retrieval Conclusion

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Mylene T. Truong, MD - 2015 Honored Educator

Mylene T. Truong, MD - 2015 Honored Educator
Making Sense of the Lung Cancer Screening Guidelines and Reporting System

All Day Location: CH Community, Learning Center

Participants
Aleksandr Rozenberg, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Paras Lakhani, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Achala Donuru, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Baskaran Sundaram, MRCP, FRCR, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The major teaching points of this exhibit are: 1. To understand that there are similarities and differences in lung cancer screening and management recommendations issued by various national organizations. 2. To review and match the NCCN and ACR Lung-RADS lung screening categories and recommendations for screen detected lung nodules. 3. Despite the National Lung Cancer Screening Trial, setting up a CT based lung cancer-screening program is still varied among institutions, as the best-practice guidelines are yet to be well established.

TABLE OF CONTENTS/OUTLINE
- Background of lung cancer screening with low dose chest CT. - CMS and USPTF recommendations for lung cancer screening. - Definitions of solid, part-solid and nonsolid nodule categories. - NCCN categorization of screen findings and follow-up guidelines. - ACR Lung-RADS categorization of screen findings and follow-up guidelines. - Similarities and differences between NCCN and ACR systems in categorizing screen detected nodules. - Similarities and differences between NCCN and ACR systems to follow-up screen detected nodules. - Downstream effects of follow-up recommendations from NCCN and ACR.
The Many Faces of Pulmonary Tumor Embolism

All Day Location: CH Community, Learning Center

Participants
Diego Preciado, MD, Sabadell, Spain (Presenter) Nothing to Disclose
Eva Castaner, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Marta Andreu, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Xavier Gallardo, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Irmgard Costa, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Viviana P. Beltran Salazar, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Beatriz Consola, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Josep Maria Mata, MD, PhD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To give an overview of the clinical findings. To illustrate the CT and pathological findings. To emphasize the differential diagnosis.

TABLE OF CONTENTS/OUTLINE
Diffuse ground-glass attenuation (GGA) on CT is observed in a variety of diseases. However, there are some radiographic signs and clinical features which are useful for differential diagnosis. The purpose of this exhibit is to expose radiologists to a series of cases, key points for differential diagnosis, and pitfalls in order to help improve the radiologist’s diagnostic accuracy.

**TABLE OF CONTENTS/OUTLINE**

- Causes of diffuse GGA
- Pathophysiology of GGA
- Review of imaging findings
- Chest computed radiography
- CT (high-resolution CT: HRCT)
- Sample cases, HRCT signs (crazy-paving appearance, mosaic pattern), correlation with pathological findings, and key points for differential diagnosis
- Pitfall
  - Mosaic perfusion due to airway disease or vascular disease
Hidden in Plain Sight: How Contrast Flow Patterns on Thoracic CTA can Reveal More than Meets the Eye

All Day Location: CH Community, Learning Center

Participants
Daniel C. Oppenheimer, MD, Rochester, NY (Presenter) Nothing to Disclose
Katherine A. Kaproth-Joslin, MD, PhD, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Dara Omer, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Abhishek Chaturvedi, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Apeksha Chaturvedi, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Sushilkumar K. Sonavane, MD, Birmingham, AL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Understand the expected flow and enhancement pattern on thoracic CTA. Evaluate a normal and abnormal pressure graph of a power injector. Normal and abnormal test bolus or bolus tracker images. Identify life threatening cases such as tamponade, systolic failure, and asystole. How to optimize contrast reinjection in cases of initial non-diagnostic scans.

TABLE OF CONTENTS/OUTLINE
1. Injection site:- Small access cannula with high flow rate mismatch: flow limited by max. pressure-Contrast extravasation
2. Suboptimal opacification of vessels:- Central venous stenosis or occlusion-Decreased cardiac output-Obstruction of the feeding artery and of the draining vein-Cardiac tamponade, LV/RV systolic failure, Asystole-Presence of ECMO or LVAD3. Considerations in rescanning with contrast.
Avoid the Traps!: Tips for Identifying and Distinguishing Normal Thoracic CT Findings from Pathology

All Day Location: CH Community, Learning Center

Participants
Aman Jivraj, MD, Halifax, NS (Presenter) Nothing to Disclose
Jo Yazer, MD, Halifax, NS (Abstract Co-Author) Nothing to Disclose
Joy N. Borgaonkar, MD, FRCP, Halifax, NS (Abstract Co-Author) Nothing to Disclose
Daria Manos, MD, FRCP, Halifax, NS (Abstract Co-Author) Nothing to Disclose
Robert M. Miller, MD, Halifax, NS (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To identify commonly misinterpreted normal thoracic CT findings. 2. To describe the characteristic CT features of these normal findings. 3. To discuss how to differentiate these normal findings from similar appearing pathology. A familiarity with key normal thoracic CT findings will help the radiologist avoid errors in interpretation and will prevent unnecessary work up.

TABLE OF CONTENTS/OUTLINE
We will provide examples of various normal thoracic CT findings which are commonly mistaken for pathology. Cases will fall into the following categories: - Lung - Mediastinum - Vascular - Contrast Related Artifacts A discussion of each case will be presented in the following format: - Imaging example - Commonly mistaken pathology - Discussion of normal finding - Tips for distinguishing this from pathology
Utility of PET-MRI in Diagnosis and Follow-up of Lung Cancer

All Day Location: CH Community, Learning Center

Participants
Ammar A. Chaudhry, MD, Corona, CA (Presenter) Nothing to Disclose
Maryam Gul, Mineola, NY (Abstract Co-Author) Nothing to Disclose
Abbas A. Chaudhry, BSc, Westbury, NY (Abstract Co-Author) Nothing to Disclose
William H. Moore, MD, Stony Brook, NY (Abstract Co-Author) Research Grant, EDDA Technology, Inc Medical Board, EDDA Technology, Inc Research Grant, Galil Medical Ltd Research Grant, Endo International plc
Robert Matthews, MD, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Review physical principles and techniques of PET-MRI (positron emission tomography-magnetic resonance imaging). Discuss clinical utility of using functional information obtained from a PET scan and structural information obtained from MR imaging in evaluating lung cancer.

TABLE OF CONTENTS/OUTLINE

Pulmonary Tuberculosis a New Look at an Old Disease: Atypical Manifestations and Uncommon Complications

All Day Location: CH Community, Learning Center

Participants
Viviana P. Beltran Salazar, MD, Sabadell, Spain (Presenter) Nothing to Disclose
Eva Castaner, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Xavier Gallardo, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Marta Andreu, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Josep Maria Mata, MD, PhD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Beatriz Consola, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Diego Preciado, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

- To show the radiological findings (chest plain film and CT) of atypical and uncommon complications of pulmonary tuberculosis.
- To illustrate the most useful features to reach the correct diagnosis.
- To offer solutions to the common clinical dilemmas in everyday practice.

TABLE OF CONTENTS/OUTLINE

We illustrate the atypical radiological findings and uncommon complications; we also comment on the pathogenesis, clinical findings, treatment, and follow-up. We classify findings according to their location:

- **Lung parenchyma:** tuberculoma, aspergilloma, cystic / bullous disease, ARDS, silicotuberculosis.
- **Bronchial tree:** tracheobronchial stenosis, bronchoolithiasis, Lady Windermere syndrome.
- **Mediastinum:** bronchoesophageal fistula, pericardial tuberculosis, fibrosing mediastinitis.
- **Vascular:** pulmonary artery pseudoaneurysms (Rasmussen aneurysm).
- **Pleural and chest wall:** concentric pleural thickening, empyema necessitatis, broncho-pleural fistula

The major teaching points of this exhibit is: Tuberculosis can have a broad spectrum of radiological findings. Awareness and recognition of uncommon complications and atypical forms are paramount to prompt diagnosis.
Chest Drain Misadventures - An On-going Problem Despite High Resolution Imaging

All Day Location: CH Community, Learning Center

Participants
Amanda C. Jewison, BMBS, Brighton, United Kingdom (Abstract Co-Author) Nothing to Disclose
Charlie Sayer, MBBS, FRCR, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Simon P. Padley, MBBS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Guy J. Burkill, MD, Sussex, United Kingdom (Presenter) Nothing to Disclose

TEACHING POINTS
1. From a review of the UK national audit database on chest drain misadventures gain an understanding of when and why it might occur.
2. Become familiar with the UK national guidelines on safe pleural drainage.
3. Review principles for safe and effective pleural drainage.

TABLE OF CONTENTS/OUTLINE
Indications and contraindications (national guidance)
CXR, Ultrasound and CT interpretation of the pleura, skin folds, fluid loculation and lung tethering
Anatomy including hazards to be avoided
Drain types and sizes
Drugs and coagulopathies - recommendations
Consent
Patient positioning
Asepsis and set up
Anaesthetising the pleura
Seldinger versus single stick - a debate on safety
Laboratory tests on pleural fluid - the relevant investigations
Safe drain flow rate
Misadventures - institutional examples and root cause analysis
Misadventures - national audit data
Discussion on the use of CXR, CT and ultrasound before, during and after pleural drainage.
TEACHING POINTS

1. The International Thymic Malignancy Interest Group (ITMIG) and the International Association for the Study of Lung Cancer (IASLC) have recently partnered to create a consistent stage classification system for thymic epithelial neoplasms. The proposed classification system was created for formal consideration for the forthcoming 8th edition of the TNM Classification of Malignant Tumors.

2. Staging requires an accurate assessment of the clinical extent of lymph node metastasis. ITMIG has recently published the first lymph node map centered on thymic epithelial neoplasms in an effort to facilitate consistent and reproducible lymph node designations.

3. Radiologists interpreting cross-sectional imaging studies performed on patients for evaluation of thymic epithelial malignancies, principally thymoma and thymic carcinoma, should be familiar with the proposed staging system and lymph node map in order to guide appropriate patient management.

TABLE OF CONTENTS/OUTLINE

1. Discuss the basis for and structure of the proposed ITMIG/IASLC staging system for thymic epithelial neoplasms. 2. Outline the basis for and structure of the proposed ITMIG/IASLC lymph node map for thymic epithelial neoplasms. 3. Illustrate the specific tumor-node-metastasis (TNM) descriptors and lymph node map with representative examples on CT, MRI, and PET/CT.

Honored Educators

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Brett W. Carter, MD - 2015 Honored Educator
Edith M. Marom, MD - 2015 Honored Educator
Mylene T. Truong, MD - 2015 Honored Educator
Melissa L. Rosado De Christenson, MD - 2012 Honored Educator
TEACHING POINTS

1. To study the types and etiopathogenesis of lung hernias.
2. To review the potential complications.
3. To discuss the role of radiological imaging including 3D reconstruction in the diagnosis and evaluation of lung hernias and their complications.

TABLE OF CONTENTS/OUTLINE

Introduction: Lung hernias are rare and often discovered incidentally. They are seen in conditions associated with increased intrathoracic pressure or reduced resistance offered by supporting elements of the thorax or both like in COPD patients. Main causes are idiopathic, post-infectious, spontaneous, post traumatic, postoperative and iatrogenic secondary to chest tube insertion. Accordingly, we see intercostal, transcervical, parasternal and transdiaphragmatic lung hernias. Lung hernias prone to trauma and may lead to complications such as infection and incarceration with gangrene. All these manifestations have distinct radiological appearances. The patient may present with localized chest pain, fever or hemoptysis. Conclusion: Identification of lung hernia is important as they are prone to develop complications. They can be identified on plain radiography; however, MDCT gives exact information about site, size and is the imaging modality of choice for evaluating potential complications. An attempt is made in this exhibit to discuss radiological appearances and clinical implications of lung hernias.

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Carlos S. Restrepo, MD - 2012 Honored Educator
Carlos S. Restrepo, MD - 2014 Honored Educator
Multiple Pulmonary Nodules: What Exists Beyond Metastases that Every Radiologist Should Know

All Day Location: CH Community, Learning Center

Participants
Ameya J. Baxi, MBBS, DMRD, San Antonio, TX (Presenter) Nothing to Disclose
Carlos S. Restrepo, MD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose
Amy L. Mumbower, MD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose
Sonia L. Betancourt Cuellar, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Daniel Vargas, MD, Aurora, CO (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To study the differential diagnosis of non-metastatic pulmonary nodules
2. To review the etio-pathogenesis and radiological spectrum common and uncommon pulmonary nodules beyond metastasis
3. To describe the spectrum of common pulmonary nodules other than metastasis

TABLE OF CONTENTS/OUTLINE
The main aim of this presentation is to describe the disease entities presenting with multiple pulmonary nodules other than metastases. It is very important for a radiologist to have broad clinical and radiological approach before considering a possibility of metastatic pulmonary nodules. The pathologies we want to present are pulmonary tuberculosis, histoplasmosis, aspergillosis, sarcoidosis, hypersensitivity pneumonitis, Granulomatosis with polyangiitis, talc granulomatosis, nodular pulmonary amyloidosis, multiple small tumours, multiple carcinoids, multiple nodular angiofollicular hyperplasia, plasma cell granulomata and benign metastatic leiomyomas. Though similar radiological appearance, they differ in epidemiology, clinical outcome, management and prognosis. Given the potential significant morbidity of lung metastasis, it is important to understand and recognize nonmetastatic nodules. Thus, knowledge of imaging appearance of multiple pulmonary nodules is important for accurate diagnosis and treatment.

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Carlos S. Restrepo, MD - 2012 Honored Educator
Carlos S. Restrepo, MD - 2014 Honored Educator
Sonia L. Betancourt Cuellar, MD - 2014 Honored Educator
3D Multiplanar Imaging in the Diagnosis and Management of Lung Transplantation Complications

All Day Location: CH Community, Learning Center

Participants
Kiran Batra, MD, Coppell, TX (Abstract Co-Author) Nothing to Disclose
Vibhor Wadhwa, MBBS, Little Rock, AR (Presenter) Nothing to Disclose
Anil K. Pillai, MD, Coppell, TX (Abstract Co-Author) Nothing to Disclose
Vaidehi Kaza, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Amit Banga, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Sachin S. Saboo, MD, FRCR, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Jose Torrealba, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Suhny Abbara, MD, Dallas, TX (Abstract Co-Author) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG

TEACHING POINTS
1. Gain knowledge of clinical scenario and learn the imaging differences among various early and late complications of lung transplant.
2. Depict the 3D multiplanar imaging with volume rendered and maximum and minimum intensity projections (MIP/MiniIP) of these complications, e.g. obstructive and restrictive graft dysfunctions.
3. Although transplant can significantly improve the quality of life and prolong survival, a myriad of pulmonary complications may result in significant morbidity and limit long-term survival. The recognition and early treatment of these complications is important for optimizing outcomes.

TABLE OF CONTENTS/OUTLINE
1. Time line of acute and chronic complications of lung transplantation.
2. Normal 3D multiplanar imaging appearances of unilateral and bilateral lung transplants.
3. Abnormal 3D multiplanar imaging with volume rendered and maximum and minimum intensity projections (MIP/MiniIP) depiction of these complications, e.g. pneumonia, mediastinitis, rejection, chronic lung allograft dysfunction (CLAD) and CLAD variants (classic BOS, ARAD, RAS), venous/arterial thrombosis, airway stenosis, lymphatic injury (chylothorax) and post-transplant lymphoproliferative disorder.
4. Diagnostic algorithm for quick evaluation of pulmonary complications following lung transplant.

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Suhny Abbara, MD - 2014 Honored Educator
A Diagnostic Approach to Pulmonary Arterial Abnormalities

All Day Location: CH Community, Learning Center

Participants
Cheng Ting Lin, MD, Baltimore, MD (Presenter) Nothing to Disclose
Elliot K. Fishman, MD, Owings Mills, MD (Abstract Co-Author) Research support, Siemens AG Advisory Board, Siemens AG Research support, General Electric Company Advisory Board, General Electric Company Co-founder, HipGraphics, Inc

TEACHING POINTS
The purpose of this exhibit is: To discuss the role of imaging in evaluating the pulmonary arteries. To demonstrate their normal radiographic appearance. To review the characteristic imaging findings of pulmonary arterial disorders.

TABLE OF CONTENTS/OUTLINE
Imaging techniques and their role in evaluating the pulmonary arteries (PA) Normal imaging appearance of the PA Categorization of PA disorders Cases - Increased PA diameter (pulmonary arterial hypertension, pulmonary artery aneurysms, AV-malformations) - Decreased PA diameter (extrinsic compression from fibrosing mediastinitis or bronchial carcinoma, Takayasu arteritis) - Filling defects (thromboembolic disease, primary sarcoma of the PA, dissection, tumoral emboli) - Congenital disorders (unilateral proximal interruption of pulmonary arteries, pulmonary sling) - Anomalous connection (patent ductus arteriosus, coronary AV fistula)

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Elliot K. Fishman, MD - 2012 Honored Educator
Elliot K. Fishman, MD - 2014 Honored Educator
Diffusion Weighted MR Imaging and Apparent Diffusion Coefficient Values of Mediastinal Lesions: Usefulness and Pitfalls in Differential Diagnosis

All Day Location: CH Community, Learning Center

Participants
Takahiko Nakazono, MD, PhD, Saga, Japan (Presenter) Nothing to Disclose
Ken Yamaguchi, MD, Saga, Japan (Abstract Co-Author) Nothing to Disclose
Ryoko Egashira, MD, Saga, Japan (Abstract Co-Author) Nothing to Disclose
Masanobu Mizuguchi, MD, Saga City, Japan (Abstract Co-Author) Nothing to Disclose
Yukari Takase, Saga, Japan (Abstract Co-Author) Nothing to Disclose
Hiroyuki Irie, MD, PhD, Saga, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purposes of this exhibit are: To review diffusion weighted MR imaging (DWI) and apparent diffusion coefficient (ADC) values of various mediastinal lesions. To review DWI and other MR imaging features of various mediastinal lesions with histopathological correlation. To recognize the usefulness and pitfalls of DWI and ADC values in differential diagnosis of mediastinal lesions.

TABLE OF CONTENTS/OUTLINE
Principles and imaging techniques of DWI in the thorax ADC histogram analysis DWI and ADC values of various mediastinal tumors (including normal thymic tissue, thymic hyperplasia, thymomas, thymic carcinomas, malignant lymphomas, germ cell tumors, neurogenic tumors, tuberculous lymphadenitis, metastatic tumors, sarcomas, thymic cyst, foregut cysts, pericardial cyst, etc.) DWI and other MR imaging features of mediastinal lesions with histopathological correlation The usefulness and pitfalls of DWI and ADC values in differential diagnosis of mediastinal lesions
Participants
Anthony D. Mohabir, MD, Manhasset, NY (Presenter) Nothing to Disclose
Leon Bacchus, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Rakesh D. Shah, MD, Manhasset, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is:
1. To review the pathogenesis of Takayasu arteritis.
2. To explain the significance of Takayasu arteritis as it pertains to clinical manifestations and symptomatology.
3. To review multimodality imaging findings of the several subtypes of Takayasu arteritis.
4. To review the imaging mimickers and pitfalls in accurate diagnosis.
5. To review systemic and targeted treatment options.

TABLE OF CONTENTS/OUTLINE
1. Takayasu Arteritis - epidemiology and pathogenesis
2. Clinical manifestations and clues aiding in accurate imaging diagnosis
3. Imaging findings on CT, MR, Angiography, and PET/CT
4. Narrowing the differential diagnosis and avoiding the imaging pitfalls
   a. Giant Cell arteritis
   b. Aortic Coarctation
   c. Vascular Thrombosis and Atherosclerosis
5. Systemic and targeted treatment options
6. Summary
The Spectrum of the Pulmonary Complications in Patients with Hematologic Malignancies

All Day Location: CH Community, Learning Center

Participants
Tassia R. Yamanari, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Ricardo V. Auad, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Guilherme H. Bachion, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Hye J. Lee, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Chang k. Chi, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Researcher, Guerbet SA

TEACHING POINTS
List the pulmonary complications in the setting of hematological malignancy diseases: infection, pulmonary infiltration of malignant cells, drug toxicity, indirect result related to therapy, and immunodeficiency related to the disease or the treatment. Recognize the imaging findings in CT of pulmonary complications in patients with hematological malignancy diseases. Understand which of the complications are more common in those submitted to hematologic stem cells transplantation.

TABLE OF CONTENTS/OUTLINE
Review the general concepts underlying the treatment of hematologic malignancies. Discuss the potential complications in hematologic patients: 1. Acute - non infectious: pulmonary hemorrhage, edema, leukostasis, drug toxicity. 2. Acute - infectious: bacterial pneumonia, fungal pneumonia, Pneumocystis jiroveci, CMV and other virus. 3. Late onset complications related to hematopoietic stem cells transplantations (HSCT): Graft-versus-host disease, constrictive bronchiolitis and cryptogenic organizing pneumonia. 4. Related to pulmonary infiltration of malignant cells. Describe which of the complications are more common in those submitted to HSCT due to the immunologic status of the patient according to time after the transplantation.
Getting on Your Nerves: Nervous System Disease the Thoracic Radiologist Should Recognize

All Day Location: CH Community, Learning Center

Awards
Cum Laude

Participants
Kristopher W. Cummings, MD, Phoenix, AZ (Presenter) Nothing to Disclose
Sreevathsan Sridhar, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Matthew S. Parsons, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Cylen Javidan-Nejad, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Sanjeev Bhalla, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

List two common sites of secondary tumor involvement of the phrenic nerve. Name the characteristic clinical presentation of disease involvement of the recurrent laryngeal nerve and stellate ganglion.

TABLE OF CONTENTS/OUTLINE

Part 1: Anatomy
Review the anatomic appearance and courses of important thoracic nerves and ganglia with emphasis of common sites of pathologic involvement
Phrenic
Recurrent laryngeal
Vagus
Sympathetic chain/stellate ganglion
Brachial plexus
Intercostal
Long thoracic

Part 2: Pathology
Extrinsic - Neoplastic and non-neoplastic involvement secondarily involving important nervous system structures
Lung cancer including superior sulcus tumors
Metastasis
Lymphadenopathy
Vascular pathology
Intrinsic - Neoplasia and diseases of important nervous system structures
Neurogenic tumors, benign
Neurogenic tumors, malignant

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Sanjeev Bhalla, MD - 2014 Honored Educator
Clinical Features and Lung Imaging Manifestations in Eosinophilic Granulomatosis with Polyangiitis

All Day Location: CH Community, Learning Center

Participants
Xiao Li Xu, MD, Beijing, China (Presenter) Nothing to Disclose
Xin Sui, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Zheng Yu Jin, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Lan Song, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Qian Ni Du, Beijing, China (Abstract Co-Author) Nothing to Disclose
Wei Song, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

the purpose of this exhibit is: 1. To review the clinical features of eosinophilic granulomatosis with polyangiitis (EGPA), including etiology and pathogenesis, clinical symptoms, laboratory tests, treatment and prognosis. 2. To fully recognize all kinds of related lung imaging appearances in EGPA and evaluate its severity. 3. To correlate the clinical findings with radiologic manifestations in EGPA. The major teaching points: ANCA-positive patients manifested as glomerulonephritis, peripheral neuropathy, pulmonary hemorrhage and purpura more frequently compared to myocardial involvement, lung non-hemorrhage infiltrates that prevailed in ANCA-negative patients. The imaging patterns are varied in EGPA: the most common HRCT manifestations are ground-glass attenuation or consolidation in either a predominantly peri-bronchovascular or a peripheral distribution. The degree of bronchial involvement correlates with asthma course. Airway patterns of EGPA on HRCT mostly manifested as obstructive ventilation dysfunction and airspace patterns as restrictive ventilation dysfunction.

TABLE OF CONTENTS/OUTLINE

Clinical features in EGPA etiology and Pathogenesis clinical symptoms and signs laboratory tests pathophysiology treatment and prognosis. Multiple radiologic appearances in EGPA-X-ray- lung HRCTRadiologic-clinical correlations
Imaging of Intrathoracic Paragangliomas
All Day Location: CH Community, Learning Center

Awards
Certificate of Merit

Participants
Daniel Ocacione, MD, Houston, TX (Presenter) Nothing to Disclose
Daniel Vargas, MD, Aurora, CO (Abstract Co-Author) Nothing to Disclose
Demetrius L. Dicks, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Grish S. Shroff, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Arun C. Nachiappan, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Ameya J. Baxi, MBBS, DMRD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose
Abhishek Chaturvedi, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Horacio Murillo, MD, PhD, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Carlos S. Restrepo, MD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Intrathoracic paragangliomas are most commonly found in mediastinal compartments (aorticopulmonary window or posterior mediastinum) but can also arise in the lungs, heart, esophagus and trachea.2. On CT intrathoracic paragangliomas appear as well defined enhancing masses, however some tumors may have hemorrhage or cystic degeneration leading to a heterogeneous appearance.3. On MRI intrathoracic paragangliomas are hyperintense on T2-weighted images and show homogenous or heterogenous intermediate signal intensity on T1-weighted images.4. 111In pentreotide is the nuclear medicine agent of choice, with a sensitivity of 94%. The sensitivity of MIBG scintigraphy is lower, as it accumulates in only functioning paragangliomas.

TABLE OF CONTENTS/OUTLINE

INTRODUCTION:
IMAGING CHARACTERISTICS OF PARAGANGLIOMAS ON CT, MRI AND NUCLEAR SCINTIGRAPHY.
EXAMPLES OF PARAGANGLIOMAS ARISING FROM:
MEDIASTINAL COMPARTMENTS
HEART AND PERICARDIUM
LUNGS
TRACHEA
ESOPHAGUS
CONCLUSION

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Carlos S. Restrepo, MD - 2012 Honored Educator
Carlos S. Restrepo, MD - 2014 Honored Educator
Thoracic Manifestations of Genitourinary Malignancies: Patterns of Spread and Treatment-related Complications

All Day Location: CH Community, Learning Center

Participants
Justin Stowell, MD, Kansas City, MO (Presenter) Nothing to Disclose
Christopher Walker, MD, Kansas City, MO (Abstract Co-Author) Author, Reed Elsevier;
Melissa L. Rosado De Christenson, MD, Kansas City, MO (Abstract Co-Author) Author, Thieme Medical Publishers, Inc; Author, Reed Elsevier; Author, American Registry of Pathology; Author, Oxford University Press;
Carol C. Wu, MD, Houston, TX (Abstract Co-Author) Author, Reed Elsevier
Brett W. Carter, MD, Houston, TX (Abstract Co-Author) Author, Reed Elsevier; Consultant, St. Jude Medical, Inc;
Sonia L. Betancourt Cuellar, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Jeffrey R. Kunin, MD, Mission Hills, KS (Abstract Co-Author) Investigator, Oncimmune LLC

TEACHING POINTS
1. Genitourinary malignancies exhibit highly variable patterns of thoracic metastatic involvement according to cell type. 2. Lymphatic spread of prostate cancer most commonly manifests as mediastinal or supraclavicular lymphadenopathy; while hematogenous dissemination occurs via either “cava-type” to the viscera or via periprostatic and paraspinal veins to the spine. 3. Familiarity with patterns of thoracic metastases from genitourinary malignancies, allows the radiologist to better evaluate and stage these malignancies, and alert referring clinicians regarding associated unexpected disease- and treatment-related complications.

TABLE OF CONTENTS/OUTLINE
1. List genitourinary primary malignancies known to metastasize to the chest 2. Delineate common and uncommon patterns of metastatic spread
Renal: IVC and right atrium invasion, lymphangitic spread, indolent growth, vanishing bone/osteolysis
Adrenal: IVC and right atrium invasion, endobronchial and skeletal metastases
Urothelial: multiple/solitary nodules +/- cavitation, cardiac and mediastinal involvement
Prostate: lymphadenopathy; sclerotic bone, pleural and pulmonary metastases
Testicular: hemorrhagic metastases, mediastinal and intracardiac mass
3. Discuss various disease- and treatment-related intrathoracic complications

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Melissa L. Rosado De Christenson, MD - 2012 Honored Educator
Sonia L. Betancourt Cuellar, MD - 2014 Honored Educator
Brett W. Carter, MD - 2015 Honored Educator
Integration of Computer-assisted Detection into Lung Cancer Screening with Low-dose CT: Utility and Pitfalls

All Day Location: CH Community, Learning Center

Participants
Masayo Fujita, Hiroshima, Japan (Presenter) Nothing to Disclose
Toru Higaki, PhD, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Yuko Nakamura, MD, Bethesda, MD (Abstract Co-Author) Nothing to Disclose
Yoshikazu Awaya, MD, Miyoshi, Japan (Abstract Co-Author) Nothing to Disclose
Yukihiro Nomura, PhD, Bunkyo-Ku, Japan (Abstract Co-Author) Nothing to Disclose
Kazuo Awai, MD, Hiroshima, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Medical Advisor, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Nemoto-Kyourindo;

TEACHING POINTS
As large-volume image data are obtained in lung cancer screening (LCS) with low-dose CT (LDCT), the burden on radiologists interpreting the images is great and perceptual errors in detecting pulmonary nodules can occur. While double-readings by two radiologists are recommended to avoid this, limited human resources and cost considerations hamper double-readings. A solution for this issue is the use of computer-aided diagnosis (CAD) systems. Although they offer benefits such as, shorter reading times, and reduced costs for LCS, the inappropriate use of CAD may lead to an increase in false-positive results. In this educational exhibit we discuss the utility and pitfalls of using CAD for LCS with LDCT.

TABLE OF CONTENTS/OUTLINE
1. Current issues in the interpretation of CT images for LCS by radiologists 1.1 Variability in the detection of pulmonary nodules among radiologists 1.2 Perceptual errors in the detection of pulmonary nodules due to reader fatigue 1.3 Limited human resources and cost-effectiveness of double readings by two radiologists 2. Current capability of CAD for detecting pulmonary nodules 3. Effect of CAD on the reading time of radiologists 4. Schema for image interpretation using CAD for CT-LCS 4.1 CAD as a second reader 4.2 CAD as a concurrent reader 4.3 CAD as a first reader 5. Cost effectiveness of CAD for CT-LCS
Evolving Radiation Therapies and Associated Radiation Induced Lung Disease (RILD): Radiologic Findings along a Time Continuum

All Day Location: CH Community, Learning Center

Awards
Certificate of Merit

Participants
Huy Q. Le, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Christopher Lee, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Scott J. Genshaft, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Fereidoun G. Abtin, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Kien Q. Vuu, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Stereotactic body radiation therapy (SBRT) is emerging as the preferred modality of treatment of various types of cancer over conventional radiation. Characteristic changes in the lung parenchyma have a histopathologic, clinical, and radiographic correlates along a time continuum after radiation treatment. Characteristic radiologic patterns and locations of RILD can be very specific to certain types of radiation treatment. Organizing pneumonia outside and beyond the boundaries of the radiation field have been reported after SBRT via a postulated autoimmune process. Understanding expected changes along a time continuum as well as their specific locations/patterns can help distinguish RILD from other lung pathology.

TABLE OF CONTENTS/OUTLINE
Spectrum of radiation therapies and the emergence of SBRT
Histopathologic, clinical presentations, and radiographic features along a time continuum of conventional and SBRT
Differential diagnosis of RILD
Characteristic locations and radiologic patterns of specific radiation therapies
Organizing pneumonia outside and beyond the boundaries of the radiation field after SBRT
Expected changes along a time continuum and specific locations/patterns of RILD
New ITMIG Classification of Mediastinal Compartments: Update and Approach to Mediastinal Masses

All Day Location: CH Community, Learning Center

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Brett W. Carter, MD, Houston, TX (Presenter) Author, Reed Elsevier; Consultant, St. Jude Medical, Inc; ;
Marcelo K. Benveniste, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Rachna Madan, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Myrna C. Godoy, MD, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Patricia M. de Groot, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Mylene T. Truong, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Melissa L. Rosado De Christenson, MD, Kansas City, MO (Abstract Co-Author) Author, Thieme Medical Publishers, Inc; Author, Reed Elsevier; Author, American Registry of Pathology; Author, Oxford University Press; ; ;
Edith M. Marom, MD, Ramat Gan, Israel (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Accurate localization of the origin of mediastinal lesions on cross-sectional imaging techniques such as CT is crucial to patient management. 2. Consensus regarding a standardized method for dividing the mediastinum into specific compartments based on CT imaging is necessary in order to appropriately describe mediastinal lesions and formulate relevant differential diagnoses. 3. Specific tools such as the "center method" and the "structure displacement tool" can be used to reliably localize mediastinal abnormalities to specific compartments. 4. Because of the increasing number of patients in whom a mediastinal abnormality is first discovered on CT, and because of its simplicity, this straightforward division can be adopted by physicians. ITMIG hopes that this system will improve tumor localization, help generate a focused differential diagnosis, and assist in tailoring biopsy and treatment plans.

TABLE OF CONTENTS/OUTLINE
1. Discuss the basis for and structure of the new ITMIG CT-based classification of mediastinal compartments. 2. Describe the use of two specific tools, the "center method" and "structure displacement tool," to localize mediastinal abnormalities to specific compartments. 3. Illustrate the specific compartments (prevascular, visceral, and paravertebral compartments) through representative examples on CT.

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Brett W. Carter, MD - 2015 Honored Educator
Mylene T. Truong, MD - 2015 Honored Educator
Edith M. Marom, MD - 2015 Honored Educator
Melissa L. Rosado De Christenson, MD - 2012 Honored Educator
Post Operative Esophageal Leaks and Mimics: Finding "The One" which Sinks the Ship

All Day Location: CH Community, Learning Center

Participants
Rachna Madan, MD, Boston, MA (Presenter) Nothing to Disclose
Breland Crudup, BS, Boston, MA (Abstract Co-Author) Nothing to Disclose
Santosh K. Selvarajan, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Jon Wee, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Brett W. Carter, MD, Houston, TX (Abstract Co-Author) Author, Reed Elsevier; Consultant, St. Jude Medical, Inc;

TEACHING POINTS
1. Esophageal leaks may rapidly lead to mediastinal and pleural/peritoneal contamination and life threatening sepsis. These are associated with high morbidity and mortality and hence early diagnosis of leak and assessment of extent of mediastinal/pleural contamination is the primary goal of cross sectional imaging. 2. In some cases, esophageal leaks may lead to development of life threatening fistulous connections such as aorto-esophageal and esophageopercardial fistulas. 3. While detection of an early leak may be life saving, not all air and/or contrast filled outpourings represent leaks, and may instead represent a normal postoperative appearance or a herniated viscus.

TABLE OF CONTENTS/OUTLINE
1. Review select scenarios where post operative appearances which may mimic esophageal leaks and emphasize awareness of these findings to prevent unwarranted surgery and interventions. 2. Discuss institutional protocols to detect esophageal leaks in complex postoperative cases, including biphasic imaging following oral and intravenous contrast, and extended field of view imaging to cover lower neck and upper abdomen to cover potential sites of leak. 3. Highlight interdisciplinary management of esophageal leaks.

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Brett W. Carter, MD - 2015 Honored Educator
How Imaging and Image-guided Procedures are Changing the Landscape of Minimally Invasive Surgical and Nonsurgical Management of Lung Cancer?

All Day Location: CH Community, Learning Center

Participants
Subramanian Subramanian, MD, Milwaukee, WI (Presenter) Nothing to Disclose
Kaushik S. Shahir, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose
Lawrence R. Goodman, MD, Milwaukee, WI (Abstract Co-Author) Author, Reed Elsevier
Elizabeth M. Gore, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose
Rahul N. Sawlani, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose
Sean M. Tutton, MD, Milwaukee, WI (Abstract Co-Author) Consultant, Benvenue Medical, Inc
Dhiraj Baruah, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Advances in thoracic imaging and procedures improve diagnosis of lung cancer.
2. This also helps guiding minimally invasive surgeries, focused radiotherapy and guided interventions.

TABLE OF CONTENTS/OUTLINE
1. Aims - a. To discuss advances in thoracic imaging techniques with relevance to thoracic oncology. b. To highlight the role of image guided preoperative nodule localization for minimally invasive surgery, radiotherapy and interventional procedures. c. To briefly review the role of imaging in design of new clinical trials, genomics and a glimpse into the future.
4. Morphological assessment using conventional CT remains the workhorse of lung cancer detection and diagnosis. However, advanced thoracic imaging and guided procedures have now become a vital component in diagnosis, treatment planning, and monitoring of treatment response as well as patient prognosis.
When to Alert the Physician on Post Esophagectomy Chest Radiographs?

All Day Location: CH Community, Learning Center

Participants
Santosh K. Selvarajan, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Rashmi Balasubramanya, MD, Darby, PA (Abstract Co-Author) Nothing to Disclose
Babitha Asha, MBBS, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Rachna Madan, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Beatrice Trotman-Dickenson, FRCP, MRCP, Boston, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Describe a method to evaluate the postoperative radiographs and formulate a differential diagnoses. Emphasis when and what findings should be evaluated further.

TABLE OF CONTENTS/OUTLINE
Discuss differential diagnoses by case based approach Subcutaneous emphysema Air leak from a pleural injury sustained during the operation. Such an air leak is not necessarily of grave significance. Worsening or new subcutaneous emphysema may represent leak of the esophageal anastomosis, displaced chest tube with side holes outside pleural space. Pneumomediastinum Esophageal rupture
Extension of pneumothorax Displaced drainage catheter Pneumopericardium Complication of pneumothorax Gastropericardial fistula Pyopneumopericardium Hazy opacification Fluid overload Acute lung injury ARDS Layering fluid/blood/chyle New consolidation Atelectasis Aspiration Pneumonia ARDS Hemorrhage Contusion Infarct Abnormal opacity Foreign body Clips spong Mediastinal widening what is satisfactory post-operative widening Gastric pull through Hematoma Abscess Collection Herniation of infra-diaphragmatic contents Lymphocole Vascular injuries New pleural effusion Chyle Fluid Hemorrhage Collection Fistula Metastases Tubes, lines and drainage catheters
Challenges in Interpretation of Staging PET/CT in Thoracic Malignancies

All Day Location: CH Community, Learning Center

Awards
Certificate of Merit

Participants
Girish S. Shroff, MD, Houston, TX (Presenter) Nothing to Disclose
Brett W. Carter, MD, Houston, TX (Abstract Co-Author) Author, Reed Elsevier; Consultant, St. Jude Medical, Inc;
Chitra Viswanathan, MD, Houston, TX (Abstract Co-Author) Consultant, Hollister Incorporated
Edith M. Marom, MD, Ramat Gan, Israel (Abstract Co-Author) Nothing to Disclose
Carol C. Wu, MD, Houston, TX (Abstract Co-Author) Author, Reed Elsevier
Mylene T. Truong, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. To discuss specific technical artifacts and quantitative errors in SUV measurements associated with the use of CT for attenuation correction of PET in integrated PET/CT imaging.
2. To review potential pitfalls in the interpretation of PET/CT in thoracic malignancies including normal variations in physiologic uptake of FDG, benign conditions such as infection and inflammation that can result in increased radiotracer uptake, and malignancies that demonstrate little to no FDG uptake.

TABLE OF CONTENTS/OUTLINE

1. Technical artifacts
   - High attenuation material on CT (metal, intravenous and oral contrast)
   - Truncation artifact (differences in field of view between PET and CT)
   - Respiratory artifact (misregistration due to acquisition of PET at quiet tidal breathing and CT at breathhold)

2. Physiologic Uptake
   - Striated muscle
   - Thymus
   - Brown fat

3. False Positive Findings
   - Infection (Tuberculosis, bacterial and fungal infections)
   - Inflammation (Sarcoidosis, Granulomatosis and Polyangiitis)
   - Iatrogenic (Chemotherapy, Radiation therapy, Invasive procedures)

4. PET Negative Malignancies
   - Small lung nodules below PET resolution
   - Lung Adenocarcinoma and precursors
   - Carcinoid

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Brett W. Carter, MD - 2015 Honored Educator
Edith M. Marom, MD - 2015 Honored Educator
Mylene T. Truong, MD - 2015 Honored Educator
Pulmonary Emphysema: A New Look at an Old Disease

All Day Location: CH Community, Learning Center

Participants
Carmen M. Botia I, MD, Murcia, Spain (Presenter) Nothing to Disclose
Begona Marquez Argente del Castillo, MD, Murcia, Spain (Abstract Co-Author) Nothing to Disclose
Elizabeth Nunez Peynado, MD, Murcia, Spain (Abstract Co-Author) Nothing to Disclose
Remedios Rodriguez Mondejar, MD, Murcia, Spain (Abstract Co-Author) Nothing to Disclose
Marta Tovar Perez, MD, Murcia, Spain (Abstract Co-Author) Nothing to Disclose
Jose Maria Garcia Santos, MD, PhD, Murcia, Spain (Abstract Co-Author) Nothing to Disclose
Mario Martinez Lopez, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Grady W. Miller, PhD, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose
Lucia Flors, MD, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose
Tallisa Altes, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose
Jose A. Cejudo Podio, MENG, Murcia, Spain (Abstract Co-Author) CEO, Medical Data System SL

TEACHING POINTS
1. To review the different imaging techniques used to study emphysema over time
2. To review the different morphologic subtypes of emphysema and correlate their imaging findings with pathology
3. To illustrate the potential advantages of new emerging imaging approaches

TABLE OF CONTENTS/OUTLINE
1. Emphysema in the past: - Chest X-ray: classic signs and limitations are described. Only valuable to depict moderate/severe disease and to assess associated comorbidities.- Sequential high-resolution CT: Increased sensitivity and specificity, allowing diagnosis on early stage and detecting complications more accurately. Morphologic subtypes with radiopathological correlation are illustrated.
2. Emphysema at present:- Multidetector CT: allows for postprocessing techniques. High accuracy in assessing emphysema qualitative and quantitatively; paramount in pre- and post-treatment evaluation of lung volume reduction surgery and bronchoscopic treatments.
3. Emphysema in the future: a) Proton and hyperpolarized gas magnetic imaging resonance. Promising technique since they provide functional and morphological information without ionizing radiation. b) Automated volumetric assessment: It allows standardized, automatic and highly reproducible quantitative measurements, key in clinical trials.
MDCT evaluation of airway neoplasms plays an important role in assessing cause and degree of airway compromise and informs management decisions. Several current interventional endobronchial procedures exist for curative intent or palliation of airway tumors. Current surgical procedures for curative intent include sleeve lobectomy and tracheal reconstruction. The radiologist must be conversant with both normal post-procedural imaging appearance and the findings of complications of airway interventions.

**TABLE OF CONTENTS/OUTLINE**

- Imaging features of airway neoplasms amenable to treatment for curative intent and those that preclude it
- Minimally invasive interventional procedures for curative intent
- Cryotherapy
- Laser ablation (YAP, YAG)
- Electrocauterization
- Brachytherapy
- Surgical procedures for curative intent
  - Sleeve lobectomy
  - Tracheal resection and reconstruction
- Palliation of nonsurgical candidates
  - Alone or in combination: Cryotherapy, laser ablation, electrocautery, brachytherapy, endobronchial mechanical debulking, dilatation and stent placement
  - Stents: measurement for sizing and normal appearance
  - Stent complications
    - Infection
    - Hemorrhage
    - Stent migration
    - Granulation tissue formation
    - Tumor overgrowth
    - Stent fracture

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Brett W. Carter, MD - 2015 Honored Educator
Recognizing the Many Faces of Radiation Induced Lung Disease: Pearls and Pitfalls of Radiologic Assessment after Treatment of Thoracic Malignancies

All Day Location: CH Community, Learning Center

Participants
Shanna Matalon, MD, Boston, MA (Presenter) Nothing to Disclose
Matthew J. Abrams, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Harvey Mamon, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Michael H. Rosenthal, MD, PhD, Boston, MA (Abstract Co-Author) Equipment support, Toshiba Corporation

TEACHING POINTS
1. The expected radiographic appearance of radiation-induced lung disease (RILD) is changing with new radiation delivery techniques, including 3-D conformal radiotherapy, IMRT, SBRT, proton therapy and tomotherapy. The differential diagnosis of a new lung opacity after radiation therapy includes RILD, infectious or drug-induced pneumonitis, local recurrence, and lymphangitic spread. The radiologist must be able to recognize and differentiate among these. 3. The appearance of RILD varies based on several factors such as total dose, fractionation, comorbid conditions, as well as timing since treatment completion

TABLE OF CONTENTS/OUTLINE
1. Review with visual depiction of modern radiation therapy techniques, including 3D conformal radiotherapy, IMRT, SBRT, proton beam therapy, and tomotherapy. 2. Case examples of the uses of radiotherapy with associated techniques and dosimetry maps 3. Timeline and imaging features of tumor response to radiotherapy as well as non-tumor parenchymal changes after radiotherapy, from early pneumonitis to fibrosis. 4. Review of challenging cases for the radiologist a. Ground glass halo: early tumor growth or radiation pneumonitis? b. Assessing for recurrent tumor within a field of consolidation and fibrosis, including role of FDG-PET c. XRT vs drug-associated pneumonitis
Mesothelioma: Diagnosis, Staging, Follow-up and Pitfalls

All Day Location: CH Community, Learning Center

Participating Authors
Marcelo K. Benveniste, MD, Houston, TX (Presenter) Nothing to Disclose
Edith M. Marom, MD, Ramat Gan, Israel (Abstract Co-Author) Nothing to Disclose
Girish S. Shroff, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Carol C. Wu, MD, Houston, TX (Abstract Co-Author) Author, Reed Elsevier
Ana Paula Benveniste, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Mylene T. Truong, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1- Malignant Pleural Mesothelioma (MPM) is an uncommon tumor although accounts for 5-28% of all malignancies that involve the pleura.
2- Imaging evaluation is essential in diagnosis, staging and assessment of treatment response in MPM and computed tomography is the most commonly used modality for tumor staging.
3- Assessment of tumor extension and lymph node involvement is essential in imaging evaluation as locally advanced tumors are amenable to resection.
4- Follow-up CT scans are used for treatment response assessment, for which accurate measurement is essential. However, for mesothelioma, these measurements are complex and controversial. Volumetric measurements are under investigation.

TABLE OF CONTENTS/OUTLINE

To describe and illustrate staging limitations of MPM and review imaging pitfalls in diagnosis and staging. To review appropriate use of different imaging modalities including CT, MRI, PET-CT and invasive procedures including thoracoscopic evaluation. To discuss guidelines for tumor measurement and follow up after treatment.

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Edith M. Marom, MD - 2015 Honored Educator
Mylene T. Truong, MD - 2015 Honored Educator
Doppelgangers of Acute Pulmonary Embolism

All Day Location: CH Community, Learning Center

Participants
Sidra J. Tayyab, MD, Houston, TX (Presenter) Nothing to Disclose
Emma C. Ferguson, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Sandra A. Oldham, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Carlos S. Restrepo, MD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose
Daniel Vargas, MD, Aurora, CO (Abstract Co-Author) Nothing to Disclose
Ameya J. Baxi, MBBS, DMRD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose
Arun C. Nachiappan, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Girish S. Shroff, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Demetrius L. Dicks, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Daniel Ocacionez, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. As a leading cause of morbidity and mortality worldwide, acute pulmonary embolism is a critical diagnosis to make accurately and in a timely manner. The gold standard for diagnosis is computed tomography pulmonary angiography (CTPA).
2. Several distinct anatomic, pathologic and artifactual findings can mimic acute pulmonary embolism, such as calcified and non-calcified lymphadenopathy, atrial appendage clot, fluid in a pericardial recess, endobronchial mucus, collateral vessels, primary or secondary tumors of the pulmonary arteries and quantum mottle artifact. Recognition of these mimickers is critical to appropriate triage and management. Inaccurate diagnosis of acute pulmonary embolism can initiate inappropriate treatment, such as anticoagulation. It is crucial to be aware of these mimics in order to optimize daily patient care.

TABLE OF CONTENTS/OUTLINE

1. Introduction
2. Anatomic mimickers: review imaging findings of anatomic mimickers such as calcified and non-calcified lymph nodes, collateral vessels, and fluid in pericardial recess
3. Pathologic mimickers: review pathologic entities such as primary and secondary pulmonary artery masses, endobronchial mucus, aspiration, and left atrial appendage clot
4. Artifactual mimickers: discuss artifacts such as quantum mottle, beam hardening, and volume averaging
5. Conclusion

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Carlos S. Restrepo, MD - 2012 Honored Educator
Carlos S. Restrepo, MD - 2014 Honored Educator
Radiologic Findings of Pleural Tumors and Tumor-like Lesions

All Day Location: CH Community, Learning Center

Participants
Takahiko Nakazono, MD, PhD, Saga, Japan (Presenter) Nothing to Disclose
Ken Yamaguchi, MD, Saga, Japan (Abstract Co-Author) Nothing to Disclose
Ryoko Egashira, MD, Saga, Japan (Abstract Co-Author) Nothing to Disclose
Yukari Takase, Saga, Japan (Abstract Co-Author) Nothing to Disclose
Masanobu Mizuguchi, MD, Saga City, Japan (Abstract Co-Author) Nothing to Disclose
Hiroyuki Irie, MD, PhD, Saga, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purposes of this exhibit are to: review the anatomy of pleura and pleural cavity. review the clinical, pathologic, and radiologic features of pleural tumors and tumor-like lesions. describe differential diagnosis and clinical management of pleural lesions.

TABLE OF CONTENTS/OUTLINE
Normal anatomy of the pleura and pleural cavity Clinical, pathologic, and radiologic features of pleural tumors and tumor-like lesions
Solitary fibrous tumor Pleural plaque and mesothelioma Pleural metastasis and dissemination Miscellaneous pleural tumors: lipoma, liposarcoma and other sarcomas, etc. Pleural lesions associated with pyothorax: chronic expanding hematoma, malignant lymphoma and other malignant tumors associated with chronic pyothorax Other pleural lesions: splenosis, catamenial hemopneumothorax, etc. Differential diagnosis and clinical management of pleural lesions
Essentials of Lung Cancer Screening with Low-dose CT

All Day Location: CH Community, Learning Center

Participants
Tan B. Nguyen, MD, Orange, CA (Presenter) Nothing to Disclose
Carol C. Wu, MD, Houston, TX (Abstract Co-Author) Author, Reed Elsevier
Mayil S. Krishnam, MBBS, MRCP, Orange, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: To review the outcomes of major lung cancer screening trials and evaluate benefits and risks of screening To discuss low-dose CT scanning techniques and understand strategies for dose reduction To learn current screening guidelines, recommendations, and reporting and management standards

TABLE OF CONTENTS/OUTLINE
Epidemiology and pathophysiology of lung cancer Outcomes of National Lung Screening Trial (NLST) Reduction in lung cancer mortality with low-dose CT screening Concerns regarding false positives, incidental findings, over-diagnosis, radiation exposure, and cost effectiveness Low-dose CT screening techniques Scanning parameters and protocol standards Basics of dose determination and calculation Dose reduction strategies, including discussion of: Scan length Tube current modulation Decreased tube potential Iterative reconstruction Desired CTDI volume and mean effective dose for patients with various body habitus Screening guidelines and recommendations Summary of key society guidelines U.S. Preventive Services Task Force (USPSTF) recommendations Centers for Medicare and Medicaid Services (CMS) coverage Lung-RADS structured reporting and management Implementation and quality assurance including for community facilities
Preoperative 3DCT as an Optimal Imaging Method for Pulmonary Segmentectomy

All Day Location: CH Community, Learning Center

Awards
Certificate of Merit

Participants
Keishi Ogura, RT, PhD, Sapporo, Japan (Presenter) Nothing to Disclose
Atsushi Watanabe, MD, PhD, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Masahiro Miyajima, MD, PhD, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Taijirou Mishina, MD, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Masaki Abukawa, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Takeo Tanaka, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Kenta Yoshikawa, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Taiki Chono, RT, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Yoshihiro Akatsuka, RT, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Mitsuhiro Nakanishi, RT, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Masamitsu Hatakenaka, MD, PhD, Sapporo, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation

TEACHING POINTS
To demonstrate the necessity for preoperative 3DCT simulation prior to pulmonary segmentectomy. To present the advantages and disadvantages of this scanning method. To describe the methods of creating the necessary 3D fusion images for preoperative simulation using clinical data.

TABLE OF CONTENTS/OUTLINE
Necessities for 3DCT: Provision of required preoperative information for simulation. Automatic extraction of pulmonary vessels (artery, vein) and bronchial branches by workstation. Automatic indication of the resection line by workstation. Optimal Scan Conditions: Determine the optimal timing of scanning for pulmonary segmentectomy. Optimal technique for administration of iodinated contrast medium. Noise reduction using iterative reconstruction. Benefits of 3D images for preoperative simulation: Provides accurate anatomical variations of the pulmonary vessels and bronchial branches. Provides information on the location of tumors, vessels, and bronchial branches. Determines the segmental resection line for pulmonary segmentectomy. A 3DCT image enables provision of advanced information such as the precise anatomy of vessels and bronchial branches and determination of segmental resection line, thus leading to safe performance of pulmonary segmentectomy and avoidance of postoperative complications.
Role of CT Findings as a Biomarker for Lung Adenocarcinoma

All Day Location: CH Community, Learning Center

Participants
Takatoshi Aoki, MD, PhD, Kitakyushu, Japan (Presenter) Nothing to Disclose
Masami Fujii, MD, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose
Michiko Kobayashi, MD, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose
Masanori Hisaoka, MD, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose
Shunsuke Kinoshita, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose
Yukunori Korogi, MD, PhD, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose
Yoshiko Hayashida, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Fumihiro Tanaka, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To recognize the clinical significance of CT findings in the management of lung adenocarcinoma.
2. To correlate CT findings with molecular biomarkers of lung adenocarcinoma.
3. To understand the relationship between CT findings and new IASLC/ATS/ERS lung adenocarcinoma classification.

TABLE OF CONTENTS/OUTLINE
1. Introduction (including etiology and brief review of new IASLC/ATS/ERS lung adenocarcinoma classification)
2. Correlation between CT findings and new IASLC/ATS/ERS classification
3. Correlation between CT findings and histological prognostic factor (lymph node metastasis, vessel invasion)
4. Correlation between CT findings and survival
5. Correlation between CT findings and growth
6. Correlation between CT findings and molecular investigations (e.g., EGFR, ALK, p53)
7. Differential diagnostic and therapeutic approach based on CT
8. Summary of the role of CT findings for the management of lung adenocarcinoma

An awareness of the spectrum of CT findings for lung adenocarcinomas, along with their pathologic/molecular findings and natural progression on CT, can lead to proper patient management. We appreciate the role of CT findings for lung adenocarcinoma management and discuss an appropriate strategy based on the CT findings.
TEACHING POINTS

Signs on chest radiographs generally suggest a specific diagnosis. The aim of this presentation is to use CT reformatted images to further the reader's understanding of why these signs produce these specific appearances. The sign and its association with the particular clinical entity will be emphasized. By presenting the accompanying CT reformatted images, the appearance of the sign on radiography will be reinforced, thus improving the reader's diagnostic ability.

TABLE OF CONTENTS/OUTLINE

| Introduction | Many diverse clinical conditions produce classic changes on chest radiographs, often referred to as 'signs.' This case-based presentation will serve as a refresher for all radiologists and provide a review of basic chest radiology for residents. |
| Cases | The majority of the presentation will follow a quiz-based format where the learner will be prompted initially with a multiple-choice question, which will be followed by the answer, the radiographic findings, and a teaching point. CT reformatted images showing the sign will be presented in each case. Signs to be reviewed include: Finger-in-glove, Deep sulcus, Hilum overlay and hilum convergence, Luftsichel, Cervico-thoracic, Hampton's hump, Ring around the artery, Golden S, Air crescent, Flat waist, Juxtaphrenic peak, Westermark, Scimitar, Continuous diaphragm, Water bottle, Oreo cookie, Fallen lung, Donut |
Radiologic Evaluation of Lung Transplant Rejection

All Day Location: CH Community, Learning Center

Participants
Jennifer Joyce, DO, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Rahul D. Renapurkar, MD, Cleveland, OH (Presenter) Nothing to Disclose
Joseph T. Azok, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Ruchi Yadav, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Sanjay Mukhopadhyay, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Charles Lane, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Narinder S. Paul, MD, Richmond Hill, ON (Abstract Co-Author) Research Grant, Toshiba Corporation; Research Grant, Carestream Health, Inc

TEACHING POINTS

With this exhibit, the reader can: 1) know the various types of rejection and newer classification of chronic lung allograft dysfunction (CLAD). 2) understand the pathologic findings in rejection and how these findings correlate with CT. 3) understand the role of imaging, particularly computed tomography (CT), in assessment of lung transplant rejection.

TABLE OF CONTENTS/OUTLINE

Timeline of lung rejection
Types of lung transplant rejection
1) Primary graft dysfunction—Pathophysiology—Role of imaging—Pathologic findings—Differential diagnosis
2) Acute rejection—Subtypes—Role of imaging—Grading of acute rejection based on histopathologic changes on transbronchial biopsy—Differential diagnosis
3) CLAD—Newer classification of CLAD: Bronchiolitis obliterans and Restrictive allograft syndrome—Role of imaging
a) Chest Radiography
b) CT—Protocol and value of expiratory phase imaging—Differential diagnosis
- CT based grading of CLAD in concordance with pulmonary function tests and pathology—Role of transbronchial biopsy—Differential diagnosis
Future directions—Potential role of Quantitative CT and MRI (T1 mapping)
Awards
Magna Cum Laude

Participants
Hsiang-Jer Tseng, MA, MD, Atlanta, GA (Presenter) Recipient of RSNA medical student research grant in 2012.
Travis S. Henry, MD, San Francisco, CA (Abstract Co-Author) Spouse, Medical Director, F. Hoffmann-La Roche Ltd
Srihari Veeraraghavan, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Brent Little, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Many pulmonary parenchymal and vascular diseases have characteristic patterns of findings at pulmonary function testing. The learner will review normal PFT results through a brief animated explanation of spirometry and diffusing capacity measurement. The learner will then identify the common patterns of abnormal PFT results of a variety of important thoracic diseases.

TABLE OF CONTENTS/OUTLINE
1. Basics of pulmonary function testing-spirometry (animation)-diffusing capacity (animation)-flow/volume loops
2. Common PFT abnormalities and imaging examples: A. Obstructive pattern (COPD, asthma); B. Restrictive pattern (fibrosis); C. Mixed pattern (combined pulmonary fibrosis emphysema); D. Pulmonary vascular pattern (pulmonary hypertension); E. Neuromuscular pattern (muscular dystrophy)
3. Challenging cases with PFT/imaging correlation-bronchiolitis obliterans-lymphangioleiomyomatosis (LAM) - diffuse idiopathic pulmonary neuroendocrine cell hyperplasia (DIPNECH) - allergic bronchopulmonary aspergillosis (ABPA) - sarcoidosis with mixed pattern of obstruction/restriction-chronic pulmonary embolism
Practical Cardiovascular Metrics: Maximizing Value of Non-Gated Chest CT Reports

Participants
Abigail V. Berniker, MD, Darby, PA (Presenter) Nothing to Disclose
Oleg Teytelboym, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Several important cardiovascular metrics can be assessed on non-gated chest CT studies, yet radiologists often under-report these parameters. Radiologists can give referring clinicians valuable information and trigger vital management algorithms by reporting basic cardiovascular quantification on non-gated chest CT exams.

TABLE OF CONTENTS/OUTLINE

Goals
This exhibit aims to: Discuss the importance of assessing great vessel and cardiac metrics on non-gated chest CT studies Emphasize how practical cardiovascular quantification makes chest CT reports more valuable to cardiologists and cardiothoracic surgeons Highlight the potential impact of these measurements on clinical management

Key metrics with case examples, measuring techniques, and structured reporting suggestions

Great vessels - Thoracic aorta - Main pulmonary artery Heart - Chamber size - Aortic valve calcification - Coronary artery calcification Management implications Cardiology or cardiothoracic surgeon consultation Risk factor modification Echocardiography Surveillance imaging

Summary: Radiologists can add value to chest CT reports by assessing practical cardiovascular parameters routinely and providing these key metrics to referring clinicians.
Surgical Approach to Pulmonary Nodules/Masses; What the Radiologist Should Know?

All Day Location: CH Community, Learning Center

Participants
Hamid Chalian, MD, Cleveland, OH (Presenter) Nothing to Disclose
Majid Chalian, MD, Cleveland Heights, OH (Abstract Co-Author) Nothing to Disclose
Bahar Mansoori, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Philip A. Linden, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Luis A. Landeras, MD, Cleveland, OH (Abstract Co-Author) Institutional Grant support, Koninklijke Philips NV

TEACHING POINTS
Review important radiographic features of a pulmonary nodule/mass in the setting of preoperative planning. Understand the most common surgical approaches to lung surgery. Identify normal and abnormal postsurgical changes (complications) by time elapsed after surgery.

TABLE OF CONTENTS/OUTLINE
Pre-Test Cases 1, 2 and 3
Guidelines for the surgical management of lung cancer
Surgical techniques: Open surgery Video-assisted thoracoscopic surgery (VATS)
Postoperative lung normal findings: Types of lung resection Non-anatomical Wedge resection Anatomical Segmentectomy Sleeve lobectomy Lobectomy Pneumonectomy Complications after surgical resection Post-Test Cases 1, 2, 3
Pleural Fistulas: When There's Nowhere Else to Go

All Day Location: CH Community, Learning Center

Participants
Aman Khurana, MD, San Diego, CA (Presenter) Nothing to Disclose
Andrew C. Yen, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Sharon S. Brouha, MD, MPH, San Diego, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Pleural space being a potential space is involved in various fistulas from neighboring tissues like esophagus, cerebrospinal fluid (CSF), bronchi, gallbladder or pancreas. A high level of suspicion is required to diagnose these potential communications, but a dedicated search for fistulous communication facilitates the diagnosis. Thoracentesis can often confirm the diagnosis suggested by imaging if needed. Through a case series, we present the salient imaging findings in the diagnosis of pleural fistulas. Our aim is to make radiologists aware of these rather uncommon communications to help them arrive at a correct diagnosis when faced with the appropriate imaging findings.

TABLE OF CONTENTS/OUTLINE
Anatomy—Parietal and visceral pleura—Bronchial anatomy—Pleura and esophagus Pleural fistulas and salient imaging findings—Bronchopleural—Extraluminal gas adjacent to the bronchial stump—The "Uncommon" fistulas—Esophageal-pleural—Oral contrast within pleural space—Thickening of esophageal wall—Pancreatico-pleural—MRCP shows a high signal connection between pancreatic pseudocyst and pleural space—Cerebrospinal fluid-pleural—Intracranial hypotension and recurrent effusions—Biliopleural fistulas—Pleural effusion with pneumonic consolidation and signs of biliary obstruction/perforation
Lung Perfusion Blood Volume (Lung PBV) Image of Pulmonary Infarction (PI) on Various Stages

All Day Location: CH Community, Learning Center

Participants
Hirofumi Koike, Nagasaki, Japan (Presenter) Nothing to Disclose
Eijyun Sueyoshi, Nagasaki, Japan (Abstract Co-Author) Nothing to Disclose
Ichiro Sakamoto, Nagasaki, Japan (Abstract Co-Author) Nothing to Disclose
Masataka Uetani, MD, Nagasaki, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
2. Purpose or Aim of the exhibit
The purpose of this exhibit is: 1. To present lung perfusion blood volume (lung PBV) image in patients with pulmonary infarction (PI) on various stages. 2. To understand mechanism of lung PBV imaging. 3. To present the lung PBV image findings in patients with PI on early phase and delay phase. 4. To understand the differences of pulmonary perfusion in patients with PI on various stages. 5. To know clinical feasibility of lung PBV image in patients with PI on various stages.

TABLE OF CONTENTS/OUTLINE
3. Content Organization: 1. Mechanism of lung PBV CT imaging. 2. Illustrative cases. Review of lung PBV image in patients with PI on various stages. 4. Discussion. 5. Summary. Conclusion with major teaching points to be emphasized. The major teaching points of this exhibit are: 1. Knowledge of lung PBV image in patients with PI on various images. 2. Understanding the mechanism and clinical meaning of lung PBV CT imaging. 3. Knowledge of clinical feasibility of lung PBV image in patients with PI on various images. 4. Knowledge of the meaning of the differences of pulmonary perfusion in patients with PI on various stages.
Something Noticed in Pulmonary Artery!: From Pathophysiology to Radiologic Findings of Pulmonary Embolism

All Day Location: CH Community, Learning Center

Participants
Sung-Joon Park, MD, Ansan, Korea, Republic Of (Presenter) Nothing to Disclose
Ji Yung Choo, MD, PhD, Ansan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ki Yeol Lee, MD, PhD, Ansan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eun-Young Kang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yu-Whan Oh, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hwan Seok Yong, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sung Ho Hwang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eun-Young Kang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Soo Y. Ham, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To understand the pathophysiology of various types of pulmonary embolism.
2. To review images of the various types of nonthrombotic pulmonary embolism.

TABLE OF CONTENTS/OUTLINE
Our exhibit will be divided into 3 sections with 1. Pathophysiology of embolism A. Traveling routes of embolic material B. Pathologic process of embolism in the pulmonary vessels and lungs 2. Thrombotic pulmonary embolism 3. Non thrombotic pulmonary embolism A. Iatrogenic pulmonary embolism 1) vertebroplasty related cement embolism 2) chemoembolization associated Lipiodol embolism 3) catheter, acupuncture needle, radioactive seed embolism 4) cosmetic injection material: hyaluronic acid / fat/ silicon 5) air embolism B. Trauma-related fat embolism C. Septic pulmonary embolism D. Tumor embolism
Participants
Hiroshi Moriya, MD, Fukushima, Japan (Presenter) Nothing to Disclose
Manabu Nakagawa, MD, Miyagigun, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To explain the clinical utility of a computer-assisted detection system (CAD) for lung cancer screening using ultra-low dose CT. 1. To show the false-positive CT findings in CAD system. 2. To show the false-negative nodules in CAD system.

TABLE OF CONTENTS/OUTLINE
[Materials and Methods] Cases with post-operative status of digestive organ cancer or breast cancer. CT scanner: Aquilion ONE, plain chest scan, conventional dose, FC17/FC13. Cases of lung cancer screening, ultra-low dose scan. Computer-assisted lung nodule detection system: Xelis lung (effective diameter: 1mm). Radiologist-detected nodules and CAD-detected nodules were compared. [Results] 995 nodules (diameter >3mm: 536, 3mm-<459) of 43 cases were evaluated. When limited to the size of 5-10mm, sensitivity was 89%, and positive predictive value was 85%. To show the false-positive CT findings and the false-negative nodules in CAD system. [Conclusion] CAD detected a large number of nodules less than 3 mm. As a result, there was an increase in false positives. And, there were some large nodules in false negative of CAD, however, there was no oversight of the radiologists. Detection algorithm is quite different from the thinking patterns of radiologists, CAD can be used as a supportive system for pulmonary nodule screening.
Participants
Ignacio Rossi, Buenos Aires, Argentina (Presenter) Nothing to Disclose
Santiago E. Rossi, MD, Capital Federal, Argentina (Abstract Co-Author) Advisory Board, Koninklijke Philips NV Speaker, Pfizer Inc Royalties, Springer Science+Business Media Deutschland GmbH
Alejandro M. Boero, MD, Capital Federal, Argentina (Abstract Co-Author) Nothing to Disclose
Cylen Javidan-Nejad, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Paola Orausclio, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Fernando R. Gutierrez, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review common incidental thoracic spine findings that can represent a diagnostic dilemma when interpreting chest computed tomographic studies. Recommend other studies when clinically relevant.

TABLE OF CONTENTS/OUTLINE
Introduction and clinical significance when concomitant spine findings are encountered. Provide a list of the most frequent etiologies and review their CT characteristics: Degenerative changes Degenerative endplate changes Bone islands versus metastatasis Infections Discitis Osteomyelitis Abscess, paraspinal Trauma Anterior Compression fractures Burst fractures Pathologic fractures due to tumor Old, healed fractures Tumors Lymphoma Leukemia Multiple Myeloma Osteoblastoma Osteoid Osteoma Tumor mimics like normal fatty marrow variants Congenital and genetic disorders Butterfly vertebra Arthritis Ankylosing Spondylitis Diffuse Idiopathic Skeletal Hyperostosis (DISH) Vascular lesions Hemangiomas Metabolic bone diseases Osteoporosis Renal osteodystrophy
Update of the proper nomenclature and significance of these different entities in daily practice.

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Santiago E. Rossi, MD - 2015 Honored Educator
Awards
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Participants
Mariko Okura, MD, Tokyo, Japan (Presenter) Nothing to Disclose
Masaki Matsusako, MD, PhD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Ryo Miyazawa, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Midori Enokido, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Naoki Wakabayashi, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Yuji Yaguchi, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Yasuyuki Kurihara, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To learn the pathogenesis of the antibodies that contribute to the lung disease. To review clinical and radiologic features of each lung disease.

TABLE OF CONTENTS/OUTLINE
I. Illustration of the pathological features of the antibodies which contribute to each lung disease. II. Clinical and radiologic features of each of these antibodies. 1. Antibodies that directly damage the lung. i) Anti basement membrane antibody : Goodpasture's disease ii) Anti GM-CSF antibody : Pulmonary alveolar proteinosis iii) PR3-ANCA : Granulomatosis with polyangiitis (GPA) iv) MPO-ANCA : Eosinophilic granulomatosis with polyangiitis (EGPA), Microscopic polyangiitis (MPA) 2. Autoimmune collagenous diseases with specific antibodies. i) Anti aminoacyl-tRNA synthetases antibody (ARS) : Dermatomyositis ii) CADM-140 (MDA5) : Dermatomyositis iii) Anti topoisomerase antibody : Systemic sclerosis 3. Miscellaneous i) IgG4 : IgG4 related lung disease ii) Anti phospholipid antibody : Pulmonary antibody iii) Light chain deposition disease : Amyloidosis iv) Agammaglobulinemia : Good's syndrome, Bruton type v) Hypergammaglobulinemia : Multicentric Castleman disease
Teaching Points

1. Traumatic thoracic lesions are common on the trauma setting and non-aortic vascular lesions may be underdiagnosed in the initial exam.
2. To review traumatic non-aortic vascular lesions on chest CT.
3. To show ancillary diagnostic findings.

Table of Contents/Outline

1. Thoracic trauma relevance
2. Definition and importance of traumatic thoracic vascular lesions
3. Causes and mechanisms of traumatic thoracic vascular lesions
4. Examples of lesions including injury to the internal thoracic artery, traumatic pseudoaneurism of intercostal artery, injury to subclavian vessels, iatrogenic lesion of superior vena cava, traumatic pulmonary artery pseudoaneurism and bullet embolization.
5. Additional findings that can help in the diagnosis.
Percutaneous Drainage of Thoracic Fluid Collections: What Radiologists Need to Know

All Day Location: CH Community, Learning Center

Awards
Certificate of Merit

Participants
Ivan Vollmer, MD, Barcelona, Spain (Presenter) Nothing to Disclose
Mariana N. Benegas Urteaga, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Angel Gayete Cara, MD, PhD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Rosario J. Perea, MD, PhD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Teresa Maria Caralt, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Marcelo Antonio Sanchez Gonzalez, MD, Barcelona, Spain (Abstract Co-Author) Research Grant, F. Hoffmann-La Roche Ltd

TEACHING POINTS

1. To learn the imaging features of thoracic fluid collections.
2. To learn when and how to drain a thoracic fluid collection.
3. To understand patient management.

TABLE OF CONTENTS/OUTLINE

Drainage of thoracic fluid collections is a relative emergency. We will review the different thoracic fluid collections that can be drained by radiologists: pleural (parapneumonic, empyema, and malignant effusions), mediastinal, pulmonary (lung abscesses and infected tumours) and pericardial effusions. We will answer the following questions about the main thoracic fluid collections: how to diagnose, when and how to drain, which guidance (ultrasound or CT-fluoroscopy), and procedures to perform before and after the drainage. The choice of imaging to detect thoracic fluid collections and guide drainage depends on the availability of the modalities, the imaging characteristics, location of the collection, and the comfort and expertise of the operator with the specific modalities. We will also review the main complications of percutaneous drainage of thoracic fluid collections (pneumothorax, pain, drain dislodgement and drain blockage) and compare these complications with those related to large-bore chest catheters inserted by thoracic surgeons.
Bronchiolitis: A Practical Approach for the General Radiologist

All Day Location: CH Community, Learning Center

Participants
Peter Winningham, MD, Kansas City, MO (Presenter) Nothing to Disclose
Santiago Martinez-Jimenez, MD, Kansas City, MO (Abstract Co-Author) Author, Reed Elsevier; Author, Oxford University Press
Melissa L. Rosado De Christenson, MD, Kansas City, MO (Abstract Co-Author) Author, Thieme Medical Publishers, Inc; Author, Reed Elsevier; Author, American Registry of Pathology; Author, Oxford University Press; ; ;
Sonia L. Betancourt Cuellar, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Carlos S. Restrepo, MD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose
Andres Eraso, MD, California, MD (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. To present clinical scenarios in which bronchiolitis is common (e.g. follicular bronchiolitis in autoimmunity, constrictive bronchiolitis from rejection in solid-organ transplantation, panbronchiolitis in Asian population)
2. To highlight specific imaging findings in each type of bronchiolitis and propose a practical algorithm to evaluate and manage bronchiolitis in everyday practice.
3. To enhance understanding of imaging findings through histologic correlation.

TABLE OF CONTENTS/OUTLINE

Bronchiolitis is a nonspecific term used to describe small airways inflammation related to a group of heterogeneous etiologies. As bronchiolitis from different etiologies share similar imaging findings, radiologic evaluation of affected patients is challenging. Infectious bronchiolitis is typically when typical CT findings of bronchiolitis are identified, while other important causes of bronchiolitis are usually overlooked (e.g. follicular, aspiration and constrictive bronchiolitis). We provide a systematic approach to the imaging assessment of affected patients.

1. Cellular bronchiolitis
   1.1. Infectious bronchiolitis
   1.2. Diffuse aspiration bronchiolitis
   1.3. Follicular bronchiolitis
   1.4. Hypersensitivity pneumonitis
   1.5. Respiratory bronchiolitis
2. Constrictive bronchiolitis

Honored Educators

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Santiago Martinez-Jimenez, MD - 2014 Honored Educator
Santiago Martinez-Jimenez, MD - 2015 Honored Educator
Melissa L. Rosado De Christenson, MD - 2012 Honored Educator
Sonia L. Betancourt Cuellar, MD - 2014 Honored Educator
Carlos S. Restrepo, MD - 2012 Honored Educator
Carlos S. Restrepo, MD - 2014 Honored Educator
How to Avoid Common Pitfalls, Seen in Daily Practice, Related to the Interpretation of Chest Computed Tomography

Awards
Certificate of Merit

Participants
Philippe Khafagy, MD, Montfermeil, France (Presenter) Nothing to Disclose
Mehdi Roumila, Montfermeil, France (Abstract Co-Author) Nothing to Disclose
Julie Seroussi, MD, Livry-Gargan, France (Abstract Co-Author) Nothing to Disclose
Mohamed Bekeheit, MBBCh, Villejuif, France (Abstract Co-Author) Nothing to Disclose
Pierre Y. Brillet, MD, PhD, Bobigny, France (Abstract Co-Author) Nothing to Disclose
Michel Cymbalista, MD, Montfermeil, France (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is:
- To review common pitfalls concerning interpretation of chest computed tomography (CT) encountered in daily practice, as well as mimicking signs.
- To learn how to use post processing tools as Multiplanar reconstruction (MPR), maximal intensity projection (MIP), minimal intensity projection (minIP), in the evaluation of pulmonary lesions, to prevent frequent pitfalls.

TABLE OF CONTENTS/OUTLINE
1. Does this nodule need follow up?
2. Pitfall concerning distribution of diffuse parenchymal micronodules
3. Is this a hypertrophied intra thoracic lymph node?
4. How to differentiate frequent cystic lesions?
5. Frequent pitfalls concerning ground glass opacity and alveolar consolidation
6. Common mistakes related to pleural thickening
7. Frequent pitfalls concerning pulmonary embolism
How to Diagnose Intrapulmonary Lymph Nodes by CT: An Underrecognized But Common Type of Benign Lung Nodule

All Day Location: CH Community, Learning Center

Participants
Carlos F. Munoz-Nunez, MD, Valencia, Spain (Presenter) Nothing to Disclose
Vicente Navarro, MD, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Pilar Calvillo Baltles, MD, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Laura Trilles-Olaso, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Lucía Flors, MD, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose
Carles Fonfria, Valencia, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The widespread use of Multidetector Computed Tomography (MDCT) has increased the detection rate of small (<10 mm) non-calciﬁed lung nodules. This small nodules are a diagnostic challenge and their workup depends on the probability of benignity/malignancy in every patient. Intrapulmonary lymph nodes are an underrecognized type of small, non-calciﬁed, peripherally located and benign lung nodule. This presentation fuses also the concepts of perifissural and peripheral lymph nodes, usually discussed separately into the same term of intrapulmonary lymph node and stress the differences with peribronchial lymph nodes. The goals of this presentation is: To review the definition of intrapulmonary lymph node. To review the CT features of intrapulmonary lymph nodes enhancing the role of volumetric HRCT (High-Resolution Computed Tomography) and MPR (Multiplanar Reconstruction) for their diagnosis.

TABLE OF CONTENTS/OUTLINE
Novel Concepts in the Diagnosis, Gradation and Respiratory Management of ARDS. Guidance from State of the Art Multimodality Imaging

Awards
Magna Cum Laude

Participants
Konstantinos Stefanidis, MD, PhD, London, United Kingdom (Presenter) Nothing to Disclose
Philip Touska, MBBS, BMedSc, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Charlie Sayer, MBBS, FRCR, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Maaz A. Abbasi, MBBS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Sisa Grubnic, MD, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Ioannis Vlahos, MRCP, FRCR, London, United Kingdom (Abstract Co-Author) Research Consultant, Siemens AG Research Consultant, General Electric Company

TEACHING POINTS

1) To understand recent changes in the clinico-radiological definition of Acute Respiratory Distress Syndrome (ARDS) according to the "Berlin" classification. 2) To present the findings of different imaging modalities in the three histopathologic phases of ARDS. 3) To present the role of Chest Radiography, Computed Tomography (CT), Lung Ultrasound (US) and novel imaging techniques (PET, MR) in the depiction, follow-up and respiratory management guidance of ARDS.

TABLE OF CONTENTS/OUTLINE

Modern radiology is not limited to the detection and radiologic description of ARDS. Existing and novel multimodality imaging techniques can guide disease imaging and management:-Multimodality imaging in the recognition, etiology and follow-up of ARDS.-Role and indications for new lung imaging techniques, including lung ultrasound, positron emission tomography, electrical impedance tomography and magnetic resonance.-Evaluation of pulmonary recruitment, overdistension and lung perfusion.-Lung assessment during mechanical ventilation and recruitment maneuvers.-Lung assessment of the "potential recruited lung" and the response to different end expiratory pressures.

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Ioannis Vlahos, MRCP, FRCR - 2015 Honored Educator
Normal Postoperative Pulmonary Changes. Clues to Complications. CT and Conventional Radiography Evaluation

All Day Location: CH Community, Learning Center

Participants
Sandra M. Ramirez, MD, Bogota, Colombia (Presenter) Nothing to Disclose
Manuel D. Torres Guzman, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Daniel F. Izquierdo Gracia, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Juana M. Vallejo, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Nelson Escobar, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Luis F. Alein, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Daniel F. Puello Correa, MD, Bogota D C, Colombia (Abstract Co-Author) Nothing to Disclose
Fabian A. Reyes Hernandez, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To illustrate the normal radiologic changes after major lung surgery (segmentectomy, lobectomy and pneumonectomy). 2. To identify the radiologic signs which lead to recognize the main complications of this procedures such as bronchopleural fistula, empyema, pneumonia, atelectasis, pulmonary edema, haemothorax, amongst others. 3. To explain the utility of CT and conventional radiography in such diagnoses.

TABLE OF CONTENTS/OUTLINE
Table of Contents: 1. Types of lung surgery. 2. Normal radiologic appearance of early postoperative changes. 3. Radiologic findings on the late normal postoperative changes. 4. Signs to look for if you suspect a complication 5. Conclusions/Summary
Imaging Diseases of the Major Airways - A Pictorial Review of Unusual Airway Pathology

All Day Location: CH Community, Learning Center

Participants
Elizabeth Robinson, London, United Kingdom (Presenter) Nothing to Disclose
Thomas R. Semple, MBBS, BSC, Hatfield, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1) There are many causes of focal disease of the major airways, many of which are extremely rare, which can be broadly divided into inflammatory, infective, benign infiltrative and malignant causes. 2) Some of these conditions have characteristic imaging findings. 3) Diagnostic radiology and functional imaging play an important role in the initial diagnosis; in planning prior to bronchoscopic biopsy or intervention and before and after surgery.

TABLE OF CONTENTS/OUTLINE

Introduction - Benign causes - Inflammatory (including examples of multiple bronchial strictures in Wegener’s granulomatosis and endobronchial sarcoid causing complete collapse of the left lung and critical right upper and middle lobar bronchial narrowing) Infiltrative (including examples of tracheobronchial amyloid) Infective (including laryngeal papillomatosis) Malignant causes - Primary (including examples of endobronchial carcinoid and adenoid-cystic carcinoma of the trachea) Secondary (including examples of metastatic deposits and direct invasion) Conclusion -
Critical Imaging Findings Before and After the Use of Radiation Therapy for Esophageal Malignancies: What the Radiologist Needs to Know

All Day Location: CH Community, Learning Center

Participants
Shanna Matalon, MD, Boston, MA (Presenter) Nothing to Disclose
Stephanie A. Howard, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Harvey Mamon, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Peter Enzinger, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Michael H. Rosenthal, MD, PhD, Boston, MA (Abstract Co-Author) Equipment support, Toshiba Corporation

TEACHING POINTS
1. Radiation therapy is used in the majority of patients with esophageal cancer, though the intent of treatment (neoadjuvant, adjuvant, definitive and palliative) varies based upon the extent of disease. 2. The anatomic location of the primary tumor influences the definition of local versus metastatic lymph nodes and also the selection of nodal locations that are included in the radiation field. 3. Imaging, especially PET/CT, is integral to the identification of suspicious lymph nodes, evaluation of response to treatment, as well as identification of toxicities and complications of chemoradiotherapy such as pneumonitis, esophagitis, and esophageal erosion or perforation.

TABLE OF CONTENTS/OUTLINE
1. Normal anatomy and histology of the esophagus and adjacent structures 2. Patterns of nodal involvement based on primary tumor site and relevance in imaging and radiation treatment planning 3. Role of imaging, in particular, FDG-PET/CT, in the initial staging of esophageal cancer and in assessment of response to treatment 4. Indications for and principles of radiation therapy in the treatment of esophageal cancer 5. Imaging features of the common toxicities and complications of radiation treatment 6. Patterns of local recurrence on surveillance imaging
Awards
Cum Laude

Participants
Nagina Malguria, MBBS, Dallas, TX (Presenter) Nothing to Disclose
Kirk G. Jordan, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Michael J. Landay, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Suhny Abbara, MD, Dallas, TX (Abstract Co-Author) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG

TEACHING POINTS
1. Systematic categorization of various complications that occur after lung transplantation.
2. Pathogenesis, clinical impact and imaging manifestations of various complications.
3. Timeline of Complications.

TABLE OF CONTENTS/OUTLINE
Various Complications of Lung Transplant
1. Surgical Complications
   Primary Graft dysfunction (reperfusion edema)
   Bronchial and vascular anastomotic complications: dehiscence, leak, stenosis
   Hemorrhage, pleural effusions, pneumothorax, mediastinal-pleural fistula
2. Infectious complications
   CMV infection, other viral infections, bacterial pneumonias, fungal infections (include pseudomembranous aspergillus tracheobronchitis specific to lung transplant), parasitic agents, mycobacterial infection
3. Immunologic complications/Malignancies
   Hyperacute rejection, Acute Rejection, Chronic Rejection, Bronchiolitis Obliterans syndrome, Posttransplant lymphoproliferative disorders
4. Others
   Pulmonary Embolism, Cryptogenic Organizing Pneumonia

Approach to differential diagnosis: Timeline, Imaging appearances, Clinical context and spirometry

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Suhny Abbara, MD - 2014 Honored Educator
What’s That Line? Lines and Tubes of the Chest, Misadventures, Pitfalls and Mimics

All Day Location: CH Community, Learning Center

Participants
Richard W. Ahn, MD, PhD, Dallas, TX (Abstract Co-Author) Co-founder, ViXa LLC; Stockholder, Vixa LLC
Suhny Abbara, MD, Dallas, TX (Abstract Co-Author) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG
Keshav M. Menon, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Nicholas Faulconer, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Jacqueline T. Caire, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Sachin S. Saboo, MD, FRCR, Dallas, TX (Presenter) Nothing to Disclose
Prashant Nagpal, MBBS, Iowa, IA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
This exhibit will systematically review normal and variant multimodality imaging appearance of common support devices, with a focus on devices in unusual locations and other pitfalls. The reader will understand common and uncommon complications of device placement. The exhibit will systematically review relevant variant anatomy when evaluating support devices.

TABLE OF CONTENTS/OUTLINE

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Suhny Abbara, MD - 2014 Honored Educator
Minimizing radiation exposure to female patients from chest CT imaging is particularly relevant given the sensitivity of female thoracic tissue to ionizing radiation and the increasing use of Chest CT Angiography (CTA) to evaluate for pulmonary embolism. The purpose of this exhibit is to 1) Discuss CT parameters with respect to their effects on radiation dose; 2) Review the patient-specific and scanner-specific factors that effect radiation dose in female patients undergoing Chest CT 3) Discuss protocol optimization techniques targeted to this particularly sensitive patient population that reduce radiation exposure and maintain diagnostic accuracy.

1) Introduction: Importance of minimizing radiation dose from CTA of the chest for women of childbearing age. 2) CT scanner and patient parameters and their effects on radiation dose to be discussed include: tube current, rotation time, tube peak voltage, pitch, noise index, patient size, size-specific dose estimates and breast position. 3) CT optimization techniques to be discussed include: scan coverage, scout acquisition, proper patient positioning, adjustments in breast positioning, weight based tube voltage settings, and Automatic Exposure Control. 4) Images and graphs will accompany the CT optimization discussion for further clarification. 5) References.
TEACHING POINTS
The purpose of this exhibit is:
(1) To review the increasing role of ultrasound in the evaluation of thoracic abnormalities, particularly in the emergency and critical care settings.
(2) To demonstrate normal lung findings via 2D and M-Mode ultrasound.
(3) To review specific signs and artifacts associated with infection, congestion, pneumothorax, fluid collections and masses.
(4) Correlate imaging findings of known thoracic pathology with x-ray, CT and ultrasound.

TABLE OF CONTENTS/OUTLINE
(1) Overview of the rising importance of lung ultrasound in the clinical setting.
(2) Normal lung anatomy
   a. Intercostal space
   b. Pleural line
   c. Lung parenchyma
   d. Diaphragm
   e. Peritoneal line
(3) Artifacts for evaluation of lung parenchyma
   a. Why are they important?
   b. What basic types of artifact patterns are there?
      i. A-lines
      ii. B-lines
(4) Clinical cases that highlight correlation with other imaging modalities
   a. Lung consolidation, Airspace versus Interstitial
   b. Acute Respiratory Failure
   c. Pneumothorax
   d. Pleural-based masses
   e. Pleural effusion
   f. Ultrasound-guided procedures
(5) Future directions and Summary
Incidental Findings in Lung Cancer CT Screening: Which Ones are Relevant?

Awards

Certificate of Merit

Participants

Myrna C. Godoy, MD, PhD, Houston, TX (Presenter) Nothing to Disclose
Erika G. Odisio, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Brett W. Carter, MD, Houston, TX (Abstract Co-Author) Author, Reed Elsevier; Consultant, St. Jude Medical, Inc;
Mylene T. Truong, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Caroline Chiles, MD, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Gregory W. Gladish, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Charles S. White, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Jeremy J. Erasmus, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

American College of Radiology Lung Imaging Reporting and Data System (Lung-RADS™) classification allows standardization of LDCT screening interpretation, reporting and recommendations for management of identified lesions. A "Category S" is used as a modifier for the Lung-RADS™ categories 1-4 in patients with other clinically significant or potentially clinically significant findings (non-lung cancer). The National Lung Screening Trial (NLST) has demonstrated a higher percentage of mortality due to cardiovascular disease (26.1%) than lung cancer (22.9%). Additionally, other neoplasm (22.3%) and respiratory illness (9.4%) were responsible for a high percentage of deaths. Identification of other significant findings in lung cancer screening is important, but standardized approach is warranted to avoid potential harms related to over investigation and iatrogenic injury.

TABLE OF CONTENTS/OUTLINE

Discuss and illustrate the most common clinically significant or potentially clinically significant findings (non-lung cancer) and appropriate management recommendation. These include: Coronary artery calcification Vascular abnormalities COPD - Emphysema predominant COPD - Airways disease predominant Smoking-related interstitial lung disease Other thoracic tumors (non-lung cancer) Abdominal abnormalities Thyroid abnormalities Breast abnormalities

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Brett W. Carter, MD - 2015 Honored Educator
Mylene T. Truong, MD - 2015 Honored Educator
Jeremy J. Erasmus, MD - 2015 Honored Educator
State of art MR Applications for Evaluation of Chest Wall and Pleural Tumors

All Day Location: CH Community, Learning Center

Participants
Ritu R. Gill, MBBS, Boston, MA (Presenter) Nothing to Disclose
Ravi T. Seethamraju, PhD, Boston, MA (Abstract Co-Author) Employee, Siemens AG; Stockholder, Siemens AG

TEACHING POINTS
At the conclusion of this live activity, participants will be able to:
1. Review the MR appearance of Chest wall and Pleural tumors, and identify key distinguishing features and develop differential diagnosis.
2. Review the role of Novel MR applications such as Diffusion weighted imaging and Dynamic Contrast Enhanced Imaging in diagnosis and management.
3. Assess the role of quantitative imaging in characterizing tumors and role of guiding management.

TABLE OF CONTENTS/OUTLINE
Review of imaging findings
Conventional MRI Diffusion weighted imaging and DCE MR findings where pertinent.
Sample cases and mimics
Future directions and summary
Key differential diagnostic points will be highlighted in the discussion of each case.
The list of cases includes:
Pleural tumors - Malignant Pleural Mesothelioma, Fibrous tumour of the pleura, Synovial sarcoma, Liposarcoma, NUT, Pleural metastases, Lymphoma.
Chest wall tumors - Elastofibroma, Ewing's sarcoma, chondrosarcoma, Askin's tumor, Desmoid.
**PURPOSE**

To review the clinical features and imaging appearances of the spectrum of diffuse idiopathic pulmonary neuroendocrine cell hyperplasia (DIPNECH) on CT, PET-CT and Octreoscan.

**METHOD AND MATERIALS**

Eleven pathology proven cases of carcinoid tumor diagnosed at our institution that had at least one available chest CT were reviewed. Patients with concurrent primary lung cancers were excluded. Gender, age, clinical presentation, and history of malignancy were recorded. CT exams were reviewed: pulmonary nodules (number, size, and distribution), bronchial wall thickening and/or bronchiectasis, mosaic attenuation and/or confirmation of air trapping on expiratory exam. PET-CT and Octreoscan were reviewed when available.

**RESULTS**

Eight of the eleven patients were women (72.7%), mean age 66.5 ± 10.4 (48-82). Six (54.5%) patients had history of an extrathoracic malignancy. All patients were asymptomatic from a respiratory standpoint. CT showed diffuse multiple solid pulmonary nodules with a peribronchovascular distribution in all patients, greater than 20 nodules in eight patients (72.7%), with some of these nodules measuring larger than 5mm in ten patients (91%). CT showed mosaic attenuation pattern in eight patients (72.7%), bronchial wall thickening in three patients (27.3%), and there was no patients with bronchiectasis. Absence of uptake in both PET-CT and Octreoscan was found in 3 of the 3 cases.

**CONCLUSION**

DIPNECH should be considered as a diagnostic possibility when multiple small pulmonary nodules are identified on CT particularly in middle-aged women with concomitant air-trapping.

**CLINICAL RELEVANCE/APPLICATION**

DIPNECH should be considered as a diagnostic possibility when multiple small pulmonary nodules are identified on CT particularly in middle-aged women with concomitant air-trapping.

**FIGURE (OPTIONAL)**

**TEACHING POINTS**

- Reader will be able to accomplish following by viewing the exhibit: Understand various diagnostic and therapeutic endobronchial interventions for tracheobronchial pathology, including, but not limited to interventions for treatment of COPD, fistulas, and bronchial stenosis.
- The viewer will recognize the typical normal and atypical imaging features of endobronchial devices, and will be able to recognize complications.

**TABLE OF CONTENTS/OUTLINE**

1. Indications for endobronchial intervention
2. Case based review of post-procedural imaging findings, differential diagnosis and complications of bronchoscopic procedures, endobronchial valves, bronchial stents, fiducial marker placement, bronchopleural fistula management, lung volume reduction coils
3. Introduction to emerging devices
4. Role of Imaging in follow-up of endobronchial devices

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Suhny Abbara, MD - 2014 Honored Educator
Beyond the Ribs: The Many Facets of Lung Herniation

All Day Location: CH Community, Learning Center

Participants
Charmi Vijapura, MD, Iowa City, IA (Presenter) Nothing to Disclose
Archana T. Laroia, MD, Fargo, ND (Abstract Co-Author) Research Consultant, VIDA Diagnostics, Inc; Research Consultant, Siemens AG
Sandeep T. Laroia, MD, Iowa City, IA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To describe the imaging findings of lung hernias and related complications with an emphasis on the utility of 3-D imaging. To review role of the radiologists in management decisions.

TABLE OF CONTENTS/OUTLINE
Clinical presentation of lung hernias Locations of lung hernias Cervical (or Apical)Thoracic Diaphragmatic Different etiologies of hernias Acquired Traumatic (Blunt vs. Post-surgical) Spontaneous Congenital Review of imaging findings Plain chest radiography Computed tomography Sample Cases Typical Strangulation Mimickers Treatment options Postsurgical complications CONCLUSION:
Lung hernias are uncommon clinical entities caused by high intrathoracic pressure or decreased resistance of the thoracic wall. Imaging with MDCT with 3D reconstruction plays an important role in diagnosis and complications of lung hernia. Pulmonary hernias can be classified by location or by etiology as congenital or acquired. Asymptomatic hernias can often be followed clinically, but imaging has an important role in complications such as strangulation for which surgical intervention may be needed. Prior knowledge of lung hernia can avoid complications that may arise from insertion of subclavian venous catheters and chest tube.
What Lies Beneath: Imaging Pleural Neoplasms and Mimics

All Day Location: CH Community, Learning Center

Participants
Kathryn Derras, MD, Vancouver, BC (Presenter) Nothing to Disclose
Alexandra Roston, West Vancouver, BC (Abstract Co-Author) Nothing to Disclose
Colin Mar, MD, Vancouver, BC (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review the anatomy and physiology of the pleura and pleural space through images and original illustrations. To explain the pathophysiology, clinical features and imaging findings (including radiography, CT, and MRI) of pleural-based neoplasms. To highlight complications of pleural-based neoplasm and the imaging findings which alter medical or surgical management. To discuss the staging of malignant pleural-based neoplasms, including the role of PET/CT.

TABLE OF CONTENTS/OUTLINE
Anatomy of the pleural space
Original illustrations
Communications with abdominal cavity
Normal appearance
Physiology of the pleural space
Pathophysiology, clinical features and imaging findings of benign pleural neoplasms: solitary fibrous tumour of pleura, lipoma
Pathophysiology, clinical features and imaging findings of malignant pleural neoplasms: malignant mesothelioma, lymphoma, malignant fibrous tumour, sarcoma, pleural metastasis
Review of what the thoracic surgeon/oncologist need to know
Staging of pleural-based neoplasms
Role of PET/CT in initial diagnosis and follow up
Pitfalls of imaging the pleural space: pleural effusion, pleural pseudotumour, extra-pleural hematoma, pleural plaques, tuberculosis, nerve sheath tumours, splenosis
'It's Hard to Breathe!': Evaluation and Treatment Planning of Tracheobronchial Lesion using CT and 3-D Printing

CH175-ED-X

All Day Location: CH Community, Learning Center

Participants
Hyun Jung Koo, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Mi Young Kim, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Chang Min Choi, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Tai Sun Park, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review the various pathologic conditions of tracheobronchial lesions that may cause airway obstruction or aspiration by using CT, bronchoscopy, and 3-D printing. Identify CT findings and the phantom modeling using 3-D printing for personalized management strategies of tracheobronchial lesions. 3. Present multimodality diagnostic approach and treatments in various cases

TABLE OF CONTENTS/OUTLINE
How to Help your Forensic Pathologist to Study Traumatic Thoracic Lesions in Violent Death with a Post Mortem Non Enhanced CT?

All Day Location: CH Community, Learning Center

Awards
Certificate of Merit

Participants
Islem Sifaoui, Angers, France (Presenter) Nothing to Disclose
Cosmina R. Nedelcu, MD, Angers, France (Abstract Co-Author) Nothing to Disclose
Guillaume Beltran, Angers, France (Abstract Co-Author) Nothing to Disclose
Amaud Gaudin, MD, Angers, France (Abstract Co-Author) Nothing to Disclose
Catherine Ridereau-Zins, MD, Angers, France (Abstract Co-Author) Nothing to Disclose
Christophe Aube, MD, PhD, Angers, France (Abstract Co-Author) Speaker, Bayer AG Support, General Electric Company

TEACHING POINTS
1. to explain how to routinely perform a post mortem non enhanced CT
2. to illustrate normal patterns of thoracic organs
3. to illustrate traumatic thoracic lesions features in correlation with autopsy findings

TABLE OF CONTENTS/OUTLINE
Background
Post mortem non enhanced CT technique
Imaging: - normal patterns of thoracic organs (lungs, mediastinum) - traumatic thoracic lesion features: aortic lesions, cardiac rupture, pulmonary lesions, diaphragm rupture.
Spectrums of Perfusion Scintigram and CT Using Dual-energy Technique for Various Pulmonary Vascular Disorders

All Day Location: CH Community, Learning Center

Participants
Munemasa Okada, MD, PhD, Ube, Japan (Presenter) Nothing to Disclose
Yoshiteru Nakashima, MD, Hofu, Japan (Abstract Co-Author) Nothing to Disclose
Takafumi Nomura, Ube, Japan (Abstract Co-Author) Nothing to Disclose
Kazuyoshi Suga, MD, Ube, Japan (Abstract Co-Author) Nothing to Disclose
Naofumi Matsunaga, MD, PhD, Ube, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Describe the techniques and pitfalls of perfusion CT and lung perfusion scintigram using 99m-Tc MAA in various pulmonary vascular diseases. Describe the differences of perfusion images between dual-energy perfusion CT and scintigram at various levels of pulmonary vessels, including the pulmonary artery, arteriovenous junction and vein.

TABLE OF CONTENTS/OUTLINE
Examination techniques
Scan and reconstruction techniques of dual-energy perfusion CT using dual-source CT
Perfusion scintigram using 99m-Tc MAA; correlation between vascular disorders and particle size
Artifact and pitfall
Artifacts of dual-energy perfusion CT: assessment of beam-hardening effect, motion and limited detector size
Correlation of scan time of dual-energy CT and pulmonary mean transit time
Perfusion scintigram: assessment of particle size and gravity effect
Findings of both modalities
1) Pulmonary arterial disorders
Acute pulmonary embolism
Chronic thromboembolism
Pulmonary vasculitis
Tumor emboli
Tumor invasion of pulmonary artery
Developmental Abnormalities of pulmonary arteries: Pulmonary atresia
2) Pulmonary arterio-venous disorders
Pulmonary arteriovenous malformation/fistula
Hepato-pulmonary syndrome
3) Pulmonary venous disorders
Developmental Abnormalities of pulmonary veins
Tumor invasion of pulmonary vein
CT Manifestations in Radiation-induced Lung Disease (RILD) after Stereotactic Body Radiotherapy (SBRT) for Non-small-cell Lung Cancer (NSCLC)

All Day Location: CH Community, Learning Center

FDA Discussions may include off-label uses.

Participants
Satoshi Kawanami, MD, Fukuoka, Japan (Presenter) Research Grant, Bayer AG; Research Grant, Koninklijke Philips NV
Takeshi Kamitani, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Yuzo Yamazaki, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Takahiko Yamashita, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Yuko Tanaka, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Hiroshi Honda, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Michinobu Nagao, MD, Fukuoka-City, Japan (Abstract Co-Author) Research Grant, Bayer AG Research Grant, Koninklijke Philips NV
Hidetake Yabuuchi, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Katsumasa Nakamura, MD, PhD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Yuji Watanabe, MD, Fukuoka, Japan (Abstract Co-Author) Research Grant, Koninklijke Philips NV Research Grant, Bayer AG

TEACHING POINTS
1. To understand two major types of the RILD in patients with NSCLC after SBRT.
2. To demonstrate CT findings of the RILD after SBRT.
3. To recognize the utility of 3-D workstations to follow NSCLC after SBRT.

TABLE OF CONTENTS/OUTLINE
Background Clinical presentation Pathology Typical CT findings of the RILD after SBRT Radiation pneumonitis; early CT findings Radiation fibrosis; late CT finding Utility of the 3-D workstation Essential late CT findings and possible causes Conclusion
TEACHING POINTS
Lung cancer prognosis and treatment depends on cancer staging and molecular profiling. Novel molecular targets and targeted therapies have increased the armamentarium of lung cancer treatments. A multidisciplinary approach to tissue sampling can limit unnecessary procedures and limit patient risk exposure when an ideal modality or combination of modalities is planned to maximize tissue for staging and molecular profiling. CT guided core biopsy is superior over CT FNA to obtain tissue.

TABLE OF CONTENTS/OUTLINE
The approach to lung cancer diagnosis and treatment has rapidly evolved over recent years with LDCT screening and specific targeted molecular therapies. Lung cancer prognosis and treatment depends on cancer staging and molecular profiling. A multidisciplinary committee (MDC) approach to tissue sampling can limit unnecessary procedures and limit patient risk exposure when an ideal modality or combination of modalities is planned to maximize tissue sampling for staging and molecular profiling. The radiologist plays a central role in the MDC not only as an imager, but also direct how tissues get sampled. Lung cancer staging and treatment, novel molecular targets, advantages and disadvantages of each MDC modality of tissue diagnosis, will be explained with the benefits of CT guided core biopsies over FNA in obtaining tissue for molecular analysis.
Awards
Certificate of Merit

Participants
Dong Un Kim, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Mi-Jin Kang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jihae Lee, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Kyung-Eun Bae, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review normal anatomy of the breast on CT. 2. To present normal postoperative or postprocedural breast on CT. 3. To present complication or abnormal postoperative findings in breast on CT.

TABLE OF CONTENTS/OUTLINE
1. Normal anatomy of the breast on chest CT. 2. Postoperative breast for malignancy on CT. 1) total mastectomy, lumpectomy (breast conserving surgery), modified radical mastectomy. 2) various complications: edema, hematoma, seroma, fat necrosis, postoperative scar, recurred tumor. 3. Postprocedural breast for cosmetic treatment on CT. 1) breast reconstruction - flap surgery: TRAM, LD flap - various complications: fat necrosis, calcified hematoma, skin calcification 2) breast augmentation - breast implant: type (silicone, saline), location (subglandular, subpectoral) - direct injection of paraffin or liquid silicone into the breast - various complications: intracapsular rupture, extracapsular rupture, siliconoma, paraffinoma 3) breast reduction - breast reduction mammoplasty - various complication: fat necrosis, oil cyst, epidermal inclusion cyst
TEACHING POINTS

1. Highlight imaging, clinical, pathological, and tumor biology parameters that may supersede current TNM staging 2. Demonstrate the database characteristics, timeline, methodology and expected modifications for TNM-8 and subsequent pending iterations

TABLE OF CONTENTS/OUTLINE

Consider factors that are currently not in the TNM classification but that currently have a greater influence on patient management and outcome than radiologically defined TNM alone and how future staging may incorporate these including:

1. CT factors: e.g. outcomes of extracapsular nodal invasion, multiple versus single, micro/macrosopic N2 disease, extent of mediastinal invasion, extent/location of satellite nodules, subsolid lesion T status, limitations of non-size T descriptors
2. Non-CT imaging predictors: MRI, PET-CT3. Pathology: e.g. Impact of microvascular or lymphatic invasion, macroscopic vs microscopic cytokeratin N2 definition4. Radpath definition and impact of pleural invasion extent5. Tumor biology: e.g. ALK-EML4 and crizotinib more important than stage6. Published TNM 8 - database characteristics, impact of demographics7. TNM-8 expected timeline and areas of expected change8. Contributing to TNM-9 and future databases - expected changes in these9. Existing proposals and rationale for future staging systems in context of rapidly evolving knowledge

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Ioannis Vlahos, MRCP, FRCR - 2015 Honored Educator
Tuberculosis: On the Verge of a Comeback? What Every Radiologist Should Know in Preparation

All Day Location: CH Community, Learning Center

Participants
Nishant D. Parekh, MD, Chicago, IL (Presenter) Nothing to Disclose
Hatice Savas, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Rishi Agrawal, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Thomas H. Grant, DO, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Eric M. Hart, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Linda B. Haramati, MD, MS, Bronx, NY (Abstract Co-Author) Investor, OrthoSpace Ltd Investor, Kryon Systems Ltd Spouse, Board Member, Bio Protect Ltd Spouse, Board Member, OrthoSpace Ltd Spouse, Board Member, Kryon Systems Ltd

TEACHING POINTS
1.) Emphasize the importance of tuberculosis (TB) as a relevant, present day diagnosis as a consequence of the emergence of MDR (multidrug resistant) and XDR (extensively drug resistant) variants, and the shifting global migration rates.
2.) Review the radiologic manifestations of TB in the immunocompetent (primary, postprimary/reactivation, and special cases).
3.) Detail the manifestations of TB in HIV/AIDS in relation to the CD4 count, along with emphasis on the immune reconstitution syndrome (IRIS).
4.) Discuss a case-based illustration of TB complications and sequelae such as aspergillomas, Rasmussen aneurysms, bronchopleural and esophagomediastinal fistulas, pericardial TB and tuberculous spondylitis.

TABLE OF CONTENTS/OUTLINE
1.) The shifting global epidemiology of TB and current role of radiology in diagnosis and treatment.
2.) Sample cases of TB in the immunocompetent and HIV/AIDS patient populations.
3.) Diagnostic algorithm for determining the various manifestations of TB in HIV/AIDS based on CD4 count.
4.) Case-based illustrations of complications and sequelae of TB.
5.) Key take home points.
Tracheobronchial Malignancies: Imaging Features and Anatomopathologic Correlation

All Day Location: CH Community, Learning Center

TEACHING POINTS

The majority of the tracheobronchial neoplasms are malignant, including direct tumor invasion (thyroid and esophageal cancer), metastatic disease and primary tracheobronchial neoplasm. The most common primary airway malignancies are squamous cell carcinoma (SCC), adenoid cystic carcinoma (ACC), mucoepidermoid carcinoma, and carcinoid tumor. SCC has a strong association with smoking and corresponds to nearly 50% of all primary tracheal malignancies. Frequently, pulmonary and mediastinal metastases are present at the diagnosis. ACC affects younger patients compared to SCC and does not have relationship with smoking. MDCT has an important role in diagnosis, treatment planning and surveillance. In addition of axial images, two-dimensional multiplanar reformation and 3D reconstruction images allow specific measurements that are valuable for endobronchial and surgical treatment planning. The metabolic behavior of each type of neoplasm varies, i.e., most SCC will present high FDG uptake, but carcinoid tumors usually have low uptake. PET/CT may assist in staging by detecting nodal and distant metastasis.

TABLE OF CONTENTS/OUTLINE

Describe the different types of tracheobronchial neoplasms and their clinical behavior. Illustrate anatomopathologic correlation of malignant tracheobronchial neoplasms. Discuss and illustrate the role of MDCT and PET/CT.

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Sonia L. Betancourt Cuellar, MD - 2014 Honored Educator
Mylene T. Truong, MD - 2015 Honored Educator
Visiting the New 2015 WHO Classification of Tumours of the Lung: Radiologic-pathologic Correlation

Awards
Certificate of Merit

Participants
Marcelo Sanchez, MD, Barcelona, Spain (Presenter) Nothing to Disclose
Mariana N. Benegas Urteaga, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Jose Ramirez, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Ivan Vollmer, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Rosario J. Perea, MD, PhD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Teresa Maria Caralt, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review the new WHO classification of Tumours of the lung.
2. To learn major changes compared to previously 2004 WHO classification, mainly in lung adenocarcinoma and neuroendocrine tumours.
3. To illustrate case-based of the new classification with radiologic-pathologic correlation.

TABLE OF CONTENTS/OUTLINE
Major changes in the new classification reflect new advances in clinical, radiologic, histologic and genetics aspects of lung cancer.
1-Introduction: new WHO classification of lung tumours
3-Cases of lung tumours with radiologic-pathologic correlation
4-Conclusions
Functional Imaging of the Mediastinum

All Day Location: CH Community, Learning Center

Participants
Jordi Broncano, MD, Cordoba, Spain (Presenter) Nothing to Disclose
Constantine A. Raptis, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Antonio Luna, MD, Jaen, Spain (Abstract Co-Author) Nothing to Disclose
Sanjeev Bhalla, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Teodoro Martin, MD, Jaen, Spain (Abstract Co-Author) Nothing to Disclose
Santiago E. Rossi, MD, Capital Federal, Argentina (Abstract Co-Author) Advisory Board, Koninklijke Philips NV Speaker, Pfizer Inc Royalties, Springer Science+Business Media Deutschland GmbH
Antonio Alvarez-Kindelan, Cordoba, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To analyze the current functional imaging techniques available (18FDG-PET/CT, DWI, DCE-MRI, DW-neurography, DTI-neurography and MR spectroscopy) for the evaluation of mediastinal lesions, with a focus in their correct acquisition and post-processing. To review the clinical applications of these techniques in the diagnostic approach of benign and malignant conditions of the mediastinum.

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Imaging techniques and optimization
   2.1. Diffusion weighted imaging (DWI)
   2.2. Perfusion - weighted MRI (DCE-MRI)
   2.3. Diffusion-weighted neurography and DTI neurography
   2.4. MR spectroscopy
   2.5. 18FDG-PET/CT
3. Clinical applications
   3.1. Differentiation of benign vs malignant lesions
   3.2. Cystic mediastinal masses
   3.2.1. Thymic cyst
   3.2.2. Pericardial cyst
   3.2.3. Bronchogenic cyst
   3.2.4. Foregut duplication cyst
   3.2.5. Pancreatic pseudocyst
   3.2.6. Thoracic duct cyst
   3.2.7. Neuroenteric cyst
   3.2.8. Cystic neoplasms
   3.3. Solid mediastinal masses
   3.3.1. Thymic origin
   3.3.2. Mesenchymal and germ cell tumors
   3.3.3. Lymphoproliferative disorders
   3.4. Tracheal and esophageal lesions
   3.5. Neural origin
   3.6. Lymph node evaluation
   3.7. Miscellaneous
4. Conclusion

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Sanjeev Bhalla, MD - 2014 Honored Educator
Santiago E. Rossi, MD - 2015 Honored Educator
Multidisciplinary Board in the Management of Interstitial Lung Disease 'The Key to Success': A Case-based Approach with Radiologic-pathologic Correlation

All Day Location: CH Community, Learning Center

Participants
Mariana N. Benegas Urteaga, MD, Barcelona, Spain (Presenter) Nothing to Disclose
Marcelo Sanchez, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Jose Ramirez, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Ivan Vollmer, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Jacobo Sellares, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Pilar Brito-Zeron, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Fernanda Hernandez-Gonzalez, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Maria Paradelo, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Carles Agusti, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Sergio Prieto, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To describe the importance of multidisciplinary approach in the characterization and management of Interstitial Lung Disease (ILD), improving diagnostic confidence and patient outcome. To understand the key role of the radiologist providing information to clinicians and what the radiologist needs to know from them to achieve an accurate diagnosis. To show clinical cases managed with multidisciplinary team discussion and pathologic correlation.

TABLE OF CONTENTS/OUTLINE
1-Introduction
2-Multidisciplinary ILD-team presentation: pulmonologist, specialists in autoimmune diseases, thoracic surgeons, pathologist and radiologist. Useful information that every radiologist needs to know from other specialists and what do they want to know from the radiologist.
3-Case-based approach illustrating the ILD-team discussion in the management of different ILD with HRCT findings and pathologic correlation: Idiopathic interstitial pneumonias, Hypersensitivity pneumonitis, Collagen vascular disease, Sarcoidosis, Lymphangioleiomyomatosis (LAM), Pulmonary Langerhans Cell Histiocytosis (PLCH).
4-Multidisciplinary discussion of clinical cases with discordance between radiological and histopathological patterns.
5-Conclusions
Diagnóstico Precoz por Imagen en la Población el CIR: Sesión del Colegio Interamericano de Radiología (CIR) en Español/Population based Preventive Imaging from CIR: Session of the Interamerican College of Radiology (CIR) in Spanish

Saturday, Nov. 28 1:00PM - 5:00PM Location: E451A

LEARNING OBJECTIVES
1) To review the state-of-the-art of population based preventive imaging
2) To discuss preventive imaging approaches in all major organ systems and key pathologies, ranging from dementia, cardiovascular disease, colon, liver, lung and breast cancer
3) To illustrate the use of different imaging technologies in preventive imaging such as CT, MRI and ultrasound

Sub-Events

SPSP01A   Introducción/Introduction

Participants
Pablo R. Ros, MD, PhD, Cleveland, OH (Moderator) Medical Advisory Board, Koninklijke Philips NV; Medical Advisory Board, KLAS Enterprises LLC; Medical Advisory Committee, Oakstone Publishing; Departmental Research Grant, Siemens AG; Departmental Research Grant, Koninklijke Philips NV; Departmental Research Grant, Sectra AB; Departmental Research Grant, Toshiba Corporation
Miguel E. Stoopen, MD, Mexico City, Mexico (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSP01B   Parte 1/Part 1

Participants
Dante R. Casale Menier, MD, Ciudad Juarez, Mexico (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSP01C   Presentación de Ponentes/Panel Introduction

Participants
Pablo R. Ros, MD, PhD, Cleveland, OH (Presenter) Medical Advisory Board, Koninklijke Philips NV; Medical Advisory Board, KLAS Enterprises LLC; Medical Advisory Committee, Oakstone Publishing; Departmental Research Grant, Siemens AG; Departmental Research Grant, Koninklijke Philips NV; Departmental Research Grant, Sectra AB; Departmental Research Grant, Toshiba Corporation

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSP01D   Colon: La Colonografía Virtual: ¿Un Método de Escrutinio en la Población?/Colon: Virtual Colonography: A Population Screening Tool?

Participants
Jorge A. Soto, MD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Honored Educators

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Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator

SPSP01E   Cardiovascular: Cribaje de Enfermedad Cardiovascular por Imagen Medica/Cardiovascular: Diagnostic Imaging in Cardiovascular Screening

Participants
LEARNING OBJECTIVES

View learning objectives under main course title.

Honored Educators

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Carlos S. Restrepo, MD - 2012 Honored Educator
Carlos S. Restrepo, MD - 2014 Honored Educator

SPSP01F Neurología: Diagnóstico Temprano de Demencias: ¿Dónde Estamos?/Neurology: Dementia Early Diagnosis: Where Are We?

Participants
Carlos Zamora, MD, PhD, Chapel Hill, NC (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

objetivos: 1) comprender conceptos clínicos básicos para el diagnóstico de los síndromes principales de demencia. 2) reconocer características anatómicas y metabólicas fundamentales de neuroimagen en los síndromes principales de demencia, con especial atención a enfermedad de Alzheimer. 3) explorar direcciones futuras y desafíos para el diagnóstico temprano. learning objectives: 1) understand basic clinical concepts for the diagnosis of major dementia syndromes. 2) recognize fundamental anatomic and metabolic neuroimaging features of major dementia syndromes, with special focus on alzheimer's disease. 3) explore future directions and challenges for early diagnosis.

SPSP01G Parte II/Part II

Participants

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSP01H Presentación de Ponetes/Panel Introduction

Participants
Miguel E. Stoopen, MD, Mexico City, Mexico (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSP01I Mama: Rol de la RM en el Cáncer de Mama en Mujeres de Alto Riesgo/Breast: Role of MR in High Risk Breast Cancer Patients

Participants
Linei A. Urban, Curitiba, Brazil (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.


Participants
Claudio S. Silva Fuente-Alba, MD, MSc, Santiago, Chile, (csilvafa@alemana.cl) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSP01K Hígado: Cribaje del Hepatocarcinoma en Pacientes de Riesgo: ¿Cómo Hacerlo y a Quién Incluir?/Liver: Hepatocellular Carcinoma Screening in High Risk Patients: How and Whom?

Participants
Carmen Ayuso, MD, PhD, Barcelona, Spain, (cayuso@clinic.ub.es) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) definir la población en riesgo de desarrollar un carcinoma hepático que debe ser incluida en un programa de cribado. 2) Analizar la mejor estrategia para llevar a cabo el cribado del hepatocarcinoma en la población en riesgo de padecerlo. 3) discutir la conducta a seguir una vez que se detecta un nódulo hepático en pacientes incluidos en un programa de cribado. 1) to define the population at risk of hepatocellular carcinoma to be included in a surveillance program. 2) to analyze the best strategy for
surveillance in patients at risk of hepatocellular carcinoma. 3) To discuss how to proceed when a liver nodule is detected in patients on surveillance.

**Comentarios Finales y Clausura/Closing Remarks**

Participants
Dante R. Casale Menier, MD, Ciudad Juarez, Mexico (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.
Chest Sunday Case of the Day

Sunday, Nov. 29 8:00AM - 11:59PM Location: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Alvaro Huete Garin, MD, Santiago, Chile (Presenter) Nothing to Disclose
Kristopher W. Cummings, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Javiera C. Araya Campos, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose
Cylen Javidan-Nejad, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Francisca C. Araya, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose
Juan-Carlos Diaz, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) To analyze interesting chest cases. 2) To understand appropriate differential diagnosis. 3) To understand the clinical significance of the diagnosis presented.
**Chest (Lung Cancer Screening)**

**Sunday, Nov. 29 10:45AM - 12:15PM Location: S404CD**

**CH  CT**

**AMA PRA Category 1 Credits ™: 1.50**

**ARRT Category A+ Credits: 1.50**

**FDA**

 Discussions may include off-label uses.

**Participants**

Mark L. Schiebler, MD, Madison, WI (Moderator) Nothing to Disclose

Brett W. Carter, MD, Houston, TX (Moderator) Author, Reed Elsevier; Consultant, St. Jude Medical, Inc; ;

**Sub-Events**

**SSA04-01 Association of COPD and COPD Phenotypes with Malignancy in the National Lung Screening Trial**

**Sunday, Nov. 29 10:45AM - 10:55AM Location: S404CD**

**Participants**

Caroline Chiles, MD, Winston-Salem, NC (Presenter) Nothing to Disclose

Ilana F. Gareen, PhD, Cranston, RI (Abstract Co-Author) Nothing to Disclose

Kathleen Brown, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

David S. Gerada, MD, Saint Louis, MO (Abstract Co-Author) Contract, VuCOMP, Inc

Jorean Sicks, MS, Providence, RI (Abstract Co-Author) Nothing to Disclose

Ella A. Kazerooni, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose

Hrudaya P. Nath, MD, Birmingham, AL (Abstract Co-Author) Research Grant, General Electric Company; Stockholder, General Electric Company

Stavroula Chysanthopoulou, Providence, RI (Abstract Co-Author) Nothing to Disclose

James G. Ravenel, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose

Surya P. Bhatt, Birmingham, AL (Abstract Co-Author) Nothing to Disclose

Reginald F. Munden, MD, DMD, Houston, TX (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To determine the association of COPD and COPD phenotypes (emphysema, airway and mixed) with lung cancer (LC) in participants with indeterminate lung nodules in the National Lung Screening Trial (NLST).

**METHOD AND MATERIALS**

We conducted a retrospective, case-control study of 817 participants (200 LC, 617 controls) in the CT-trial arm with 6-19 mm indeterminate lung nodules. 8 readers performed a visual analysis for centrilobular emphysema (CLE), bronchial wall thickening, centrilobular nodularity and interstitial fibrosis. Readers were asked to classify each scan as normal, emphysema-predominant COPD, airway-predominant COPD or mixed pattern COPD. Spirometry results (FEV1/FVC, FEV1) were used to classify each participant as normal or mild, moderate, severe or very severe COPD.

**RESULTS**

In a univariate analysis for LC diagnosis, emphysema-predominant COPD phenotype had an odds ratio (OR) of 1.530 (95% confidence interval (CI): 0.994, 2.354), airway-predominant COPD an OR of 1.004 (95% CI: 0.619, 1.629) and the mixed pattern an OR of 0.764 (95% CI: 0.427, 1.367) (reference = normal). Increasing CLE severity was associated with LC diagnosis for trace (OR 1.378, 95% CI: 0.879, 2.160), mild (OR 1.704, 95% CI: 1.073, 2.706) and moderate (OR 2.133, 95% CI: 1.326, 3.431). The number of patients with severe CLE was small with inconclusive results (; OR 1.105, 95% CI: 0.580, 2.103). Increasing airflow limitation was not strongly associated with increasing odds ratios for LC [mild OR 0.917 (95% CI: 0.533, 1.577), moderate OR 1.278 (95% CI: 0.865, 1.889), severe OR 0.939 (95% CI: 0.525, 1.681), very severe OR 2.040 (95% CI: 0.653, 6.374), reference normal].

**CONCLUSION**

Both an emphysema-predominant COPD phenotype by CT and increasing severity of CLE were associated with an increased LC risk in patients with indeterminate lung nodules on CT screening, while airflow limitation had a less strong relationship. The latter may be due to the lack of specificity of COPD phenotype available from spirometry. The NLST received funding from the National Cancer Institute through the grants U01 CA079778 and U01CA 080098

**CLINICAL RELEVANCE/APPLICATION**

Risk calculation for indeterminate nodules incorporates COPD history. CT information on both emphysema-predominant COPD phenotype and severity may perform better in risk prediction than spirometry.

**Honored Educators**

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Ella A. Kazerooni, MD - 2014 Honored Educator
To compare differences in the relative risk (RR) of lung cancer (LC) by nodule consistency and sex in the CT arm of the NLST.

METHOD AND MATERIALS

By study design, all CT-detected nodules measuring 4-30 mm were characterized by consistency (solid=SN, nonsolid/ground glass=GGN, and part-solid=PSN). For each nodule consistency, the following were calculated: sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for LC for both men (M) and women (W). For each nodule consistency, RR was calculated as the ratio of the probability of LC given a reported nodule consistency to the probability of LC given no nodule of the same consistency.

RESULTS

Of 26,455 participants in the CT arm of the NLST, 9994 (37.8%) had a positive screen at ≥ 1 time point. 8062 (81%) had 1 nodule consistency and 1932 (19%) had >1 nodule consistency. The RR of LC was significantly higher for women than men for GGNs (2.68 W vs. 1.68 M, p=0.0026), whereas SNs had the lowest PPV in women (7.9%) and GGNs had the lowest PPV in men (6.6%).

CONCLUSION

Rates of lung cancer are influenced by both nodule consistency and sex. Subsolid nodules are associated with a higher risk of lung cancer for women than men.

CLINICAL RELEVANCE/APPLICATION

Radiologists should be aware of sex-related differences in risk of lung cancer for subsolid nodules when interpreting CT screening studies.

Honored Educators

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Phillip M. Boiselle, MD - 2012 Honored Educator

SSA04-03 Comparing Lung-RADS and the McWilliams Nodule Malignancy Score: Which Approach Works Best to Select Screen Detected Pulmonary Nodules for More Aggressive Follow-up?

Participants

Sarah J. Van Riel, MD, Nijmegen, Netherlands (Presenter) Research Grant, MeVis Medical Solutions AG
Francesco Ciompi, PhD, Nijmegen, Netherlands (Abstract Co-Author) Nothing to Disclose
Mathilde Winkler Wille, Hellerup, Copenhagen, Denmark (Abstract Co-Author) Nothing to Disclose
Ernst T. Scholten, MD, Haarlemmerliede, Netherlands (Abstract Co-Author) Nothing to Disclose
Asger Diksens, Hellerup, Denmark (Abstract Co-Author) Nothing to Disclose
Karan Chung, MD, Nijmegen, Netherlands (Abstract Co-Author) Nothing to Disclose
Mathias Prokop, PhD, Nijmegen, Netherlands (Abstract Co-Author) Speakers Bureau, Bayer AG Speakers Bureau, Bracco Group Speakers Bureau, Toshiba Corporation Speakers Bureau, Koninklijke Philips NV Research Grant, Toshiba Corporation
Cornelia M. Schaefer-Prokop, MD, Nijmegen, Netherlands (Abstract Co-Author) Advisory Board, Riverain Technologies, LLC
Bram Van Ginneken, PhD, Nijmegen, Netherlands (Abstract Co-Author) Stockholder, Thirona BV Co-founder, Thirona BV Research Grant, MeVis Medical Solutions AG Research Grant, Canon Inc Research Grant, Toshiba Corporation Research Grant, Riverain Technologies, LLC

PURPOSE

In 2014 Lung-RADS was published to standardize CT lung screening reporting and management, based on nodule type, size, and growth. In 2013 the McWilliams model was published providing a nodule malignancy probability based on nodule size, type, morphology and subject characteristics. Threshold of the McWilliams score provides an alternative over Lung-RADS categories to determine work-up for screen-detected nodules. We compare both approaches on an independent data set.

METHOD AND MATERIALS

All 60 cancers were selected from the Danish Lung Cancer Screening Trial, in the first scan where they were visible, and 120 randomly selected benign nodules from baseline scans were added, all from different participants. Data had been acquired using a low-dose (16x0.75mm, 120kVp, 40mAs) protocol, and 1mm section thickness reconstruction. For each nodule, the malignancy probability was calculated using McWilliams model 2b. Parameters were available from the screening database or scored by an
expert radiologist. Completely calcified nodules and perifissural nodules were given a score of 0, in accordance with the McWilliams model. All nodules were categorized into their Lung-RADS category based on nodule type and diameter. Perifissural nodules were treated as regular solid nodules, in accordance with Lung-RADS guidelines. Sensitivity and specificity were calculated, for each Lung-RADS category cut-off. For each specificity level, corresponding sensitivity of the McWilliams model was determined.

RESULTS

McWilliams performed substantially better than Lung-RADS in selecting malignant nodules for more aggressive follow-up. Defining Lung-RADS category 2/3/4A/4B and up as a positive screening result, nodule malignancy specificity was 21%/65%/86%/99% and sensitivity was 100%/85%/58%/32%. At the same specificities, McWilliams's sensitivity was higher with 100%/96%/86%/45%.

CONCLUSION

For every cut-off level in Lung-RADS, the McWilliams model operating at the same specificity has superior sensitivity to differentiate malignant from benign nodules.

CLINICAL RELEVANCE/APPLICATION

The McWilliams model seems to be a better tool than Lung-RADS to provide a malignancy risk and help radiologists determine which subgroup of nodules detected in a screening setting need more invasive work-up.

SSA04-04  Sex- and Gender-linked Differences in Baseline Characteristics of the National Lung Screening Trial

Sunday, Nov. 29 11:15AM - 11:25AM Location: S404CD

Participants
Caroline Chiles, MD, Winston-Salem, NC (Presenter) Nothing to Disclose
Fenghai Duan, PhD, Providence, RI (Abstract Co-Author) Nothing to Disclose
Judith K. Amorosa, MD, Somerville, NJ (Abstract Co-Author) Nothing to Disclose
Stavroula Chysanthopoulou, Providence, RI (Abstract Co-Author) Nothing to Disclose
Sarah DeMello, Providence, RI (Abstract Co-Author) Nothing to Disclose
Martin Tammemagi, PhD, St. Catherines, ON (Abstract Co-Author) Nothing to Disclose
Phillip M. Boiselle, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE

Evaluate baseline characteristics of male and female participants in the National Lung Screening Trial (NLST) to determine sex- and gender-linked differences at enrollment that could influence trial results in terms of lung cancer (LC) risk.

METHOD AND MATERIALS

The NLST enrolled men (M) and women (W) aged 55 -74, current or former smokers with > 30 pack-year smoking history. At registration, all participants completed questionnaires regarding demographics, personal/family history of cancer, and smoking history. Demographic characteristics of these participants were stratified by sex and compared with LC risk as determined by the Prostate Lung Colon Ovarian (PLCO) screening trial logistic-regression model for lung cancer prediction (PLCOM2012). Using this model, the mean 6-yr risk of LC was calculated for M and W participants.

RESULTS

Baseline characteristics that increase LC risk in female NLST participants included their lower educational level [13.62 years ± 2.28 (W), 14.05 years ± 2.49 (M)], lower BMI [28 (W), 29 (M)], higher self-reported history of COPD [6.44% (W), 4.08% (M)], and higher family history of LC [23.78% (W), 20.32% (M)], p<0.001 for all comparisons. Baseline characteristics that decrease their LC risk included younger age [61.2 (W), 61.6 years (M)], decreased smoking intensity [26.64 cigarettes per day (W), 29.69 (M), p<0.001], and shorter smoking duration [39.24 yrs (W), 40.27 (M)], p<0.001 for all comparisons. Based on the PLCOM2012 model for lung cancer prediction, the mean calculated 6-yr LC risks were similar for both sexes [0.0319 ± 0.0274 (W), 0.0323 ± 0.0283 (M), p=0.07].

CONCLUSION

Despite significant differences in a variety of individual LC predictors between men and women, the mean calculated 6-yr risk of LC was similar for male and female NLST participants. These findings are consistent with reported similar lung cancer incidence rates between men and women within each trial arm of the NLST.

CLINICAL RELEVANCE/APPLICATION

Risk factors for LC may vary according to sex characteristics. Including these in risk modeling may improve selection of individual patients for screening.
Prevalence of Pulmonary Multi-nodularity in CT Lung Cancer Screening and Lung Cancer Probability

Participants
Niamh M. Long, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Ramon E. Sosa, BA, New York, NY (Abstract Co-Author) Nothing to Disclose
Michelle S. Ginsberg, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
Lung cancer screening with computed tomography (CT) reduces mortality in high-risk patients with a smoking history. The rate of lung cancers detected based on positive screening CT in the National Lung Screening Trial (NLST) was 2.4%. The aim of this study was to assess the radiological findings in a cohort of patients with a previous history of malignancy, who underwent CT screening for lung cancer.

METHOD AND MATERIALS
The IRB approved this study. Patients with a previous history of a malignancy, either cured from that disease or with a life expectancy of at least 5 years, were referred for low dose CT lung cancer screening between 5/2/2011 and 9/24/2014. Initial CTs and all available follow up CTs were retrospectively reviewed by 2 radiologists in consensus. CT features assessed included nodule size, morphology and number. Clinical features recorded included pack year smoking history, type of previous cancer and previous cancer therapy. The Lung-RADS™ scoring system was retrospectively applied to all studies.

RESULTS
140 patients were studied. 61 (43%) male, 79 (56%) female, mean age 66 (40-80). 139 patients (99%) had a smoking history [mean pack years 57 (0-120)]. All had a previous history of cancer: 58 (41%) breast, 21 (15%) head and neck and 17(12%) lung. All patients had at least 1 chest CT, 42 had 2 Cts, 30 had 3 Cts and 9 had at least 4 Cts. 8 (6%) patients were diagnosed with cancer on screening CT (7 lung carcinoma, 1 chest wall sarcoma). 2 (1%) patients had a biopsy or surgery for lesions identified on screening CT (1 atypical pneumocyte hyperplasia, 1 nodular scar). 49 (35%) patients were considered to have a positive screening CT (recalled for repeat chest CT earlier than 330 days), 33 (23%) after the 1st screen, 16 (20%) after the 2nd screen, and 6 (15%) after the 3rd screen. After the 1st screen, the Lung-RADS™ categories were: 4 - 6, 3 - 9% and < 2- 84%. The most common incidental findings were emphysema 26%, post-surgical change 8% and post-radiation change 16%.

CONCLUSION
Patients with a previous history of a malignancy undergoing screening chest CT have a higher rate of screen detected neoplasm as compared to the incidence reported in a non oncologic group such as the NLST.

CLINICAL RELEVANCE/APPLICATION
Patients with a prior cancer history have a higher rate of screen detected lung cancer than reported in the NLST. Larger studies are needed in this group who may benefit from lung cancer screening.

SSA04-06 CT Screening for Lung Cancer: Frequency of Adrenal Enlargement Identified in Baseline and Annual Repeat Rounds and Results of Follow-up Imaging

Sunday, Nov. 29 11:35AM - 11:45AM Location: S404CD

Participants
Minxia Hu, New York, NY (Presenter) Nothing to Disclose
Rowena Yip, MPH, New York, NY (Abstract Co-Author) Nothing to Disclose
David F. Yankelevitz, MD, New York, NY (Abstract Co-Author); Royalties, General Electric Company
Claudia I. Henschke, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
To determine the frequency of adrenal enlargement by age, gender, smoking status, family history of lung cancer and other comorbidities in low-dose CT screening for lung cancer as well as the progression at first annual and longer follow-up.

METHOD AND MATERIALS
HIPAA-compliant Informed consent was obtained on 4,776 participants in screening between 1992 to 2014. At enrollment, all were asymptomatic for lung cancer, 40 years of age or older, current, former, and never smokers and completed a background questionnaire. Adrenal gland was considered as enlarged if the longest diameter measured 6 mm or more. Univariate and multivariate analysis using logistic regression analysis was performed to identify significant characteristics of those with and without adrenal enlargement.

RESULTS
On the baseline CT scan, 202 (4%) of 4,776 participants had at least one adrenal enlarged gland. Among the 11,591 annual repeat CT scans, 5 (0.04%) participants had a newly enlarged adrenal gland. Multivariate analysis showed that the frequency significantly increased with increasing decades of age (OR = 1.4, 95% CI: 1.2-1.7) and for those smoking at baseline enrollment (OR = 1.7, 95% CI: 0.9-3.5). Of the 202 with adrenal enlargement, the diameter was 6-9 mm for 40 (20%), 10-19 mm for 93 (46%), 20-29 mm for 55 (27%), 30-39 for 12 (6%) and 40 mm or more for 2 (1%); only currently smoking was a significant predictor of size (P = 0.04). Focusing on the 200 whose adrenal gland was less than 40 mm, first annual repeat CT scans were available for 133 and the adrenal size decreased in 3 (2%), was unchanged in 82 (62%), and increased by less than 10 mm in remaining 48 (36%). Upon further follow-up (median follow-up time of 80 months, IQR: 49-107), none increased by more than 10 mm and none had documented adrenal metastases.

CONCLUSION
Adrenal enlargement is a frequent finding on baseline scans. They tend to be slow growing and their frequency is related to both age and smoking status.

CLINICAL RELEVANCE/APPLICATION
Adrenal enlargement on baseline scanning is a frequent finding, and for those without lung cancer annual surveillance as follow up appears sufficient.

SSA04-07 Prevalence of Pulmonary Multi-nodularity in CT Lung Cancer Screening and Lung Cancer Probability
Participants
Robin Peters, MD, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose
Marjolein A. Heuvelmans, BSc, Groningen, Netherlands (Presenter) Nothing to Disclose
Peter M. Van Ooijen, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose
Geertvrid H. De Bock, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose
Mattihjs Oudkerk, MD, PhD, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the association of pulmonary multi-nodularity with lung cancer probability in baseline computed tomography (CT) lung cancer screening.

METHOD AND MATERIALS
In a low-dose CT lung cancer screening trial, participants were selected with at least one non-calcified nodule at baseline. The trial was approved by the Ministry of Health. All participants gave informed consent. The per-participant number of baseline nodules was determined. The probability of lung cancer was compared for categories based on number of baseline nodules using chi-square testing. Lung cancer diagnosis was confirmed by histology. Nodules were classified as benign if they did not show significant growth for up to six years after baseline.

RESULTS
3,392 participants with 7,258 nodules were included. 1,746/3392 participants (51.5%) had one nodule, 800/3392 (23.6%) had two nodules, 354/3392 (10.4%) had three nodules, 191/3392 (5.6%) had four nodules, and 301/3392 (8.9%) had over four nodules at baseline. Lung cancer was diagnosed in these nodules during baseline in 62 participants, and during later rounds in another 75 participants (cancer rate 4.0%). Mean nodule count in subjects with only benign nodules was 2.14±1.8, compared to 2.34±2.2 (p=NS) in screennees with lung cancer. The probability of lung cancer was 61/1746 (3.5%) in case a participant had one nodule, 37/800 (4.6%) for two nodules, 17/354 (4.8%) for three nodules, 12/191 (6.3%) for four nodules and 10/301 (3.3%) when a participant had over four nodules (p=NS). Lung cancer diagnosis during baseline screening was made in the largest nodule in 60/62 (96.8%) cases.

CONCLUSION
Multi-nodularity is common in baseline CT lung cancer screening. The relationship between nodule count and lung cancer probability is complex, with a possible peak in probability of malignancy in subjects with four nodules. Lung cancer was detected most frequently in the nodule with the largest volume.

CLINICAL RELEVANCE/APPLICATION
Malignancy probability does not change with the increase of the number of lung nodules in a patient. Each nodule found in lung cancer screening subjects should be assessed separately, with recommendation for nodule management based on the nodule with the largest volume.

SSA04-08 Occurrence and Lung Cancer Probability of Newly Detected Solid Nodules at Incidence CT Lung Cancer Screening

Participants
Joan E. Walter, BSc, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose
Marjolein A. Heuvelmans, BSc, Groningen, Netherlands (Presenter) Nothing to Disclose
Pim A. De Jong, MD, PhD, Utrecht, Netherlands (Abstract Co-Author) Nothing to Disclose
Rozemarin Vliegenthart, MD, PhD, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose
Mattihjs Oudkerk, MD, PhD, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose

PURPOSE
To determine the occurrence of new solid nodules and their respective lung cancer rate at the incidence screening rounds of a large randomized low-dose computed tomography (LDCT) lung screening trial.

METHOD AND MATERIALS
This trial was approved by the Ministry of Health. All participants gave informed consent. In total, 7,557 individuals underwent baseline LDCT screening. Following baseline, incidence-screenings took place after 1, 3 and 5.5 years. For this study, participants were selected with solid non-calcified nodules, newly detected after baseline and also in retrospect not present on any previous screening. Lung cancer diagnosis was based on histology, and benignity was based on either histology or a stable volume for at least two years.

RESULTS
At incidence screenings, in total 1,484 new solid nodules were identified in 949 participants. The median age of participants with new solid nodules was 59 years (interquartile-range 55-63 years), and 77% (735/949) were male. After one year, at least one new nodule was present in 4.7% (344/7295) of participants, and after two more years additional new nodules were found in 7.1% (491/6922) of participants. Eventually, in 7.9% (75/949) of participants with new solid nodules, a new solid nodule was proven to be lung cancer (in total 77 cancers). Most of the detected lung cancers were adenocarcinoma (30/77 [39.0%]), squamous cell carcinoma (20/77 [26.0%]) or small cell lung cancer (9/77 [11.7%]), and a majority (48/77 [62.3%]) was diagnosed at stage I.

CONCLUSION
New solid nodules are common findings in CT lung cancer screening and carry a substantial risk of malignancy. More research concerning new nodules is necessary to determine a sufficient follow-up strategy and evaluate distinguishing nodule features of...
benign and malignant new nodules.

**CLINICAL RELEVANCE/APPLICATION**

During LDCT lung cancer screening, in almost 8% of participants with new solid nodules, one of these nodules is malignant and guidelines may need to consider a more stringent follow-up for new nodules.

**SSA04-09 Comparing Inter-reader Variability of Manual Diameter and Semi-automated Volumetric Measurements for Pulmonary Nodules in Lung Cancer Screening**

Sunday, Nov. 29 12:05PM - 12:15PM Location: S404CD

**Participants**

Arjun Nair, MD,FRCR, London, United Kingdom (Presenter) Nothing to Disclose
Sze Mun Mak, MBBS,FRCR, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Nicholas J. Screaton, BMBCh, Cambridge, United Kingdom (Abstract Co-Author) Nothing to Disclose
John A. Holemans, MBBS, Liverpool, United Kingdom (Abstract Co-Author) Nothing to Disclose
Stephen W. Duffy, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
John K. Field, PhD, Liverpool, United Kingdom (Abstract Co-Author) Nothing to Disclose
David R. Baldwin, MD, Nottingham, United Kingdom (Abstract Co-Author) Nothing to Disclose
Anand Devaraj, MBBS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Guidelines propose that solid nodules with baseline diameter<6mm return to annual lung cancer screening. However, the accepted range of inter-reader variability (IRV) in manual diameter measurements derives from a single study. We aimed to (1) quantify IRV for both manual diameter and semi-automated volumetric measurements (Vol), and (2) assess inter-reader agreement for diameter-based categorisation, for solid nodules that may potentially require CT follow-up based on their volumes.

**METHOD AND MATERIALS**

Solid nodules between 50-300mm³ that had been measured by two trial radiologists at baseline CT in a national lung screening trial were reviewed. Two radiologists also independently measured diameters using electronic callipers. Diameter measurements were used to categorise nodules according to Lung-RADS for each reader. IRV was calculated using Bland-Altman analysis for diameter and volume measurements in all nodules, and for nodules ≥6mm. Inter-reader agreement for Lung-RADS categorisation was compared using the weighted kappa statistic (multirater K). The percentage of nodules where readers would have disagreed on the need for CT follow-up, using diameters according to Lung-RADS, was calculated.

**RESULTS**

286 nodules (mean diameter 5.0 ± 1.2mm, mean volume 99.5 ± 51.8mm³) in 200 subjects were studied. Absolute and percentage mean (and 95% confidence intervals, CIs) difference between readers were 0.2 (-1.2,1.6) mm and 4.5% (-22.7%, 31.6%) respectively for diameter, and 4.6(-101.6, 110.8) mm³ and 1.3% (-19.9%, 22.6%) respectively for volume. Percentage mean (and 95% CIs) differences between readers for diameter and volume in the 54/286 nodules measuring ≥6mm were 3.0% (-27.2%, 33.3%) and 0.1% (-1.1%, 1.4%). Multirater K for Lung-RADS categorisation was 0.67. Radiologists would have disagreed on the need for CT follow-up using diameter in Lung-RADS in 18/286 nodules (10.9%).

**CONCLUSION**

IRV in diameter is slightly higher than in semi-automated volumetry, for solid nodules with volumes 50-300mm³, but substantially lower using volumetry for nodules measuring ≥6mm in this volume range. However, inter-reader agreement for categorisation according to diameter remains good.

**CLINICAL RELEVANCE/APPLICATION**

Diameter measurement provides good overall agreement for nodule categorisation, but size reproducibility could substantially be improved using semi-automated volumetry for nodules deemed positive.
Purpose/Objective(s): In this study, our purpose was to compare the difference of overall survival (OS) between squamous (SCC) and non-squamous cell (non-SCC) non-small cell lung cancer patients, with consideration of other clinical factors.

Materials/Methods: Study population included patients treated from 2002 to 2014 in our center and with data recorded in the Tumor Registry. Age, gender, race, marital status, insurance status, tumor location, clinical stage, pathology, alcohol and smoking history, and treatments were tested for their significances. All alive patients had to be followed for at least 12 months to enter this study. Kaplan-Meier analysis and Cox proportional hazards model were used to determine differences in overall survival (OS). All tests were two-sided and p = 0.05 was considered to be significant.

Results: A total of 1116 consecutive patients were entered this study. Kaplan-Meier analysis and Cox proportional hazards model were used to determine differences in overall survival (OS). All tests were two-sided and p = 0.05 was considered to be significant. Results: A total of 1116 consecutive patients were entered this study. Kaplan-Meier analysis and Cox proportional hazards model were used to determine differences in overall survival (OS). All tests were two-sided and p = 0.05 was considered to be significant.

Abstract Co-Author
Feng-Ming Kong, MD, PhD, Augusta, GA (Abstract Co-Author) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): The study was designed to isolate possible risk factors predicting an increased risk of recurrence. Materials/Methods: From 184 primary lung SBRT cases treated between 2010 and 2012 at one institution, 6 known locally recurrent cases were identified positively with FDG-PET scans and/or pathology. 30 patients with a PET scan at least 24 months post SBRT were selected as the control group. All patients were planned using BrainlabTM and treatment delivered using five to seven 6MV photon beams delivering 50 Gy in 5 consecutive fractions on a Novalis Tx machine assisted with CBCT, 6D robotic alignment, and respiratory gating. Collected parameters included age, gender, histopathology, and biomarkers. Results: In the locally recurrent group, 5 of 6 cases were diagnosed as squamous cell carcinoma with none TTF-1 positive, while 25 of 30 locally controlled cases were identified as adenocarcinoma (ACA), as shown in the following table. Group: Local Recurrent Locally Controlled p-value *Cases 630n/aGender (M:F) 4:28:220.057 Age (mean) 78.878.1 n/a SCC 52 ACA 125 TTF-1 (+) 023 *Note: Z test for two population proportions, two-tailed.

Conclusion: SCC appears to have a strong correlation to local recurrence in this study using 50 Gy in 5 fractions. The following factors predicted local recurrence in our study: 1. Squamous cell histology: 1/6 of recurrences vs 1/30 of locally controlled. 2. TTF-1 negative: all recurrences were TTF-1 negative vs 23.3% of the locally controlled. This is a pilot study looking at our confirmed local recurrences. We plan to expand our analysis to include tumor size and other histologic factors, location (motion), image acquisition and other dosimetric factors.

Sunday, Nov. 29 10:45AM - 11:05AM Location: S104A

Participants
Noting to Disclose

References
1. Squamous cell histology: 1/6 of recurrences vs 1/30 of locally controlled. 2. TTF-1 negative: all recurrences were TTF-1 negative vs 23.3% of the locally controlled. This is a pilot study looking at our confirmed local recurrences. We plan to expand our analysis to include tumor size and other histologic factors, location (motion), image acquisition and other dosimetric factors.
Participants
Jonas Stroeeder, MD, Homburg, Germany (Presenter) Nothing to Disclose
Philippe Jagoda, MD, Homburg/saar, Germany (Abstract Co-Author) Nothing to Disclose
Jochen Fleckenstein, Homburg, Germany (Abstract Co-Author) Nothing to Disclose
Amo Buecker, MD, Homburg, Germany (Abstract Co-Author) Consultant, Medtronic, Inc Speaker, Medtronic, Inc Co-founder, Aachen Resonance GmbH Research Grant, Siemens AG
Guenther K. Schneider, MD, PhD, Homburg, Germany (Abstract Co-Author) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Research Grant, Bracco Group;

PURPOSE
The purpose of this study was to evaluate DWI of the thorax in determination of tumor volume and assessment of target volume for radiotherapy planning of non-small cell lung cancer (NSCLC) in comparison to a FDG-PET-CT based approach.

METHOD AND MATERIALS
13 pts with NSCLC and indication for primary radio-(chemo)therapy were prospectively evaluated with both MRI and PET-CT. 13 primary tumors with UICC stages I (4 pts.), II (1 pt.), IIIA (3 pts.) and IIIB (5 pts.) were evaluated. For MRI a respiratory gated T2-weighted sequence in axial orientation and non-gated DWI (b= 0, 800, 1400 and ADC map) were acquired on a 1.5 T scanner (Siemens, Magnetom® Aera). FDG PET-CT was performed as part of the routine staging. Both MR and PET-CT images were coregistered on a radiation treatment planning system (Phillips, Pinnacle3®). For the FDG-PET-CT data a semiautomatic contouring of the gross tumor volume (GTV) of the primary tumor based on a “source-to-background”-Algorithm was applied. For DWI and the T2w sequences a visual definition of the GTV was performed. Beside a statistical comparison of the GTV an evaluation of the target volume based on the "Hausdorff-Distance" (HD) and the "Dice Similarity Coefficient" was performed.

RESULTS
The median values (+ range) of the GTV for PET-CT and MRI (DWI and T2w imaging) did not differ significantly (PET-CT 69 ml (3 - 229 ml), DWI 71 ml (4 - 361 ml), T2w 65 ml (5 - 350 ml). The measured tumor volumes with all three techniques showed a highly significant correlation (PET/CT vs. DWI: r=0.97; PET/CT vs. T2w imaging: r=0.89; DWI vs. T2 imaging: r=0.92; p <0.0001). However in 9 out of 13 cases DWI showed a larger volume as compared with the FDG-PET data (mean difference 29.8% ± 19.5%). Comparing PET-CT and DWI a good agreement regarding the spatial target volume was found (HD: 2.5 ± 1.1 mm; DC 0.65 ± 0.08), which showed a tendency of decreased agreement with increasing tumor volumes.

CONCLUSION
FDG-PET-CT and MR based GTV definition overall shows a good agreement, especially regarding the spatial-topographic tumor localization. Tumor volumes may differ considerably in a particular case and further studies have to evaluate the added value of DWI in radiotherapy planning.

CLINICAL RELEVANCE/APPLICATION
Based on our initial findings DWI in radiation therapy planning can give important additional information and should be evaluated in larger scale studies.

SSA22-05 The Impact of Respiratory Movement on Local Recurrence in Patients with Stage I Non-Small Cell Lung Cancer in the Treatment of Intensity Modulated SBRT

Participants
Tomohiro Itonaga, Tokyo, Japan (Presenter) Nothing to Disclose
Hidetsugu Nakayama, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Yu Tajima, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Sachika Shiraishi, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Mitsuru Okubo, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Ryuji Mikami, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Kouichi Tokuyue, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose

ABSTRACT
Purpose/Objective(s): Phase II study of intensity-modulated stereotactic body radiotherapy (SBRT) using compensated filter for patients with stage I NSCLC was conducted. In this study, an internal target volume (ITV) was set to compensate for respiratory uncertainty under restriction of respiratory movement. The purpose of this study was to evaluate outcomes and prognostic factors when patients with stage I NSCLC were treated using this method.

MATERIALS/Methods: This study was approved by our facility’s ethical board. All patients provided written informed consent. Eligible criteria included the following: 1. patients who are unsuitable for surgery, 2. cytologically or histologically proven NSCLC, a tumor highly suspected of having NSCLC due to high accumulation in positron emission tomography or tumor growth rates of 25% compared to a previous image, 3. a clinical stage of T1-2N0M0 according to the 7th UICC TNM classification. To restrict the respiratory movement, the abdomen was pressed by a custom-made plastic immobilization belt. While wearing this device, a planning CT was taken during the inspiratory and expiratory phases, and the tumor localization. Tumor volumes may differ considerable in a particular case and further studies have to evaluate the added value of DWI in radiotherapy planning.

RESULTS
The median values (+ range) of the GTV for PET-CT and MRI (DWI and T2w imaging) did not differ significantly (PET-CT 69 ml (3 - 229 ml), DWI 71 ml (4 - 361 ml), T2w 65 ml (5 - 350 ml). The measured tumor volumes with all three techniques showed a highly significant correlation (PET/CT vs. DWI: r=0.97; PET/CT vs. T2w imaging: r=0.89; DWI vs. T2 imaging: r=0.92; p <0.0001). However in 9 out of 13 cases DWI showed a larger volume as compared with the FDG-PET data (mean difference 29.8% ± 19.5%). Comparing PET-CT and DWI a good agreement regarding the spatial target volume was found (HD: 2.5 ± 1.1 mm; DC 0.65 ± 0.08), which showed a tendency of decreased agreement with increasing tumor volumes.

CONCLUSION
FDG-PET-CT and MR based GTV definition overall shows a good agreement, especially regarding the spatial-topographic tumor localization. Tumor volumes may differ considerably in a particular case and further studies have to evaluate the added value of DWI in radiotherapy planning.

CLINICAL RELEVANCE/APPLICATION
Based on our initial findings DWI in radiation therapy planning can give important additional information and should be evaluated in larger scale studies.

SSA22-04 Evaluation of Tumor Volume and Target Volume Definition Based on Diffusion-weighted MRI in Radiotherapy of Non-small Cell Lung Cancer

Participants
Kouichi Itonaga, Tokyo, Japan (Presenter) Nothing to Disclose
Mitsuru Nakayama, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Yu Tajima, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Sachika Shiraishi, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Mitsuru Okubo, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Ryuji Mikami, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Kouichi Tokuyue, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose

ABSTRACT
Purpose/Objective(s): Phase II study of intensity-modulated stereotactic body radiotherapy (SBRT) using compensated filter for patients with stage I NSCLC was conducted. In this study, an internal target volume (ITV) was set to compensate for respiratory uncertainty under restriction of respiratory movement. The purpose of this study was to evaluate outcomes and prognostic factors when patients with stage I NSCLC were treated using this method.

MATERIALS/Methods: This study was approved by our facility’s ethical board. All patients provided written informed consent. Eligible criteria included the following: 1. patients who are unsuitable for surgery, 2. cytologically or histologically proven NSCLC, a tumor highly suspected of having NSCLC due to high accumulation in positron emission tomography or tumor growth rates of 25% compared to a previous image, 3. a clinical stage of T1-2N0M0 according to the 7th UICC TNM classification. To restrict the respiratory movement, the abdomen was pressed by a custom-made plastic immobilization belt. While wearing this device, a planning CT was taken during the inspiratory and expiratory phases, and the tumor was determined as the volume which covered the CTV in both phases. A compensator-based intensity modulated SBRT dose of 75 Gy given in 30 fractions was prescribed to PTV. Results: Forty-three patients with a total of 45 tumors at stage I NSCLC who underwent SBRT were entered into this study at Tokyo Medical University between March 2012 and March 2014. The median age of patients was 60 years (range, 49-90), and the male/female ratio was 24/15. Of the 45 tumors, 29 were T1, 16 were T2. Eighteen tumors were located in the upper lobe, 6 in the middle lobe and lingual segment, and 21 in the lower lobe. Regarding histological type, 12 tumors was identified as adenocarcinoma, 9 as squamous cell carcinoma, 8 as non-small-cell carcinoma and 16 were unidentified. During follow-up (median 15 months), actuarial local progression-free rates at 1-year and 2-years were 92.3% (95% confidence interval [CI] 78.0 to 97.5%) and 87.2% (95% CI, 67.5 to 95.3%), respectively. The actuarial local progression-free survival rate in patients with an ITV 30 ml larger than their GTV was significantly lower than those with a difference of 30 ml or less (p=0.029). Tumor histology, tumor location and minimum dose of ITV had no significant effect on local progression-free survival.
rates by univariate analysis. By multivariate analysis, an ITV minus GTV volume larger than 30 ml (hazard ratio = 11.2, p = 0.04) was a statistically significant indicator of poor local progression-free survival rates. Minimum dose of ITV and tumor location were not significant. Conclusion: A large volume of ITV minus GTV was a negative prognostic factor for local progression in SBRT, which suggested that in instance of high respiratory movement, special technique of respiratory gaiting or tumor-tracking may be necessary.

**SSA22-06** Comparison of Dose Distributions Calculated with Different Dose Calculation Algorithms in Pulmonary Lung Lesions in Order to Analyze the Influence of Different Algorithms on the Dose Prescription

Sunday, Nov. 29 11:35AM - 11:45AM Location: S104A

Participants
D. Correa, Bern, Switzerland (Presenter) Nothing to Disclose
D. Henzen, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
B. K. Shrestha, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Daniel Schmidhalter, PhD, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Natalie D. Klass, MD, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Marco Malthaner, PhD, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Bernd Klaeser, MD, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Nando Martineit, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Kathrin Zaugg, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Michael W. Schmuckling, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To introduce more accurate algorithms like Monte Carlo (MC) into the clinical routine, an adjustment of the currently used EPL or PB dose prescription is required. The goal of this study was to find the dose prescription adjustment when switching from PB to MC in iPlan and from EPL to MC in MultiPlan, respectively. For that reason dose distributions calculated with the different algorithms were analyzed for patients with malignant pulmonary lung lesions with different tumor size and location.

**METHOD AND MATERIALS**
For 124 lung lesions, treated between 2010 and 2014 at the Novalis TX (Varian Medical Systems) and at the CyberKnife (Accuray), dose distributions were initially calculated with PB and retrospectively re-calculated with MC in iPlan. In the same way, dose distributions were initially calculated with EPL and retrospectively re-calculated with MC in Multiplan. We compared the PB with the MC dose distribution within iPlan as well as the EPL with the MC dose distribution within MultiPlan. The following parameter were compared: minimum dose to 99% (D99), 95% (D95) and Dmean of the different target volumes (GTV, CTV, ITV, PTV), prescription isodose volume (PIV), the heterogeneity index (HI) and Dmean as well as Dmax to the organs at risk (OARs). Based on changes in D99, D95 and mean PTV dose, the prescription dose was converted from PB to MC and from EPL to MC, respectively.

**RESULTS**
So far, 64/124 lesions were evaluated (PB n=52, EPL n=12). The D99 and D95 to the PTVs were reduced when using MC in comparison to PB and EPL. Reduction was larger for peripheral tumors than for central tumors (up to 25% vs. 5%). Maximum in reduction was seen in small peripheral lesions, i.e. the PIV can be reduced up to 95% (PB volume 8.36ccm vs. MC volume 0.37ccm). Based on D95, for small peripheral lesions the PB prescription of 5x12Gy has to be reduced to 5x9.5Gy for MC. The mean and maximum dose to OARs decreased when using MC in comparison to EPL or PB.

**CONCLUSION**
Our preliminary results confirm that the dose prescription has to be adjusted when switching from PB to MC in iPlan. Furthermore we found, that the adjustment is different when switching from PB to MC in iPlan in comparison to switching from EPL to MC in MultiPlan.

**CLINICAL RELEVANCE/APPLICATION**
Future trials will show, if the more accurate dose calculation by MC might increase the probability of tumor control and/or might lower the toxicity.

**SSA22-07** Dynamic Contrast-enhanced Perfusion Area-Detector CT Assessed by different Mathematical Models vs. FDG-PET/CT: Capability for Therapeutic Outcome Prediction in Non-Small Cell Lung Cancer Patients with Chemoradiotherapy

Sunday, Nov. 29 11:45AM - 11:55AM Location: S104A

Participants
Yoshiiharu Ohno, MD, PhD, Kobe, Japan (Presenter) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA; Shinichiro Seki, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Hisanobu Koyama, MD, PhD, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Yasuko Fujisawa, MS, Otawara, Japan (Abstract Co-Author) Employee, Toshiba Corporation
Naoki Sugihara, MENG, Otawara, Japan (Abstract Co-Author) Employee, Toshiba Corporation
Takeshi Yoshikawa, MD, Kobe, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation
Sumaki Matsumoto, MD, PhD, Kobe, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation; Noriyuki Negi, RT, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Tohru Murakami, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Kazuo Sugimura, MD, PhD, Kobe, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group

**PURPOSE**
To directly compare the capability for therapeutic outcome prediction between dynamic first-pass contrast-enhanced (CE-) perfusion area-detector CT (ADCT) assessed by different mathematical methods and FDG-PET/CT in non-small cell lung cancer (NSCLC) patients treated with chemoradiotherapy.
METHOD AND MATERIALS

53 consecutive Stage IIIB NSCLC patients underwent PET/CT, dynamic CE-perfusion ADCT, chemoradiotherapy, and follow-up examination. In each patient, therapeutic outcomes were assessed as therapeutic effect based on RECIST guideline, disease free interval and overall survival. Then, all patients were divided into two groups as follows: 1) complete or partial response (CR+PR) and 2) stable and progressive diseases (SD+PD) groups. In this study, total tumor perfusion (TTPDMS) and tumor perfusions from pulmonary (TPPDMPS) and systemic (TPSDMS) circulations by dual-input maximum slope method, extraction fraction (EF) and distribution volume (DV) by Patlak plot method, tumor perfusion (TPSMS) by single-input maximum slope method, and SUVmax were assessed at each targeted lesion, and averaged to determine final values in each patient. To compare the capability for distinguishing CR+PR from SD+PD groups, ROC analyses were performed. Finally, disease free interval and overall survival between responders and non-responders assessed by all indexes as having no significant differences for differentiation capability on ROC analyses were compared by Kaplan-Meier method followed by log-rank test.

RESULTS

Area under the curves (Azs) of TTPDMS (Az=0.81), TPSDMS (Az=0.85) and SUVmax (Az=0.84) had significantly larger than that of TPPDMS (Az=0.69, p<0.05). On disease free interval and overall survival assessments, responders had significantly longer disease free interval and overall survival than non-responders on TPSDMS (disease free: p=0.002, overall: p=0.001), TPSMS (disease free: p=0.0004, overall: p=0.03) and DV (disease free: p=0.03, overall: p=0.04).

CONCLUSION

Dynamic first-pass CE-perfusion ADCT provide a few good predictors, and have better potential than PET/CT for therapeutic outcome prediction in NSCLC patients treated with chemoradiotherapy.

CLINICAL RELEVANCE/APPLICATION

Dynamic first-pass CE-perfusion ADCT provide a few good predictors, and have better potential than PET/CT for therapeutic outcome prediction in NSCLC patients treated with chemoradiotherapy.

SSA22-08 Impact of Thoracic Radiation (TRT) on Survival of Extensive-Stage Small Cell Lung Cancer (ES-SCLC): A Singapore Population-Based Outcome Study

Sunday, Nov. 29 11:55AM - 12:05PM Location: S104A

Participants
Yu Yang Soon, Singapore, Singapore (Presenter) Nothing to Disclose
Huili Zheng, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Shaun Z. Ho, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Wee Yao Koh, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Cheng Nang Leong, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
En Yen Loy, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Jeremy C. Tey, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Balamurugan Vellayappan, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Swee Peng Yap, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Kam Weng Fong, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Ivan W. Tham, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Randomized studies have shown that TRT improved survival outcomes in patients with ES-SCLC responding to first line chemotherapy. This retrospective cohort study aims to evaluate the use of TRT and its impact on survival.

Materials/Methods: All patients diagnosed with ES-SCLC without brain metastases in the only two Singapore national cancer centers from 2003 to 2010 were identified using the institutions’ pathology registries. We linked the treatment records to the national death registry. Demographic and clinical factors associated with the use of TRT were identified. Propensity score analyses were compared by Kaplan-Meier method followed by log-rank test.

RESULTS

Controlling for demographic and clinical characteristics, TRT was associated with lower risk of death (Hazard ratio of 10 for tumor control, the median equivalent dose in 2 Grays (Gy) per fraction is 32.5Gy (range 4.7Gy to 60Gy). Patients treated with prophylactic cranial irradiation (adjusted odds ratio [OR] 4.85; 95% Confidence Interval [CI] 1.13 to 24.38, P = 0.034) were more likely to receive TRT. Controlling for demographic and clinical characteristics, TRT was associated with lower risk of death (Hazard ratio 0.48; 95% CI 0.34 to 0.67, P Conclusion: TRT has been not widely adopted in the treatment of ES-SCLC in Singapore and may be associated with improved survival. A larger population based outcome study to validate the survival benefit of thoracic radiation is warranted.

SSA22-09 A Retrospective Evaluation of Stereotactic Body Radiation Therapy for Pulmonary Oligometastases in a Multicenter Study

Sunday, Nov. 29 12:05PM - 12:15PM Location: S104A

Participants
Kuniaki Katsui, Okayama, Japan (Presenter) Nothing to Disclose
Yuzuru Nibe, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Hideomi Yamashita, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Takaya Yamamoto, Sendai, Japan (Abstract Co-Author) Nothing to Disclose
Wataru Takahashi, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Jiro Kawamori, Chuo, Japan (Abstract Co-Author) Nothing to Disclose
Keiichi Jingu, MD, Sendai, Japan (Abstract Co-Author) Nothing to Disclose
Keiichi Nakagawa, MD, PhD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Atsuo Terahara, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Susumu Kanazawa, MD, Okayama, Japan (Abstract Co-Author) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Oligometastases was divided into sync-oligometastases and oligo-recurrence, the difference being that the
The primary site of oligometastases was uncontrolled (sync-oligometastases) or controlled (oligo-recurrence). The purpose of this study was to evaluate treatment outcomes after stereotactic body radiotherapy (SBRT) for pulmonary oligometastases. Materials/Methods: A total of 96 patients (65 males and 31 females) who received SBRT for pulmonary oligometastases between January 2004 and April 2014 at 4 high-volume institutions in Japan were enrolled in this retrospective study. The primary sites were the colorectum (n=25), lung (n=24), head and neck (n=8), and others (n=39). Ten cases were sync-oligometastases, 79 cases were oligo-recurrences and 7 cases were unclassified oligometastases. The median disease-free interval (DFI) between initial therapy and SBRT was 24 months (range, 0-246 months). The median prescribed BED was 105.6 Gy (range, 75-134.4 Gy). Overall survival (OS), local control rate (LCR) and relapse-free survival rate (RFS) were calculated using Kaplan-Meier curves, and the log-rank test was used to compare the curves. Multivariate analysis for RFS was performed using a Cox proportional hazards model. Statistical significance was set at p Results: The median follow-up periods were 21 months (range, 1-119 months) for all patients. The 3-year OS, LCR and RFS rates were 52%, 75% and 25%, respectively. Radiation pneumonitis of grade 3 was found in 2 patients and gastrointestinal toxicity of grade 4 was found in 1 patient. No grade 5 toxicity occurred. The 3-year RFS for sync-oligometastases was 0% and that for oligo-recurrence was 28% (Figure, p Conclusion: In SBRT for pulmonary oligometastases, control of the primary site is a significant prognostic factor for RFS.
**PURPOSE**

Subsets of non-small cell lung cancer (NSCLC) are driven by mutations in key oncogenes, with unique biology including susceptibility to targeted treatment. Additionally, those mutations could lead to phenotypic differences of the primary tumor that can be assessed with quantitative imaging. In this study, we investigated whether somatic mutation are associated with, and hence can be predicted by CT tumor volume-based features of NSCLC patients.

**METHOD AND MATERIALS**

We included 117 NSCLC patients with treatment-planning CT scans in our analysis and clinical genotyping for the epidermal growth factor receptor (EGFR) and Kirsten rat sarcoma viral oncogene homolog (KRAS) oncogenes. We extracted four volumetric features describing volume and diameters (x/y axis and 3D) of the primary tumor. Volumetric differences between mutant and wild-type tumors were assessed using Wilcoxon test. Predictive value of the volumetric features for mutation status was assessed using the area under the curve (AUC).

**RESULTS**

Genotype distribution included 14 (12%) EGFR mutant, 35 (30%) KRAS mutant, and 68 (58%) wild-type tumors. All volumetric features for EGFR mutant were significantly (p-value <0.05) lower than for KRAS mutant and Wild-Type. No volumetric features were significantly different between KRAS and Wild-Type. The median (Q1-Q3) for volume was 10.2(6.1-29.6), 39.3(14.3-89.7) and 49(10.7-119) for EGFR, KRAS and Wild-Type respectively. All volumetric features were also significant predictive features for EGFR mutation with median (range) AUC of 0.69(0.67-0.70) and all p-value<0.05. However, the AUC was only 0.51(0.50-0.51) for KRAS mutation.

**CONCLUSION**

EGFR mutant primary tumors were significantly smaller (for all volumetric features) than KRAS or Wild-Type. Moreover, all volumetric features were significantly predictive for EGFR. KRAS and Wild-Type could not be discriminated only based on volumetric features. A larger set of imaging features (e.g. Radiomics) would help find more predictive biomarkers for tumor mutation status.

**CLINICAL RELEVANCE/APPLICATION**

Subsets of non-small cell lung cancer (NSCLC) are driven by mutations in key oncogenes, with unique biology including susceptibility to targeted treatment. An early detection of those mutations based on volumetric information would allow to adapt patients’ treatment, therefore potentially improving patients’ outcome.
METHOD AND MATERIALS

Patients with undiagnosed nodules ≤15 mm were randomized to either no localization (N=27) or preoperative microcoil localization (N=29). Patients excluded from this study included 8 patients with benign disease and 22 who had completion lobectomies. Coils were placed with the distal end deep to the nodule and the superficial end coiled on the visceral pleural surface with subsequent visualization by intraoperative fluoroscopy and VATS. 14 nodules were removed by VATS wedge excision alone incoil group and 12 in non image guided group. Primary outcome was CT evidence of local recurrence at the resection margin.

RESULTS

All patients were followed with a median follow up of 40 months, range 20-60 months. Follow up CT scans done at 6 monthly intervals. In patient who had wedge alone there were 0/14 recurrences in microcoil patient and 2/12 in non image-guided group. Local recurrences occurred at 8 and 21 months in patients with metastatic colon cancer and T1N0 bronchogenic adenocarcinoma respectively. Both patients underwent repeat VATS wedge excisions.

CONCLUSION

Pre-operative localization of small peripheral pulmonary nodules using CT guided microcoil localization followed by fluoroscopic VATS wedge resection resulted in no local recurrence compared to 2/12 local recurrences in non image-guided group.

CLINICAL RELEVANCE/APPLICATION

Pre-operative CT guided microcoil localization of SSPN allows the surgeon to achieve optimal resection margins decreasing risk of local recurrence at staple line.

CH203-SD-SUA4 Direct Organ Dose Measurements and Image Quality Analysis in Low Dose Lung Cancer Screening CT Scans

Participants

Izabella Lipharlaski, MS, Gainesville, FL (Presenter) Nothing to Disclose
Rebecca H. Lamoureux, MS, BS, Gainesville, FL (Abstract Co-Author) Nothing to Disclose
Catherine Camanza, Gainesville, FL (Abstract Co-Author) Nothing to Disclose
Anna Menc, Gainesville, FL (Abstract Co-Author) Nothing to Disclose
Sylvia Gyamong, MD, Gainesville, FL (Abstract Co-Author) Nothing to Disclose
Lynn N. Rill, PhD, Gainesville, FL (Abstract Co-Author) Nothing to Disclose
Nupur Verma, MD, Gainesville, FL (Abstract Co-Author) Nothing to Disclose
Tan-Lucien Mohammed, MD, Gainesville, FL (Abstract Co-Author) Nothing to Disclose
Manuel M. Arreola, PhD, Gainesville, FL (Abstract Co-Author) Nothing to Disclose

PURPOSE

The National Lung Screening Trial (NLST) and the United States Preventative Services Task Force (USPSTF) have recommended using low-dose computed tomography for early detection of lung cancer. Direct measurements in post-mortem subjects were carried out to determine organ doses that would be experienced by patients undergoing a lung cancer screening CT exam. Parameters were varied to provide as low dose as possible while satisfying image quality for the purpose of identifying lung nodules in past smokers.

METHOD AND MATERIALS

Two female cadavers and an anthropomorphic chest phantom were scanned on a commercial 320-slice CT scanner using a lung cancer screening protocol recommended by the AAPM. All subjects were scanned from the top to the bottom of the lungs at 120 kVp, tube current modulation employed within 10 mA and 150 mA, and a noise target index (SD) of 20. Further dose savings were attained by reducing the voltage to 100 kVp and increasing the SD to 25. Organ doses were directly measured in one of the post-mortem subjects using direct dosimetry methods utilizing optically stimulated luminescent dosimeters. Three thoracic radiologists were recruited to perform a blinded observer study, grading visualization of lung parenchyma, sharp reproduction of the lung detail, and overall diagnostic confidence with a score of (1) for unacceptable, (2) for borderline acceptable, or (3) for acceptable image quality.

RESULTS

Scanning with the AAPM recommended protocol resulted in a CTDIvol of 3.3 mGy, and average organ doses for the skin, breasts, lungs, liver, stomach, small intestine, colon, and ovaries of 5.9, 5.2, 4.0, 4.5, 3.9, 1.7, 2.9, and 0.15 mGy, respectively. Increasing the SD to 25 resulted in an average organ dose reduction of 21%. Reducing the voltage to 100 kVp resulted in reductions of 33% and 36% for an SD of 20 and 25, respectively. The majority of readers found all images to be of acceptable quality.

CONCLUSION

Methods used in this study allowed direct measurement of organ doses and the ability to perform multiple scans on the same subject for dosimetry and image quality analysis. Relative to the AAPM recommended protocol, average organ doses reductions of 36% can be achieved without degraded image quality.

CLINICAL RELEVANCE/APPLICATION

With the nationwide acceptance of the lung cancer screening CT initiative, it is imperative to identify an adequate protocol that considers both radiation dose and image quality.

CH102-ED-SUA5 Pulmonary Embolism Evolution and Follow-up: A Clinicoradiological Review of Current Concepts and Guidance

Participants

Charlie Sayer, MBBS, FRCR, London, United Kingdom (Presenter) Nothing to Disclose
Jaymin H. Patel, MBBS, BSC, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
TEACHING POINTS

1. Review expected/unexpected time evolution of acute and chronic PE on CT pulmonary angiography (CTPA) 2. Correlate serial CTPA evolution to clinical/physiological parameters (e.g. echocardiography & right heart catheterization) and patient outcome (e.g. development of chronic thromboembolic pulmonary hypertension (CTEPH)) 3. Dual energy CTPA (DE-CTPA) utility to improve assessment of acute/chronic/resolved PE 4. Guidance criteria for follow up of acute PE

TABLE OF CONTENTS/OUTLINE

Selection of imaging cases demonstrating the range of PE evolution appearances and discussion of the relevant literature and evolving evidence base. 1. Acute PE - early/complete resolution (differences between anticoagulation and thrombolysis) 2. Acute PE - risk/incidence/timeline of incomplete resolution 3. Evolution of missed chronic PE 4. Infarction patterns and pathological basis (ground glass, reverse halo, solid, melting) 5. Use of DE-CTPA in PE prognosis: significance of pulmonary blood volume (PBV) defects (resolution/persistence at follow-up) 6. Risk of pulmonary hypertension (PH) following PE 7. Dual phase CTPA utility (diagnostic confidence, identification of haemodynamic changes) 8. Current clinicoradiological research concepts in PE evolution e.g. CTEPH versus PH with 'in situ thrombus', a controversial distinction

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Ioannis Vlahos, MRCP, FRCR - 2015 Honored Educator
The Effects of Pure and Hybrid Iterative Reconstruction Techniques on High-resolution Computed Tomography in the Evaluation of Interstitial Lung Disease


Participants
Sushilkumar K. Sonavane, MD, Birmingham, AL (Moderator) Nothing to Disclose

Sub-Events


CH204-SD-SUB1 The Effects of Pure and Hybrid Iterative Reconstruction Techniques on High-resolution Computed Tomography in the Evaluation of Interstitial Lung Disease

Station #1

Participants
Masaki Katsura, MD, PhD, Tokyo, Japan (Presenter) Nothing to Disclose
Jiro Sato, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Masaaki Akahane, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Koichiro Yasaka, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Soichiro Miki, MD, Bunkyo-Ward, Japan (Abstract Co-Author) Nothing to Disclose
Kuni Ohtomo, MD, Tokyo, Japan (Abstract Co-Author) Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group

PURPOSE
To compare image quality and visualization of normal and pathologic structures at high-resolution computed tomography (HRCT) for interstitial lung disease, with images reconstructed with model-based iterative reconstruction (MBIR), adaptive statistical iterative reconstruction (ASIR), and filtered back projection (FBP) techniques.

METHOD AND MATERIALS
We evaluated 16 consecutive patients with known or suspected interstitial lung disease who underwent unenhanced standard-of-care chest CT examinations with a 64-row multi-detector CT (Discovery CT750HD). CT acquisition involved the use of automatic tube current modulation with a fixed noise index of 32.1 at 0.625 mm. Other scanning parameters were as follows: acquisition mode: helical; tube voltage: 120 kVp; field of view: 35 cm; pitch: 0.984:1; gantry rotation time: 0.5 sec; and table speed: 39.37 mm per gantry rotation. HRCT of each lung was created in 0.625 mm contiguous axial slices with field of view of 20 cm. HRCT images were reconstructed with FBP, 50% ASIR-FBP blending (ASIR50), and MBIR. Both FBP and ASIR involved the use of the bone kernel. Objective image noise was measured in the lung parenchyma. Subjective image quality was assessed in a blinded manner for subjective image noise, streak artifacts, small anatomic details (secondary pulmonary lobular structures, pleura, large and small bronchi and vessels), and pathologic findings (reticulation, altered attenuation, and bronchiectasis). Data were analyzed using the sign test and pair-wise Student's t-test.

RESULTS
MBIR images had significantly lower quantitative image noise (23.3 ± 3.3) compared to ASIR images (37.4 ± 6.2, P < 0.01) and FBP images (48.9 ± 8.8, P < 0.01). Significant improvements in subjective image noise, streak artifacts, and visualization of normal and pathologic structures were observed with the use of MBIR (P < 0.01 each for MBIR vs. the other two image data sets), while no significant difference was observed between ASIR and FBP (P > 0.9).

CONCLUSION
MBIR significantly improves image noise and streak artifacts at HRCT over ASIR and FBP, and results in superior visualization of normal and pathologic structures in interstitial lung disease.

CLINICAL RELEVANCE/APPLICATION
MBIR improves visualization of interstitial lung disease patterns at HRCT compared with ASIR and FBP. MBIR is expected to enhance the value of HRCT examinations for patients with interstitial lung disease.

PURPOSE
To investigate the characteristics and prevalence of diffuse pulmonary ossification (DPO) in various fibrosing interstitial lung diseases (FILD) and to evaluate the diagnostic utility of DPO.

METHOD AND MATERIALS
2411 consecutive new patients attending the interstitial lung disease unit were reviewed. 892 with a multidisciplinary consensus
diagnosis of (IPF) (n=456, male:female (M:F)=366:90, age 72 (range: 38-93)), nonspecific interstitial pneumonia (NSIP) (n=244, M:F=79:165, age 60.5 (range: 23-86)) and chronic hypersensitivity pneumonitis (CHP) (n=192, M:F=76:116, age 66 (range: 35-88)) were identified, and their volumetric HRCT studies were reviewed. Pulmonary ossification (PO) was documented as present when small nodules (<4mm diameter) were identified on bone window settings (width=2500, level=500). Diffuse PO (DPO) was defined as “bilateral ≥10 nodular ossifications (Definition 1)” or, more stringently as “≥1 lobes with ≥5 nodular ossifications bilaterally (Definition 2).” Nodules were analyzed by lobe as to their shape (nodular or dendriform), number, extent, axial distribution, and the background parenchymal pattern of ILD. HRCTs were also evaluated for the predominant parenchymal pattern.

RESULTS
For the entire population of FILD DPO prevalence was 166/892 (18.6%) and 106/892 (11.9%) for Definitions 1 and 2 respectively. DPO prevalence using Definition 1 was significantly higher in IPF (28.5%) than all non-IPF cases (8.3%, p=0.0001), NSIP alone (11.1%, p<0.0001) or CHP alone (4.7%, p<0.0001). On multivariate analyses: male gender (p<0.001), coarseness of FILD (p<0.001) and presence of IPF (p<0.001) were independently associated with higher density of nodular ossifications. DPO was an independent predictor of the diagnosis of IPF (p=0.011).

CONCLUSION
Nodular ossifications are a frequent finding in FILD and are significantly more prevalent in IPF than in other FILD. The presence of nodular ossifications is a useful corroborative CT sign of IPF.

CLINICAL RELEVANCE/APPLICATION
DPO has a much higher prevalence in IPF than other fibrosing lung diseases. DPO is an independent predictor of IPF and may be a useful corroborative sign of IPF.

CH206-SD- SUB3
Idiopathic Pleuroparenchymal Fibroelastosis; CT-Pathologic Correlation in 17 Cases

Participants
Takeki Johkoh, MD, PhD, Itami, Japan (Presenter) Research Consultant, Bayer AG Research Consultant, F. Hoffman-La Roche Ltd
Tonomori Tanaka, MD, Toyama, Japan (Abstract Co-Author) Nothing to Disclose
Junya Fukuoka, Nagasaki City, Japan (Abstract Co-Author) Nothing to Disclose
Hiroyuki Taniguchi, MD,PhD, Seto, Japan (Abstract Co-Author) Research Consultant, Bayer AG; Research Consultant, F. Hoffmann-La Roche Ltd; Research Consultant, Pfizer Inc
Michio Shigematsu, MD, PhD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD, Suita, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
To describe CT findings of idiopathic pleuroparenchymal fibroelastosis (iPPFE) and to correlate them with pathologic findings.

METHOD AND MATERIALS
The study included 17 patients with iPPFE who were done either surgical lung biopsy (n=15) or autopsy (n=2). The pathological diagnosis is pure PPFE in five cases, PPFE with usual interstitial pneumonia (UIP) (PPFE+UIP) in nine, and PPFE with fibrosing non-specific interstitial pneumonia (NSIP) (PPFE+NSIP) in three. The patients ranged from 30 to 85 years of age (mean 65), and included 10 males and seven females. CT findings were independently evaluated by two observers. Each CT finding was precisely correlated with corresponding pathologic finding.

RESULTS
Apical subpleural areas of airspace consolidation with dilated air bronchogram were seen in all cases. Loss of volume of bilateral upper lobes were seen in all five cases with pure PPFE (100%) and three withPPFE+UIP while it was not found in those with PPFE+NSIP. Pathological pleural thickening was just seen in each one case with either, pure PPFE, PPFE+UIP or PPFE+NSIP. Apical subpleural cysts were seen in three cases with pure PPFE(60%)and two with PPFE+UIP (22%) while no cases with PPFE+NSIP had it. Histologically, some apical cysts are continued to the areas with fibroelastosis. Lower lobe involvement was seen in two cases with pure PPFE(40%). The CT finding is a thickened linear opacity extending from pleura and pathologically corresponded to the extensions of fibroelastosis along veins or interlobular septa(Fig). In the cases with PPFE +UIP or NSIP, reticular opacities were seen in the lower lung fields on CT.

CONCLUSION
Pure PPFE sometimes involves lower lung fields and the corresponding CT finding is a thickened linier opacity extending from pleura. Characteristic CT findings of PPFE consist of not only apical subpleural airspace consolidation with dilated air bronchogram and upper loss of volume but also apical cysts presumably derived from fibroelastosis. Pathological pleural involvement is not always seen.

CLINICAL RELEVANCE/APPLICATION
PPFE sometimes involves lower lung fields and the corresponding CT finding is a thickened linier opacity extending from pleura. Characteristic CT findings of PPFE consist of not only apical subpleural airspace consolidation with dilated air bronchogram and upper loss of volume but also apical subpleural cysts

CH207-SD- SUB4
Validation of the McWilliams Risk Prediction Model for the Probability of Cancer in Subsolid Nodules from the National Lung Screening Trial

Participants
Kamal Chung, MD, Nijmegen, Netherlands (Presenter) Nothing to Disclose
Francesco Ciompi, PhD, Nijmegen, Netherlands (Abstract Co-Author) Nothing to Disclose
Ernst T. Scholten, MD, Haarlemmerlee, Netherlands (Abstract Co-Author) Nothing to Disclose
Sarah J. Van Riel, MD, Nijmegen, Netherlands (Abstract Co-Author) Research Grant, MeVis Medical Solutions AG
Mathias Prokop, PhD, Nijmegen, Netherlands (Abstract Co-Author) Speakers Bureau, Bayer AG Speakers Bureau, Bracco Group
A prediction model for lung nodules was proposed by McWilliams et al. (NEJM, 2013) for predicting the probability of malignancy in pulmonary nodules. However, studies have shown the different course of subsolid nodules compared to solid nodules. Purpose of this study was to validate the McWilliams risk prediction model only for subsolid nodules.

**METHOD AND MATERIALS**

The study group consisted of 71 cancers from the NLST trial that presented as subsolid lesions and were visible on baseline scans. These lesions were compared to 620 randomly selected subsolid lesions that were not diagnosed as malignancies within a median follow-up of 6.5 years. Baseline scans were annotated using automatic detection and volumetry to estimate the effective diameter (Cirrus Lung Screening, Nijmegen, the Netherlands). An experienced radiologist identified the malignant lesions following the anatomic information as provided by the NLST database. Cases of doubt were excluded from the analysis. Other predictors of cancer were taken from the NLST database. ROC analysis was performed to determine the discrimination of malignant from benign subsolid nodules in both the parsimonious (1B) and the full model (2B). The parsimonious model uses sex, nodule size, upper lobe location and spiculation as predictors of cancer, the full model additionally considers age, family history of lung cancer, emphysema, nodule type and nodule count.

**RESULTS**

McWilliams models 1B and 2B were applied to predict the probability of malignancy, and showed an area under the curve (AUC) of 0.863 and 0.894, respectively. The difference between the two models was significant (p = 0.005).

**CONCLUSION**

Both parsimonious and full McWilliams risk prediction models show a high discrimination for benign from malignant subsolid nodules based on baseline information alone, the full model performed better than the parsimonious model.

**Clinical Relevance/Application**

The McWilliams risk prediction model helps in predicting the probability of malignancy in subsolid nodules only taking baseline information into account.

**Teaching Points**

The purpose of this exhibit is to explain: The new 2013 guidelines divide IIP’s into “major groups” and rare entities based on prevalence. Idiopathic lymphoid interstitial pneumonia (LIP) joins pleuroparenchymal fibroelastosis in the rare category. The major groups further classify the more common entities by clinical cause and histological patterns. A new clinical behavior classification groups IIP based on progression and treatment goals. This new clinical behavior classification governs radiology surveillance intervals.

**Table of Contents/Outline**

Classic IIP Types review Reorganization into major groups and rare entities Where the classic IIP’s fall A closer look at the major groupings New rare entities The new clinical behavior classifications How the IIP’s are divided clinically Proposed monitoring strategies and treatment goals The new IIP summary based on the 2013 update
Imaging of Pulmonary Fibrosis

Sunday, Nov. 29 2:00PM - 3:30PM Location: E451B

Participants
David A. Lynch, MBBCh, Denver, CO (Moderator) Research support, Siemens AG; Scientific Advisor, PAREXEL International Corporation; Consultant, Boehringer Ingelheim GmbH; Consultant, Gilead Sciences, Inc; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Veracyte, Inc;

LEARNING OBJECTIVES
1) Understand the current clinical approach to diagnosis and management of pulmonary fibrosis. 2) Identify the major CT imaging features of the idiopathic interstitial pneumonias based on the revised ATS/ERS diagnostic criteria for IPF. 3) Differentiate idiopathic pulmonary fibrosis from nonspecific interstitial pneumonia and chronic hypersensitivity pneumonitis. 4) Identify important complications of IPF. 5) Understand evolving role of quantitative CT in assessment of lung fibrosis.

ABSTRACT
Recent clinical trials in idiopathic pulmonary fibrosis (IPF) have resulted in approval of two new treatments for this condition. Given the central role of the radiologist in making the CT diagnosis of IPF, it is critical to understand the diagnostic criteria for this condition as recently revised by the ATS/ERS, and to distinguish it from other fibrosing interstitial pneumonias including nonspecific interstitial pneumonia (NSIP), connective tissue disease related lung fibrosis (CVD-ILD), and chronic hypersensitivity pneumonitis (HP). The radiologist also has an important role in identifying complications of lung fibrosis including acute exacerbations and lung cancer. Substantial advances have been made in developing CT techniques for quantification of lung fibrosis, which correlate with clinical severity and with mortality.

Sub-Events

RC101A Advances in Management of Pulmonary Fibrosis

Participants
Imre Noth, MD, Chicago, IL (Presenter) Speakers Bureau, Sumitomo Dainippon Pharma Co, Ltd; Speakers Bureau, F. Hoffmann-La Roche Ltd; Speakers Bureau, Boehringer Ingelheim GmbH; Consultant, ImmuneWorks, Inc; Consultant, Gilead Sciences, Inc; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Boehringer Ingelheim GmbH

LEARNING OBJECTIVES
View learning objectives under main course title.

RC101B Fibrosing Interstitial Pneumonia: How to Sort Out the IP’s

Participants
Justus E. Roos, MD, Durham, NC (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

RC101C Critical Issues in Imaging of Idiopathic Pulmonary Fibrosis

Participants
David A. Lynch, MBBCh, Denver, CO (Presenter) Research support, Siemens AG; Scientific Advisor, PAREXEL International Corporation; Consultant, Boehringer Ingelheim GmbH; Consultant, Gilead Sciences, Inc; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Veracyte, Inc;

LEARNING OBJECTIVES
View learning objectives under main course title.

RC101D Quantification of Pulmonary Fibrosis

Participants
Brian J. Bartholmai, MD, Rochester, MN (Presenter) License agreement, ImBio, LLC; Scientific Advisor, ImBio, LLC; Scientific Advisor, Bristol-Myers Squibb Company

LEARNING OBJECTIVES
View learning objectives under main course title.
Participants
Simon S. Lo, MD, Cleveland, OH (Moderator) Research support, Elekta AB;

Sub-Events

RC120A  **Fundamentals in Radiation Oncology Imaging of Head and Neck Cancer**

Participants
Hilda E. Stambuk, MD, New York, NY (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Define key anatomy and understand pathways of tumor spread for head and neck cancers. 2) Identify radiographic features of the patterns of tumor involvement. 3) Understand the implications of radiographic imaging in treatment planning.

**ABSTRACT**
Radiographic imaging is integral to diagnosis, extent of disease assessment, treatment planning and post-treatment surveillance in patients with head and neck cancer. Since the overwhelming majority of cancers of the head and neck are squamous cell carcinoma, these tumors will be the primary focus of the lecture. In addition, choosing the appropriate imaging modality is of vital importance in effective evaluation and therefore the pros and cons of imaging modalities in particular subsites will be presented. The patterns of tumor spread depend on the site of origin of the tumor and will be discussed in detail for some of the common sites such as nasopharynx and oropharynx that are treated primarily with radiation. The implications of pathways of tumor involvement including perineural spread on treatment planning will be emphasized. This lecture will provide radiation oncologists a basic understanding of the role of imaging and will highlight pearls and pitfalls that can influence management.

RC120B  **Fundamentals in Radiation Oncology Imaging of Thoracic Malignancies**

Participants
Matthew M. Harkenrider, MD, Maywood, IL (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) To review the normal imaging changes after precision radiotherapy for lung cancer. 2) To discuss methods of distinguishing recurrence vs. fibrosis after stereotactic radiotherapy. 3) To highlight difficult imaging cases in assessing response after radiotherapy.

**ABSTRACT**

RC120C  **Fundamentals in Radiation Oncology Imaging of Skull Base Tumors**

Participants
Jason Rockhill, MD, Seattle, WA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Identifying imaging techniques to help delineate target volumes for skull based tumors. 2) Discuss the challenges of determining target volumes for skull based tumors in the resected and non-resected patient. 3) Review key features to follow by imaging of skull based tumors after radiation therapy.

RC120D  **Imaging and RT QA in Cancer Clinical Trials: The Advanced Technology Consortium (ATC), the Quality Assurance Review Center (QARC), and the Imaging and Radiation Oncology Core (IROC)**

Participants
Thomas J. Fitzgerald, MD, Worcester, MA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Describe diagnostic imaging and radiation therapy utilization in clinical trials. 2) Describe the role of quality assurance in imaging and radiation therapy in clinical trials. 3) Describe future QA strategies in the National Clinical Trials Network (NCTN).
Integrated application of genomics, quantitative imaging and “big data” has the potential to positively transform cardiovascular disease (CVD). CVD develops over an individual’s lifetime.

**ABSTRACT**

Biomarkers have been embraced by both the scientific and regulatory communities as surrogates end points for clinical trials, paving the way for their widespread use in medicine. The field of imaging biomarkers has exploded, and their integration into clinical practice relies on using and intersects with the field of bioinformatics. Once specific biomarkers are show to have value, easily integrating them into the digital environment of the radiologist and communicating them to the health care providers and or directly to patients efficiently and seamlessly is important for their value and impact on health to be realized. Culturally, it is taking radiologists from the era of description and largely qualitative reporting, into a quantitative future state, and leveraging informatics to extract information from imaging alone or together with data available in the electronic medical record is essential for future success in this new world. To get there, understanding the impact of this approach as a value of our services, and standardization of imaging techniques along the lines of what the RSNA QIBA initiative is designing, are essential, so that imaging biomarkers are robust, accurate and reproducible. Embracing this approach enables and facilitates new approaches, relationships of imaging and IT researchers, vendors and consumers, to fully realize the possibilities. This course will discuss and describe the overall constructs, and use tangible exams of using this in practice today and for the future.

**LEARNING OBJECTIVES**

1) To learn what the term precision medicine means. 2) To understand how informatics intersects with clinical radiology to enable precision medicine in practice. 3) To learn through concrete examples how informatics based radiology precision medicine impacts health.

**ABSTRACT**

The era of personalized/precision medicine offers the potential to utilize patient and lesion specific data to personalize screening and diagnostic work-up, diagnosis, and treatment selection to a particular patient to optimize effectiveness. Although recently, the emphasis has been on utilization of genomic data in personalized medicine, there is a ‘gold mine’ of useful data in previously conducted clinical trials as well as patient medical electronic records that has, until now, gone largely untapped. The purpose of this presentation is to describe how the screening, diagnosis, and treatment of lung nodules can be personalized utilizing data from the NLST and PLCO clinical trials and how the Fleischner Guidelines and screening criteria for lung cancer can be modified according to the characteristics of an individual patient and individual nodule. The presentation will also include ways in which a facility can collect local data on their own patients to supplement these reference databases with experience from their own patient population.

**LEARNING OBJECTIVES**

1) Describe how data from a clinical trial can be repurposed as a decision support tool. 2) List some of the potential techniques that can be utilized to predict likelihood of a malignant nodule from the NLST database. 3) Explain how the Fleischner Guidelines can be personalized utilizing data from NLST and PLCO. 4) Detail the implications for lung screening trials of having access to NLST and PLCO data. 5) Demonstrate how a healthcare enterprise can create their own local reference database using information from their own patient population.
prevention and care and reduce the health and economic consequence of CVD. In this talk we will review how easily obtainable imaging biomarkers, already available, can power this change. Measures of cardiac and vascular structure and function as well as body composition provide great insight into and individual’s risk of CVD, level of physical activity, diet, vascular health and general well-being.
Report of the RSNA Research and Education Foundation

Participants
Ronald L. Arenson, MD, San Francisco, CA (Presenter) Nothing to Disclose

Sub-Events

PS12A Report of the RSNA Research and Education Foundation

Abstract
The RandE Foundation - Our Future is Now This year marks the 100th anniversary of the RSNA’s founding. As radiology looks toward the future, one wonders what the next 100 years will look like for our specialty and whether the central role of radiologists in healthcare will be sustained. Analogous to our clinical radiology mantra, if we are not at the radiology research table we will be on the menu. As a leading global force in radiology, the RSNA is poised to lead the specialty into the next century and exceed the incredible success of the past 100 years. The RandE Foundation will play a key role in radiology's future by continuing its support of inspiring investigators and those pursuing innovative approaches to education. To meet these research and education needs head-on, the Foundation launched Inspire-Innovate-Invest, The Campaign for Funding Radiology's Future® at last year’s annual meeting. This bold campaign seeks to raise $17.5 million to fund grants in radiologic research and education, bridging the gaps in funding for promising investigators and educators. To date our campaign has been a success with individuals, private practice and corporate donors generously pushing us to the mid-way point in our goal. There is still a long way to go. The future of our specialty depends on the commitment and generosity of each of us, the members of the imaging community. This year, the Foundation will fund 92 grants totaling $3.6 million. The RandE is funding 25% of our ever increasing number of excellent grant applications. While pleased with these achievements, imagine what the RandE Foundation could fund with additional support from all of us as radiology colleagues? During the meeting week, please take time to visit the RandE Foundation Booth, located on Level 3 of Lakeside Center to learn more about how you can be a part of the campaign and support the RandE Foundation and the future robustness of our specialty.

Participants
Jonathan B. Kruskal, MD, PhD, Boston, MA (Presenter) Author, UpToDate, Inc
Donald P. Frush, MD, Durham, NC (Presenter) Nothing to Disclose
Bruce B. Forster, MD, Vancouver, BC (Presenter) Travel support, Siemens AG; Travel support, Toshiba Corporation;
Christine M. Glastonbury, MBBS, San Francisco, CA (Presenter) Author with royalties, Reed Elsevier
Michelle M. McNicholas, MD, Dublin, Ireland (Presenter) Nothing to Disclose
Melissa L. Rosado De Christenson, MD, Kansas City, MO (Presenter) Author, Thieme Medical Publishers, Inc; Author, Reed Elsevier; Author, American Registry of Pathology; Author, Oxford University Press; ; ;
Jorge A. Soto, MD, Boston, MA (Presenter) Nothing to Disclose

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Melissa L. Rosado De Christenson, MD - 2012 Honored Educator
Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator
Jonathan B. Kruskal, MD, PhD - 2012 Honored Educator
Chest Monday Case of the Day
Monday, Nov. 30 7:00AM - 11:59PM Location: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Alvaro Huete Garin, MD, Santiago, Chile (Presenter) Nothing to Disclose
Kristopher W. Cummings, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Javiera C. Araya Campos, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose
Cylen Javidan-Nejad, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Juan-Carlos Diaz, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose
Francisca C. Araya, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1) To analyze interesting chest cases. 2) To understand appropriate differential diagnosis. 3) To understand the clinical significance of the diagnosis presented.
CURRENT EVIDENCE FOR LUNG CANCER SCREENING: THE NORTH AMERICAN PERSPECTIVE

LEARNING OBJECTIVES

1) Compare evidence for LDCT screening for lung cancer from the North American and European trials. 2) Classify screen-detected lung nodules and recommend appropriate management. 3) Incorporate the essential elements of a clinical lung cancer screening program. 4) Critique the evidence for and against screening patients who do not meet current eligibility criteria for LDCT screening.

ABSTRACT

There is an increasing body of evidence for low-dose CT (LDCT) screening for lung cancer. This multisession course will review data from North American and European trials, with emphasis on mortality reduction, cost-effectiveness, and stage shift; classification of lung nodules by appearance and size, measurement of nodule growth, and management strategies; elements of an effective clinical screening program; and the evidence for limiting screening to patients who meet current eligibility criteria based on age and smoking history versus including patients on the basis of expanded criteria.

PURPOSE

To compare the detectability of pulmonary nodules on low-dose CT (LDCT) scans with hybrid iterative reconstruction (effective radiation dose about 2.0 mSv) and ultra-low dose CT (U-LDCT, about 0.2 mSv) scans and to investigate the feasibility of U-LDCT for lung cancer screening.

METHOD AND MATERIALS

Institutional review board approval and informed consent from all 50 subjects were obtained. The subjects (median age 64 years, range 53-75 years; smoking history median 46.5 packs/year, range 34.5 - 100 packs) underwent CT lung cancer screening with both LDCT and U-LDCT on a 320 detector-row scanner (Aquilion One, Toshiba). For LDCT we used our routine scan parameters for lung cancer screening (120 kVp, tube current regulated automatically [noise index 22], detector configuration 80 x 0.5 mm, pitch factor 1.39, reconstruction slice thickness and interval 2.0 mm). LDCT images were routinely reconstructed with hybrid iterative reconstruction (AIDR 3D, Toshiba). For U-LDCT we applied 5 mAs; the other parameters were as for LDCT. U-LDCT images were reconstructed with newly-developed full iterative reconstruction (FIRST, Toshiba). By consensus, 2 radiologists visually evaluated U-LDCT images as to pulmonary nodules (diameter ≥ 4 mm) identified on LDCT images using a 3-point subjective scale where grade 3 = the nature of the nodule, i.e. solid, part-solid, ground glass (SN, p-SN, GGN), could be accurately identified, grade 2 = the nodule, but not its nature, could be easily identified, and grade 1 = the nodule could not be identified.

RESULTS

In the 50 subjects we identified 75 nodules on LDCT images (SN, n=20; p-SN, n=5; GGN, n=50). Of these, all 20 SNs were classified as grade 3, all 5 p-SNs as grade 3, and 30 of the 50 GGNs as grade 3, 15 as grade 2, and 5 as grade 1 (60-, 30-, and 10%, respectively).
CONCLUSION
The detectability of SNs and p-SNs on U-LDCT images with full IR was comparable to LDCT images. However, 10% of GGNs were not detected on U-LDCT images.

CLINICAL RELEVANCE/APPLICATION
As the detectability of pulmonary nodules was almost comparable on LDCT- and U-LDCT images with full IR except GGNs, lung cancer screening using U-LDCT may be feasible.

RC201-03  Current Evidence for Lung Cancer Screening - The European Perspective
Monday, Nov. 30 9:00AM - 9:20AM Location: S406B

Participants
Marjolein A. Heuvelmans, BSc, Groningen, Netherlands, (m.a.heuvelmans@umcg.nl) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Compare evidence LDCT screening for lung cancer from the North American and European trials. 2) Classify screen-detected lung nodules and recommend appropriate management. 3) Incorporate the essential elements of a clinical lung cancer screening program. 4) Critique the evidence for and against screening patients who do not meet current eligibility criteria for LDCT screening.

RC201-04  The Role of Volume and Predicted Volume-doubling Time in Differentiating Benign from Potential Malignant New Nodules at Incidence CT Lung Cancer Screening
Monday, Nov. 30 9:20AM - 9:30AM Location: S406B

Participants
Joan E. Walter, BSc, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose
Marjolein A. Heuvelmans, BSc, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose
Geertje H. De Bock, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose
Pim A. De Jong, MD, PhD, Utrecht, Netherlands (Abstract Co-Author) Nothing to Disclose
Rozejemarijn Vliegenthart, MD, PhD, Groningen, Netherlands (Presenter) Nothing to Disclose
Matthijs Oudkerk, MD, PhD, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare volume and predicted growth rate of benign and malignant new solid nodules in a large randomized low-dose computed tomography (LDCT) lung screening trial.

METHOD AND MATERIALS
This trial was approved by the Ministry of Health. All participants gave informed consent. Following baseline LDCT screening, incidence-screenings took place after 1, 3 and 5.5 years. For this study, participants were selected with solid non-calcified nodules, newly detected after baseline and also in retrospect not present on any previous screen. Nodule volume was generated semi-automatically by Lungcare software (Siemens, Erlangen, Germany). Growth rate at initial detection was estimated by calculating the slowest predicted volume-doubling time (pVDT), according to the formula pVDT=[ln(2)*Δt]/[ln(V2/V1)], using the study’s detection limit of 15mm3 (V1), the volume of the new nodule at initial detection (V2), and the time interval between current and last screen (Δt [days]). Lung cancer diagnosis was based on histology, and benignity was based on either histology or a stable volume for at least two years. Difference in volume and pVDT between benign and malignant nodules was evaluated by Mann-Whitney U testing.

RESULTS
In total, 1,484 new solid nodules in 949 participants were identified of which 77 (5.2%) were malignant. The median volume of benign (44mm3, interquartile-range [IQR] 22-122mm3) and malignant (373mm3, IQR 120-974mm3) new nodules, as well as the median pVDT of benign (288 days, IQR 153-566 days) and malignant (144 days, IQR 116-213 days) new nodules differed significantly (P<0.001 for both). The calculated median pVDT of adenocarcinomas (183 days, IQR 138-299 days) and squamous-cell carcinomas (150 days, IQR 117-223 days) was comparable to VDT of fast-growing baseline cancers of the same histological type as previously published (196 days, IQR 135-250 days and 142 days, IQR 91-178 days).

CONCLUSION
Volume and pVDT may be used to differentiate between benign and malignant solid nodules, newly detected at incidence LDCT lung cancer screening.

CLINICAL RELEVANCE/APPLICATION
A new nodule's initial growth rate can be estimated by the predicted volume-doubling time, which is a new measure that may be helpful in differentiating benign from malignant new nodules.

RC201-05  Lung Nodule Characterization
Monday, Nov. 30 9:30AM - 9:50AM Location: S406B

Participants
Thomas E. Hartman, MD, Rochester, MN (Presenter) Author, Cambridge University Press

LEARNING OBJECTIVES
1) Compare evidence LDCT screening for lung cancer from the North American and European trials. 2) Classify screen-detected lung nodules and recommend appropriate management. 3) Incorporate the essential elements of a clinical lung cancer screening program. 4) Critique the evidence for and against screening patients who do not meet current eligibility criteria for LDCT screening.

RC201-06  Can Morphological Features Differentiate between Malignant and Benign Pulmonary Nodules, Detected in a Screen Setting?
LEARNING OBJECTIVES

1) Compare evidence LDCT screening for lung cancer from the North American and European trials. 2) Classify screen-detected lung nodules and recommend appropriate management. 3) Incorporate the essential elements of a clinical lung cancer screening program. 4) Critique the evidence for and against screening patients who do not meet current eligibility criteria for LDCT screening.

Participants

Jane P. Ko, MD, New York, NY (Presenter) Speaker, Siemens AG

PRESENTATION

PURPOSE

Existing nodule classification systems and risk models (e.g., McWilliams model, Lung-RADS) consider only nodule type, size, growth, and the presence of a spiculated border. However, radiologists consider additional morphological features when assigning a malignancy risk. Goal of the study was to determine the power of additional morphological features to differentiate between benign and malignant nodules.

METHOD AND MATERIALS

All 60 cancers were selected from the Danish Lung Cancer Screening Trial, in the first scan where they were visible, and a benign set of 120 randomly selected and 120 size-matched benign nodules from baseline scans were included, all from different participants. Data had been acquired using a low-dose (16x0.75mm, 120 kVp, 40 mAs) protocol, and 1mm section thickness reconstruction. Seven radiologists were asked to score the presence of morphological features for each nodule referring to density distribution (homogeneous, inhomogeneous, high, low), lesion margin (spiculation, lobulation, demarcation by interlobular septa, sharply-defined, ill-defined), lesion surrounding (distortion of the surrounding parenchyma, pleural/fissure retraction, attachment to pleura, fissure or vessel) and lesion architecture (thickened wall of a bulla, bubbles, air bronchogram). Separately per observer and feature, chi square analysis was used to determine the power to discriminate between benign and malignant nodules. Features with a p-value <0.05 in ≥4 observers are reported.

RESULTS

Significant differences were seen for inhomogeneous density distribution (p <0.001 - 0.003) and pleural/fissure retraction (p <0.001 - 0.047) in 7 observers. The presence of bubbles (p <0.001 - 0.025), spiculation (p <0.001), lobulation (p <0.001), and an ill-defined nodule border (p<0.001-0.012) were significant in 6 observers. The presence of a thickened bulla wall in 5 observers (p<0.001-0.042), and air bronchogram (p<0.001-0.006) and distortion of surrounding architecture (p<0.001-0.004) was significantly different in 4 observers.

CONCLUSION

We have identified several morphological features that are significantly associated with malignancy of pulmonary nodules, but not included in current risk prediction models.

CLINICAL RELEVANCE/APPLICATION

Morphological features can be used to differentiate malignant from benign nodules. Further studies will show whether integration of more morphological features will increase the power of risk prediction.

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Santiago E. Rossi, MD - 2015 Honored Educator

RC201-07 Questions and Answer

Monday, Nov. 30 10:00AM - 10:15AM Location: S406B

Participants

Jane P. Ko, MD, New York, NY (Presenter) Speaker, Siemens AG

RC201-08 Lung Nodule Management

Monday, Nov. 30 10:30AM - 10:50AM Location: S406B

Participants

Jane P. Ko, MD, New York, NY (Presenter) Speaker, Siemens AG

PURPOSE

Existing nodule classification systems and risk models (e.g., McWilliams model, Lung-RADS) consider only nodule type, size, growth, and the presence of a spiculated border. However, radiologists consider additional morphological features when assigning a malignancy risk. Goal of the study was to determine the power of additional morphological features to differentiate between benign and malignant nodules.

METHOD AND MATERIALS

All 60 cancers were selected from the Danish Lung Cancer Screening Trial, in the first scan where they were visible, and a benign set of 120 randomly selected and 120 size-matched benign nodules from baseline scans were included, all from different participants. Data had been acquired using a low-dose (16x0.75mm, 120 kVp, 40 mAs) protocol, and 1mm section thickness reconstruction. Seven radiologists were asked to score the presence of morphological features for each nodule referring to density distribution (homogeneous, inhomogeneous, high, low), lesion margin (spiculation, lobulation, demarcation by interlobular septa, sharply-defined, ill-defined), lesion surrounding (distortion of the surrounding parenchyma, pleural/fissure retraction, attachment to pleura, fissure or vessel) and lesion architecture (thickened wall of a bulla, bubbles, air bronchogram). Separately per observer and feature, chi square analysis was used to determine the power to discriminate between benign and malignant nodules. Features with a p-value <0.05 in ≥4 observers are reported.

RESULTS

Significant differences were seen for inhomogeneous density distribution (p <0.001 - 0.003) and pleural/fissure retraction (p <0.001 - 0.047) in 7 observers. The presence of bubbles (p <0.001 - 0.025), spiculation (p <0.001), lobulation (p <0.001), and an ill-defined nodule border (p<0.001-0.012) were significant in 6 observers. The presence of a thickened bulla wall in 5 observers (p<0.001-0.042), and air bronchogram (p<0.001-0.006) and distortion of surrounding architecture (p<0.001-0.004) was significantly different in 4 observers.

CONCLUSION

We have identified several morphological features that are significantly associated with malignancy of pulmonary nodules, but not included in current risk prediction models.

CLINICAL RELEVANCE/APPLICATION

Morphological features can be used to differentiate malignant from benign nodules. Further studies will show whether integration of more morphological features will increase the power of risk prediction.

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Santiago E. Rossi, MD - 2015 Honored Educator

RC201-07 Questions and Answer

Monday, Nov. 30 10:00AM - 10:15AM Location: S406B

Participants

Jane P. Ko, MD, New York, NY (Presenter) Speaker, Siemens AG

RC201-08 Lung Nodule Management

Monday, Nov. 30 10:30AM - 10:50AM Location: S406B

Participants

Jane P. Ko, MD, New York, NY (Presenter) Speaker, Siemens AG

Presenters

Jane P. Ko, MD, New York, NY (Presenter) Speaker, Siemens AG

Participants

Jane P. Ko, MD, New York, NY (Presenter) Speaker, Siemens AG

LEARNING OBJECTIVES

1) Compare evidence LDCT screening for lung cancer from the North American and European trials. 2) Classify screen-detected lung nodules and recommend appropriate management. 3) Incorporate the essential elements of a clinical lung cancer screening program. 4) Critique the evidence for and against screening patients who do not meet current eligibility criteria for LDCT screening.
Follow-up Recommendation Compliance in a Clinical CT Lung Screening Program

PURPOSE
To assess patient compliance with follow-up recommendations in a clinical CT lung screening program.

METHOD AND MATERIALS
We retrospectively assessed the rate of patient compliance with exam follow-up recommendations in our CT lung screening program. All patients evaluated fulfilled the NCCN high-risk criteria for lung cancer screening and underwent screening between 1/12/2012 and 6/12/2013. Screened patients referred from outside our institution were excluded due to limited follow-up. Patients with negative, benign, or probably benign results were recommended to have a repeat screening exam in 6-12 months. Patients with suspicious findings were recommended to undergo a pulmonary consultation. To be considered compliant, patients had to be no more than 90 days past due for their next recommended exam or clinical evaluation as of 9/12/2014. Patients who died, were diagnosed with cancer, exceeded the program age limit, or became otherwise ineligible for additional screening were considered adherent. Compliance rates were assessed across multiple factors including sex, age, smoking history, baseline exam result, and NCCN high-risk group status.

RESULTS
901 high-risk patients from our institution underwent a baseline CT lung screening exam between 1/12/2012 and 6/12/2013. 772/901 (85.7%) were compliant as of 9/12/2014. 155/901 (17.2%) were non-compliant during the study interval of which 26 (16.8%) returned to screening compliance by 9/12/2014. The most common reasons for non-compliance were refusal to undergo the follow-up exam (66.7%), inability to contact the patient (20.9%), and patient inability to obtain a followup order from their physician (7.8%). 23/901 (2.6%) were discharged for reasons other than non-compliance. Subgroup analysis demonstrated a statistically significant increase in screening compliance among female patients (p = 0.035) and among those patients 65-73 years old (p=0.040).

CONCLUSION
High rates of compliance with CT lung screening recommendations are achievable in clinical practice.

CLINICAL RELEVANCE/APPLICATION
Monitoring patient compliance with exam follow-up recommendations and reviewing reasons for non-compliance are important quality initiatives in a clinical CT lung screening program.

Building a Clinical Program

PURPOSE
To determine trends in CT lung cancer screening at leading academic medical centers (AMCs).

METHOD AND MATERIALS
A survey was emailed in March 2015 to thoracic radiologists at 21 leading AMCs, identified from the US News and World Report listings of top hospitals, cancer centers, and pulmonary medicine centers. Radiologists who currently offer lung cancer screening were asked additional questions ranging from patient selection policies to implementation of Lung-RADS in their practice. 2015 survey results were compared to March 2013 and March 2014 survey results for select questions that overlapped between the 3 surveys.

RESULTS
Of the 18 survey respondents (86% response rate), 17 (94%) have an active CT screening program, similar to 2014. Concerning
Of the 18 survey respondents (86% response rate), 17 (94%) have an active CT screening program, similar to 2014. Concerning patient volumes, 14 of 17 (82%) sites reported that the number screened was stable to increased over the past 3 to 6 months, and substantially fewer sites scan ≤5 patients per week compared to prior years (29% in 2015; 74% in 2014; and 87% in 2013). Regarding charges, a self-pay model was used exclusively at only 1 of 17 sites (6%) in 2015, a decrease from 47% in 2014. NLST entry criteria remained the most common patient selection criteria in 2015, but 4 sites (24%) have adopted the new CMS guidelines and 5 sites (29%) are now using expanded NCCN criteria. Concerning solid nodule size thresholds for defining a positive screen, 12 of 17 sites (71%) now use ≥6 mm, an increase from 11% in 2014. With regard to accreditation, 8 of 17 sites (47%) are designated as an ACR screening site and almost all other sites are planning to apply for this designation. A majority of sites (13 of 17, 76%) have incorporated Lung-RADS, whereas the remaining sites use other guidelines such as NCCN. Nearly half of all sites (8 of 17, 47%) have introduced local training and/or credentialing policies for participating radiologists. Only 1 site uses software for volumetric nodule measurement and computer aided detection, whereas 5 of 17 (29%) sites use data management software for tracking patient data.

CONCLUSION

Screening practices are rapidly evolving at leading AMCs, with greater conformity to nodule size criteria and management guidelines following the release of updated screening guidelines and Lung-RADS.

CLINICAL RELEVANCE/APPLICATION

Over the last 2 years, leading AMCs have experienced greater patient volumes, increased payor mix, revised solid nodule size threshold from 4 mm to ≥6 mm, and incorporation of Lung-RADS.

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Phillip M. Boiselle, MD - 2012 Honored Educator

RC201-12  Screening: Out of the Box

Monday, Nov. 30 11:30AM - 11:50AM Location: S406B

Participants

Brady J. McKee, MD, Burlington, MA (Presenter) Spouse, Advisory Board, Medtronic, Inc;

LEARNING OBJECTIVES

1) Compare evidence LDCT screening for lung cancer from the North American and European trials. 2) Classify screen-detected lung nodules and recommend appropriate management. 3) Incorporate the essential elements of a clinical lung cancer screening program. 4) Critique the evidence for and against screening patients who do not meet current eligibility criteria for LDCT screening.

RC201-13  Panel Discussion

Monday, Nov. 30 11:50AM - 12:00PM Location: S406B

Participants
Participants
Dominik Fleischmann, MD, Palo Alto, CA (Moderator) Research support, Siemens AG;

Sub-Events

**RC212A  TAVR: The Surgeon’s Perspective**

Participants
Michael Fischbein, Stanford, CA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Understand the epidemiology, surgical and novel transcatheter treatment options for aortic stenosis. 2) Be able to analyze current evidence for the effectiveness of TAVR in different risk groups. 3) Comprehend the elements of a successful TAVR program implementation.

**RC212B  CTA for TAVR Planning: Current Evidence**

Participants
Jonathon A. Leipsic, MD, Vancouver, BC (Presenter) Speakers Bureau, General Electric Company Speakers Bureau, Edwards Lifesciences Corporation Consultant, Heartflow, Inc Consultant, Circle Cardiovascular Imaging Inc

**LEARNING OBJECTIVES**
1) Review the recent advancements in the field of TAVR. 2) Review the published literature defining the role of MDCT for device selection and annular sizing. 3) Discuss the other ancillary roles of MDCT in TAVR planning.

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Jonathon A. Leipsic, MD - 2015 Honored Educator

**RC212C  Measurements, Workflow, Training and Q/A**

Participants
Shannon Walters, Stanford, CA, (shannon.walters@stanford.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Define elements of an effective TAVR image analysis workflow. 2) Discuss the variety and applicability of measurement/imaging tools. 3) Develop training plans to improve inter observer agreement. 4) Improve efficiency and reliability through quality assurance.
Imaging Evaluation of Post-Radiation Therapy Normal Tissue Effects

Monday, Nov. 30 8:30AM - 10:00AM Location: S403A

**Participants**
Gregory Videtic, MD, FRCPC, Cleveland, OH, (videtig@ccf.org) *(Moderator)* Nothing to Disclose

**Sub-Events**

**RC220A  Post-radiation Therapy Lung Imaging**

**Participants**
Gregory Videtic, MD, FRCPC, Cleveland, OH, (videtig@ccf.org) *(Presenter)* Nothing to Disclose
Michelle S. Ginsberg, MD, New York, NY *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**
1) To review short term and long term changes following radiation therapy. Post SBRT changes will also be reviewed which can differ from more traditional conformal radiotherapy changes. 2) To distinguishing evolving post RT changes from recurrence which is critical in the follow up of these patients. Use of PET/CT in these cases will be discussed.

**ABSTRACT**

With the improvement of outcomes of treatment for pediatric cancers, the number of long-term survivors continues to rapidly grow. Although the use of radiation therapy has generally declined over recent decades, it continues to play an essential role in treatment of many children with Wilms tumor, Ewing sarcoma, rhabdomyosarcoma, or Hodgkin lymphoma and some patients undergoing bone marrow transplant for leukemia. Though cured of their disease, long-term survivors often experience late-effects from radiation therapy with accompanying findings on body imaging. The session will describe late effects on multiple organ systems including musculoskeletal, gastrointestinal, and pulmonary, and relate the imaging findings to radiation techniques including dose and radiation fields.

**RC220B  Post-radiation Therapy Pediatric Body Imaging**

**Participants**
Ralph P. Ermoian, MD, Seattle, WA, (ralphpe@uw.edu) *(Presenter)* Nothing to Disclose
R. Paul Guillerman, MD, Houston, TX *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**
1) Attendees will be able to list at least one common late body imaging finding associated with radiation treatment for Ewing sarcoma, Hodgkin lymphoma, Wilms tumor and transplant conditioning with total body irradiation. 2) Attendees will be able describe the relationship between dose and target volume in discussing late imaging findings on the musculoskeletal, hepatic and gastrointestinal systems.

**ABSTRACT**

Primary and secondary liver cancer is becoming a larger proportion of the radiology case load due to increasing incidence and the introduction of new treatment techniques. In particular, new radiotherapy techniques like stereotactic body radiotherapy (SBRT) are being applied routinely for hepatic lesions. However, SBRT induces changes that are difficult to distinguish from local recurrence. Many changes manifest over time and knowledge of the natural history of radiation changes is important. Some changes are transient and others are predictive of critical clinical outcomes. Radiologists are being pressured to provide clinical input as their opinions often result in significant changes in management. These management changes include high risk and expensive treatments. Therefore, we review the literature and provide practical case examples to assist radiologists in a) identifying normal changes b) determining the appropriate investigations with multidisciplinary input c) selecting appropriate predictive parameters for clinically important endpoints such as recurrence.

**RC220C  Post-radiation Therapy Liver Imaging**

**Participants**
Michael I. Lock, MD, FRCPC, London, ON, (michael.lock@lhsc.on.ca) *(Presenter)* Research Consultant, Accuray Incorporated; Speaker, AbbVie Inc
Ashkan A. Malayeri, MD, Bethesda, MD, (ashkan.malayeri@nih.gov) *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**
1) Discuss the current literature on radiological liver changes induced by radiation. 2) Describe the incidence and long-term morphology/natural history of these changes. 3) Apply practical concepts that distinguish recurrence from normal changes in a growing subject area where evidence is just emerging.

**ABSTRACT**

With the improvement of outcomes of treatment for pediatric cancers, the number of long-term survivors continues to rapidly grow. Although the use of radiation therapy has generally declined over recent decades, it continues to play an essential role in treatment of many children with Wilms tumor, Ewing sarcoma, rhabdomyosarcoma, or Hodgkin lymphoma and some patients undergoing bone marrow transplant for leukemia. Though cured of their disease, long-term survivors often experience late-effects from radiation therapy with accompanying findings on body imaging. The session will describe late effects on multiple organ systems including musculoskeletal, gastrointestinal, and pulmonary, and relate the imaging findings to radiation techniques including dose and radiation fields.
Common Dilemmas in Lung Imaging
Monday, Nov. 30 8:30AM - 10:00AM Location: E450B

Participants

Sub-Events

RC251A  An Algorithm for Lung Nodule Interpretation

Participants
Christian J. Herold, MD, Vienna, Austria (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To understand how different clinical scenarios influence the management of patients with pulmonary nodules. 2) To apply state-of-the-art features, methods and guidelines for the work-up of pulmonary nodules. 3) To develop an algorithm for the management of pulmonary nodules for various risk groups.

RC251B  Current Concepts in Lung Cancer Staging: What the Clinician Wants to Know

Participants
Brett W. Carter, MD, Houston, TX, (bcarter2@mdanderson.org) (Presenter) Author, Reed Elsevier; Consultant, St. Jude Medical, Inc.

LEARNING OBJECTIVES
1) Outline the staging system used for lung cancer. 2) Illustrate specific TNM descriptors through representative examples on imaging studies. 3) Synthesize TNM descriptors into stages and evaluate the impact on patient management. 4) Review limitations of the current system and assess the potential influence on image interpretation.

ABSTRACT
Lung cancer is the most common cause of cancer-related death in men and women in the United States. The seventh edition of the TNM staging system for lung cancer was published in 2009 by the International Union Against Cancer and the American Joint Committee on Cancer and was based on findings from the International Staging Project of the International Association for the Study of Lung Cancer (IASLC). In addition to the inclusion of small cell lung cancer and bronchopulmonary carcinoid, key revisions were made to the tumor (T) and metastasis (M) descriptors based on differential 5-year survival. As accurate staging of lung cancer is crucial to formulating treatment plans and optimizing survival, radiologists should be familiar with the current TNM staging system and understand the strengths of weaknesses of the various thoracic imaging techniques used to diagnose and stage the disease.

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Brett W. Carter, MD - 2015 Honored Educator

RC251C  A Simple Approach to Interstitial Lung Disease

Participants
Michael D. Hope, MD, San Francisco, CA, (michael.hope@ucsf.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify key findings of lung fibrosis and small airways disease. 2) List 4 telltale findings of specific subtypes of interstitial lung disease. 3) Apply a simple methods for reliable characterization of the majority of cases of interstitial lung disease.
**Case-based Review of Magnetic Resonance (An Interactive Session)**

Monday, Nov. 30 | 10:30AM - 12:00PM | Location: S100AB

**LEARNING OBJECTIVES**

1) Understand the role of MRI in diagnosing abnormalities of the breast. 2) Be familiar with the MRI appearance of select cardiothoracic abnormalities. 3) Effectively use MRI to diagnose disorders of the head and neck. 4) Distinguish between a variety of brain lesions based on MRI appearance.

**ABSTRACT**

This session will help attendees recognize and manage select, commonly encountered breast, cardiothoracic, head and neck, and brain abnormalities based on their MRI appearances using a case-based, interactive format.

**Sub-Events**

**MSCM22A  Breast MRI**

Participants
John R. Leyendecker, MD, Dallas, TX (Director) Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**ABSTRACT**

Participants
Fiona J. Gilbert, MD, Cambridge, United Kingdom (Presenter) Medical Advisory Board, General Electric Company; Research Grant, GlaxoSmithKline plc; Research Grant, General Electric Company

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**ABSTRACT**

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Suhny Abbara, MD - 2014 Honored Educator

**MSCM22B  Cardiothoracic MRI**

Participants
Suhny Abbara, MD, Dallas, TX (Presenter) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**ABSTRACT**

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Suhny Abbara, MD - 2014 Honored Educator

**MSCM22C  Head and Neck MRI**

Participants
Daniel W. Williams III, MD, Winston Salem, NC (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**MSCM22D  Brain MRI**

Participants
Mauricio Castillo, MD, Chapel Hill, NC (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the differential diagnosis and imaging features of intraventricular masses in children and adults. 2) Review the cerebral complications of treatment vascular malformations. 3) Review the differential diagnosis and imaging features of masses arising in the cerebello-pontine angle region. 4) Review the differential diagnosis of cerebral microbleeds.
Participants
Archana T. Laroia, MD, Fargo, ND (Moderator) Research Consultant, VIDA Diagnostics, Inc; Research Consultant, Siemens AG

Sub-Events

CH216-SD-MOA1 Antisynthetase Syndrome: Computed Tomography Findings of Adult Patients with Antibodies to Aminoacyl-tRNA Synthetases

Station #1

Participants
Yuko Waseda, Kanazawa, Japan (Presenter) Nothing to Disclose
Takeshi Johkoh, MD, PhD, Itami, Japan (Abstract Co-Author) Research Consultant, Bayer AG Research Consultant, F. Hoffman-La Roche Ltd
Ryoko Egashira, MD, Saga, Japan (Abstract Co-Author) Nothing to Disclose
Hiromitsu Sumikawa, MD, Suita, Japan (Abstract Co-Author) Nothing to Disclose
Satoshi Watanabe, MD, Kanazawa, Japan (Abstract Co-Author) Nothing to Disclose
Hazuki Takato, MD, PhD, Kanazawa, Japan (Abstract Co-Author) Nothing to Disclose
Yasuhiro Hamaguchi, MD, PhD, Kanazawa, Japan (Abstract Co-Author) Nothing to Disclose
Akira Shiraki, MD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Yoshinao Muro, MD, PhD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Masahide Yasui, MD, Kanazawa, Japan (Abstract Co-Author) Nothing to Disclose
Helmut Prosch, MD, Vienna, Austria (Abstract Co-Author) Nothing to Disclose
Christian J. Herold, MD, Vienna, Austria (Abstract Co-Author) Nothing to Disclose
Kazuo Kasahara, MD, PhD, Kanazawa, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
Autoantibodies against aminoacyl-tRNA synthetases (ARS) are highly specific for polymyositis and dermatomyositis (PM/DM). The chest computed tomography (CT) findings of patients with anti-ARS-antibody-positive interstitial lung disease (anti-ARS-ILD) are still unknown. The aim of this study was to describe the CT findings in patients with anti-ARS-ILD.

METHOD AND MATERIALS
The CT findings of 64 patients with anti-ARS-ILD were retrospectively reviewed by two independent observers paying attention not only to the existence and distribution of ground-glass attenuation, consolidation, reticulation, and traction bronchiectasis. CT patterns were also categorized. There were 16 male and 48 female patients, aged 54.5 ± 13.5 years (mean). Sixteen patients had anti Jo-1, 23 had anti-EJ, nine had anti-PL-7, seven had anti-PL-12, five had anti-KS, and three had anti-OJ antibodies.

RESULTS
Overall, 63 patients (98.4%) had lower lobe predominance of CT findings, 61 patients (95.3%) showed peripheral opacities, and 47 patients (73.4%) showed peribronchovascular opacities. Ground-glass attenuation, consolidation, and reticulation showed similar distribution patterns. Regarding detailed CT findings, 89.1% of patients had lower volume loss, 76.6% had interlobular septal thickening, and 67.2% had thickening of bronchovascular bundles. The final radiologic diagnoses were as follows: inconsistent with usual interstitial pneumonia (UIP) in 63 patients (98.4%), non-specific interstitial pneumonia (NSIP) in 35 patients (55.6%), organizing pneumonia (OP) in four patients (6.3%) and OP with fibrosis in 22 patients (34.9%).

CONCLUSION
The characteristic CT findings of patients with ARS-ILD were areas with ground-glass attenuation and reticulation, predominantly distributed as lower and peribronchovascular lesions, which are compatible with NSIP. One-third of cases showed OP with fibrosis.

CLINICAL RELEVANCE/APPLICATION
The characteristic CT findings of patients with anti-ARS-ILD were areas of ground-glass attenuation and reticulation predominantly distributed as lower and peribronchovascular lesions, which were compatible with fibrosing non-specific interstitial pneumonia. One-third of our patients with anti-ARS-ARD had CT findings of organizing pneumonia with fibrosis.
To evaluate the benefit of the PROPELLER technique (Periodically Rotated Overlapping Parallel Lines with Enhanced Reconstruction) for MR imaging of the lung.

**METHOD AND MATERIALS**

The study was approved by the internal review board. Patients participating in a lung cancer screening program were recruited for the comparison of T2-weighted PROPELLER and T2-weighted Fast Spin Echo (FSE) sequences at 1.5 Tesla. Two readers evaluated pulmonary lesions, artifacts, and image quality. Artifacts and image quality were rated using a four-point scale ranging from 1 to 4 with a higher score indicating less artifacts and better image quality. Lesion detection was correlated to low-dose computed tomography (CT) findings as gold standard. Wilcoxon rank-test for ratings of artifacts and image quality, sensitivity, and specificity values for lesion detection, and Cohen's kappa for inter-rater agreement were used.

**RESULTS**

Thirty patients were included. 17 had lesions below 8 mm, and 7 had lesions above 8 mm as seen on CT. For reader 1 (R1) and reader 2 (R2), the PROPELLER sequence allowed for higher detection rates of pulmonary lesions below 8 mm with a sensitivity of 56% (R1) and 59% (R2) for PROPELLER compared to 50% (R1) and 53% (R2) for FSE. Specificity was also higher for PROPELLER with 94% (R1) and 83% (R2) compared to 78% (R1) and 76%. Lesions above 8 mm were detected by both readers with a sensitivity of 100% on both PROPELLER and FSE images. For both readers, specificity was higher on PROPELLER images with 100% compared to 96%. The PROPELLER sequence showed less pulsation and motion artifacts (p<0.001), and higher image quality (p=0.001 R1, p=0.002 R2) compared to FSE. Inter-rater agreement was excellent for lesion detection (0.84 - 0.95) and good to excellent for artifacts and image quality (0.66 - 0.84).

**CONCLUSION**

Compared to FSE, PROPELLER allows for improved detection of pulmonary lesions. The superior image quality and the very robust artifact reduction make PROPELLER a promising technique for MR imaging of the lung. Moreover, the PROPELLER sequence is very suitable for patients with pulmonary disease since it is a free breathing technique not requiring breathholds.

**CLINICAL RELEVANCE/APPLICATION**

The PROPELLER sequence is well suited for pulmonary MR imaging with superior image quality, less artifacts, and a higher detection rate of focal pulmonary lesions compared to the FSE sequence.

**CH210-SD-MOA3**

**Prediction of Therapeutic Effect of Chemotherapy for Non-small-cell Lung Cancer using Perfusion CT: Comparison between Regimens with and without Anti-angiogenic Agent**

**Station #3**

**Participants**

Hidetake Yabuuchi, MD, Fukuoka, Japan (Presenter) Nothing to Disclose
Satoshi Kawanami, MD, Fukuoka, Japan (Abstract Co-Author) Research Grant, Bayer AG; Research Grant, Koninklijke Philips NV
Takeshi Kamitani, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Yuzo Yamasaki, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Michinobu Nagao, MD, Fukuoka-City, Japan (Abstract Co-Author) Research Grant, Bayer AG Research Grant, Koninklijke Philips NV
Hiroshi Honda, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Chemotherapy regimen for advanced non-small cell and non-squamous cell lung cancer is selected based on EGFR mutation and ALK gene translocation. Sandler et al. reported that the addition of bevacizumab to paclitaxel plus carboplatin in the treatment of non-small-cell lung cancer has significantly prolonged the survival. However, histological biomarker for bevacizumab has not yet reported, therefore imaging biomarker such as perfusion CT is expected. Thus, the purpose of our study was to elucidate whether the parameters derived from pre-treatment perfusion CT could predict the therapeutic response in patients who underwent chemotherapy for non-small-cell lung cancer.

**METHOD AND MATERIALS**

Sixty-six patients (42 men, 24 women; age range 29-82 years, mean 63.4) with stage III or IV non-small-cell lung cancer who underwent chemotherapy were enrolled. The chemotherapy regimens were with bevacizumab in 20 patients and without bevacizumab in 46 patients. All patients underwent perfusion CT within a week before the initiation of chemotherapy. Analyzed parameters of perfusion CT were pre-treatment pulmonary artery flow (PAF) and bronchial artery flow (BAF). We calculated the tumor reduction rate two courses after the chemotherapy as follows: %Δ = [(pre-treatment tumor size - post-treatment tumor size)/ pre-treatment tumor size]x100%. Pearson correlation coefficients were used to examine the relationship between the PAF or BAF and the tumor reduction rate after two courses of chemotherapy. We separately evaluated in both regimens with and without bevacizumab.

**RESULTS**

Significant correlation was found between pre-treatment BAF in regimen with bevacizumab and tumor size reduction rate after two courses of chemotherapy (r² = 0.43, P < .01). Pre-treatment BAF in regimen without bevacizumab, pre-treatment PAF in regimens with and without bevacizumab showed no significant correlation with tumor size reduction rate after two courses of chemotherapy.

**CONCLUSION**

Pre-treatment BAF derived from perfusion CT seems to be a promising tool to help predicting the response to chemotherapy with bevacizumab in patients with non-small cell and non-squamous cell lung cancer.

**CLINICAL RELEVANCE/APPLICATION**

Perfusion CT might be useful for predicting the early response to chemotherapy with bevacizumab in patients with non-small cell and non-squamous cell lung cancer.

**CH211-SD-MOA4**

**Resolution Rate of Pneumothorax (PTX) Following Transthoracic Needle Biopsy (TTNB) in a Cohort of Relatively Asymptomatic Patients Undergoing Subsequent PET/CT**
In the timely work-up of lung cancer, FDG PET scans are frequently scheduled in close proximity to TTNB. Using associated attenuation correction CT scans to provide a “window” on lung structure, we have studied prevalence of PTX as a function of interval following TTNB in these relatively asymptomatic outpatients. The purpose of this investigation was therefore (1) to determine prevalence of PTX as a function of time following TTNB in lung cancer patients and (2) to estimate the rate of resolution of PTX in these patients.

METHOD AND MATERIALS

Using RIS, 2,603 patients who underwent PET/CT scanning for characterization of solitary lung nodule in years 2013-2014 were retrospectively identified. Of this group, 263 patients (10.1%) had undergone TTNB at our institution between 1-14 days prior to their PET/CT scan and were subjects of the study. Their PET/CT reports were reviewed to document presence of PTX. Studies were then sorted according to the interval between TTNB and scan and the frequency of PTX at each interval was noted. Size of PTXs was also noted (large, medium and small), with a weighted average size calculated for each interval between 1-14 days.

RESULTS

The study cohort of 263 patients included 120 men (45.6%) with mean age of 68.8±10.6 years. Representative prevalences of PTX on CT were 33% at 1 day, 16% at 3 days and 6% at 1 week. Average size of PTXs declined over the course of 11 days; no PTXs were detected after day 11. Daily prevalence data were fit according to statistical models. 99 (37.6%) patients had PTX identified on post-biopsy plain radiograph; 9 patients with small or medium PTXs on subsequent CT did not have PTX identified on post-biopsy plain film.

CONCLUSION

Performance of PET/CT scanning in close proximity to lung biopsy provides a fortuitous cross-sectional window into natural history of PTX. Prevalence of PTX as detected on attenuation correction CT declined from an initial frequency of 33% on day 1, approximately halving every 3.2 days, with no PTXs detected after day 11. A subset of patients with PTX on CT scans was not identified on initial plain film due to sensitivity of detection vs. delayed development.

CLINICAL RELEVANCE/APPLICATION

Natural history of untreated PTX following TTNB is not well known. This knowledge will aid clinicians in decision making when PTXs are detected remote to lung biopsies.

**Understanding Lung-RADS™: A Practical Approach**

**PURPOSE**

The NLST has demonstrated a 20% decrease in lung cancer specific mortality rate with low-dose CT (LDCT) screening compared to screening with chest radiograph. The USPSTF recommended LDCT screening for asymptomatic individuals at high risk for lung cancer (B recommendation). Based on recent reanalysis of the effect of different nodule size cutoffs defining a positive screening in NLST and ELCAP data, the ACR Lung-RADS™1.0 increased the size threshold for a positive screening result from 4-mm greatest transverse diameter to a 6-mm transverse bidimensional average for solid nodules, which reduces the false positive rate. Ground-glass nodules (GGNs) are classified as Lung-RADS 2 -benign appearance or behavior (<20mm in size) or Lung-RADS 3 -probably benign (≥ 20mm), given the slow-growth rate of these lesions when malignant, which decreases overdiagnosis. ACR Lung-RADS 1.0 allows standardization of LDCT screening interpretation, reporting and recommendations for management of identified nodules.

**TABLE OF CONTENTS/OUTLINE**

1. Describe the ACR Practice Parameter for Performing LDCT. 2. Demonstrate proper technique for nodule measurement. 3. Describe the ACR Lung-RADS 1.0 for reporting LDCT. 4. Illustrate different ACR Lung-RADS categories and management recommendation. 5. Discuss potential pitfalls in nodule detection, characterization and management.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/
PURPOSE

We evaluated the feasibility of simultaneous single scan of krypton ventilation and iodine perfusion using dual-energy CT (DECT).

METHOD AND MATERIALS

The study was approved by institutional animal experimental committee. For 10 beagle dogs, we first made an airway obstruction and then, a pulmonary arterial occlusion after one week. For each animal model, 3 sessions of DECT (Single static scan at the end of 80% krypton ventilation without iodine enhancement [krypton CT], 80% krypton ventilation with iodine enhancement [mixed contrast CT], iodine enhancement after a 30-minute washout with oxygen [iodine CT]) were performed. Krypton maps were made for krypton CT and mixed contrast CT, and iodine maps were made for mixed contrast CT and iodine CT. Two radiologists assessed the presence of krypton or iodine defects on each map, and measured the overlay HU in the diseased segment and contralateral control segment. Results were compared between krypton maps of krypton CT and mixed contrast CT, and between iodine maps of iodine CT and mixed contrast CT using the Wilcoxon signed-rank test.

RESULTS

In airway obstruction models, krypton defects were visually distinguishable only in the diseased segment on the krypton map of krypton CT, but not in mixed contrast CT. However, measured overlay HU values of the diseased segment (3.5 ± 1.4 and 39.9 ± 1.4, respectively) on krypton maps were significantly decreased compared to the contralateral segment (17.7 ± 2.6 and 46.3 ± 4.4, respectively) in both krypton CT and mixed contrast CT (P = 0.002 for both). In all pulmonary arterial occlusion models, iodine defects were noted in the diseased segment on the iodine map either from iodine CT or mixed contrast CT. In iodine maps of the pulmonary arterial occlusion model, measured overlay HU values were significantly lower in the diseased segment (9.51 ± 4.72 and 13.78 ± 4.49, respectively) than in the contralateral segment (86.7 ± 10.4 and 90.2 ± 6.6, respectively) in both iodine CT and mixed contrast CT (P = 0.002 for both).

CONCLUSION

Although some qualitative limitations may exist, it might be feasible to analyze pulmonary ventilation and perfusion simultaneously using DECT.

CLINICAL RELEVANCE/APPLICATION

Dual-energy CT with krypton and iodine can possibly create a single CT scan that gives information on both ventilation and perfusion with detailed anatomical information.

PURPOSE

To demonstrate the feasibility of kinematic MR imaging using 2D subsecond steady-state free precession (SSFP) in evaluating dynamic changes of thoracic cage size and cross sectional area of lung field (CSL) during forced breathing with quantitative measurements in the comparison with pulmonary function test (PFT).
METHOD AND MATERIALS
Forty nine healthy, nonsmoker volunteers were included. After PFT, kinematic MR imaging of the thorax was performed in the sagittal plane using subsecond sagittal SSFP sequence during deep inspiration and subsequent forced breathing to evaluate dynamic changes of thoracic cage size and CSL. Thoracic cage was divided into three portions (upper, middle, lower) on the sagittal image, and the following measurements were performed at each position: 1) APD1.0=the difference of antero-posterior diameter (APD) between maximal inspiration and 1 second after the start of forced breathing, 2) tidal APD=the difference of APD between maximal inspiration and maximal expiration, and 3) APD1.0%=(APD1.0)/(tidal APD)*100. Regarding CSL, similar measurements such as CSL1.0, tidal CSL and CSL1.0% were performed, and these factors were compared with PFT including forced expiratory volume in 1 second (FEV1.0), vital capacity (VC) and FEV1.0%.

RESULTS
APD1.0 of upper position (20.8±4.5mm) was significantly larger than those of middle (15.1±4.9mm, p<0.001) and lower position (13.2±4.3mm, p<0.001). Tidal APD of upper position (29.2±5.7mm) was significantly larger than those of middle (21.6±5.2mm, p<0.001) and lower position (18.1±4.4mm, p<0.001). Regarding APD1.0%, there were no significant differences among 3 positions. CSL1.0, tidal CSL and CSL1.0% were significantly correlated with FEV1.0 (7884.9±1462.9mm2, p<0.001, r=0.814), VC (10668.5±1420.5mm2, p<0.001, r=0.797), and FEV1.0% (73.8±8.6%, p<0.001, r=0.53), respectively.

CONCLUSION
Dynamic changes of CSL measured by kinematic MR imaging using 2D subsecond SSFP were well correlated with PFT. Dynamic changes of thoracic cage size at upper position may be predominantly associated with volume-related pulmonary function.

CLINICAL RELEVANCE/APPLICATION
Kinematic MR imaging using 2D subsecond SSFP may be used for the assessment of pulmonary function, providing additional information to static MR findings based on morphology and signal intensity.

Efficacy of Annual Computed Tomography Screening of the Chest in the Detection of Thoracic Neoplasm and other Complications in Post-Cardiac Transplant Recipients  
Station #3

Participants
Kushal Y. Mehta, MD, Newark, NJ (Presenter) Nothing to Disclose
Bita Ameri, MD, Newark, NJ (Abstract Co-Author) Nothing to Disclose
Michael A. Sadler, MD, Newark, NJ (Abstract Co-Author) Nothing to Disclose
David Baran, Newark, NJ (Abstract Co-Author) Nothing to Disclose
Vadim Spektor, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
It is well documented that cardiac transplant patients are at a significantly increased risk of developing thoracic neoplasms and opportunistic infections in the post-transplant period. Although surveillance for these complications with routine computed tomography (CT) screening of the chest is commonly practiced, there are no current guidelines in the literature defining how often these patients should undergo screening. We sought to determine the efficacy of annual screening chest CT in cardiac transplant patients for the detection of such complications.

METHOD AND MATERIALS
A total of 238 patients received cardiac transplants at our institution between the years 2005 to 2011. We retrospectively reviewed the reports and imaging of annual chest CT’s performed in these patents. Patients either lost to follow up or did not have routine yearly chest CT’s were excluded, creating a total sample size of 155. Chest CT’s demonstrating immediate post transplant complications in the peri-operative period (between 6 weeks to 3 months post transplant) and chest CT’s performed in between annual chest CT’s for non-screening indications, were also excluded. Any finding in the chest CT report requiring either short-term imaging follow up (i.e. a new nodule) or immediate action (i.e. biopsy of new mass/lymphadenopathy) was deemed “clinically actionable”. 

RESULTS
Forty patients out of a total of 155 had “clinically actionable” findings. In 22 of the 40 patients, the finding was a new pulmonary nodule, which either resolved or remained stable on a follow up chest CT, compatible with a benign entity. In 12 of the 40 patients, biopsy proven malignancy was the outcome. In 4 of the 40 patients, an opportunistic infection was identified and subsequently treated. The remaining 2 patients had a finding in the last 6 months for which a follow-up chest CT has not yet been performed.

CONCLUSION
Performing annual chest CT’s in post cardiac transplant patients aids in the early detection of thoracic neoplasm and opportunistic infections, both of which cause significant morbidity and mortality if not identified in a timely fashion in this high-risk population.

Clinical Role and Accuracy of CT-guided Percutaneous Needle Biopsy of Cavitary Pulmonary Lesions  
Station #4

Participants
Nantaka Kiranantawat, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Milena Petranoivic, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Subba R. Digumarthy, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Carol C. Wu, MD, Houston, TX (Abstract Co-Author) Author, Reed Elsevier
Jo-Anne O. Shepard, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
To determine the feasibility, accuracy and complications of CT-guided percutaneous needle biopsy of cavitary pulmonary lesions.

METHOD AND MATERIALS

A retrospective review was conducted of CT-guided percutaneous needle biopsies (PNB) on 53 consecutive patients (M:F 22:31, mean age 65y) with cavitary pulmonary lesions (mean diameter 33+/−18 mm and mean wall thickness = 12+/−8 mm). Fine needle aspirations for cytology, microbiology and 20G core biopsies of the cavity wall were performed in 53, 30 and 18 cases, respectively; 6 cases also aspirated intra-cavitary fluid. Microbiology was submitted when on-site cytology was negative for malignancy or suspicious for infection. The final diagnosis was established through surgical correlation, microbiology or clinico-radiologic follow-up for at least 18 months after biopsy. Univariate analysis was used to compare the diagnostic success group to the diagnostic failure group with regards to lesion characteristics and complications of chest tube insertion.

RESULTS

The overall accuracy for a specific diagnosis for malignancy, infection or a benign etiology was 81%. A final diagnosis of malignancy was established by either surgical correlation or clinical and imaging follow-up in 33 patients (62%) (22 lung cancers and 11 metastases). PNB demonstrated a sensitivity of 91% and specificity of 100% for malignancy. A benign etiology was established in 20 patients (38%) (7 Mycobacterium avium-intracellular infections, 8 bacterial infections, 1 fungal infection and 4 other), with PNB demonstrating a 81% sensitivity and 100% specificity for a diagnosis of infection. Microbiology aspirates from PNB identified a specific organism in 81% (13/16). Complication rate was 28%: 13 pneumothoraces; 8 self-resolving, 5 requiring chest tube, 1 small hemothorax, and 1 mild hemoptysis. A higher failure rate and chest tube rate was seen in cavities with a thinner wall.

CONCLUSION

CT-guided percutaneous biopsy of cavitary pulmonary lesions provided high sensitivity for specific diagnoses with acceptable complication rate. Cavitary lesions are secondary to malignancy in 62% and infection in 30%. Microbiology should be submitted in all patients with cavitary lesions, especially in the absence of on-site cytology.

CLINICAL RELEVANCE/APPLICATION

Our study highlights the usefulness of CT-guided percutaneous needle biopsy in the diagnosis of cavitary pulmonary lesions.
MSCT21

Case-based Review of Thoracic Radiology (An Interactive Session)

Monday, Nov. 30 1:30PM - 3:00PM Location: S100AB

CH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Diana Litmanovich, MD, Haifa, Israel (Director) Nothing to Disclose

Sub-Events

MSCT21A Congenital Thoracic Pathology

Participants
Edward Y. Lee, MD, MPH, Boston, MA (Edward.Lee@childrens.harvard.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Review the current imaging technique for evaluating congenital thoracic anomalies in infants and children. 2) Learn important clinical aspects and characteristic imaging features of various congenital thoracic anomalies in pediatric patients. 3) Discuss key imaging findings which allow differentiation among various congenital thoracic anomalies in infants and children.

MSCT21B Diffuse Lung Disease

Participants
Sujal R. Desai, MBBS, London, United Kingdom, (sujal.desai@nhs.net) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To become familiar with the key patterns of diffuse interstitial lung diseases on chest radiography and HRCT. 2) To understand the relationships between HRCT signs and histopathologic changes. 3) To become familiar with some of the common types of diffuse interstitial lung diseases.

ABSTRACT
The diffuse lung diseases (DLDs) are an intriguing and challenging group of lung disorders in which a multidisciplinary approach to management is key. Imaging tests (and specifically, high-resolution computed tomography [HRCT]) are an important part of the evaluation of patients with suspected and established DLDs. A systematic approach to the diagnosis is important: an awareness of HRCT sign and the relationship between radiologic and histopathologic patterns is crucial. In addition to the differential diagnoses, this session will stress some of the important HRCT signs of DLDs and, where appropriate, the relationship with pathologic features.

MSCT21C Cystic Lung Disease

Participants
Andetta R. Hunsaker, MD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify dominant features in cystic lung disease and distinguish between their varied radiologic presentations. 2) Detect additional features in patients with cystic lung disease which will be helpful in diagnosis. 3) Differentiate between true cystic lung disease and mimickers such as bronchiectasis. 4) Recommend appropriate follow-up based on the diagnosis.

ABSTRACT
Abstract not needed.
PURPOSE
Comparison of tumor response with volumetric assessment for tumor size after treatment of primary or secondary lung tumors with microwave ablation (MWA), radiofrequency ablation (RFA) and laser-induced interstitial tumor therapy (LITT).

METHOD AND MATERIALS
Between 04/2002 and 09/2013 165 patients (70 males, 95 females) suffering from 263 lesions (primary or secondary lung tumor) were treated with thermal ablation (MWA, RFA and/or LITT). Patients with colorectal carcinoma with lung metastases were not included in this study. At 24-hour; 3-, 6-, 12-, 18- and 24-month intervals diagnosis and follow-up were accomplished using magnetic resonance imaging (MRI), unenhanced and contrast-enhanced computed tomography (CT). The results were evaluated in a retrospective study according to the RECIST criteria and survival data were assessed. Patients treated with more than one method of thermal ablation (n=10) were excluded from patient-related analysis. Patients without follow-up data were excluded from relapse analysis.

RESULTS
In 19 patients with 25 lesions treated with LITT recurrent foci were found in 27.3% of lesions. Average tumor volume of lesions with complete response (CR) was 6.1 ml before therapy, in lesions with recurrent foci 15.39 ml. Recurrence rate (RR) for 3, 6, 12, 18, 24 months was 16.7%, 7.1%, 0%, 10% and 11.1%. In 40 patients with 65 lesions treated with RFA recurrent foci were found in 20.4% of lesions. Average tumor volume of lesions with CR was 2.82 ml before therapy, in lesions with recurrent foci 16.73 ml. RR for 3, 6, 12, 18, 24 months was 2.1%, 7.7%, 12.5%, 11.1% and 0%. 106 patients with 173 lesions were treated with MWA. Average tumor volume of lesions with CR was 5.52 ml before therapy, in lesions with recurrent foci 19.14 ml. RR for 3, 6, 12, 18, 24 months was 1%, 5.1%, 0%, 2.9% and 11.1%. There was a significant difference in rates of recurrent foci between LITT, RFA and MWA (P=0.038, Fisher test) with the lowest RR in the MWA group. Mean survival was 983 days in patients treated with LITT, 899 days with MWA and 690 days with RFA using the Kaplan-Meier method (P= 0.003).

CONCLUSION
In conclusion LITT, RFA and MWA showed a significant difference in the treatment of primary and secondary lung metastases regarding CR, RR and mean survival

CLINICAL RELEVANCE/APPLICATION
MWA showed the best results concerning RR, LITT concerning mean survival

PURPOSE
To retrospectively evaluate local tumor control, time-to-progression, and survival in patients with CRC lung metastases who received laser-induced thermotherapy (LITT), microwave ablation (MWA), or radiofrequency ablation (MWA).
METHOD AND MATERIALS
In this retrospective study data on 109 patients (71 males/38 females; mean, 68.6±11.2 years; range, 34-94) were collected in 231 CT-guided ablation sessions from 05/2000-12/2013. 47 patients (125 ablations) underwent MWA, 21 patients (31 ablations) LITT and 41 patients (75 ablations) RFA. CT was performed at 24 hours and at 3, 6, 12, 18 and 24 months post ablation. Survival rates were calculated from first ablation using Kaplan-Meier and log-rank test. Volume changes were measured by the Kruskal-Wallis method.

RESULTS
Local tumor control was achieved in MWA in 91/103 (88.3%) lesions, in LITT in 17/25 (68%) lesions, and in RFA in 45/65 (69.2%) lesions with significant differences in MWA vs. LITT at 18 months (p=0.01) and in MWA vs. RFA at 6 (p=0.004) and 18 (p=0.01) months. Median time-to-progression was 7.5 months in MWA, 10.4 months in LITT and 7.2 months in RFA with no significant difference. 1-, 2- and 4-year overall survival was 82.7%, 67.5% and 16.6% for MWA (median: 32.8 months), 95.2%, 47.6% and 23.8% for LITT (median: 22.1 months), and 76.9%, 50.8% and 8% for RFA (median 24.2 months) with no significant difference. 1-, 2-, 3-, and 4-year progression-free survival was 54.6%, 29.1%, 10.0% and 1% for MWA, 96.8%, 52.7%, 24% and 19.1% for LITT; and 77.3%, 50.2%, 30.8% and 16.4% for RFA with no significant difference.

CONCLUSION
MWA, LITT and RFA are effective therapeutic options for CRC lung metastases with differences documented in local tumor control and no significant differences in progression time, overall survival and progression-free survival rates.

CLINICAL RELEVANCE/APPLICATION
LITT, RFA and MWA in the treatment of colorectal lung metastases can be used with similar results concerning progression time, overall survival and progression-free survival rates. MWA, however, results in better local tumor control.

SSE05-03  CT-Guided Hook-Wire Localization Prior to Video Assisted Thoracoscopic Surgery (VATS) of Suspected Pulmonary Metastases: Safety, Efficacy and Outcome

Monday, Nov. 30 3:20PM - 3:30PM Location: S402AB

Participants
Nour-Eldin A. Nour-Eldin, MD, PhD, Frankfurt Am Main, Germany (Presenter) Nothing to Disclose
Nagy N. Naguib, MD, MSc, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Thomas Lehnert, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Mohammed A. Alsuhbi, BMBS, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Martin Beeres, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Stefan Zangos, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess the feasibility, safety and efficacy of CT-guided pulmonary nodule localization using hooked guide wire before thoracoscopic surgical resection.

METHOD AND MATERIALS
The study included 79 consecutive patients with a history of malignancies outside the lung associated with suspected pulmonary nodules. The CT-guided-hook wire localization procedures were performed under aseptic conditions and local anesthesia. Mean lesion size was 0.7 cm (range 0.5 - 1.8 cm) and the mean lesion distance to the pleural surface was 1.5 cm (range 0.2 - 5 cm). All lesions (n=82) were marked with a 22-G hook-wire. The technique was designed to insert the tip of hook-wire within or maximally 1 cm from the edge of the lesion.

RESULTS
The hooked-guide wire was positioned successfully in all 82 pulmonary nodules within mean time of 9 min (8-20 min, SD: 2.5). The procedure time was inversely proportional to the size of the lesion (Spearman correlation factor 0.7). The mean total radiation dose associated with the procedure was 336 mGy.cm from which the mean DLP of the guide-wire localization was 31 mGy.cm (9.2%). Minimal pneumothoraces were observed in 5 patients (7.6%) without requirement for chest tubes. Pneumothorax was not correlated to the histopathology of the pulmonary nodules (p value > 0.09). Pneumothorax was significantly correlated to emphysema (p value: 0.02). Focal perilesional pulmonary hemorrhage was developed in 4 patients (5%). Both hemorrhage and pneumothorax were significantly correlated to lesion < 10 mm (p value: 0.02 and 0.01 respectively). The resected volume of lung tissue was significantly larger in lesions in which the guide wire was inserted at 1 cm distance from the lesion; in comparison to lesions in which the guide-wire was positioned within the lesion (p = 0.01). Additionally, the volume of resected lung tissue was significantly correlated to lesion of increased distance from the pleural surface > 2.5 cm in comparison to lesions of less than the 2.5 cm from the pleural surface.

CONCLUSION
CT-guided pulmonary nodule localization prior to thoracoscopic resection could allow a safe and accurate surgical guidance for the localization of small pulmonary nodules during thoracoscopic resection.

CLINICAL RELEVANCE/APPLICATION
This technique facilitates the identification and allows adequate resection of small pulmonary nodules during thoracoscopic resection.

SSE05-04  Pneumothorax Complicating Coaxial and Non-Coaxial CT-Guided Lung Biopsy: Comparative Analysis of Determining Risk Factors

Monday, Nov. 30 3:30PM - 3:40PM Location: S402AB

Participants
Nour-Eldin A. Nour-Eldin, MD, PhD, Frankfurt Am Main, Germany (Presenter) Nothing to Disclose
PURPOSE
To assess the scope and determining risk factors related to the development of pneumothorax throughout CT-guided biopsy of pulmonary lesions in coaxial and non-coaxial techniques

METHOD AND MATERIALS
The study included CT-guided percutaneous lung biopsies in 650 consecutive patients (407 males, 243 females; mean age 54.6 years, SD: 5.2) from November 2008 to June 2013 in a retrospective design. Patients were classified according to lung biopsy technique into coaxial-group (318 lesions) and non-coaxial-group (332 lesions). Exclusion criteria for biopsy were: lesions < 5mm in diameter, uncorrectable coagulopathy, positive-pressure ventilation, severe respiratory compromise, pulmonary arterial hypertension or refusal of the procedure.

RESULTS
The incidence of pneumothorax complicating CT-guided lung biopsy was less in the non-coaxial group (23.2%, 77 out of 332) than the coaxial group (27%, 86 out of 318). The difference in incidence between both groups was statistically insignificant (p = 0.14). Significant risk factors for the development of pneumothorax in both groups were emphysema (p < 0.001 in both groups), traversing a fissure with the biopsy needle (p-value 0.005 in non-coaxial group and 0.001 in coaxial group), small lesion, less than 2cm in diameter (p-value 0.02 in both groups), location of the lesion in the basal or mid sections of the lung (p = 0.003 and < 0.001 in non-coaxial and coaxial groups respectively) and increased needle track path within the lung tissue of more than 2.5cm (p-value 0.01 in both groups). Simultaneous incidence of pneumothorax and pulmonary hemorrhage was 27.3% (21/77) in non-coaxial group and in 30.2% (26/86) in coaxial-group. Conservative management was sufficient for treatment of 91 out of 101 patients of pneumothorax in both groups (90.1%).

CONCLUSION
Pneumothorax complicating CT-guided core biopsy of pulmonary lesions, showed insignificant difference between coaxial and non-coaxial techniques. However, both techniques have the same significant risk factors including small and basal lesions, increased lesion's depth from pleural surface, increased length of aerated lung parenchyma crossed by biopsy needle and passing through pulmonary fissures in the needle tract.

CLINICAL RELEVANCE/APPLICATION
Significant risk factors of pneumothorax complicating lung biopsy in both coaxial and non-coaxial techniques are similar and include: technical risk factors, patient related risk factors, and lesion associated risk factors.

SSE05-05 Appearances Can be Deceiving: Pulmonary Nodules in Non-pulmonary Solid Tumor Bearing Patients are not Always Metastatic

Participants
Mauricio R. Moura SR, MD, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Publio C. Viana, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcos R. Menezes, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Milena Mak, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Rafael Bitton, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Olavo Feher, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

PURPOSE
Pulmonary nodules (PNs) in patients (pts) with non-pulmonary solid tumors present a diagnostic challenge; comprising other possibilities than metastatic disease, such as primary lung cancers, infectious diseases and scar tissue. The precise diagnosis will ultimately impact in treatment decisions and prognosis. This study aimed to determine variables correlated with finding metastatic disease on a pulmonary biopsy, helping the decision process of indicating a PN biopsy in this scenario.

METHOD AND MATERIALS
To assess the scope and determining risk factors related to the development of pneumothorax throughout CT-guided biopsy of pulmonary lesions in coaxial and non-coaxial techniques.
inappropriate subsequent treatments. Tissue sampling is still fundamental for accurately diagnosing and treating cancer patients.

**Purpose**

To assess the technical and diagnostic success of CT-guided transthoracic needle biopsy (TNB) of subsolid pulmonary nodules.

**Method and Materials**

Retrospective review of 94 TNB of subsolid nodules performed between 2009-2013 with standard co-axial technique using 19 g introducer, 22 g fine needle aspirate and 20 g core needles and under conscious sedation. Inclusion criteria included surgical correlation or a minimum follow up of 2 years by imaging. There were a total of 94 patients (M:F 29: 65; mean age and range; 70.4 and 33-89 years). The mean size and range of nodule; 25mm; range 7-95mm. Fine needle aspirate was performed in all and core biopsy was done in 21 patients (24 %). Technical success rate for all attempts was calculated. Sensitivity and specificity for malignant and benign diagnoses for successful biopsies was calculated (86/94). The correlation with surgical pathology was available for 69% (59/86) and complication rate of procedure were assessed.

**Results**

The technical success was 95% (89/94). There were 80 cancers and 6 benign lesions. The overall accuracy of TNB is 93% (80/86). There were 6 false negative malignant nodules on TNB. The sensitivity and specificity on TNB for malignant lesions is 92 and 100%. The concordance with surgery was 90 % (53/59). The sensitivity of biopsy was higher for nodules >20 mm (95% vs. 88%) and for nodules <50% groundglass component (98% vs. 94 %). Core biopsy improved yield in only 5% (1/21). Minor hemoptysis was seen in 7.7%, pneumothorax in 21%. 19 patients had a small pneumothorax on CT (20.9%). No patient required a chest tube.

**Conclusion**

CT-guided transthoracic needle biopsy of subsolid nodules is a safe procedure with a high sensitivity and specificity for diagnosing malignant nodules.

**Clinical Relevance/Application**

The high sensitivity and specificity of transthoracic needle biopsy in subsolid nodules, supports wider application of this technique, especially in the era of lung cancer screening.

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Subba R. Digumarthy, MD - 2013 Honored Educator
**LEARNING OBJECTIVES**
1) Review the current imaging technique for evaluating of airway disorders in adult population, with an emphasis on radiation dose reduction.
2) Learn important clinical aspects and characteristic imaging features (both static and dynamic) of various airways abnormalities.
3) Discuss key imaging findings which allow differentiation among various airway disorders, as well as alternative imaging modalities such as thoracic MRI.

**ABSTRACT**

**MSCT22A Airway Disorders**

Participants
Diana Litmanovich, MD, Haifa, Israel (Director) Nothing to Disclose

**SUB-EVENTS**

Participants
Diana Litmanovich, MD, Haifa, Israel (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

To review pathology of the pulmonary arteries and aorta, focusing on cross-sectional imaging.

**MSCT22B Pulmonary Arteries and Aorta**

Participants
Charles S. White, MD, Baltimore, MD (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Incorporate up-to-date epidemiological understanding of thoracic trauma into clinical practice.
2) Identify key imaging features of thoracic trauma in modern civilian and military settings with an emphasis on those features which alter clinical management.
3) Describe the pathogenesis of blast lung injury, its imaging appearance and prognosis.

**ABSTRACT**

Thoracic trauma is a key component of clinical practice, and radiological evaluation of trauma patients is integral to their surgical management. The medical understanding of civilian thoracic trauma has historically been informed by experiences in military combat. In turn, the development of modern imaging technology in the civilian sector has revolutionized triage and operative planning of trauma patients in both civilian and military settings. This complex interplay between civilian and military trauma care continues today, particularly with the advent of urban warfare. One example of the applicability of military thoracic trauma to the civilian sector is blast injury, a hallmark of modern combat trauma that has increased significantly in the civilian developed world. Most radiologists will care for thoracic trauma patients in medical treatment facilities equipped with modern imaging and surgical capabilities in a civilian setting and with civilian patterns of injury. However, in addition to conventional trauma radiology, exposure to modern combat-specific trauma cases will continue the educational and mutually beneficial interaction between civilian and military trauma medicine and ultimately benefit patient care.
PUBLICATION

RSNA Diagnosis Live™: Chest and Abdomen
Monday, Nov. 30 4:30PM - 6:00PM Location: E451B

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.50

Participants
Paul J. Chang, MD, Chicago, IL, (pchang@radiology.bsd.uchicago.edu) (Presenter) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Medical Advisory Board, Merge Healthcare Incorporated
Gregory L. Katzman, MD, Chicago, IL (Presenter) Nothing to Disclose
Neety Panu, MD, FRCPC, Thunder Bay, ON (Presenter) Nothing to Disclose

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.
Participants
Alvaro Huete Garin, MD, Santiago, Chile (Presenter) Nothing to Disclose
Kristopher W. Cummings, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Javiera C. Araya Campos, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose
Cylen Javidan-Nejad, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Juan-Carlos Diaz, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose
Francisca C. Araya, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) To analyze interesting chest cases. 2) To understand appropriate differential diagnosis. 3) To understand the clinical significance of the diagnosis presented.
**MSES31A Large Airway Disease**

Participants
Phillip M. Boiselle, MD, Boston, MA (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Accurately identify normal large airway anatomy, variants, and common forms of pathology on MDCT scans. 2) Employ a pattern-based approach to facilitate accurate diagnosis of congenital and acquired causes of large airways disease on MDCT scans. 3) Recognize the overlap of MDCT airway findings between health and disease states.

**ABSTRACT**

1. Accurately identify normal large airway anatomy, variants, and common forms of pathology on MDCT scans. 2. Employ a pattern-based approach to facilitate accurate diagnosis of congenital and acquired causes of large airways disease on MDCT scans. 3. Recognize the overlap of MDCT airway findings between health and disease states.

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Phillip M. Boiselle, MD - 2012 Honored Educator

**MSES31B Pleural Disease**

Participants
Travis S. Henry, MD, San Francisco, CA (*Presenter*) Spouse, Medical Director, F. Hoffmann-La Roche Ltd

**LEARNING OBJECTIVES**

1) Identify pleural thickening and differentiate the appearance from normal pleura on imaging. 2) Differentiate different causes of unilateral and bilateral pleural effusions to help narrow a differential diagnosis or provide a specific diagnosis. 3) Identify different manifestations of asbestos-related pleura disease. 4) Provide a differential diagnosis for pleural tumors.

**ABSTRACT**

1) Identify pleural thickening and differentiate the appearance from normal pleura on imaging. 2) Differentiate different causes of unilateral and bilateral pleural effusions to help narrow a differential diagnosis or provide a specific diagnosis. 3) Identify different manifestations of asbestos-related pleura disease. 4) Provide a differential diagnosis for pleural tumors.

**MSES31C HRCT Reticular Pattern**

Participants
Susan J. Copley, MD, FRCR, London, United Kingdom, (sue.copley@imperial.nhs.uk) (*Presenter*) Consultant, Boehringer Ingelheim GmbH; Consultant, InterMune, Inc

**LEARNING OBJECTIVES**

1) Accurately identify the Reticular pattern on HRCT. 2) List the differential diagnosis for the reticular pattern. 3) Recognize distinguishing features of particular entities that may result in this pattern.

**ABSTRACT**

1) Accurately identify the Reticular pattern on HRCT. 2) List the differential diagnosis for the reticular pattern. 3) Recognize distinguishing features of particular entities that may result in this pattern.
Participants
Jeffrey R. Galvin, MD, Baltimore, MD (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) Describe the range of lung injury resulting from the inhalation of cigarette smoke. 2) Explain the general mechanisms of cigarette smoke injury. 3) List the currently accepted diagnostic categories. 4) Identify the key imaging features of smoking related lung disease.

ABSTRACT
Symptomatic cigarette smokers are a common source of referral for diagnostic imaging. Radiologists are regularly confronted with an array of findings on plain radiography and computed tomography that mirror varying combinations of emphysema, airway inflammation, airway fibrosis and the changes of pulmonary Langerhans' cell histiocytosis (PLCH). In addition, there is growing acceptance of a link between cigarette smoke and alveolar wall fibrosis. The radiologist is confronted with an extensive list of smoking-related diagnostic categories including: emphysema, obstructive bronchitis, respiratory bronchiolitis-interstitial lung disease (RB-ILD), desquamative interstitial pneumonia (DIP), PLCH and acute eosinophilic pneumonia. These injuries are best understood through correlation of the imaging with pathology and physiology.

Active Handout: Jeffrey R. Galvin

Sub-Events
RC301A Introduction
Participants
Jeffrey R. Galvin, MD, Baltimore, MD (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1. Describe the range of lung injury resulting from the inhalation of cigarette smoke. 2. Explain the general mechanisms of cigarette smoke injury. 3. List the currently accepted diagnostic categories.

ABSTRACT
Symptomatic cigarette smokers are a common source of referral for diagnostic imaging. Radiologists are regularly confronted with an array of findings on plain radiography and computed tomography that mirror varying combinations of emphysema, airway inflammation, airway fibrosis and the changes of pulmonary Langerhans' cell histiocytosis (PLCH). In addition, there is growing acceptance of a link between cigarette smoke and alveolar wall fibrosis. The radiologist is confronted with an extensive list of smoking-related diagnostic categories including: emphysema, obstructive bronchitis, respiratory bronchiolitis-interstitial lung disease (RB-ILD), desquamative interstitial pneumonia (DIP), PLCH and acute eosinophilic pneumonia. These injuries are best understood through correlation of the imaging with pathology and physiology.

RC301B CT Definable Subtypes of COPD
Participants
Alexander A. Bankier, MD, PhD, Boston, MA (Presenter) Author with royalties, Reed Elsevier Consultant, Olympus Corporation

LEARNING OBJECTIVES
1) Describe the current Fleischner classification of chronic obstructive pulmonary disease (COPD). 2) Identify the different categories of emphysema and associated abnormalities on computed tomography. 3) Explain the relationship between image derived assessment of COPD and clinical assessment including pulmonary function.

ABSTRACT
Symptomatic cigarette smokers are a common source of referral for diagnostic imaging. Radiologists are regularly confronted with an array of findings on plain radiography and computed tomography that mirror varying combinations of emphysema, airway inflammation, airway fibrosis and the changes of pulmonary Langerhans' cell histiocytosis (PLCH). In addition, there is growing acceptance of a link between cigarette smoke and alveolar wall fibrosis. The radiologist is confronted with an extensive list of smoking-related diagnostic categories including: emphysema, obstructive bronchitis, respiratory bronchiolitis-interstitial lung disease (RB-ILD), desquamative interstitial pneumonia (DIP), PLCH and acute eosinophilic pneumonia. These injuries are best understood through correlation of the imaging with pathology and physiology.

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**RC301C**  
**Inflammatory Lung Disease in Smokers**

Participants  
Seth J. Kligerman, MD, Denver, CO (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the categories of cigarette smoke related lung inflammation.  
2) Classify the smoking-related inflammatory disorders including: respiratory bronchiolitis, desquamative interstitial pneumonia, pulmonary Langerhans cell histiocytosis and acute eosinophilic pneumonia.  
3) Identify the key imaging features of smoking-related inflammatory disease on imaging.  
4) Understand how pathologic changes mirror findings on imaging.

**ABSTRACT**

Smoking Related Lung Disease: Radiologic-Pathologic Correlation

Symptomatic cigarette smokers are a common source of referral for diagnostic imaging. Radiologists are regularly confronted with an array of findings on plain radiography and computed tomography that mirror varying combinations of emphysema, airway inflammation, airway fibrosis and the changes of pulmonary Langerhans' cell histiocytosis (PLCH). In addition, there is growing acceptance of a link between cigarette smoke and alveolar wall fibrosis. The radiologist is confronted with an extensive list of smoking-related diagnostic categories including: emphysema, obstructive bronchitis, respiratory bronchiolitis-interstitial lung disease (RB-ILD), desquamative interstitial pneumonia (DIP), PLCH and acute eosinophilic pneumonia. These injuries are best understood through correlation of the imaging with pathology and physiology.

**RC301D**  
**Fibrotic Lung Disease in Smokers**

Participants  
Jeffrey R. Galvin, MD, Baltimore, MD (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the categories of cigarette smoke related lung fibrosis.  
2) Identify the key imaging features that indicate the presence of lung fibrosis.  
3) Explain the importance of imaging in the interpretation of pulmonary functions.

**ABSTRACT**

Symptomatic cigarette smokers are a common source of referral for diagnostic imaging. Radiologists are regularly confronted with an array of findings on plain radiography and computed tomography that mirror varying combinations of emphysema, airway inflammation, airway fibrosis and the changes of pulmonary Langerhans' cell histiocytosis (PLCH). In addition, there is growing acceptance of a link between cigarette smoke and alveolar wall fibrosis. The radiologist is confronted with an extensive list of smoking-related diagnostic categories including: emphysema, obstructive bronchitis, respiratory bronchiolitis-interstitial lung disease (RB-ILD), desquamative interstitial pneumonia (DIP), PLCH and acute eosinophilic pneumonia. These injuries are best understood through correlation of the imaging with pathology and physiology.
**Pediatric Series: CV/Chest**

**Tuesday, Dec. 1 8:30AM - 12:00PM Location: E353A**

**RC313-02**  
**4D flow MRI Based Volumetric Aortic Peak Velocity Quantification: Efficiency, Observer Variability and Comparison to 2D Phase Contrast MRI**  
**Tuesday, Dec. 1 8:50AM - 9:00AM Location: E353A**

Participants  
Cynthia K. Rigsby, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose  
Kelly Jarvis, Chicago, IL (Abstract Co-Author) Nothing to Disclose  
Varun Chowdhary, MD, BS, Chicago, IL (Abstract Co-Author) Nothing to Disclose  
Alex Barker, Chicago, IL (Abstract Co-Author) Nothing to Disclose  
Bradley D. Allen, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose  
Joshua D. Robinson, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose  
Susanne Schnell, Chicago, IL (Abstract Co-Author) Nothing to Disclose  
Cynthia K. Rigsby, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose  

**PURPOSE**  
Standard methods for measuring peak blood flow velocity include Doppler echocardiography and 2D CINE phase contrast (PC) MRI. Due to their reliance on single-direction velocity encoding and regional flow analysis (2D planes) both methods can underestimate peak velocities, especially in cases of complex flow jets as commonly seen in patients with abnormal aortic valves. The aim of this study was to test the feasibility and efficiency of a new method for volumetric peak velocity quantification of aortic peak systolic blood flow velocities in a cohort of pediatric BAV patients using 4D flow MRI and velocity maximum intensity projections (MIPs).

**METHOD AND MATERIALS**  
51 pediatric BAV patients (age = 14 ± 5, range = 3-24 years, 18 female) underwent aortic 4D flow MRI (1.5T Aera, Siemens, Germany). After pre-processing (velocity anti-aliasing, phase offset correction) and 3D segmentation of the aorta, velocity MIPs were generated to determine peak velocities in the ascending aorta, arch, and descending aorta by two independent observers. 4D flow derived peak velocities were compared to results from 2D CINE PCMRI from the same study for 36 BAV patients.

**RESULTS**  
4D flow peak systolic velocities were significantly higher than 2D CINE PC MRI (2.02±0.72 m/s vs 1.72±0.81 m/s, p = 0.0001, Wilcoxon signed-rank test). Bland-Altman analysis of peak velocity assessment showed excellent inter-observer variability (mean difference = -0.005 m/s, limits of agreement = ± 0.192 m/s) with low average inter-observer error 2.0 %. The estimated time for 4D flow MRI pre-processing and segmentation was 20 min. Average analysis time (calculation of velocity MIP, ROI analysis) was 92 ± 49 s.

**CONCLUSION**  
4D flow MRI in combination with 3D segmentation of the aorta and velocity MIP analysis can be used to determine aortic peak systolic velocity with high efficiency and low observer variability. The full volumetric coverage and 3-directional velocity of 4D flow MRI fully captures complex aortic flow patterns and is thus better suited to identify the highest velocity in an entire aortic segment compared to 2D CINE PC MRI, which underestimated peak velocities in our BAV cohort by 15%.
PURPOSE
Preoperative assessment of VSDs is routinely performed by echocardiography. However, it seems to be challenging to obtain precise and reproducible findings, due to the limited angulations that are available. Additional preoperative evaluation by Computed Tomography (CT) has become reasonable in the recent years for complex congenital heart disease and allow for assessment of the size of VSDs in a static and isovolumetric dataset. Our aim was to evaluate the accuracy of size measurement of congenital ventricular septal defects (VSD) using High Pitch Computed Tomography Angiography of the thorax compared to echocardiography and intraoperative findings in children with congenital heart disease below 1 year.

METHOD AND MATERIALS
Angiography of the chest was performed using a second and third generation Dual-Source CT in 54 patients (median age 7 days, range 1-348 days) with a high-pitch protocol (p=3.2-3.4) at low tube voltages (70-80 kV). The margins of the VSDs were categorized into four different types by CT. With the exception of apical septal defects the size of the defects seems not to correlate with a specific location. Median radiation dose was as low as 0.37 mSv (range 0.12 - 2.00 mSv).

RESULTS
Mean deviation of the CT-measurements compared to the intraoperative findings was not statistically significant (3.5 ± 3.0 mm, p=0.21), while the mean difference compared to echocardiography was significantly higher (7.4 ± 4.8 mm, p<0.01). The VSDs can be classified into four different types by CT. With the exception of apical septal defects the size of the defects seems not to correlate with a specific location. Median radiation dose was as low as 0.37 mSv (range 0.12 - 2.00 mSv).

CONCLUSION
High Pitch Computed Tomography Angiography of the thorax provides precise measurements of VSDs in pediatric patients with congenital heart disease younger than one year.

CLINICAL RELEVANCE/APPLICATION
Preoperative High Pitch Computed Tomography Angiography of the thorax, besides the advantages in imaging of the coronaries and great intrathoracic vessels, provides precise measurements of VSDs at reasonable low radiation dose.

RC313-04 Image Quality and Accuracy of a Prototype Self-Navigated 3D Whole-heart Sequence for the Assessment of Coronary Artery Anomalies in a Pediatric Patient Population

Participants
Giuseppe Muscogiuri, MD, Charleston, SC (Presenter) Nothing to Disclose
Akos Varga-Szemes, MD, PhD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Carlo N. De Cecco, MD,PhD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Pal Suranyi, MD, PhD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Julian L. Wichmann, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
U. Joseph Schoepf, MD, Charleston, SC (Abstract Co-Author) Research Grant, Bracco Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; ;
Paola Maria Cannao, MD, San Donato Milanese, Italy (Abstract Co-Author) Nothing to Disclose
Stefanie Mangold, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Davide Piccini, Lausanne, Switzerland (Abstract Co-Author) Employee, Siemens AG
Wolfgang Rehwald, Erlangen, Germany (Abstract Co-Author) Employee, Siemens AG
Anthony M. Hlavacek, MD, Charleston, SC (Abstract Co-Author) Investigator, Siemens AG Research Grant, Siemens AG
Ami C. Nutting, MD, Charleston, SC (Abstract Co-Author) Research Grant, Siemens AG

PURPOSE
The aim of this study was to assess the feasibility, image quality, and diagnostic performance of a prototype non-contrast enhanced self-navigated 3D (SN3D) whole-heart MRA acquisition in comparison with coronary CT angiography (cCTA) for delineating the coronary artery origin and proximal course in pediatric patients with suspected coronary artery anomalies.

METHOD AND MATERIALS
Seven patients (13±3 years) with suspected coronary artery anomalies underwent a reference standard cCTA (SOMATOM Flash, Siemens Healthcare, Forchheim, Germany) and a research non-contrast cardiac MRA (MAGNETOM Avanto 1.5T, Siemens Healthcare, Erlangen, Germany) for the assessment of the origin and proximal course of the coronary arteries. The steady-state free precession based SN3D MRA was performed using the following parameters: TR/TE 3.1/1.5ms, flip angle 115°, FOV 220mm, voxel size: 1.1mm³, and 12064 radial views distributed over 377 heartbeats. Subjective image quality of the SN3D MRA and cCTA was evaluated using a 4-grade scale (1, nondiagnostic; 2, sufficient; 3, good; 4, excellent). Visualization of the left anterior descending (LAD), circumflex (LCX) and right coronary arteries (RCA), as well as the time of acquisition and signal to noise...
ratio (SNR), were assessed. Wilcoxon test was used to compare subjective image quality between cCTA and MRA.

RESULTS
The acquisition time of the SN3D MRA was 5.9±1.4min with an average heart rate of 81bpm, while the mean SNR was 274±9. MRA and cCTA image quality ratings were 2.3±0.7 and 3.3±0.7, respectively (p<0.05). SN3D MRA allowed the visualization of the left main, the LAD and the RCA with good agreement to cCTA in all cases, but failed to visualize the LCX in a single case.

CONCLUSION
In this preliminary study there was good agreement for the evaluation of coronary artery anatomy between SN3D MRA and cCTA. The novel radial SN3D sequence allows for the acquisition of an isotropic volume in a free-breathing fashion in about half the time as a standard respiratory-navigated coronary MRA, with an improved ease of use, without penalties in image quality, and without radiation exposure, contrast agent administration or the need for general anesthesia.

CLINICAL RELEVANCE/APPLICATION
This non-contrast self-navigated MRA sequence provides relatively rapid, free-breathing radiation-free evaluation of anomalies of the coronary artery origin and proximal course in children.

PURPOSE
While 3D CT angiography (CTA) images are useful for evaluating the complex anatomy in patients with congenital heart disease, they require higher contrast enhancement to identify blood vessels and soft tissues. However, the thin pediatric vessel wall imposes an injection pressure limit and can result in poor CT enhancement. As the gauge of the fenestrated- is smaller than of the conventional nonfenestrated catheter, optimal enhancement can be achieved by controlling the injection pressure. We compared the injection rate, aortic enhancement, and injection pressure when intravenous contrast material was injected with fenestrated- and conventional non-fenestrated catheters.

METHOD AND MATERIALS
We randomly divided 34 pediatric patients seen between December 2014 and March 2015 into two groups. Group A consisted of 18 children (age one week to 8 months, body weight 3.6 ± 1.2 kg) and group B of 16 (age one week to 12 months, body weight 3.3 ± 0.9 kg). In group A we delivered the contrast medium via a 22-gauge conventional non-fenestrated catheter and in group B we used a 24-gauge fenestrated catheter. Whole-heart helical CTA scans were performed on a 64-detector scanner (GE VCT, tube voltage 80 kVp, detector configuration 64 x 0.625 mm, rotation time 0.4s/r, helical pitch 1.375, preset AEC noise index 12) and the injection rate, aortic enhancement, and injection pressure were compared in groups A and B.

RESULTS
The mean injection rate and aortic enhancement were 0.9 ± 0.1 ml/sec and 468 ± 45.0 HU in group A and 0.87 ± 0.3 ml/sec and 444 ± 63.5 HU in group B. There was no significant difference in the injection rate and aortic enhancement (p = 0.34, p = 0.38). The maximum injection pressure was significantly lower in group B than group A (0.33 vs. 0.55 kg/cm², p < 0.05).

CONCLUSION
Use of the fenestrated catheter decreases the injection pressure limit while retaining the injection rate and aortic enhancement of conventional catheters.

CLINICAL RELEVANCE/APPLICATION
With use of the fenestrated catheter, pediatric CT angiography obtains the optimal aortic enhancement by changing injection rate in safety.

PURPOSE
To evaluate the effect of dual-source parallel RF transmission on the B1 homogeneity, the image quality (image contrast and off-resonance artifacts) in the cine b-SSFP sequence and the repeatability of left-ventricle cardiac function in 3.0T CMR of children.

RESULTS
The mean injection rate and aortic enhancement were 0.9 ± 0.1 ml/sec and 468 ± 45.0 HU in group A and 0.87 ± 0.3 ml/sec and 444 ± 63.5 HU in group B. There was no significant difference in the injection rate and aortic enhancement (p = 0.34, p = 0.38). The maximum injection pressure was significantly lower in group B than group A (0.33 vs. 0.55 kg/cm², p < 0.05).

CONCLUSION
Use of the fenestrated catheter decreases the injection pressure limit while retaining the injection rate and aortic enhancement of conventional catheters.

CLINICAL RELEVANCE/APPLICATION
With use of the fenestrated catheter, pediatric CT angiography obtains the optimal aortic enhancement by changing injection rate in safety.
METHOD AND MATERIALS
The prospective intraindividual comparison study was approved by the institutional ethics committee and written informed consent was obtained. The 3.0T cardiac magnetic resonance (CMR) was performed in 30 chronic myocarditis children by using the dual-source radiofrequency (RF) transmission with patient-adaptive RF shimming. B1 homogeneity and image contrast with and without RF shimming were quantitatively evaluated and t-test was used for statistical significance. The off-resonance artifacts were evaluated independently by two readers. Statistical significance was assessed by the Mann-Whitney U test and inter-observer agreement by Cohen's kappa test. The inter-observer agreement of LV cardiac function with dual-source RF transmission was evaluated by Bland-Altman analysis and the intra-class correlation coefficient (ICC).

RESULTS
Compared with single-source RF transmission, dual-source RF transmission with patient-adaptive RF shimming performed a higher mean percentage of flip angle (FA), lower coefficient of variation (CV) and higher image contrast in both free-breathe (NBH) and breathe-hold (BH) scanning (P <0.05 for all). The scores of off-resonance artifacts with patient-adaptive RF shimming were lower than that without RF shimming (P <0.05) and inter-observer agreement between two readers was good to very good (kappa values from 0.66 to 0.86). A high level inter-observer agreement for cardiac function with RF shimming was acquired both in NBH scanning (CV: 1.91%-11.84%; ICC, 0.83-0.98) and BH scanning (CV: 0.52%-4.44%; ICC, 0.98-0.99)

CONCLUSION
Dual-source parallel RF transmission with patient-adaptive RF shimming could significantly improve the B1 homogeneity and image contrast, reduce the off-resonance artifacts in the b-SSFP cine image and show excellent reproducibility of cardiac function in the 3.0T CMR of children.

CLINICAL RELEVANCE/APPLICATION
Dual-source parallel RF transmission could significantly improve the B1 homogeneity and image quality and is suitable for the 3.0T cardiac magnetic resonance in children.

RC313-07 Estimation of Functional Lung Capacity and Correlation with the Results of Infant Pulmonary Function Test and Quantitative CT Assessment in Infants with Postinfectious Bronchiolitis Obliterans

Tuesday, Dec. 1 9:40AM - 9:50AM Location: E353A

Participants
Mi-Jung Lee, MD, PhD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Yoon Hee Kim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyun Joo Shin, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Myung-Joon Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Myung Hyun Sohn, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the possibility for estimating functional lung capacity from ventilation inhomogeneity using infant pulmonary function test (iPFT) and quantitative CT assessment for air trapping in infants with postinfectious bronchiolitis obliterans (BO).

METHOD AND MATERIALS
This prospective study included infants with clinically and radiologically proven BO since 2009. We performed iPFT in these patients and measured tidal volume (TV), functional residual capacity (FRC) and lung clearance index (LCI) by sulphur hexafluoride multiple breath washout using an ultrasonic flow meter. From chest CT, we calculated total lung volume (CT-TLV) and imaging functional lung volume (CT-FLV) which showed higher attenuation than the mean attenuation of the grossly normal and air trapping areas. We compared iPFT and CT parameters using Spearman correlation analysis.

RESULTS
Thirteen infants (M:F = 11:2) were included in this study. The age was 3-17 months with the mean of 10.4 ± 4.5 months. The mean body weight and height were 9.4 ± 1.7 kg and 75.9 ± 8.0 cm. The values of TV, FRC and LCI were 82.0 ± 19.9 ml, 184.1 ± 49.1 ml and 8.2 ± 1.3, respectively. For chest CT, the effective radiation dose was 0.2-1.8 mSv with the mean of 0.66 ± 0.86 mSv. The values of normal lung attenuation and air trapping attenuation on CT were -571.3 ± 63.1 HU and -767.1 ± 58.3 HU. And the mean percentage of flip angle (FA), lower coefficient of variation (CV) and higher image contrast in both free-breathe (NBH) and breathe-hold (BH) scanning (P <0.05) and inter-observer agreement between two readers was good to very good (kappa values from 0.66 to 0.86). A high level inter-observer agreement for cardiac function with RF shimming was acquired both in NBH scanning (CV: 1.91%-11.84%; ICC, 0.83-0.98) and BH scanning (CV: 0.52%-4.44%; ICC, 0.98-0.99)

CONCLUSION
Both iPFT and chest CT can demonstrate ventilation inhomogeneity and estimate functional lung capacity in infants with postinfectious BO with good correlation. Both methods can be useful and complementary for evaluating in these patients.

CLINICAL RELEVANCE/APPLICATION
Not only infant pulmonary function test but also quantitative chest CT assessment can demonstrate ventilation inhomogeneity and estimate functional lung capacity in infants who are not easy to evaluate lung function due to limited compliance.

RC313-08 Coronary Artery Imaging in Children

Tuesday, Dec. 1 9:50AM - 10:10AM Location: E353A

Participants
Lorna Browne, MD, FRCR, Denver, CO (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) How to successively image the coronary arteries in children with both MR and CT. 2) How to interpret a range of coronary artery anomalies and pathologies.
**RC313-09** Dynamic Airway Imaging  
Tuesday, Dec. 1 10:30AM - 10:50AM Location: E353A

Participants  
Rajesh Krishnamurthy, MD, Houston, TX (Presenter) Research support, Koninklijke Philips NV; Research support, Toshiba Corporation

**LEARNING OBJECTIVES**

1) Discuss indications and protocols for dynamic airway imaging in children using CT and MRI, with emphasis on advantages offered by new generation CT scanners. 2) Learn appropriate use of common post-processing tools and measurement metrics for the pediatric airway that correlate well with bronchoscopy. 3) Understand imaging findings that distinguish between intrinsic and extrinsic airway pathology. 4) Review common applications for dynamic airway imaging, including tracheobronchomalacia, vascular mediated airway compromise, complete tracheal rings, mediastinal masses, and airway tumors.

**ABSTRACT**

This talk will provide an overview of indications and protocols for dynamic airway imaging in children using CT and MRI, with emphasis on advantages offered by new generation CT scanners, and post-processing tools that allow derivation of metrics similar to bronchoscopy. We will review examples of intrinsic and extrinsic airway pathology in children, including tracheobronchomalacia, vascular mediated airway compromise, complete tracheal rings, mediastinal masses, and airway tumors.

**RC313-10** Comparison of a ROI-based and a Whole-lung Segmentation Based Approach for MR Lung Perfusion Quantification in Two-year Old Children after Congenital Diaphragmatic Hernia Repair  
Tuesday, Dec. 1 10:50AM - 11:00AM Location: E353A

Participants  
Meike Weidner, Mannheim, Germany (Presenter) Nothing to Disclose  
Verena Sommer, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose  
Frank G. Zoellner, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose  
Claudia Hagelestein, MD, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose  
Thomas Schaible, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose  
Stefan O. Schoenberg, MD, PhD, Mannheim, Germany (Abstract Co-Author) Institutional research agreement, Siemens AG  
Wolfgang Neff, MD, PhD, Alzey, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

By the means of a region-of-interest (ROI) based approach it has been demonstrated that 2-year old children after congenital diaphragmatic hernia (CDH) repair show reduced MR lung perfusion values on the ipsilateral side. As ROI-based approaches only cover parts of the lung tissue, this study aimed to evaluate if results can be reproduced by segmentation of whole lung, whether there are differences between both approaches and as a consequence which technique should be applied.

**METHOD AND MATERIALS**

DCE-MRI was performed in 30 children (24.3±1.8 month) after CDH repair using a 3D TWIST sequence (Siemens Healthcare, Germany). 0.05 mmol/kg body weight of contrast agent (Dotarem, Guerbet, France) were administered. Pulmonary blood flow (PBF) was calculated based on a pixel-by-pixel deconvolution approach. For ROI-based quantification, three circular ROIs (apical, middle and basal) per lung side were used both in the ventral and dorsal lung. Propagation of those circular ROIs through five adjacent sliced generated 6 cylindrical ROIs in the ventral and dorsal lung respectively. For whole-lung analysis, the whole lung was contoured. In both techniques larger vessels were excluded from analysis (Fig. A).

**RESULTS**

In the ROI-based approach, PBF was significantly reduced on the ipsilateral side (74.5±30.3 ml/100ml/min) in comparison to the contralateral side (113.1±40.4 ml/100ml/min; p<0.0001). Also in the whole-lung-based approach ipsilateral PBF was significantly lower (73.9±25.5 ml/100ml/min) than in the contralateral lung (102.3±31.8 ml/100ml/min; p<0.0001). In the ipsilateral lungs, quantification results of the ROI-based and the whole-lung segmentation based approach were equal (p=0.50). In the contralateral lungs, the ROI-based approach significantly overestimated PBF in comparison to the whole-lung approach by approximately 9.5% (p=0.0013; Fig. B).

**CONCLUSION**

MR lung perfusion in 2-year children after CDH is significantly reduced ipsilaterally, both when quantified by a ROI-based and a whole-lung based approach. In the contralateral lung, the ROI-based approach significantly overestimates perfusion results and therefore whole lung segmentation should be preferred.

**CLINICAL RELEVANCE/APPLICATION**

With MR lung perfusion imaging, perfusion deficits after congenital diaphragmatic hernia can be depicted. Whole-lung segmentation for quantification is advisable, as a ROI-based approach can overestimate results.

**RC313-11** Functional Lung MRI for Non-invasive Monitoring of Regional Effects of Inhaled Hypertonic Saline in Children with Cystic Fibrosis  
Tuesday, Dec. 1 11:00AM - 11:10AM Location: E353A

Participants  
Till F. Kaireit, Hannover, Germany (Presenter) Nothing to Disclose  
Julius Renne, MD, Hannover, Germany (Abstract Co-Author) Nothing to Disclose  
Christian O. Schoenfeld, MD, Hannover, Germany (Abstract Co-Author) Nothing to Disclose  
Andreas Vosskrebenzev, Hannover, Germany (Abstract Co-Author) Nothing to Disclose  
Marcel Gutberlet, Dipl Phys, Hannover, Germany (Abstract Co-Author) Nothing to Disclose  
Angela Schulz, Hannover, Germany (Abstract Co-Author) Nothing to Disclose  
Gesine Hansen, Hannover, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

DCE-MRI was performed in 30 children (24.3±1.8 month) after CDH repair using a 3D TWIST sequence (Siemens Healthcare, Germany). 0.05 mmol/kg body weight of contrast agent (Dotarem, Guerbet, France) were administered. Pulmonary blood flow (PBF) was calculated based on a pixel-by-pixel deconvolution approach. For ROI-based quantification, three circular ROIs (apical, middle and basal) per lung side were used both in the ventral and dorsal lung. Propagation of those circular ROIs through five adjacent sliced generated 6 cylindrical ROIs in the ventral and dorsal lung respectively. For whole-lung analysis, the whole lung was contoured. In both techniques larger vessels were excluded from analysis (Fig. A).

**RESULTS**

In the ROI-based approach, PBF was significantly reduced on the ipsilateral side (74.5±30.3 ml/100ml/min) in comparison to the contralateral side (113.1±40.4 ml/100ml/min; p<0.0001). Also in the whole-lung-based approach ipsilateral PBF was significantly lower (73.9±25.5 ml/100ml/min) than in the contralateral lung (102.3±31.8 ml/100ml/min; p<0.0001). In the ipsilateral lungs, quantification results of the ROI-based and the whole-lung segmentation based approach were equal (p=0.50). In the contralateral lungs, the ROI-based approach significantly overestimated PBF in comparison to the whole-lung approach by approximately 9.5% (p=0.0013; Fig. B).

**CONCLUSION**

MR lung perfusion in 2-year children after CDH is significantly reduced ipsilaterally, both when quantified by a ROI-based and a whole-lung based approach. In the contralateral lung, the ROI-based approach significantly overestimates perfusion results and therefore whole lung segmentation should be preferred.

**CLINICAL RELEVANCE/APPLICATION**

With MR lung perfusion imaging, perfusion deficits after congenital diaphragmatic hernia can be depicted. Whole-lung segmentation for quantification is advisable, as a ROI-based approach can overestimate results.
LUNG US has great potential since the current methods for estimating lung edema are unsatisfactory (CXRs are nonspecific, invasive and the lung clearance index (LCI)). After manual segmentation of each lobe mean and coefficient of variation (CoV) were calculated.

RESULTS
Comparing the CF group to healthy controls, mean values of T1(21) (1176ms vs. 1246 ms, p < 0.01 ) and FV (0.67 vs. 0.95, p <0.001) were significantly lower and the CoV significantly higher (CoV T1(21) 0.08 vs. 0.04; CoV FV 0.73 vs. 0.37, p <0.001 for all). In CF group receiving treatment, mean values in the whole lung of OTF (pre 13.1/post 12.7 10-4/s/%O2), FV (pre 0.69/post 0.76), PBF (pre 98/post 102m/100 ml/min), LCI (pre 12.1/post 13.1) and the morpho-functional score (pre 15 / post 17) did not show a significant difference between pre and post treatment measurements (p > 0.05). Also data on a lobar level in the treatment group as well as measurements in the CF-control group did not show any significant differences between the 2 MRI exams (p > 0.05).

CONCLUSION
Compared to healthy controls functional lung MRI detects significantly increased ventilation heterogeneity in CF patients. After a single treatment with inhalation of hypertonic saline (7% NaCl) neither functional lung MRI nor LCI detected a significant change in CF patients.

CLINICAL RELEVANCE/APPLICATION
This study shows the feasibility of functional lung MRI, as a non-invasive, radiation-free tool for visualization and quantification of potential regional treatment effects in patients with CF.

RC313-12 Comparison of Lung Ultrasound and Chest Radiography in Estimating Lung Edema after Surgery for Congenital Heart Disease in Children

Tuesday, Dec. 1 11:10AM - 11:20AM Location: E353A

Participants
Laura Martellus, Helsinki, Finland (Presenter) Nothing to Disclose
Anu Kaskinen, Helsinki, Finland (Abstract Co-Author) Nothing to Disclose
Kirs Lauerma, MD, Helsinki, Finland (Abstract Co-Author) Nothing to Disclose
Paula Rautiainen, Helsinki, Finland (Abstract Co-Author) Nothing to Disclose
Sture Andersson, Helsinki, Finland (Abstract Co-Author) Nothing to Disclose
Olli Pitkanen, Helsinki, Finland (Abstract Co-Author) Nothing to Disclose

PURPOSE
Lung edema is a frequent complication after surgery for congenital heart disease in children. A readily available accurate measure for lung edema is lacking. Chest radiographs (CXR) are commonly used for this purpose. CXR, however, is inaccurate especially in intensive care when portable supine radiographs are used. In lung ultrasound (US) vertical artifacts known as B-lines have been shown to correlate with lung liquid. In adults with congestive heart disease B-lines in US correlates with lung edema scored from CXR. Our aim was to compare lung US and CXR in estimating lung edema in children after surgery for congenital heart disease.

METHOD AND MATERIALS
Lung US was performed on 50 children 1-6 h postoperatively using a high-frequency linear transducer. Videoclips from three anterolateral intercostal spaces on both sides were stored. An observer blinded to the patient data and CXR scored the abundance of B-lines on each videoclip using a 5-step scale (0 = no artefact, 1 = B-lines in <25% of surface area, 2 = <50%, 3 = <75%, and 4 = >75%). The postoperative CXR were evaluated for lung edema at the right and left upper and lower lobes, the middle lobe and lingula using a 4-step scale (0 = normal lung, 1 = minimal opacity, 2 = opacity partially obscuring lung vessels, 3 = opacity totally obscuring lung vessels). For each patient a mean score for US (B-line score), and for CXR (CXR LE score) was calculated.

RESULTS
There was a significant positive correlation between the B-line score and the CXR LE score (R = 0.65, p < 0.001).

CONCLUSION
Lung US is a promising diagnostic tool in evaluation of postoperative lung edema in patients with congenital heart disease.

CLINICAL RELEVANCE/APPLICATION
Lung US has great potential since the current methods for estimating lung edema are unsatisfactory (CXRs are nonspecific, invasive techniques are unreliable in patients with intracardiac shunts).

RC313-13 Computerized Texture Analysis of Pulmonary Nodules in Pediatric Osteosarcoma Patients:
addition, PDV showed significant correlation with decrease in the diameter of the FSA (r=0.602, p<0.001).

significant factors predicting PDV≥50% (B=-26.227, p<0.001), and the decrease in diameter of FSA (B=-21.476, p=0.009). In
PDV≥50% and 13 patients with PDV<50% (1.0±5.4 vs 2.1±1.1, respectively, p<0.001). Enhancement degree of EPS was the only

RESULTS
A total of 51 patients were included in our study with the following inclusion criteria: (a) antenatally diagnosed with EPS, (b)
underwent a CT scan within 1 month after birth, and (c) had more than one follow-up CT without treatment. Spontaneous
regression of EPS was determined by percent decrease of volume (PDV) and decrease in diameter of feeders. Volume of EPS and
diameters of feeding systemic arteries (FSA) were evaluated on all 148 CT. For the enhancement degree of EPS, CT attenuation
regression of EPS was determined by percent decrease of volume (PDV) and decrease in diameter of feeders. Volume of EPS and
diameters of feeding systemic arteries (FSA) were evaluated on all 148 CT. For the enhancement degree of EPS, CT attenuation

Purpose
To evaluate the value of computerized 3D texture analysis for differentiation of pulmonary metastases from non-metastatic lesions in pediatric osteosarcoma patients.

METHOD AND MATERIALS
Our study comprised 42 pathologically confirmed pulmonary nodules in 16 children with osteosarcoma who had undergone
preoperative CT scans between January 2009 and December 2014. Each pulmonary nodule was manually segmented and its
computed texture features were extracted by using an in-house software program. Multivariate logistic regression analysis was
performed to investigate the differentiating factors of metastatic nodules from non-metastatic lesions. A subgroup analysis was
performed to identify significant differentiating parameters in non-calcified pulmonary nodules. The ROC curve was created to
evaluate the discriminating performance of established model.

RESULTS
There were 24 metastatic pulmonary nodules and 18 non-metastatic pulmonary lesions. Pulmonary metastases and non-metastatic
lesions exhibited significant differences in various histograms and volumetric parameters (P<.05). Multivariate analysis revealed
that higher mean Hounsfield units (HU) (adjusted odds ratio (OR), 1.02) and larger effective diameter (OR, 17.03) are significant
differentiators (P<.05). The subgroup analysis with non-calcified pulmonary nodules (13 metastases and 18 non-metastases)
revealed significant differences between metastases and non-metastases in various parameters. Multivariate logistic regression
analysis revealed that lower entropy (OR, 0.01) and larger effective diameter (OR, 38.92) are significant predictors of non-calcified
pulmonary metastases (P<.05). The established logistic regression model of subgroup showed excellent discriminating performance
in ROC analysis (AUC, 0.927).

CONCLUSION
Metastatic pulmonary nodules from osteosarcoma can be accurately differentiated from non-metastatic pulmonary lesions by using
computed texture analysis. High HU and larger effective diameter were the significant predictors for pulmonary metastases,
while lower entropy and larger effective diameter were for non-calcified pulmonary metastases from non-metastatic lesions.

CLINICAL RELEVANCE/APPLICATION
The computerized 3D texture analysis can accurately differentiate pulmonary metastases from non-metastatic pulmonary lesions in pediatric osteosarcoma patients.

RC313-14 Extralobar pulmonary sequestration: initial CT findings predicting spontaneous regression in neonates
Tuesday, Dec. 1 11:30AM - 11:40AM Location: E353A

Participants
Hee Mang Yoon, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Jin Seong Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ahyoung Jung, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Young Ah Cho, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Chong Hyun Yoon, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
In general, it is accepted that extralobar pulmonary sequestration (EPS) may spontaneously regress. However, radiologic features
associated with spontaneous regression of EPS have not been well documented. Therefore, we tried to find the CT features
descending spontaneous regression of EPS.

METHOD AND MATERIALS
A total of 51 patients were included in our study with the following inclusion criteria: (a) antenatally diagnosed with EPS, (b)
underwent a CT scan within 1 month after birth, and (c) had more than one follow-up CT without treatment. Spontaneous
regression of EPS was determined by percent decrease of volume (PDV) and decrease in diameter of feeders. Volume of EPS and
diameters of feeding systemic arteries (FSA) were evaluated on all 148 CT. For the enhancement degree of EPS, CT attenuation
number of EPS and the back muscle were measured on initial CT and the ratio of EPS-to-back muscle was calculated. The PDV and
the changes in diameter of FSA between initial and follow-up CT scans were calculated. Univariate and multivariate linear regression
analysis were performed to assess factors related to PDV and decrease in diameter of FSA.

RESULTS
PDV more than 50% (PDV≥50%) was noted in 20 patients (38.5%) within one year, in other 12 patients (23.1%) between one and
two years, and in 6 patients after two years. The enhancement degree of EPS was significantly different between 38 patients with
PDV≥50% and 13 patients with PDV<50% (1.0±5.4 vs 2.1±1.1, respectively, p<0.001). Enhancement degree of EPS was the only
significant factors predicting PDV≥50% (B=−26.227, p<0.001), and the decrease in diameter of FSA (B=−21.476, p=0.009). In
addition, PDV showed significant correlation with decrease in the diameter of the FSA (r=0.602, p<0.001).
CONCLUSION
The volume of EPS had spontaneously decreased more than 50 % within 2 years without treatment in 63% of patients. The most important factor predicting spontaneous regression of the EPS was the enhancement degree on initial CT scan. Therefore, a significant volume regression and decrease in diameter of FSA can be expected without any treatment in a neonate with EPS showing hypoenhancement on initial CT scan.

CLINICAL RELEVANCE/APPLICATION
The enhancement degree of EPS on initial CT scan is significantly associated with spontaneous regression of EPS during follow-up. Based on this result, we can more confidently predict spontaneous regression of EPS in neonates.

Participants
Kamlesh U. Kukreja, MD, Bellaire, TX (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1. Describe different types of chest interventions for children.
Case-based Review of Nuclear Medicine: PET/CT Workshop-Cancers of the Thorax (In Conjunction with SNMMI) (An Interactive Session)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S406A

CH CT NM OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Janis P. O'Malley, MD, Birmingham, AL (Director) Nothing to Disclose
Katherine A. Zukotynski, MD, Toronto, ON (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Apply basic anatomic, pathologic, and physiologic principles to the interpretation of PET/CT with emphasis on cancers of the thorax. 2) Identify artifacts that can influence interpretation of PET/CT studies and analyze factors that can improve image quality while minimizing patient risk. 3) Demonstrate understanding of issues on current and future practice patterns.

ABSTRACT
Purpose
To retrospectively evaluate the capability of computed-tomography (CT) radiomic features in predicting EGFR mutation status in surgically resected peripheral lung adenocarcinomas in Asian cohort patients.

Method and Materials
This study was approved by the institutional review board, with waiver of informed consent. 298 patients (167 for training and 131 for validation) with surgically resected peripheral lung adenocarcinomas were enrolled in this study. The EGFR mutations at exons 18 - 21 were determined by amplification refractory mutation system-PCR. We used Definiens Developer XD© (Munich, Germany) as the image analysis platform to perform tumor segmentation and feature extraction.

Results
Mutant EGFR was significant associated with neversmoker status (p=0.041), lepidic predominant adenocarcinomas subtype (p=0.030), and low or intermediate pathologic grade (p=0.041) in peripheral lung adenocarcinomas. Eight radiomic features were significantly associated with the presence of EGFR mutation, including three size base features, four tumor location based features, and one runlength and cooccurrence based feature. The results of a multivariable model showed that the most important predictors of harboring EGFR mutation in Asian patients with peripheral lung adenocarcinoma were histologic subtype (OR 1.99, 95% CI 0.97-4.06), smoking status (OR 0.55, 95% CI 0.29-1.03), and one radiomic feature describing tumor location (OR 0.01, 95% CI <0.001-1.10). The AUC value calculated from the predictive logistic model was 0.650 (95% CI: 0.567 - 0.734), and the AUC value computed by cross-validation method was 0.569 (95% CI: 0.480 - 0.659). The AUC value of this predictive model on the independent validation dataset was 0.696 (95% CI: 0.605 - 0.787).

Conclusion
CT based radiomic features of peripheral lung adenocarcinomas can capture useful information regarding tumor phenotype, and the current model we built could be highly useful to predict the presence of EGFR mutations in peripheral lung adenocarcinoma in Asian patients when mutational profiling is not available or possible.

Clinical Relevance/Application
The significant association between radiomic features and EGFR mutation status for patients with peripheral lung adenocarcinomas would serve as image biomarker to allow identification of patients with high incidence of harboring EGFR mutations.
To investigate the potential relationship between iodine uptake levels estimated from single source dual-energy CT (DE-CT) and perfusion parameters with dual-input perfusion CT in lung cancer.

METHOD AND MATERIALS

This study was an institutional review board-approved study, and written informed consent was obtained from all patients. Twenty patients with lung cancers (including 12 of adenocarcinoma, 6 of squamous carcinoma and 2 of small cell lung cancer) underwent whole volume perfusion CT and single source DE-CT with 320-row CT in one examination(3O5 perfusion then DE-CT). The dual-input maximum slope CT perfusion (DI-CT) analysis was employed. Then, the single source DE-CT was applied, and iodine uptake were estimated by the difference (λ) and the slope (λHU) between the CT numbers of net enhancement in 40keV and 70keV monochromatic images. For the perfusion CT, the pulmonary trunk and the ascending aorta were selected as the input arteries for the pulmonary circulation and the aortic circulation respectively. Pulmonary flow (PF), aortic flow (AF), and a perfusion index (PI, =PF/ (PF + AF) were calculated using the maximum slope method. The DI-CT and DE-CT parameters were analyzed by Pearson/Spearman correlation analysis, respectively.

RESULTS

There are significant correlations between λ, λHU and AF, PF. Correlation coefficient between λ and AF, PF are 0.615 (P <0.01) and 0.526 (P<0.05), respectively. Correlation coefficient between λHU and AF, PF are 0.575 (P <0.01) and 0.538 (P<0.05), respectively. There is a positive correlation between the DI-CT and DE-CT parameters.

CONCLUSION

Both the single source DE-CT and dual-input CT perfusion analysis method can be used to estimate lung cancer perfusion. This study demonstrates that the iodine uptake of lung cancer estimated from DE-CT is significant correlated with the pulmonary flow and aortic flow supplying the tumors.

CLINICAL RELEVANCE/APPLICATION

The iodine uptake of lung cancer estimated from single source DE-CT may assess tumor perfusion in consistent with the whole volume perfusion CT. It has potential value to reflect tumor pathophysiology and treatment response.

SSG03-04 Effect of Energy Level on Texture Analysis in Simultaneously Acquired Dual-Energy Chest CT

Tuesday, Dec. 1 11:00AM - 11:10AM Location: S404CD

Participants

James Sorensen, MBCh, Houston, TX (Presenter) Nothing to Disclose
Deep Pujara, MBBS, Houston, TX (Abstract Co-Author) Nothing to Disclose
Ummati Shah, BDS,MPH, Houston, TX (Abstract Co-Author) Nothing to Disclose
Grish S. Shroff, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Laurence E. Court, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Jeremy J. Erasmus, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Myrna C. Godoy, MD, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Cihan Duran, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE

To characterize the effect of dual-energy CT (DECT) energy levels on some commonly used texture analysis features, and on the ability of these features to differentiate between tissue types.

METHOD AND MATERIALS

18 consecutive patients underwent chest DECT for investigation of lung nodules. All images were acquired on Siemens Somatom Definition Flash scanners. Various image acquisition and post processed data sets were evaluated, including 70keV monochromatic, 100 and 140 kVp, and a mixed 100/140 kVp (0.6 weighting factor). In each patient, a series of cylindrical ROIs were drawn in 5 different healthy tissues (bone, muscle, lung, fat, and liver), as well as an ROI delineating the lung lesion under investigation. Histogram, GreyLevel Coocurrence Matrix, and RunLength Matrix based texture features were then calculated in each ROI from each CT image set. The diagnostic accuracy of the features acquired from each reconstruction was then tested by using them in a machine-learning classifier to identify the tissue type present in each ROI. The diagnostic accuracy of the predictions derived from each reconstruction was then noted.

RESULTS

All textural features were found to vary considerable with the CT energy level. In nearly all tissues, and for all feature classes, the change in feature values with different image data sets followed a simple linear regression, with r^2 values typically > 0.9. The exceptions to this were fat, which had a slightly weaker positive relation for most features, and skeletal muscle, in which feature values of all classes were found to change unpredictably with energy. In general, GLCM features were the most predictable in response to changes in kilovoltage (with r^2 usually >0.95), while RLM were the least (r^2>0.8). The ability of this group of features to identify tissue types varied only slightly across the evaluated CT datasets, ranging from 77%-99% with mixed 100/140kVp, to 84% at 100kVp.

CONCLUSION

Textural features were accurately able to differentiate between tissue types on DECT, and this accuracy was independent of energy level. All textural features showed variation according to the energy level used, and for most tissue types this followed a simple linear relation.

CLINICAL RELEVANCE/APPLICATION

By using a simple correction factor, textural feature values in most tissues can be directly compared between CT scans acquired with different energy levels and reconstruction datasets.
**SSG03-05  Lesion Differentiation with Material Decomposition Images Acquired from Dual Energy CT of the Chest**

**Tuesday, Dec. 1 11:10AM - 11:20AM Location: S404CD**

**Participants**
- Alexi Otrakji, MD, Boston, MA (Presenter) Nothing to Disclose
- Azadeh Tabari, Boston, MA (Abstract Co-Author) Nothing to Disclose
- Andrew Primak, PhD, Malvern, PA (Abstract Co-Author) Employee, Siemens AG
- Jo-Anne O. Shepard, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
- Mannudeep K. Kalra, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
- Subba R. Digumarthy, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
- Shaunagh McDermott, FFR(RCSI), Boston, MA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To assess imaging characteristics of pulmonary abnormalities seen on material decomposition images of dual energy CT of the chest.

**METHOD AND MATERIALS**
In an IRB approved retrospective study, 83 patients (mean age: 61±14 years, M:F 45:38, mean weight 77±18 kg) underwent dual-energy chest CT on dual source multidetector CT (Siemens Definition Flash) or a single source 64-row multidetector CT (GE 750HD Discovery). Virtual monochromatic (60 keV) images were reviewed for presence of pulmonary embolism, as well as presence, shape, size, location, and attenuation characteristics of pulmonary abnormalities. Pulmonary blood volume (PBV) images were assessed for presence and size of blood volume abnormalities in the area of pulmonary abnormalities seen on other images. Data were analyzed using Wilcoxon Signed Rank test.

**RESULTS**
In pulmonary embolism with infarction, the size of decreased perfusion on PBV images was greater or equal to the size of pulmonary opacities on 60 keV images (size mismatch between attenuation and decomposition images in 10/83 patients). Decreased PBV (“perfusion defect”) was also seen in 6/83 patients with non-occlusive pulmonary embolism without definite pulmonary infarction. The "stripe sign" described in perfusion nuclear scans was negative in all patients with infarctions and perfusion defects. In patients with atelectasis, pneumonia or emphysema the size of perfusion abnormalities on PBV was smaller or equal to the size of pulmonary opacity or lucency seen on 60 keV images (no size mismatch). Areas of heterogeneously increased perfusion on PBV with associated "Swiss cheese" appearance was seen in 17/83 patients with pneumonia. PBV abnormality in 34/83 patients with atelectasis is characterized by homogeneously increased perfusion on PBV. Perfusion abnormality in 15/83 patients with lucent lesions (emphysema, air trapping, cysts) is characterized by homogeneous hypo-perfusion on PBV images.

**CONCLUSION**
Size matching of area of abnormalities seen on attenuation and on PBV images help differentiate pulmonary opacities from pulmonary infarcts, pneumonia and atelectasis. Lessons from nuclear medicine (V:Q) can help the chest radiologists interpret DECT.

**CLINICAL RELEVANCE/APPLICATION**
Simultaneous interpretation of virtual monochromatic and PBV images can increase the diagnostic confidence of differentiating between the lung lesions.

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**SSG03-06  Reproducibility and Consistency of Dual Energy Computed Tomography (DECT) Pulmonary Blood Volume (PBV) Measurements in Repeated Examinations**

**Tuesday, Dec. 1 11:20AM - 11:30AM Location: S404CD**

**Participants**
- Sam Dumontell, MBBS, London, United Kingdom (Presenter) Nothing to Disclose
- Jaymin H. Patel, MBBS, BSc, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
- Charlie Sayer, MBBS, FRCP, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
- Ioannis Vlahos, MRCP, FRCP, London, United Kingdom (Abstract Co-Author) Research Consultant, Siemens AG Research Consultant, General Electric Company

**PURPOSE**
To evaluate the reproducibility of DECT in the measurement of PBV in patients with and without pulmonary embolism (PE).

**METHOD AND MATERIALS**
133 patients were identified from a 3yr retrospective review of all patients undergoing more than one DECT for suspected PE.
Iodine-density Analysis Using Enhanced ssDECT Imaging in Differentiating Benign and Malignant Serous Cavity Effusion

Tuesday, Dec. 1 11:30AM - 11:40AM Location: S404CD

Participants
Ye Ju, Dalian, China (Presenter) Nothing to Disclose
Ailian Liu, MD, Dalian, China (Abstract Co-Author) Nothing to Disclose
Yijun Liu, Dalian, China (Abstract Co-Author) Nothing to Disclose
Meiyu Sun, Dalian, China (Abstract Co-Author) Nothing to Disclose
Shifeng Tian, Dalian, China (Abstract Co-Author) Nothing to Disclose
Lingxin Kong, Dalian, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess the value of quantitatively iodine concentration measurement of enhanced ssDECT imaging in the differential diagnosis of malignant and benign serous cavity effusion.

METHOD AND MATERIALS
Approval for this retrospective HIPAA-compliant study was obtained from the institutional review board, and informed consent was waived. From August 2012 to February 2015, a total of 51 patients, including 17 cases of benign serous effusion and 34 cases of malignant serous effusion proven by histopathological diagnosis or laboratory examination, underwent plain and three-phase enhanced iodine-based material density imaging. The iodine density images (M-IE) in the effusion were measured at plain and three-phase enhanced iodine-based material density images, and the iodine concentration (M-IA) in the artery was also measured. The normalized iodine concentration (NIC = M-IE / M-IA) was calculated. The difference of normalized iodine concentration (D-I) was also calculated. The difference of these parameters was evaluated statistically by Mann-Whitney Test.

RESULTS
For N-N pairs all regional PBV measures showed a significant difference between the two scans: Both Lungs (25 v 26), Right Lung (25 v 25), Left Lung (25 v 26), 6 Regions (22 v 22, 26 v 26, 28 v 28, 24 v 23, 26 v 27, 27 v 28), all p>0.05. ICC concordance in all regions was moderate to substantial (Mean 0.66, 0.57-0.73) improving further when corrected for central pulmonary enhancement (Mean 0.75, 0.65-0.82). For the N-PE pairs all regional PBV measures showed significant reduction on the PE positive study: Both Lungs (31 v 25), Right Lung (31 v 25), Left Lung (31 v 27), 6 Regions (28 v 21, 31 v 25, 33 v 28, 28 v 23, 32 v 27, 34 v 29), all p<0.01. In the N-PE group the PE positive study demonstrated significantly increased variance of the 6 standard region PBVs compared to the normal study (554 v 1062, p=0.04), whereas comparable variance comparison in the N-N pairs was not statistically different.

CONCLUSION
In patients undergoing repeated DECT, PBV measures are reproducible with a high degree of concordance within individual patients when normal, but with significant reduction and variability in all lung regions when PE is present.

CLINICAL RELEVANCE/APPLICATION
The reproducibility of DECT PBV measures in normality and their predictable absolute value reduction and increased variance in PE raises the possibility of using such measures to assess treatment response.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Ioannis Vlahos, MRCP, FRCR - 2015 Honored Educator

SSG03-07  Iodine-density Analysis Using Enhanced ssDECT Imaging in Differentiating Benign and Malignant Serous Cavity Effusion

S404CD
SPECT/CT in all patients, SUVmax was also assessed by ROI measurement placed over each nodule.

On all generated images at the two phases and difference of values between early and late phases on VNC image (ΔVNC).

the capability of dual-point CE-DECT for nodule evaluation in each patient, ROIs were placed over all nodules for measuring values obtained at 80 and 140kV, we generated virtual non-contrast (VNC) images and iodine maps at early and late phases.

DECT and FDG-PET/CT, and pathological and/or follow-up examinations.

Fifteen consecutive patients who had 19 lung nodules totally (10 men, 5 women, mean age: 70.5 years) underwent dual-point CE-DECT and FDG-PET/CT, and pathological and/or follow-up examinations.

PURPOSE
To directly and prospectively compare the capability of dual-point contrast-enhanced (CE-) dual-energy CT (DECT) for distinguishing malignant from benign pulmonary nodules as compared with FDG-PET/CT.

METHOD AND MATERIALS

Eleven consecutive smokers (7 male and 4 female, mean age: 69 years) prospectively underwent low-dose unenhanced and xenon-enhanced CT as well as xenon-CT as Sub-CT method. To evaluate the capability of regional ventilation difference on each method, regional ventilation was assessed by consensus of board certified chest radiologists according to previously reported 3-point scoring system on a per segment basis. To determine the functional lung volume in each subject was calculated based on visual scores according to past literatures. To evaluate qualitative capability for regional ventilation assessment, the inter-method agreements were determined by kappa statistics. To determine quantitative capability for regional ventilation and pulmonary functional loss assessments among three methods, functional lung volume was correlated each other by Pearson's correlation. Finally, functional lung volume on each method was also correlated with FEV1%.

RESULTS

Inter-method agreements were as follows: DECT vs. Sub-CT, κ=0.90, DECT vs. SPECT/CT, κ=0.82, Sub-CT vs. SPECT/CT, κ=0.79. On correlation of functional lung volume among three methods, there were excellent correlations among three methods (DECT vs. Sub-CT: r=0.99, p<0.0001; DECT vs. SPECT/CT: r=0.96, p<0.0001; Sub-CT vs. SPECT/CT: r=0.96, p<0.0001). In addition, FEV1% had excellent correlations with all methods (DECT: r=0.93, p<0.0001; Sub-CT: r=0.93, p<0.0001; SPECT/CT: r=0.88, p<0.0001).

CONCLUSION
Xenon CT can be obtained by DECT and subtraction CT methods, and have similar potentials to evaluate regional ventilation and pulmonary functional loss as well as krypton ventilation SPECT/CT.

CLINICAL RELEVANCE/APPLICATION
Xenon CT can be obtained by DECT and subtraction CT methods, and have similar potentials to evaluate regional ventilation and pulmonary functional loss as well as krypton ventilation SPECT/CT.

SSG03-09 Dual-Point Contrast-Enhanced Dual-Energy CT vs. FDG-PET/CT: Capability for Distinguishing Malignant from Benign Pulmonary Nodules

Tuesday, Dec. 1 11:50AM - 12:00PM Location: S404CD

Participants
Sachiko Miura, MD, Kashihara, Japan (Abstract Co-Author) Nothing to Disclose
Yoshisharu Ohno, MD, PhD, Kobe, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yukuin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA; Yasuho Fujisawa, MS, Otawara, Japan (Abstract Co-Author) Employee, Toshiba Corporation
Noriyuki Negi, RT, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Tohru Murakami, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Naoki Sugihara, MENG, Otawara, Japan (Abstract Co-Author) Employee, Toshiba Corporation
Shinichiro Seki, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Hisanobu Koyama, MD, PhD, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Takeshi Yoshikawa, MD, Kobe, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation
Sumiaki Matsumoto, MD, PhD, Kobe, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation
Kazuo Sugimura, MD, PhD, Kobe, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group

PURPOSE
To directly and prospectively compare the capability of dual-point contrast-enhanced (CE-) dual-energy CT (DECT) for distinguishing malignant from benign pulmonary nodules as compared with FDG-PET/CT.

METHOD AND MATERIALS

Fifteen consecutive patients who had 19 lung nodules totally (10 men, 5 women, mean age: 70.5 years) underwent dual-point CE-DECT and FDG-PET/CT, and pathological and/or follow-up examinations. According to the pathological and follow-up examinations, all nodules were divided into two groups as follows: malignant (n=15) and benign (n=4) nodules. From dual-point CE-DECT data obtained at 80 and 140kV, we generated virtual non-contrast (VNC) images and iodine maps at early and late phases. To determine the capability of dual-point CE-DECT for nodule evaluation in each patient, ROIs were placed over all nodules for measuring values on all generated images at the two phases and difference of values between early and late phases on VNC image (ΔVNC). On FDG-PET/CT in all patients, SUVmax was also assessed by ROI measurement placed over each nodule. To evaluate differences of all CE-
DECT indices and SUVmax between malignant and benign nodule groups, Student’s t-test was performed. For distinguishing malignant from benign nodules, ROC-based positive test was performed to determine feasible threshold values of the indices as having significant differences between the two groups. Finally, sensitivity (SE), specificity (SP) and accuracy (AC) were compared each other by means of McNemar’s test.

**RESULTS**

On comparison between the two groups, there were significant differences between malignant and benign groups on ΔVNC (malignant vs. benign: 0.67±4.2HU vs. 10.8±7.6HU, p=0.002) and SUVmax (malignant vs. benign: 6.7±4.6 vs. 1.5±0.58, p=0.0007). When applied feasible threshold values, diagnostic performance of ΔVNC (SE: 100 [15/15] %, SP: 50 [2/4] %, AC: 89.5 [17/19] %) was slightly better than that of SUVmax (SE: 86.7 [13/15] %, SP: 50 [2/4] %, AC: 78.9 [15/19] %), although there were no significant differences (p>0.05).

**CONCLUSION**

Dual-point CE-DECT is considered at least as valuable as FDG-PET/CT for distinguishing malignant from benign nodules.

**CLINICAL RELEVANCE/APPLICATION**

When applied dual-point CE-DECT technique, CE-DECT is considered at least as valuable as FDG-PET/CT for distinguishing malignant from benign nodules in routine clinical practice.
**PURPOSE**

The purpose of this study is to evaluate the contribution of radiation exposure at scanogram acquisition to an organ dose in ultra-low dose chest CT screening using anthropomorphic phantom.

**METHOD AND MATERIALS**

Anthropomorphic chest phantom (THRA1, Kyoto Kagaku, Japan) was used in this study. Radiophotoluminescent glass dosimeters (GD-352M, Chiyada Technol, Japan) were inserted to right lung, left lung, breast, heart, front skin and back skin on chest phantom for organ dose measurement. Ultra-low dose chest CT scanning was performed on Discovery CT750 HD (GE Healthcare, WI) and helical scan protocol was follows: 0.625mm x 64ch detector collimation 0.4 sec rotation speed, 120kVp, 10mA, and 0.984:1 helical pitch. Scanogram acquisition was performed with two tube voltages (80kVp and 120kV) and two directions (anterior-posterior and lateral). Organ dose at each region in chest phantom were measured for helical scan and scanogram acquisitions, separately. The contribution of scanogram acquisition to organ dose for whole scan (scanogram + helical scan) was evaluated for each scanogram protocols.

**RESULTS**

The contribution of scangram with 120kVp to organ dose was 33.5% (right lung), 22.9% (left lung), 13.6% (breast), 20.6% (heart), 9.0% (front skin) and 39.7% (back skin), while the contribution of scanogram with 80kVp was 12% (right lung), 7.0% (left lung), 3.6% (breast), 5.6%(heart), 1.9% (front skin) and 16.5% (back skin). Switching tube voltage to 80kVp in scanogram, organ dose decreased to 24.5% (right lung), 17.1% (left lung), 10.3% (breast), 15.9% (heart), 7.2% (front skin) and 27.8% (back skin).

**CONCLUSION**

This phantom study indicated that contribution of radiation exposure at scanogram acquisition to organ dose was 9 - 40% for 120kVp and 2 - 17% for 80kVp in ultra-low dose chest CT screening. Using lower tube voltage in scanogram, organ dose decreased to 10 - 28%.

**CLINICAL RELEVANCE/APPLICATION**

In ultra-low dose chest CT screening, radiation exposure at sonogram acquisition to organ dose should not be ignored and appropriate acquisition protocol selection reduces radiation dose.
METHOD AND MATERIALS
The CT findings of 20 patients with anti-MDA5-ILD were retrospectively reviewed by two independent observers paying attention to not only the existence and distribution of ground-glass attenuation (GGA), consolidation (CON), reticulation (RET), and tractionbronchiectasis (TBE). CT patterns were also categorized. There were 7 male and 13 female patients, aged 53.6 ± 13.5 years. All patients were clinically diagnosed with dermatomyositis, 14 of whom showed amyopathic symptoms.

RESULTS
All anti-MDA5-ILD patients exhibited bilateral abnormal shadows; bilateral areas with GGA were found in 20 (100.0%) of 20 patients; CON was found in 14 (70.0%) of 20 patients; and RET was found in 17 (85.0%) of 20 patients. The predominant overall anatomic distribution was peripheral in 20 (100.0%) of 20 patients; peribronchovascular in 5 (25%); and diffuse in 1 patient (5.0%). In the group with less-consolidation-on CT (patients who had equal to or less than 5% consolidation), there were more patients (44.4%) with only peripheral predominance in those with more-CON (patients who had more than 5% consolidation). Conversely, in the group with more-CON, peribronchovascular CON appeared in addition to peripheral (66.7%), CON was predominantly distributed as lower and peripheral in the early stages, and as lower and as peribronchovascular in addition to those with progression. The final radiologic diagnoses were as follows: all patients (100.0%) had inconsistent usual interstitial pneumonia (UIP); 2 patients (10.0%) had nonspecific interstitial pneumonia (NSIP); 16 patients (80.0%) had organizing pneumonia (OP); and 2 patients (10.0%) were unclassifiable. The 30% of OP patients had lower volume loss, might be fibrosing OP.

CONCLUSION
The characteristic CT findings of patients with anti-MDA5-ILD were areas of CON predominantly distributed as lower and peripheral lesions in the early stages, and as lower and as peribronchovascular lesions in addition to those with progression. One third of OP patients had lower volume loss considered as OP with fibrosis.

CLINICAL RELEVANCE/APPLICATION
The characteristic CT findings of anti-MDA5-ILD were areas of CON predominantly distributed as lower and peripheral lesions in the early stages.

CH218-SD-TUA3
Interstitial Lung Diseases With Idiopathic Inflammatory Myopathy? Correlation of CT Findings With Specific Antibodies and Onset in 224 Patients

Station #3
Participants
Takeshi Johkoh, MD, PhD, Itami, Japan (Presenter) Research Consultant, Bayer AG Research Consultant, F. Hoffman-La Roche Ltd Hiroyuji Taniguchi, MD, PhD, Seto, Japan (Abstract Co-Author) Research Consultant, Bayer AG; Research Consultant, F. Hoffmann-La Roche Ltd; Research Consultant, Pfizer Inc Takaumi Suda, MD, PhD, Harnamatsu, Japan (Abstract Co-Author) Nothing to Disclose Yuko Waseda, Kanazawa, Japan (Abstract Co-Author) Nothing to Disclose Akira Shiraki, MD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose Kininori Fujimoto, MD, PhD, Kurume, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
To describe CT findings of interstitial lung diseases (ILD) with idiopathic inflammatory myopathy (IIM), including polymyositis and dermatomyositis, paying special attention to specific antibodies and onset.

METHOD AND MATERIALS
CT findings of 224 patients with ILD with IIM were independently evaluated by two observers. The patients ranged from 18 to 75 years of age (mean 52), and included 84 males and 140 females. 85 patients showed acute onset while remaining 139 demonstrated chronic one. In 170 patients assessed anti-MDA5-ILD were areas of CON predominantly distributed as lower and peripheral lesions in the early stages, and as lower and as peribronchovascular lesions in addition to those with progression. The final radiologic diagnoses were as follows: all patients (100.0%) had inconsistent usual interstitial pneumonia (UIP); 2 patients (10.0%) had nonspecific interstitial pneumonia (NSIP); 16 patients (80.0%) had organizing pneumonia (OP); and 2 patients (10.0%) were unclassifiable. The 30% of OP patients had lower volume loss, might be fibrosing OP.

RESULTS
CT findings were categorized into following three types; 1. consolidation with loss of volume in bilateral lower fields (fibrosing OP type; n=85)(Fig.1), 2. reticular opacities with traction bronchiectasis along bronchus predominantly in bilateral lower fields (fibrosing NSIP type; n=135)(Fig.2), 3. compact consolidation scattered in lower and subpleural areas(n=4)(Fig 3). Fibrosing OP type was more common seen in chronic cases (n=36; 26%)than in acute (n=49; 58%)(chi-square test; p<0.001) while fibrosing NSIP type was more frequent in acute cases(n=32;38%)than in chronic (n=103; 74%)(p<0.001). Fibrosing NSIP pattern was less frequently found in the cases with anti-MD-5 antibody (n=4; 33%) than in those without it (n=39; 70%)(p<0.001). Anti-ARS antibody was not related with CT patterns. Scattered small areas with ground-glass attenuation was more commonly seen in chronic cases(n=10; 7.2%)than in acute(n=30; 35%)(p<0.001)

CONCLUSION
Acute cases often show fibrosing OP pattern and scattered small areas with ground-glass attenuation on CT. Fibrosing NSIP pattern is less frequently seen in the cases with anti-MD-Santibody. Synchronized evaluation of CT findings and specific antibodies is feasible for the assessment of progress and prognosis of ILD with IIM.

CLINICAL RELEVANCE/APPLICATION
Acute ILD with IIM often shows predominantly lower areas of airspace consolidation on CT. Chronic ILD with IIM commonly has fibrosing NSIP pattern on CT. Fibrosing NSIP pattern is less frequently seen in the cases with anti-MD-5 antibody.

CH219-SD-TUA4
Efficacy and Safety of Dual Energy Chest CT with Low Volume Intravenous Contrast: Assessment of Aortic and Pulmonary Vasculature

Station #4
Participants

Participants
Contrast induced nephropathy (CIN) is a common and important adverse effect of intravenous contrast. Our study aim was to assess the feasibility of performing dual energy chest CT (DECT) with low contrast volume in evaluation of vascular abnormalities.

**METHOD AND MATERIALS**

Our IRB approved study included 60 adult patients (M: F 20:40, mean age 64 ± 14 years) who underwent either fixed delay (35 seconds) DECT (FD-DECT) with 35 ml of contrast (370mg %) or bolus tracking (BT-DECT) with 25 to 35 ml of contrast (370mg %). Scans were performed on single and dual source DECT capable CT scanners. All CT exams were assessed subjectively for the presence of pulmonary embolism (up to subsegmental level), lung and mediastinal lesions, and artifacts in virtual monochromatic (v-mono) images (40-60 keV). Subjective and quantitative contrast enhancement was assessed on virtual moneenergetic images. The CTDI vol, SSDE, and DLP were recorded. The estimated GFR (eGFR) was recorded before and after CT exams in 51 patients (unavailable in 9 patients). Data were analyzed using student’s t-test.

**RESULTS**

Mean weight and CTDI vol were 69 ± 13 Kg (44-110) and 8 ± 1.4 mGy (6-16). Mean HU values of main pulmonary arteries on v-mono images were 287 ± 90 HU for FD-DECT and 555 ± 225 HU for BT-DECT. Optimal/excellent enhancement of main, lobar, and segmental pulmonary arteries was seen in 92%, 86%, 76% of cases respectively for FD-DECT, and in 100%, 100%, and 90% of cases respectively for BT-DECT. Optimal/excellent quality for the assessment of mediastinal lesions and aortic enhancement was noted in most cases. Contrast enhancement in smaller vessels (subsegmental pulmonary arteries) was significantly better at 40 keV as compared to 60 keV (p = 0.007). There was no significant difference in eGFR before and after low contrast volume injection in all patients (S1/S1) with available creatinine levels (p>0.9).

**CONCLUSION**

Optimal enhancement of pulmonary arteries and aorta can be safely performed with 25-35 ml of contrast agent (9-13 grams of iodine). Bolus tracking technique with DECT acquisition and 40 keV images provide better results as compared to the fixed delay technique and 60 keV images.

**CLINICAL RELEVANCE/APPLICATION**

Patients with compromised renal function can be scanned with low contrast volume (9-13 grams of iodine). Bolus tracking technique with DECT acquisition and 40 keV images provide better results as compared to the fixed delay technique and 60 keV images.

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Subba R. Digumarthy, MD - 2013 Honored Educator

**CH220-SD-** Radiological Prediction about Tumor Invasiveness of Lung Adenocarcinoma on High Resolution CT

**TUAS**

**Participants**

Masahiro Yanagawa, MD, PhD, Suita, Japan (Presenter) Nothing to Disclose
Takeki Johkoh, MD, PhD, Itami, Japan (Abstract Co-Author) Research Consultant, Bayer AG Research Consultant, F. Hoffman-La Roche Ltd
Masayuki Noguchi, MD, Tsukuba-Shi, Japan (Abstract Co-Author) Nothing to Disclose
Eichi Morii, MD, Suita, Japan (Abstract Co-Author) Nothing to Disclose
Osamu Honda, MD, PhD, Suita, Japan (Abstract Co-Author) Nothing to Disclose
Noriyuki Tomyama, MD, PhD, Suita, Japan (Abstract Co-Author) Nothing to Disclose
Ken Ueda, MD, Suita, Japan (Abstract Co-Author) Nothing to Disclose
Maki Masada, MD, Suita, Japan (Abstract Co-Author) Nothing to Disclose
Tomoko Kobu, Suita, Japan (Abstract Co-Author) Nothing to Disclose
Akitoshi Hata, MD, Suita, Japan (Abstract Co-Author) Nothing to Disclose

**Abstract Co-Author**

To evaluate CT features and size of solid portion to differentiate among adenocarcinoma in situ (AIS), minimally invasive adenocarcinoma (MIA), and invasive adenocarcinoma (IVA) by comparing with pathological findings.

**METHOD AND MATERIALS**

Our internal Ethics Review Board approved. High resolution (HR) CT images (CT750HD; GE) of 48 patients were reconstructed at 0.625mm slice thickness and 20cm field of view. Two independent observers classified nodules into 4 subgroups: ground-glass nodule (GGN); part-solid; solid; and scattered with complicated distribution of solid-like portions. Visual density of GGNs were subjectively evaluated using reference standard images: faint GGN(Ga), CT values< -700 hoursfield unit (HU); normal GGN(Gb), from -700 to -400HU; dense GGN(Gc), >-400HU; and mixed (Gb+Gc, Ga+Gc, Gb+Gc). The following CT findings were evaluated by the same two independent observers: margin of nodule (faint, external or internal convex, polygonal); distribution of solid portion (peripheral, non-peripheral); distribution of air bronchogram (with or without disruption and/or irregular dilatation); and pleural indentation. One radiologist measured the longest diameter of the solid portion and total tumor. Pathological findings included the followings: collapse and invasiveness diameter, histological diagnoses (AIS, MIA, IVA).
RESULTS

22 AISs showed 16 GGNs (7Ga, 5Gb, 2Gc, 1Ga+Gc, 1Gb+Gc), 4 part-solids, and 2 scattered. 6 MIAs showed 1 GGN (Gb+Gc), 3 part-solids, and 2 solids. 20 IVAs showed 1 GGN (Gb), 3 part-solids, and 16 solid. The longest diameter of the solid portion and total tumor was 18.8mm±5.6 and 10.7mm±9.9 (mean±SD), respectively. There were significant differences in HRCT features between AIS and MIA or IVA (Pearson's chi-squared test, p<0.02). Significant HRCT features of MIA or IVA were nodules with non-peripheral solid portion (p=0.01), air bronchogram with disruption and/or irregular dilatation (p=0.02), and pleural indentation (p=0.02). The solid portion>5.3mm on HRCT was the significant indicator of pathological invasiveness (Receiver Operating Characteristic analysis, p<0.001).

CONCLUSION

MIA or IVA may be distinguished from AIS by non-peripheral solid portion, air bronchogram with disruption and/or irregular dilatation, and pleural indentation. The solid portion>5.3 mm on HRCT corresponds to pathological invasiveness.

CLINICAL RELEVANCE/APPLICATION

HRCT features may be helpful in differentiating AIS from MIA or IVA.
The Association Between Pulmonary Hemodynamics Measured by Phase-Contrast MRI and Acute Exacerbations of Interstitial Lung Diseases

**PURPOSE**

Exacerbations of interstitial lung diseases (ILDs) are associated with an accelerated decline in lung function and death. Pulmonary hypertension is an important complication of ILDs and a risk factor for acute exacerbations. Phase-contrast MRI (PC-MRI) can estimate pulmonary hemodynamics noninvasively. This study aimed to determine the association between pulmonary hemodynamics measured by PC-MRI and a history of acute exacerbations in patients with ILDs.

**METHOD AND MATERIALS**

The institutional review board approved this study and waived informed consent. Pulmonary hemodynamics, measured by PC-MRI in 43 patients with ILDs, were reviewed retrospectively. Patients were divided into the exacerbation group (Ex: n=8) and the non-exacerbation group (NEx: n=35). The exacerbation group had acute exacerbations requiring hospitalization after PC-MRI was performed. Evaluation criteria were heart rate (HR), average flow (AveFlow), average velocity (AveVel), acceleration time (AT) and ratio calculated from a time-intensity curve in a pulmonary trunk. Ratio was defined as the maximal change in flow rate during ejection divided by the acceleration volume. Statistical comparisons were by t-tests.

**RESULTS**

AveFlow (Ex: 74.4±24.1 vs. NEx: 61.8±9.7 ml/s; P= 0.01) and AveVel (Ex: 12.8±4.6 vs. NEx: 10.3±1.8 cm/s; P= 0.01) were significantly reduced in the exacerbation group. HR (Ex: 74±11 vs. NEx: 77±10 bpm; P= 0.4), AT (Ex: 109±19 vs. NEx: 103±19 msec; P= 0.4), and ratio (Ex: 255±90 vs. NEx: 327±175 /sec²; P= 0.3) were not statistically significant.

**CONCLUSION**

Pulmonary blood flow reduction, as detected by PC-MRI, was associated with acute exacerbations in patients with ILDs.

**CLINICAL RELEVANCE/APPLICATION**

There is an association between pulmonary hypertension and acute exacerbations of ILDs, and pulmonary blood flow reduction is probably a risk factor for acute exacerbations of ILDs.

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High Resolution CT with New Model-based Iterative Reconstruction (MBIR) with Resolution Preference Algorithm for the Evaluation of Lung Nodules; What has Changed from Conventional MBIR and Adaptive Statistical Iterative Reconstruction?

**PURPOSE**

To investigate the image quality of high resolution CT (HRCT) reconstructed with new version of model-based iterative reconstruction algorithm with resolution preference 20 algorithm (MBIR3) comparing with conventional model-based iterative reconstruction (MBIR2) and adaptive statistical iterative reconstruction (ASIR).

**METHOD AND MATERIALS**

Images of patients who underwent standard-of-care CT with a 64-row multidetector CT (Discovery CT750HD) including chest were retrospectively reviewed and those who have solitary lung nodules were included. High resolution CT images of the lung nodule (field of view of the affected side of lung) were reconstructed with ASIR, MBIR2 and MBIR3. Region of interest was placed on the lung parenchyma and the standard deviation (i.e. objective image noise) was recorded. A radiologist who was blinded to the patient information and reconstruction algorithm was included in subjective image analyses. All the images were shown in a random manner.
and followings were included; subjective image noise (5-point scale), streak artifact (3-point scale), visibility or sharpness of small structures (5- or 3-point scales), adequateness for evaluation of internal characteristics or border of the lung nodule (both 5-point scales) and diagnostic acceptability (5-point scale).

RESULTS

Objective image noise was 24.4/19.8/37.7 (MBIR3/MBIR2/ASIR), and significant differences were seen between each algorithm (p<0.0001, paired t-test). As for subjective image noise, there was no significant difference between MBIR3 (4.9) and MBIR2 (4.9) (p=1.000, sign test) and MBIR3 was significantly better than ASIR (3.0) (p<0.0001, sign test). Streak artifact and visibility of small structures in MBIR3 (3.0 and 3.0) and MBIR2 (3.0 and 3.0) improved significantly compared to ASIR (2.1 and 2.0) (both p<0.0001, sign test). As for the sharpness of small structures, MBIR3 (3.7) was significantly better than MBIR2 (2.5) and ASIR (3.0) (p<0.005, sign test). Significant improvement in the adequateness for evaluation of internal characteristics and border of the lung nodule and diagnostic acceptability in MBIR3 (4.3, 4.4 and 4.4) was seen, compared to MBIR2 (4.1, 4.1 and 4.1) and ASIR (3.0, 3.0 and 3.0) (all p<0.0001, sign test).

CONCLUSION

For evaluating lung nodules with HRCT, MBIR3 provides better image quality compared to MBIR2 and ASIR.

CLINICAL RELEVANCE/APPLICATION

For evaluating lung nodules with HRCT, MBIR3 is better than MBIR2 and ASIR.

CH225-SD-TUBS

Accurate Co-registration of Ex Vivo Histology and In Vivo CT in Ground Glass Nodules Enables the Identification of Computer Extracted Textural Features to Predict Extent of Invasion

Station #5

Participants

Mirabela Rusu, DPhil, MENG, Cleveland, OH (Presenter) Employee, General Electric Company
Prabhakar Rajiah, MD, FRCR, Cleveland, OH (Abstract Co-Author) Institutional Research Grant, Koninklijke Philips NV
Robert C. Gilkeson, MD, Cleveland, OH (Abstract Co-Author) Research Consultant, Riverain Technologies, LLC Research support, Koninklijke Philips NV Research support, Siemens AG
Michael Yang, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Frank Jacono, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Philip A. Linden, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Anant Madabhushi, MS, Piscataway, NJ (Abstract Co-Author) Research partner, Siemens AG Research partner, General Electric Company Research partner, F. Hoffmann-La Roche Ltd Founder and President, IBRiS, Inc

PURPOSE

One in four nodules on baseline CT are ground glass (GG) in appearance, and often represent early cancers. When resected, GG nodules (GGN) have good prognosis as disease free survival at 5 years is 67-100%. The outcome depends on extent of invasive adenocarcinoma, which is difficult to assess based off human interpretation of CT alone. The definitive identification of invasion is only possible on histology samples from lung resections. We employed advanced 3D histology reconstruction and 3D co-registration to precisely map the extent of invasion from ex vivo histology onto in vivo CT. Such mapping provides the ground truth for invasion and in situ components enabling the identification of computer extracted features on CT for distinguishing invasive from in situ adenocarcinoma.

METHOD AND MATERIALS

A total of 10 subjects with surgical resected nodules and pre-surgical CT were included in our IRB approved retrospective study. Sequential (>2) HandE histology slices were obtained, digitized and annotated by a pathologist who outlined the in situ and invasive components. Four patients had in situ adenocarcinoma, while the rest had significant adenocarcinoma (invasion > 5mm). We created the CT invasion ground truth by (1) reconstructing the 3D histology volume using a matlab-based groupwise registration, and (2) elastically co-registering it with the CT nodule using the ITK-based package elastix. Next, 189 textural features, e.g. intensity statistics or Haralick, are extracted from the invasion mapping and in situ nodules and compared using Fisher Criterion and Wilcoxon sum rank tests.

RESULTS

The deviation of blood vessels between the histology and CT was within 1.5 mm, indicating an accurate multimodal alignment. Fisher Criterion revealed that a first order statistics of CT intensity achieved the best separation between invasive and in situ compartments. This feature along with another 72 computer extracted features were found to be statistically significantly different between the invasive and in situ compartments (p-val < 0.05).

CONCLUSION

Histology-CT fusion enabled the identification of computer extracted features on CT that appear to distinguish invasive from in situ adenocarcinoma on CT.

CLINICAL RELEVANCE/APPLICATION

This preliminary study suggests that the detection of invasive adenocarcinoma on pre-surgical CT is possible, thus enabling an early intervention for invasive tumors, and avoiding biopsy or surgery for benign nodules.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Prabhakar Rajiah, MD, FRCR - 2014 Honored Educator
**LEARNING OBJECTIVES**

1) Review role of SBRT in the primary management of early stage NSCLC. 2) Review updates to the literature on SBRT including:
   a. Dose and schedule of SBRT. b. Comparison of SBRT to surgery.

**ABSTRACT**

Stereotactic Body Radiotherapy (SBRT) is an important treatment modality for patients with inoperable Non-Small Cell Lung Cancer. It provides effective local control of early stage Lung Cancers and is associated with minimal toxicity. In this presentation I will review this role and discuss the current literature comparing SBRT to observation and surgery.

**RESULTS**

We identified a total of 53 lung adenocarcinomas treated with lung ablation and which had genetic testing to identify both EGFR and KRAS mutations. Surgical or biopsy specimens were considered only if they were from the same site as the ablation (either pre- or post-ablation). A subset of the EGFR mutants were also tested for T790M mutation. Local recurrence was either biopsy proven or based on a combination of clinical and imaging parameters. Chi-square test was used to identify statistically significant association with local recurrence.

**CONCLUSION**

KRAS mutations are associated with statistically significant increased risk of local recurrence compared to WT. The local recurrence
rate of EGFR mutations are equivalent to WT. In our study EGFR local recurrences only occurred in the setting of T790M acquired resistance.

CLINICAL RELEVANCE/APPLICATION

KRAS mutation status of lung adenocarcinoma patients may be used as a prognostic tool to better stratify patients prior to lung ablation.

VSIO31-04 Minimally Invasive Surgery for Limited Lung Metastases

Tuesday, Dec. 1 2:20PM - 2:40PM Location: S405AB

Participants
Shanda Blackmon, MD, MPH, Rochester, MN (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Define the role of surgical pulmonary metastasectomy. 2) Review the literature regarding surgical pulmonary metastasectomy. 3) Review advantages to minimally invasive surgical pulmonary metastasectomy. 4) Define future goals of a novel approach to combined multi-specialty approach to lung metastasectomy.

ABSTRACT

Care of the patient with pulmonary metastases (PM) has evolved through the years to now include a larger group of patients who may benefit from metastasectomy. The two most consistent prognostic factors for overall survival remain disease free interval (DFI) and number of pulmonary nodules. The one consistent factor in all series is that only patients achieving a complete (R0) resection have a longer survival. Many series find the # of nodules is no longer a factor determining survival if R0 resection can be obtained, even repeated metastasectomy. We no longer view extra-PM as a disqualifier for resection, as long as the dz can be completely resected and controlled. Patients are typically referred for immediate surgery if they present with a single PM or have a limited # of mets and a long DFI. Those who develop metastatic dz early are treated initially with chemotherapy to determine the pace of dz progression, if any, on treatment. Patients responding to chemotherapy, those with stable dz, and those with slow progression are referred for resection while those with rapidly progressive metastatic dz receive alternative chemotherapy treatment. Adjuvant chemotherapy is continued only if there is evidence of clinical benefit from preoperative chemotherapy. CT scanning is routinely performed to monitor dz progression. The surgical approach should be individualized. As imaging improves our ability to localize smaller nodules, less invasive options become more appealing and may facilitate less difficult repeat metastasectomy. Ablation (SABR/SBRT or lung CT-guided ablation by cryoablation, radiofrequency ablation or microwave ablation) has been used to treat patients with PM, and our institution uses a lung ablation tumor board to review which lesions are best treated with each modality, focusing on R0 treatment, lung preservation, and location of the tumor. Lung preservation achieved by ablation is important in patients who have had previous resections or who have compromised pulmonary function or in whom a lobectomy would be required for nodule removal. More prospective studies are needed and are underway. Better understanding of the biology of the tumor and more developed histologic-specific nomograms may ultimately improve our ability to better select patients. As systemic therapy improves, treatment of local residual oligometastic dz will become an increasingly important consideration.

VSIO31-05 Percutaneous Ablation of Lung Metastases

Tuesday, Dec. 1 2:40PM - 3:00PM Location: S405AB

Participants
Alison R. Gillams, MBChB, London, United Kingdom, (alliesorting@gmail.com) (Presenter) Advisory Board, Covidien AG

LEARNING OBJECTIVES

1) To define the patients most suitable for percutaneous image guided ablation of their metastases. 2) To present clinical outcomes of percutaneous ablation in the common metastatic groups - colorectal, sarcoma, renal, head and neck etc. 3) To understand the role of ablation in conjunction with other therapeutic modalities - surgery, SBRT or chemotherapy.

ABSTRACT

Ablation is a very effective tool for the local control of small volume lung tumours. It is the optimal technique for bilateral or small volume but multifocal disease. Although any metastatic deposit can be treated, the most common tumour groups to be referred for ablation are colorectal, sarcoma, head and neck and renal tumours. Colorectal metastases form the largest single cohort of patients. Results from metastasectomy suggest a survival advantage. Number, distribution and speed of development i.e. disease free interval between primary resection and the development of lung metastases, are considered when deciding whether a patient is operable. Surgical preference is given to fit patients with fewer than 3 metachronous metastases, preferably unilateral, a longer DFI and number of pulmonary nodules. The one consistent factor in all series is that only patients achieving a complete (R0) resection have a longer survival. Many series find the # of nodules is no longer a factor determining survival if R0 resection can be obtained, even repeated metastasectomy. We no longer view extra-PM as a disqualifier for resection, as long as the dz can be completely resected and controlled. Patients are typically referred for immediate surgery if they present with a single PM or have a limited # of mets and a long DFI. Those who develop metastatic dz early are treated initially with chemotherapy to determine the pace of dz progression, if any, on treatment. Patients responding to chemotherapy, those with stable dz, and those with slow progression are referred for resection while those with rapidly progressive metastatic dz receive alternative chemotherapy treatment. Adjuvant chemotherapy is continued only if there is evidence of clinical benefit from preoperative chemotherapy. CT scanning is routinely performed to monitor dz progression. The surgical approach should be individualized. As imaging improves our ability to localize smaller nodules, less invasive options become more appealing and may facilitate less difficult repeat metastasectomy. Ablation (SABR/SBRT or lung CT-guided ablation by cryoablation, radiofrequency ablation or microwave ablation) has been used to treat patients with PM, and our institution uses a lung ablation tumor board to review which lesions are best treated with each modality, focusing on R0 treatment, lung preservation, and location of the tumor. Lung preservation achieved by ablation is important in patients who have had previous resections or who have compromised pulmonary function or in whom a lobectomy would be required for nodule removal. More prospective studies are needed and are underway. Better understanding of the biology of the tumor and more developed histologic-specific nomograms may ultimately improve our ability to better select patients. As systemic therapy improves, treatment of local residual oligometastic dz will become an increasingly important consideration.

VSIO31-06 Complications and Management after Lung Ablation

Tuesday, Dec. 1 3:00PM - 3:20PM Location: S405AB

Participants
Damian E. Dupuy, MD, Providence, RI, (ddupuy@lifespan.org) (Presenter) Research Grant, NeuWave Medical Inc Board of Directors, BSD Medical Corporation Stockholder, BSD Medical Corporation Speaker, Educational Symposium

LEARNING OBJECTIVES

1) Understand the most common adverse events related to lung ablation. 2) Learn how to prevent and treat some of these adverse events. 3) Illustrate some of the more severe adverse events (grade 3-5) with clinical examples.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying
Morphological Appearance of Radiofrequency Ablated Stage I NSCLC in Medically Inoperable Patients as Related to Recurrence: Results from the ACOSOG Z4033 (Alliance Trial)

Tuesday, Dec. 1 3:20PM - 3:30PM Location: S405AB

Participants
Lillian Xiong, MD, Providence, RI (Presenter) Nothing to Disclose
Erica S. Alexander, BS, Providence, RI (Abstract Co-Author) Nothing to Disclose
Shauna Hillman, MS, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Angelina D. Tan, BS,BA, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Grayson L. Baird, MS, Providence, RI (Abstract Co-Author) Nothing to Disclose
Hiran Fernando, MD, Boston, MA (Abstract Co-Author) Consultant, CSA Medical, Inc Research Consultant, Galil Medical Ltd Research Grant, Deep Breeze Ltd
Damian E. Dupuy, MD, Providence, RI (Abstract Co-Author) Research Grant, NeuWave Medical Inc Board of Directors, BSD Medical Corporation Stockholder, BSD Medical Corporation Speaker, Educational Symposia

PURPOSE
This study evaluates tumor and ablation zone morphology as related to recurrence in medically inoperable patients with stage I NSCLC undergoing CT-guided RFA in a prospective multi-center trial.

METHOD AND MATERIALS
This prospective, multicenter group trial was approved by each institutional review board. 54 patients from 16 US sites were enrolled, of these, 50 patients (23 Men, 27 Women; mean age 75.3±7.5 years) met eligibility requirements. Patients were followed using CT; evidence of CT recurrence and pre- and post-ablation imaging characteristics were recorded. Characteristics evaluated included tumor/ablation zone shape (round, ovoid, bilobed, irregular), size, borders (smooth, speculated, lobulated), distance to large vessels/airway and distance to pleura.

RESULTS
A difference was observed for months to recurrence between those with ablation zones greater than 3cm and less than 3cm (p=.0023). The median time of recurrence for those with ablation zones less than 3cm was 8.16 months, while the median time for those with zones greater than 3cm could not be determined. Recurrence free probability was 30% for those with ablation zones less than 3cm and 75% for those with zones greater than 3cm. No significant differences were found between those with and without recurrence for age (p=.47), performance score (p=.43), histology (p=.34), baseline tumor SUV (p=.91), tumor size (p=.59), peak power (p=.92), peak current (p=.63), max temp (p=.65), total time (p=.28), shape (p=.30), cavitation (p=.29), sphericity (p=.45), distance from tumor edge to large vessel (p=.62), and distance to pleura (p=.25).

CONCLUSION
Of those morphological characteristics considered, size of ablation zone appears to be most predictive of recurrence-free survival for those patients treated with RFA for early stage lung cancers.

CLINICAL RELEVANCE/APPLICATION
Post-radiofrequency ablation zones greater than 3-cm were significantly less likely to be associated with recurrent disease, in a multi-institutional prospective study of 50 stage I NSCLC patients.

Honored Educators

LEARNING OBJECTIVES
1) To understand why cementoplasty alone is not always appropriate for bone fracture management (palliation and/or prevention).
2) To introduce the percutaneous screw fixation technique.
3) To present clinical outcomes of percutaneous screw fixation in bone cancer patients.

ABSTRACT
Bone fractures can result in significant pain and loss of function in cancer patients. Percutaneous screw fixation is a very new technique that consists in the insertion of screws in bone structures through a very small skin incision under imaging guidance. The indications are twofold for bone fracture: palliative and preventive. 1/ For patients suffering from pathological or non-pathological fracture the goal of the screw fixation is to achieve a stabilization of the fracture fragments that will result in pain palliation. Typically, the fractures that can be fixed are located in the sacrum, the iliac crest, the acetabulum roof, the pubic ramus and the proximal femur. Cementoplasty can be performed in association (augmented screw fixation) in order to improve the screw’s tip anchorage. 2/ For patients with impending osteolytic metastases, the decision to perform percutaneous augmented screw fixation instead of cementoplasty alone is done by the fact the strength properties of the cement are strong in compression but weak for tensile or shear stresses. Typically, the impending osteolytic metastases that can be consolidate using percutaneous augmented screw fixation are located in the iliac crest, the acetabulum and in the proximal femur. Percutaneous screw fixation is a very effective tool that must be considered as a part of the therapeutic arsenal of the interventional radiologists. Firstly, because it is a minimally invasive procedure that avoids extensive surgical exposure and secondly because the accuracy provided by CT- or Flat panel- guidances results in high technical success and very low complication rate for the screw placement.

RESULTS

The lesions treated with MRgFUS were 18 in the lower extremities, 2 in the upper ones and 2 in the vertebral body. They were treated in less than 100 min. The combination of focused ultrasound with magnetic resonance (MR) imaging enables physicians to perform precise localized tumor tissue ablation, while using MR thermometry for real-time temperature monitoring. Clinical studies on the use of MR-guided focused ultrasound surgery (MRgFUS) for palliation of painful bone metastases demonstrated excellent response rates and safety. Results of a randomized controlled trial will be reviewed to discuss safety and efficacy of MRgFUS for treating bone metastases in patients with persistent or recurrent pain after RT, or who were otherwise not candidates for RT, or who declined RT. MRgFUS has several advantages that may positively influence safety and effectiveness compared with other ablative therapies. These include high-resolution imaging of the targeted tumor and nontargeted normal anatomy, intra-procedural MR thermometry accurate within approximately 2° to verify adequate temperatures to achieve ablation while respecting normal tissue tolerances, and immediate post-treatment validation of the extent of ablation.

ABSTRACT

Bone metastases are common in patients with advanced cancer and are the greatest contributor to cancer-related pain, often severely affecting quality of life. Many patients with advanced cancer are undertreated for pain. Radiation therapy (RT), together with systemic therapies and analgesics, is standard of care for localized metastatic bone pain, although up to two-thirds of patients have residual pain after RT, leaving them with limited treatment options. These include reirradiation, which results in temporary pain reduction in some patients, surgical intervention, and percutaneous cryoablation. More effective systemic therapies are prolonging survival of cancer patients with metastatic disease, resulting in an increased need for alternative therapies for painful bone metastases. Focused ultrasound is a minimally invasive technique that delivers acoustic energy to heat lesions focally to ablative temperatures of more than 65°C. The combination of focused ultrasound with magnetic resonance (MR) imaging enables physicians to perform precise localized tumor tissue ablation, while using MR thermometry for real-time temperature monitoring.

METHOD AND MATERIALS

From March 2011 to March 2014 we treated 40 OO, 18 with MRgFUS (ExAblate InSightech, Israel) and 22 with RFA (Needle Electrode, Boston Scientific-USA). For each patient we chose the less invasive treatment, when applicable. When the lesion could be easily reached with the US beam, the patient was treated with MRgFUS; otherwise, the patient was treated with RFA. Sixteen OO were treated with MRgFUS in the lower arm and 2 in the upper ones. The treatments lasted a mean time of 110 minutes. The lesions treated with RFA were 18 in the lower extremities, 2 in the upper ones and 2 in the vertebral body. They were treated in less than 100 min. The follow-up was performed by MRI and CT up to a maximum of two years; the clinical evaluation was performed using the visual analogue scale (VAS).

RESULTS

All patients, except one treated with MRgFUS and subsequently re-treated with RFA, showed a regression of painful symptomatology. After treatment, they no longer needed any pain medication. The mean hospitalization time was 2 days for patients treated with MRgFUS and 2.4 days for those submitted to RFA. The mean VAS value, 2 years after treatment, showed an overall improvement of 100% (from 8.2 to 0). At the first control at one week after the procedure, patients treated with MRgFUS showed a lower mean VAS value (0.5) as compared with that of RFA (0.8). The results of MRI and CT, 2 years after the treatment, showed in all cases the disappearance of both bone edema (MRI) and nidus with central calcification and peripheral osteosclerosis (CT), that are typical findings of the osteoid osteoma. In no case, major complications were observed.
CONCLUSION

Though based on a limited group of patients, our study demonstrates the safety and effectiveness of both techniques in the treatment of OO, by which it was possible to obtain an optimal clinical and imaging outcome. Compared with RFA, MRgFUS is less invasive, but to be successful, it is mandatory that the US beams properly reach the region of interest.

CLINICAL RELEVANCE/APPLICATION

To evaluate safety and efficacy of an innovative technique of ablation, MRgFUS, which promises to be even less invasive than RFA, which is currently the gold standard in the treatment of OO.

VSIO31-12  Spine Metastases Palliation-Ablation Stabilization

Tuesday, Dec. 1 4:50PM - 5:10PM Location: S405AB

Participants
Jonathan M. Morris, MD, Rochester, MN ( Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1. Learn the basics of ablative technologies available for use in the spine and sacrum. 2. Define current indications for percutaneous ablation in the Spine and Sacrum. 3. How we do it. Lessons learned and resources needed. 4. Define local control rates for the varied tumors treated. 5. Discuss our experience with palliative outcomes for pain relief. 6. Limitations of ablation in the neurosis. 7. Postablative kyphoplasty/vertebroplasty. 8. Discuss unique considerations for cervical, thoracic, lumbar spine and sacrum.

ABSTRACT

Oligometastatic disease involving the spine and sacrum is growing due to an aging population as well as improved survival rates of varied primary malignancies. 70% of all cancer patients will have metastatic disease with 40% involvement of the neuroaxis and 20% with epidural disease. While radiation therapy continues to be the primary treatment a subset of tumors are not radiosensitive and of those which are there are non responders. Starting in 2009 this clinical need led us to develop an ablation service dedicated to the spine and sacrum to aid in the treatment of oligometastatic disease. This talk will enable the attendee to learn the basics of ablative technologies in the spine and sacrum. Learn current indications for this technologies. Learn "how we do it" including lessons learned and resources need to perform this type of treatment. We will discuss the role of post ablative kyphoplasty/vertebroplasty. Finally we will review our palliative pain relief results as well as local control rates in the increasing types of tumors treated.

VSIO31-13  Ablation is Front-line Therapy for Desmoid Tumors

Tuesday, Dec. 1 5:10PM - 5:30PM Location: S405AB

Participants
Afshin Gangi, MD, PhD, Strasbourg, France ( Presenter) Nothing to Disclose

Handout:Afshin Gangi


VSIO31-14  CT-guided Cryoablation as Single Treatment or Combined with Radiotherapy in the Management of Bone and Soft Tissue Lesions

Tuesday, Dec. 1 5:30PM - 5:40PM Location: S405AB

Participants
Francesco Arrigoni, Coppito, Italy ( Presenter) Nothing to Disclose
Silvia Mariani, MD, L'Aquila, Italy ( Abstract Co-Author) Nothing to Disclose
Alice La Marra, MD, L'Aquila, Italy ( Abstract Co-Author) Nothing to Disclose
Luigi Zugaro, L'Aquila, Italy ( Abstract Co-Author) Nothing to Disclose
Antonio Barile, MD, L'Aquila, Italy ( Abstract Co-Author) Nothing to Disclose
Carlo Masciocchi, MD, L'Aquila, Italy ( Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate safety and efficacy of percutaneous CT-guided cryoablation, performed with multiple cryoprobes (also in combination with Radiotherapy) in the treatment of bone and soft tissue lesions.

METHOD AND MATERIALS

Up to April 2015, we treated 27 patients with percutaneous CT-guided cryoablation. All patients but one had osteolytic bone metastases; one patient had a recurrence of aggressive fibromatosis of the shoulder. Prior to treatment, the patients were evaluated with the VAS questionnaire for pain which resulted in a mean value of 7.6. For a faster and more comfortable procedure, we employed three to six cryoprobes for each lesion under fluoroscopic guide. The area of cryoablation (iceball) and the position of the cryoprobes were controlled during the procedure with a wide-volume acquisition, employing 3D and MPR reconstruction. Follow-up studies at 3 and 6 months were performed with CT and VAS questionnaire. No major complications occurred during the procedures.

RESULTS

We observed a reduction of pain in all patients. The mean VAS value dropped from 7.6 to 1.6 one week after treatment and remained substantially unchanged until the end of follow-up (6 months). CT follow-up showed progression of the disease in no case. Only size reduction or stationary CT findings were observed.

CONCLUSION

Our results show the effectiveness of cryoablation, particularly in combination with RT, in terms of tumoral mass control and particularly of pain relief. Through thermoablation in fact it is possible to obtain a prompt relief of pain, and enhancement of the
quality of life immediately after the treatment. The main advantages are the possibility to treat the whole lesion at the same time
with the use of multiple cryoprobes and to check in real time the treated volume; the main limitations are represented by the low
number of patients recruited and by the length of the follow-up.

CLINICAL RELEVANCE/APPLICATION
To evaluate safety and effectiveness of cryoablation also in combination with RT in the management of painful bone and soft tissue
lesions, with the aim of reducing tumoral mass and pain.

VSIO31-15 Bone Metastases Tumor Board

Participants
Matthew R. Callstrom, MD, PhD, Rochester, MN (Moderator) Research Grant, Thermedical, Inc Research Grant, General Electric
Company Research Grant, Siemens AG Research Grant, Galil Medical Ltd
Quantitative CT Imaging Features Improve Prediction of EGFR Mutation Status in Lung Adenocarcinomas

Tuesday, Dec. 1 3:00PM - 3:10PM Location: S404CD

Participants
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (Moderator) Research Grant, Guerbet SA;
Mark S. Parker, MD, Mechanicsville, VA (Moderator) Nothing to Disclose

Purpose
To retrospectively identify the relationship between epidermal growth factor receptor (EGFR) mutation status, predominant histologic subtype, and computed tomographic (CT) characteristics in surgically resected lung adenocarcinomas in an Asian cohort patients.

Method and Materials
This study was approved by the institutional review board, with waiver of informed consent. Findings of preoperative chest CT were retrospectively evaluated in 385 surgically resected lung adenocarcinomas. 30 CT descriptors that characterized tumor location, size, shape, margin, density, enhancement, internal, external, and associated findings were assessed. EGFR mutations at exons 18 - 21 were determined by using a polymerase chain reaction (PCR)-based assay. Univariable and multivariable analyses were performed for this study. The area under ROC curve (AUC) was computed using the leave-one-out cross-validation method.

Results
EGFR mutations were found in 168/385 patients (43.6%). Mutations were found more frequently among female, never smokers, and with lepidic predominant adenocarcinomas, intermediate pathologic grade, among tumors of smaller size, with spiculation, GGO or mixed GGO, air bronchogram, cavitation, vascular convergence, thickened adjacent bronchovascular bundles, and pleural retraction, and also among tumors without pleural attachment, well-defined margin, marked heterogeneous enhancement, severe peripheral emphysema, severe peripheral fibrosis, or lymphadenopathy (P < 0.05). The most important and significantly independent predictors of harboring EGFR activating mutation for the model with both clinical variables and CT features were never smokers, tumors of smaller size, with cavitation, homogeneous enhancement, and pleural retraction when adjusting for gender, pathologic grade, and thickened adjacent bronchovascular bundles. ROC curve analysis showed that clinical predictors combined with CT features (AUC = 0.76) were superior to clinical predictors alone (AUC = 0.61).

Conclusion
Quantitative CT imaging features of lung adenocarcinomas in combination with clinical predictors can predict EGFR mutation status better than clinical predictors alone.

Clinical Relevance/Application
Selecting patients with high potential for EGFR mutations by combining imaging-based predictors with known clinical variable may result in a population with a greater sensitivity to EGFR-TKI treatment.

18F-FDG Uptake as a Prognostic Factor for Tumor Recurrence in Patients with Pathologic Stage I Lung Adenocarcinomas

Tuesday, Dec. 1 3:10PM - 3:20PM Location: S404CD

Participants
Ying Liu, MD, Beijing, China (Presenter) Nothing to Disclose
Ning Wu, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose

Purpose
To analyze the 18F-FDG uptake features and the correlation between 18F-FDG uptake and tumor recurrence in patients with pathologic stage 1 lung adenocarcinomas.

Method and Materials
One hundred and seventeen patients with stage 1 lung adenocarcinomas proved by surgery were studied retrospectively. Eighty-
four patients had a subsequent follow-up. The tumors' SUVmax in different groups of size, density, tumor differentiation degree and T staging were analyzed by Kruskal-Wallis test. The correlations between the SUVmax and clinicopathologic factors were analyzed using Spearman rank correlation. The disease-free survival (DFS) periods in different clinicopathologic groups were estimated using the Kaplan-Meier method and Log-rank test.

RESULTS
The SUVmax of pathologic stage 1 lung adenocarcinomas were significantly different in different groups of size, density, tumor differentiation degree and T staging, respectively (P<0.01). The SUVmax was positively correlated with the size of the adenocarcinomas (P<0.01), and were both negatively correlated with the density and tumor differentiation degree (P<0.01). But there was no correlation with the tumors'T stage (P>0.05). The patients with an SUVmax of ≥2.5 had a much better DFS period than those with an SUVmax of ≤2.5. The DFS periods showed no statistical differences in other clinicopathologic groups (P>0.05). But tumor with a poorly differentiated degree was associated with reduced DFS period compared with those with well differentiated degree (P<0.05).

CONCLUSION
18F-FDG uptake is correlated with the tumor differentiation degree, and has a prognostic value for predicting the tumor recurrence in the patients with pathologic stage 1 lung cancer. The patients with an SUVmax of <2.5 have a much better DFS periods than those with an SUVmax of ≥2.5.

CLINICAL RELEVANCE/APPLICATION
The level of metabolic activity observed with 18F-FDG uptake correlates with the probability of tumor recurrence in the patients with pathologic stage 1 lung cancer.

SSJ05-03 Evaluation of Texture Analysis Parameters in EGFR or ALK-Positive Advanced Non-Small Cell Lung Cancer (NSCLC)

Tuesday, Dec. 1 3:20PM - 3:30PM Location: S404CD

Participants
Caroline Caramella, MD, Villejuif, France (Presenter) Nothing to Disclose
Maria Virginia Bluthgen, Villejuif, France (Abstract Co-Author) Nothing to Disclose
Silvia Rosselini, Villejuif, France (Abstract Co-Author) Nothing to Disclose
Samy Ammari, Villejuif, France (Abstract Co-Author) Nothing to Disclose
Charlotte Leduc, MD, Villejuif, France (Abstract Co-Author) Nothing to Disclose
Francesco Facchinetti, Villejuif, France (Abstract Co-Author) Nothing to Disclose
Eva Haspinger, Villejuif, France (Abstract Co-Author) Nothing to Disclose
Charles Ferte, Villejuif, France (Abstract Co-Author) Nothing to Disclose
Stefan Michiels, Villejuif, France (Abstract Co-Author) Nothing to Disclose
Clarisse Dromain, MD, Villejuif, France (Abstract Co-Author) Nothing to Disclose
Jean-Charles Soria, Villejuif, France (Abstract Co-Author) Nothing to Disclose
Benjamin Besse, Villejuif, France (Abstract Co-Author) Nothing to Disclose

PURPOSE
The quantitative assessment of heterogeneity in tumor images through Texture Analysis is an emerging tool that can potentially provide a non-invasive prognostic biomarker. We investigated if Texture Analysis parameters derived from contrast-enhanced CT (CTTA) were associated with EGFR/ALK status and have a prognostic value in NSCLC patients treated with tyrosine-kinase inhibitors.

METHOD AND MATERIALS
The CT images of advanced NSCLC patients with EGFR mutation or ALK translocation treated with tyrosine-kinase inhibitors were retrospectively reviewed. CTTA using the filtration-histogram method was applied to the region of interest (ROI) in the primary tumor of the enhanced-CT by two independent operators to examine the inter-individual reproducibility. A Wilcoxon test was used to correlate CTTA and EGFR / ALK status and a Cox model to evaluate the prognostic value of CTTA for overall survival. A p-value cutoff of 0.01 was used to adjust for multiple testing.

RESULTS
CTTA parameters were evaluated in CT scan from 68 patients recruited in 2 centers between 2008 and 2013, of them, 80.9% (n=55) were EGFR mutated and 19.1% (n=13) ALK+ NSCLC. The CTTA measures were highly reproducible between the 2 operators as indicated by Bland-Altman plots and correlation values. The skewness of the distribution was significantly different between EGFR mutated and ALK+ tumors for coarse texture with spatial filter value 3.3 (p=0.002), filter value 2.8 (p=0.001) and medium texture with spatial filter value 2.2 (p=0.004). The median follow-up time was 35 months; 39 deaths occurred. The A unit increase in skewness in coarse texture (2.8 spatial filter) was significantly associated with better survival with an univariate cox analysis (HR: 0.36 [0.2-0.69] p=0.002). A multivariate analysis adjusted by prognostic factors (PS, lymphocyte count, hepatic and adrenal metastasis) indicate a similar trend for better survival (HR: 0.40 [0.2-0.8] p=0.01).

CONCLUSION
CTTA parameters were reproducible between the 2 operators. The skewness was significantly different between EGFR mutated and ALK rearranged advanced NSCLC and may have a prognostic value.

CLINICAL RELEVANCE/APPLICATION
Texture analysis of CT images is a simple tool that has proven inter-individual reproducibility and that might have a potential to provide prognostic and molecular indicators to help clinicians in their treatment strategy.
To prospectively and directly compare the capability for N-stage assessment between dynamic contrast-enhanced (CE-) perfusion area-detector CT (ADCT) and FDG-PET/CT in non-small cell lung cancer (NSCLC) patients.

METHOD AND MATERIALS

44 consecutively pathologically diagnosed NSCLC patients (26 males, 18 females; mean age 67 years) were candidates for surgical treatment underwent dynamic CE-perfusion ADCT that were performed at two or three different positions as single examination, PET/CT, surgical treatment and pathological examination. From all perfusion ADCT data in each subject, whole chest perfusion map was computationally generated based on dual- and single-input maximum slope and Patlak plot methods by means of previously reported software. For quantitative diagnosis of metastatic lymph node and N-stage, perfusion parameters and SUVmax at each lymph node were evaluated by ROI measurement. Then, Student’s t-test was performed to determine the difference between metastatic and non-metastatic lymph nodes. To determine the diagnostic capability and feasible threshold value on a per node basis analysis, ROC analyses were performed among all indexes as having significant difference between two groups. Finally, sensitivity, specificity and accuracy for diagnosis of metastatic lymph node and N-stage were compared by means of McNemar’s test.

RESULTS

Systemic arterial perfusion from dual-input maximum slope method and SUVmax had significant difference between metastatic and non-metastatic lymph nodes (p<0.05). Although there was no significant difference of area under the curve between systemic arterial perfusion and SUVmax on a per node basis analysis (p>0.05), specificity (SP: 92.1%) and accuracy (AC: 92.8%) of former were significantly higher than those of latter (SP: 88.3%, p=0.004; AC: 88.3%, p=0.005). In addition, when assessed N-stage in all patients, accuracy of systemic arterial perfusion (75%) was also significantly higher than that of SUVmax (55.8%, p=0.008).

CONCLUSION

Dynamic CE-perfusion ADCT has better potential for N-stage assessment than PET/CT in NSCLC patients.

CLINICAL RELEVANCE/APPLICATION

Dynamic CE-perfusion ADCT has better potential for N-stage assessment than PET/CT in NSCLC patients.
RESULTS
Mean total lung volume decreased by 17.8% in expiration (6877 ± 1641 mL in inspiration and 5495 ± 1160 mL in expiration). Mean expiratory bronchial collapse was 15%. The degree of bronchial lumen collapsibility correlated well with the magnitude of volume reduction of the corresponding lobes (Spearman's r = 0.7, p = 0.001). Importantly, this correlation holds also true for the individual lobes. Considering also the emphysema phenotype, collapsibility and volume reduction were stronger for homogenous compared to heterogeneous emphysematous lobes (diameter reduction 13.1% vs 25.1%; volume reduction 14.2% vs 19.4%, respectively).

CONCLUSION
With about 15%, collapsibility of 3rd generation bronchi in COPD patients was significantly lower than that in the trachea and the main bronchi compared to earlier published data. Bronchial wall consistency (cartilage rings vs. cartilage + membranous wall) seem to be the reason for these differences. The collapsibility correlated well with the reduction in lung volume.

CLINICAL RELEVANCE/APPLICATION
The degree and the sites of increased bronchial lumen collapsibility have severe clinical consequences for understanding and planning novel endobronchial therapies.

Sensitivity of Airway Wall Thickness Measurements: Influence of Small Airways

Tuesday, Dec. 1 3:50PM - 4:00PM Location: S404CD

Participants
Jean-Paul Charbonnier, Nijmegen, Netherlands (Presenter) Nothing to Disclose
Laurens Hogeweg, MSC, Nijmegen, Netherlands (Abstract Co-Author) Nothing to Disclose
Jan-Martin Kuhnigk, PhD, MS, Bremen, Germany (Abstract Co-Author) Stockholder, MeVis Medical Solutions AG
David A. Lynch, MBCh, Denver, CO (Abstract Co-Author) Research support, Siemens AG; Scientific Advisor, PAREXEL International Corporation; Consultant, Boehringer Ingelheim GmbH; Consultant, Gilead Sciences, Inc; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Veracyte, Inc;
Eva M. Van Rikxoort, PhD, Nijmegen, Netherlands (Abstract Co-Author) Stock holder, Thirona BV Co-founder, Thirona BV

PURPOSE
Changes in the morphology of the airways contributes to lung function impairment in chronic obstructive pulmonary disease (COPD). Measurements of airway morphology might be influenced by the quality of the airway segmentation. In this study we investigate the stability of a commonly used airway measurement (Pi10) from CT scans for varying segmentation depths of the airways.

METHOD AND MATERIALS
Inspiratory low-dose thoracic CT scans of 267 subjects, well distributed over GOLD stages, were selected for this study. Airways were automatically extracted by a state-of-the-art segmentation method and manually corrected to ensure a leakage free segmentation. Airway wall thickness quantification was performed in orthogonal cross-sections every 1mm throughout the entire airway tree using an intensity-integration technique which accounts for partial volume effects. Using regression on all cross-sectional measurements, airway morphology was expressed as the square root of wall area at airways with a perimeter of 10mm (Pi10). To determine the sensitivity of the Pi10 measurement to the length of the segmented airway tree, sensitivity analysis was performed on Pi10 by leaving-out wall measurements of the smallest airways and recalculating the Pi10. For each subject, Pi10 regression analysis was repeated excluding airways with a lumen perimeter below 6mm, 8mm or 10mm. The recalculated Pi10 measurements were compared to the baseline Pi10.

RESULTS
The segmented airway trees consisted for 55% of airways with lumen diameters below 10mm, 19% below 8mm, and 1% below 6mm. The average baseline Pi10 of all subjects was 2.43 +/- 0.56 (range [1.40, 4.36]), which corresponds to an average airway wall thickness (for an airway with a lumen perimeter of 10mm) of 0.52mm +/- 0.21mm. By excluding airways with a lumen perimeter below 6, 8 or 10mm from the regression analysis, absolute changes in Pi10 were 0.003 +/- 0.004 (0.11%), 0.035 +/- 0.023 (1.46%), and 0.107 +/- 0.087 (4.6%), respectively, corresponding to changes in airway wall thickness (at 10mm lumen perimeter) of 0.001, 0.013, and 0.039mm.

CONCLUSION
The commonly used Pi10 measurement to express airway morphology from a CT scan is insensitive to the exclusion of smaller airways in the computation.

CLINICAL RELEVANCE/APPLICATION
When expressing airway morphology as Pi10, there is no need to (manually) adjust automatic airway segmentation methods to include smaller airways in order to obtain an accurate Pi10 measurement.
Emergency Radiology (Chest Emergencies)
Tuesday, Dec. 1 3:00PM - 4:00PM Location: N227

SSJ06-01 Predicting Pulmonary Embolus in ED Patients with Isolated Below-the-Knee Deep Vein Thrombosis

Participants
Martin L. Gunn, MBChB, Seattle, WA (Moderator) Research support, Koninklijke Philips NV; Spouse, Consultant, Wolters Kluwer NV; Medical Advisor, TransformativeMed, Inc; Mariano Scaglione, MD, Castel Volturno, Italy (Moderator) Nothing to Disclose

Sub-Events

Purpose
Existing literature is mixed regarding risk of isolated below-the-knee deep vein thrombosis (BKDVT) relating to development of pulmonary embolus (PE). Patients with acuity of symptoms triggering an emergency department (ED) visit may be at higher risk. This study aims to quantify and characterize the risk of PE in ED patients found to have BKDVT.

Method and Materials
In this IRB-approved, HIPAA compliant study, ED lower extremity ultrasounds from 2005-2015 were reviewed to identify patients with isolated BKDVT. Medical records were reviewed for either PE protocol or conventional protocol chest CT within 1 month of the index ultrasound to assess for PE. Key clinical factors at presentation were determined, including venous territories involved and history of DVT, malignancy, medical risk factors (e.g. smoking, genetic predisposition, medications, travel), recent surgery/hospitalization, and respiratory symptoms/pain. Chi Square test was performed to compare utility of clinical factors in assessing risk of PE in patients with BKDVT, with statistical significance set at p<0.05.

Results
135 studies were identified with isolated BKDVT, with patients of average age 57.1 +/- 17.2 (mean +/- SD) with a range of 21-93, including 51% male, 49% female. BKDVT was identified in the posterior tibial (50%), peroneal (42%), gastrocnemius (19%), anterior tibial (2%), and soleal (1%) veins. Patients either had 1 (84%) or 2 territories (16%) involved, with 8% bilateral. 50 patients (37%) underwent chest CT in the prescribed period. No difference was seen in age (p=.232), gender (p=.774), or territories involved (p=.830) in those who underwent CT versus those who did not. Of those with CT, 31 (62%) had PE. Presence of two territories (e.g. posterior tibial and peroneal) was associated with higher likelihood of PE (p=0.018). Other clinical factors were not meaningful, including history of DVT (p=.232), malignancy (p=.756), medical risk factors (p=.255), recent surgery/hospitalization (p=1.00), symptoms (p=.773), and bilaterality (p=.637).

Conclusion
ED patients presenting with isolated BKDVT have a very high incidence (62%) of concurrent PE. While the utility of predictive factors is limited due to this high incidence, presence of BKDVT in two venous territories was highly associated with PE.

Clinical Relevance/Application
ED patients with isolated below-the-knee deep vein thrombosis have a much higher rate of PE than traditionally expected.

SSJ06-02 Ultra-low-dose Chest CT with Iterative Reconstructions vs Chest X-Ray in Emergency Settings. Is it the Beginning of a New Era? Preliminary Observations

Participants
Francesco Macri, MD, Nimes, France (Presenter) Nothing to Disclose
Joel Greffier, Nimes, France (Abstract Co-Author) Nothing to Disclose
Alina Chica Rosa, MD, Nimes, France (Abstract Co-Author) Nothing to Disclose
Cornelia Freitag, Nimes, France (Abstract Co-Author) Nothing to Disclose
Gian Franco Gualdi, MD, Roma, Italy (Abstract Co-Author) Nothing to Disclose
Ahmed Larbi, MD, Nimes, France (Abstract Co-Author) Nothing to Disclose
Jean Paul Beregi, MD, Nimes, France (Abstract Co-Author) Nothing to Disclose

Purpose
To evaluate the diagnostic power of the ultra-low-dose CT (ULD-CT) of the chest compared to the chest X-ray (CXR) at the emergency room (ER).
Patients with dubious CXR performed at the ER searching for pneumothorax, fractures and pneumopathy who underwent a ULD-CT within 48 hours. ULD-CT acquisition was performed on a 64 slices MDCT (Somatom Definition AS+, Siemens) with 100 kVp ± 20 (depending on the patient constitution) and fixed 10 mAs, without injection of intravenous iodinated contrast media. Images were reconstructed with Sinogram-AFFirmed-Iterative-Reconstructions (SAFIRE, Siemens) with S4 and I50f for pulmonary parenchyma and with S3 and I30f for the mediastinum. A radio-physicist evaluated the dose differences between CXR and ULD-CT. Two radiologists independently evaluated the diagnostic quality of the images and the diagnostic degree of confidence.

RESULTS
A total of 136 patients (M 72; F 64) with a mean age of 63 years (± 20.5) and a mean BMI 23.6 kg/m2 (± 5.1) were enrolled. The effective dose for CXR was 0.133 ± 0.132 mSv, 59% lower than CXR French Diagnostic Reference Levels (fDRL): 0.225 mSv. The effective dose for ULD-CT was 0.189 ± 0.035 mSv, 97% lower than chest CT fDRL: 6.65 mSv. ULD-CT revealed a higher quantity of small pneumothoraxes and fractures and better depicted the pneumopathies compared to CXR. Readers recorded a high score of diagnostic confidence level for ULD-CT. Diagnostic decision-making was possible even on noisy CT images.

CONCLUSION
ULD-CT with iterative reconstructions, with an irradiation dose close to CXR, allowed a reliable study of the patients with the suspicion of pneumothorax, fractures and pneumopathy.

CLINICAL RELEVANCE/APPLICATION
Ultra-low-dose chest CT with iterative reconstructions improves the management of the ER patients with suspicion of pneumothorax, fractures and pneumopathy by reducing the delay of diagnosis and avoiding redundant exposure.

SSJ06-03 Dual-Energy CT of Chest in Pulmonary Angiography: Maximizing Optimal Contrast Enhancement with a Non-Linear Blending Technique
Tuesday, Dec. 1 3:20PM - 3:30PM Location: N227

Participants
Teresa I. Liang, MD, Vancouver, BC (Presenter) Nothing to Disclose
Ismail T. Ali, MBChB, MD, Vancouver, BC (Abstract Co-Author) Nothing to Disclose
Memoona Mian, MD, FRCR, Vancouver, BC (Abstract Co-Author) Nothing to Disclose
Patrick D. McLaughlin, FFRRCSI, Cork, Ireland (Abstract Co-Author) Speaker, Siemens AG
Savvas Nicolaou, MD, Vancouver, BC (Abstract Co-Author) Institutional research agreement, Siemens AG

PURPOSE
CT Pulmonary angiography (CT PE) is the gold standard for diagnosis of pulmonary emboli (PE). However, in suboptimal conditions, contrast enhancement is inadequate for diagnostic purposes, and scans often need to be repeated. In this study we evaluate the utility of Dual Energy CT (DECT PE) non-linear blending technique in patients with suspected PE in comparison to a standard 100 kVp scan.

METHOD AND MATERIALS
Thirty-five patients between September 19, 2013 and 2014 with a suspected PE, underwent a standardized high-pitch DECT PE protocol to generate standard 100kVp (DECT-100) and non-linear blended images (DECT-OC). Visualization of the pulmonary arteries on the two image sets was scored on a Likert scale from 1 to 5 by two readers (Score of 5 = excellent sharp visualization of anatomical structures, no image noise and artifacts; score of 1 = poor visualization of anatomical structures, and severe image noise and artifacts). Each segment was assessed for diagnostic ability of possible PE. Mean and standard deviation of CT values within pulmonary arteries, muscle, and air were recorded, and signal to noise (SNR) and contrast to noise (CNR) ratios were generated as a quantitative index of image quality. Student t-test and Wilcoxon rank sum test were used for statistical analysis, and p<0.05 was considered significant.

RESULTS
Visualization scores were significantly better on all segments (Main, left and right, lobar, segmental and subsegmental pulmonary arteries) on the DECT-OC images for both readers (p<0.0001). In the 490 pulmonary artery segments evaluated, 34 were non-diagnostic on the DECT-100 images, whereas only 7 were non-diagnostic on the DECT-OC images (p<0.0001). Mean SNR was 97% higher (27.67 vs. 54.53, p<0.0001) and mean CNR was 105% higher (14.76 vs 30.27, p<0.0001) on the DECT-OC images.

CONCLUSION
The application of a DECT non-linear blending technique for the diagnosis of PE helps significantly improve SNR, CNR, and arterial visualization in comparison to a standard 100 kVp scan, yielding substantially improved diagnostic image quality.

CLINICAL RELEVANCE/APPLICATION
Non-linear blended DECT PE allows optimal visualization of the pulmonary vasculature leading to improved detection of PE, and may be especially useful in suboptimal studies to avoid repeat scans.

SSJ06-04 Sickle Cell Patients Undergoing CT Pulmonary Angiography in the Emergency Department: An Analysis
Tuesday, Dec. 1 3:30PM - 3:40PM Location: N227

Participants
David D. Bates, MD, Boston, MA (Presenter) Nothing to Disclose
Z Liu, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Christina A. LeBedis, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Nagaraj-Setty Holalkere, MD, Boston, MA (Abstract Co-Author) Owner, imaginglink, LLC

PURPOSE
To analyze the data for patients with sickle cell disease being evaluated in the emergency department with CT pulmonary angiography.

**METHOD AND MATERIALS**

This retrospective study was approved by our Institutional Review Board. Patients with sickle cell disease were evaluated with CT pulmonary angiography (CTPA) 42 times in the Emergency Department over 26 months beginning in November 2011. Clinical data and imaging were reviewed and compared with patients from the same period. Studies were classified as positive for acute pulmonary embolus, negative for acute pulmonary embolus, or indeterminate. Wells' scores were calculated for each sickle patient as well as a control group based on the medical records. Statistical analysis was performed.

**RESULTS**

Patients with sickle cell undergoing CTPA in the emergency department were significantly more likely to have either 'Moderate' or 'High' risk Wells' scores (53.7% vs. 31.0, p < 0.05), more likely to be female (76.19% vs. 62.79%, p < 0.05), and had lower mean age (31.74 vs. 55.26 years, p < 0.05). No statistically significant difference was observed for the rate of acute PE between sickle cell patients and the ER population (7.14% vs. 10.67%).

**CONCLUSION**

Sickle cell patients are younger and are more likely to be female than the general population of patients undergoing CTPA in the ED. Sickled patients are also more likely to be categorized as either 'Moderate' or 'High' risk based on Wells' criteria than a control group. No significant difference in the rate of acute PE was observed for sickle patients compared with the general population of patients when undergoing CTPA in the ED.

**CLINICAL RELEVANCE/APPLICATION**

Sickle cell patients are younger and are more likely to be female than the general population of patients undergoing CTPA in the ED. Sickled patients are also more likely to be classified as Moderate or High Risk based on Wells' criteria when being evaluated with CTPA in the emergency department (ED). Despite the higher risk profile, no difference was observed in the rate of acute PE for sickle cell patients, though the small sample size limits sensitivity for the detection of a true difference in the incidence of acute PE. Younger and female, sickle cell patients as a group may be at higher risk for the stochastic effects of ionizing radiation. Our study suggests that risk stratification models used in clinical decision pathways for the evaluation of PE in the general population may not be appropriate for use in sickle cell patients.

**SSJ06-05 The Impact of Maximum Aortic Wall Thickness on Patient Outcomes in Acute Type A Intramural Hematoma**

**Tuesday, Dec. 1 3:40PM - 3:50PM Location: N227**

**Participants**

Michael K. Atalay, MD, PhD, Providence, RI (Presenter) Nothing to Disclose
Ashley A. Tuttle, MD, Providence, RI (Abstract Co-Author) Nothing to Disclose
Grayson L. Baird, MS, Providence, RI (Abstract Co-Author) Nothing to Disclose
Dennis Kwon, MD, Providence, RI (Abstract Co-Author) Nothing to Disclose
Neil Sodha, MD, Providence, RI (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Aortic intramural hematoma (IMH) is an uncommon acute aortic injury that can heal spontaneously or progress to potentially life-threatening complications. Maximum IMH thickness (Tmax) and luminal compression ratio (LCR) have been proposed as potentially useful metrics for identifying patients who are more likely to experience complications. The aim of this study was to correlate Tmax and LCR with patient outcomes in all Type A IMH cases performed in a large tertiary referral center over 11 years.

**RESULTS**

Over the study period, 54 thoracic IMH cases were captured in PACS, 23 (43%) of which were Type A and 31 (57%) Type B. Mean Type A patient age was 77±12 years and 13 (57%) of the 23 patients were female. Outcomes in 7 patients were unknown (1 Type A, 6 Type B). Of those remaining, 7 (32%) Type A cases and 10 (40%) Type B cases showed regression on serial follow-up imaging. A significant interaction for regression was observed for IMH Type and Tmax (p=0.039). For each millimeter increase in Tmax the odds of regression for Type A IMH decreased 26%. The Tmax for 50% probability of Type A regression was 8.6 mm. The mean Tmax for those Type A cases showing regression was 8.6 mm and for those showing progression 14.6 mm (p=0.015). There was no significant correlation between LCR or Dmax and patient outcomes for Type A IMH.

**CONCLUSION**

Maximal aortic wall thickness predicts the odds of spontaneous resolution or stability of Type A IMH and may in turn impact clinical management.

**CLINICAL RELEVANCE/APPLICATION**

The maximal aortic wall thickness in Type A IMH may potentially be used as a metric for adverse outcomes to guide medical versus surgical management.

**SSJ06-06 Effect of Patient Lung Volume on Contrast Volume Administration During Computed Tomography Pulmonary Angiography**

**Tuesday, Dec. 1 3:50PM - 4:00PM Location: N227**

**Participants**

Charbel Saade, PhD, Beirut, Lebanon (Presenter) Nothing to Disclose
Fadi M. El-Merhi, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Mukbil H. Hourani, MD, Beirut, Lebanon (Abstract Co-Author) Nothing to Disclose
Hassain Al-Mohiy, Abha, Saudi Arabia (Abstract Co-Author) Nothing to Disclose
Bassam El-Achkar, MD, Beirut, Lebanon (Abstract Co-Author) Nothing to Disclose
PURPOSE
To investigate the effect of patient lung volume and contrast volume on pulmonary artery opacification using a patient-specific contrast formula during pulmonary multidetector CT angiography.

METHOD AND MATERIALS
IRB approval for this prospective study was obtained. CTPA was performed on 120 patients with suspected PE using a 64-channel computed tomography scanner and a dual-barrel contrast injector. Patients were assigned to two protocol groups: protocol A, the department’s conventional protocol, employed a fixed 80 mL contrast volume, intravenously injected at 4.5 mL/s; protocol B used a patient-specific contrast formula based on patient cardiovascular dynamics. Both protocols used a 50 mL saline flush at 4.5 mL/s and a craniocaudal scan direction. The mean cross-sectional opacification profile of eight central and eleven peripheral pulmonary arteries and veins were measured for each patient and arteriovenous contrast ratio (AVCR) calculated for each lung segment. Mean lung volume were quantified using a computer aided detection software. Protocols were compared using Mann-Whitney U non-parametric statistics. Inter-observer variations were investigated using Kappa methods.

RESULTS
A number of pulmonary arteries demonstrated increases in opacification (p<0.03) for protocol B compared with A whilst opacification in the heart and all veins was reduced in protocol B (p=0.05). Subsequently, increased AVCR in protocol B compared with A was observed at all anatomic locations (p<0.0002) where this ratio was calculated. Mean contrast volume demonstrated a reduction in protocol B (33±9 mL) compared to A (80±1mL). In protocol B larger lung volumes were significantly correlated to larger volumes of contrast (p<0.03). Inter-observer variation was observed with protocol B compared with A with the latter metric increasing from κ = 0.28 to 0.71 respectively.

CONCLUSION
Significant improvements in visualisation of the pulmonary vasculature can be achieved with low contrast volume. Patient lung volume is significantly correlated to contrast volume administration employing a patient-specific contrast formula.

CLINICAL RELEVANCE/APPLICATION
Matching patient lung volume and contrast injection timing with vessel dynamics significantly improves vessel opacification and reduces contrast dose in the assessment of pulmonary embolism (PE) during computed tomography pulmonary angiography (CTPA).
**RC401**

**Practical Issues in Chest Imaging (An Interactive Session)**

Tuesday, Dec. 1 4:30PM - 6:00PM Location: E353C

**AMA PRA Category 1 Credits ™: 1.50**
**ARRT Category A+ Credits: 1.50**

**Participants**

**Sub-Events**

**RC401A  A Pattern Based Approach to Acute Parenchymal Opacities**

Participants

Amita Sharma, MBBS, Boston, MA (asharma2@mgh.harvard.edu) (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) At the conclusion of the session the attendee will be able to identify patterns of acute parenchymal opacities in a patient presenting with acute dyspnea. The attendee will learn to classify the distribution of disease according to the craniocaudal, axial distribution and distribution relative to the secondary pulmonary lobule. They will understand how to describe radiologic abnormalities as air-space opacities, including ground glass and consolidation, nodular opacities, linear opacities and areas of decreased attenuation. This knowledge will enable the attendee to apply a pattern based approach to differential diagnosis of acute parenchymal opacities in their clinical practice. This will enable a more focused differential diagnosis that can be used to direct further evaluation and management.

**ABSTRACT**

Patients often present to the emergency room with acute dyspnea. The chest radiograph or chest CT scan may show diffuse parenchymal opacities that may be due to a number of etiologies, such as infection, pulmonary edema, or malignancy. By analyzing the distribution of disease, characterizing the most pronounced radiologic abnormalities and incorporating the presence of ancillary findings, it is possible for the radiologist to offer a limited differential diagnosis to direct further evaluation or management. This talk will illustrate the common diseases that present with acute dyspnea and provide practical tips on the approach to diffuse parenchymal abnormalities detected on imaging.

**RC401B  Unravelling Pulmonary Lymphoproliferative Disorders**

Participants

Sam S. Hare, MBBS, MA, London, United Kingdom (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe native pulmonary lymphoid tissue with emphasis on MDCT appearances of intrapulmonary lymph nodes. 2) Provide a simple classification system for the pulmonary lymphoproliferative disorder spectrum. 3) Identify the breadth of MDCT patterns associated with pulmonary lymphoproliferative disease. 4) Contrast the imaging manifestations of LIP versus pulmonary lymphoma. 5) Detect key MDCT patterns in secondary pulmonary lymphoma.

**ABSTRACT**

Pulmonary lymphoproliferative disorders (LPD) comprise a complex group of focal or diffuse abnormalities: benign LPD and primary pulmonary lymphoma are relatively rare whereas secondary pulmonary lymphoma is far more common. Understanding the spectrum of LPD, coupled with the diversity of potential imaging findings, is crucial because the radiologist is often the first to suggest the diagnosis and is therefore pivotal in differentiating these entities. This presentation will discuss practical LPD concepts relevant to everyday chest imaging by reviewing the more commonly encountered CT patterns in this disorder spectrum.

**RC401C  ICU Radiology**

Participants

Matthew D. Gilman, MD, Boston, MA (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the anatomic considerations of the more common ICU tubes and lines. 2) Recognize the proper positioning and malpositions of the more common ICU tubes and lines. 3) Understand the techniques of VA and VV ECMO and the implications for imaging.

**ABSTRACT**

Critical care patients often require invasive support and monitoring devices to support life and direct clinical management decisions. These tubes and lines are among the most common urgent findings in the imaging of the ICU patient. This presentation will illustrate the anatomy, proper positioning, and malpositions of the more common tubes and lines with illustrations and examples. Newer support devices (ECMO) and the potential pitfalls in imaging these patients will also be illustrated.

**RC401D  Infections in Immunocompromised Hosts: Keeping Pace with the Changing Landscape**

Participants

Rachna Madan, MD, Boston, MA (rmadan@partners.org) (*Presenter*) Nothing to Disclose
LEARNING OBJECTIVES

1) Discuss spectrum of immunocompromised hosts and infections associated with specific immune deficits. 2) To review clinical presentation, and imaging findings of pulmonary infections with emphasis on immunocompromised hosts. 3) Review imaging signs in infections. 4) Review the role of percutaneous sampling especially in tissue invasive infections where bronchoscopy and bronchial lavage may have low yield. 5) Discuss revised EORTC/MSG criteria for diagnosis of invasive fungal infections. 6) Emphasize diagnostic conundrums such as presence of multiple infectious processes, mimics of infection and immune reconstitution inflammatory syndrome (IRIS). 7) Use case scenarios to illustrate formulation of differential diagnosis by combining clinical, serological data with imaging findings.

ABSTRACT

Infections are the most common pulmonary complications in immunocompromised patients and lung is the most frequently affected site of tissue invasive infection. It is imperative to adopt an aggressive approach to getting specific microbiologic diagnosis. Early cross sectional imaging with CT allows narrowing of differential diagnosis using radiological features and gives clues about the mechanism of spread, possible organism, burden of disease and guides subsequent invasive procedures such as lung biopsy. Imaging signs must be applied with caution and it is important to consider non-infectious etiologies. Pursuit of a unifying diagnosis is not always possible. Multiple infections may co-exist in a single organ. The radiologist must take on the role of an image guided clinician and combine clinical, serological and microbiological data with imaging features in making a diagnosis.
LEARNING OBJECTIVES

1) Understand the current process of how reimbursement for new procedures and technology is obtained from CPT code development, valuation and coverage. 2) Using Lung Cancer Screening as an example, the participants will become familiar with the specific processes for obtaining coverage for new screening programs in the public and private sectors and how a myriad of governmental agencies and other policymaking groups are involved in determining which new procedures are covered. 3) Understand how obtaining coverage will bring this new technology to the mainstream. 4) Interactive techniques will be used to engage the audience in the consideration of strategic partnerships between industry, clinical research, governmental agencies and third party payors.

URL

Handout:Pamela Kassing

Handout:Ezequiel Silva
http://abstract.rsna.org/uploads/2015/14000570/Lung Cancer ScreeningSpeaker notes.docx
Chest Wednesday Case of the Day
Wednesday, Dec. 2 7:00AM - 11:59PM Location: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Alvaro Huete Garin, MD, Santiago, Chile (Presenter) Nothing to Disclose
Kristopher W. Cummings, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Javiera C. Araya Campos, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose
Cylen Javidan-Nejad, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Juan-Carlos Diaz, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose
Francisca C. Araya, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) To analyze interesting chest cases.
2) To understand appropriate differential diagnosis.
3) To understand the clinical significance of the diagnosis presented.
Case-based Review of Pediatric Radiology (An Interactive Session)
Wednesday, Dec. 2 8:30AM - 10:00AM Location: S406A

Participants
Sudha A. Anupindi, MD, Philadelphia, PA (Director) Nothing to Disclose

LEARNING OBJECTIVES
1) To apply a systematic approach in the evaluation of pediatric diseases. 2) To identify essential imaging features of various pediatric congenital, musculoskeletal, abdominal and neurological diseases using a multimodality approach. 3) To understand and develop best imaging practice for various pediatric diseases.

ABSTRACT
To apply a systematic approach in the evaluation of pediatric diseases To identify essential imaging features of various pediatric congenital, musculoskeletal, abdominal and neurological diseases using a multimodality approach To understand and develop best imaging practice for various pediatric diseases

Sub-Events
MSCP41A  Fetal Thoracic and Abdominal Anomalies

Participants
Christopher I. Cassady, MD, Houston, TX (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

MSCP41B  Pediatric Abdominopelvic Tumors

Participants
M. Beth McCarville, MD, Memphis, TN (Presenter) Support, General Electric Company

LEARNING OBJECTIVES
View learning objectives under main course title.

MSCP41C  Congenital Disorders of the Genitourinary Tract

Participants
Tracy N. Kilborn, MBChB, Cape Town, South Africa (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.
Participants
Georgeann McGuinness, MD, New York, NY (Moderator) Nothing to Disclose
Brett M. Elicker, MD, San Francisco, CA, (brett.elicker@ucsf.edu) (Presenter) Nothing to Disclose
Daria Manos, MD, FRCP, Halifax, NS, (daria.manos@nshealth.ca) (Presenter) Nothing to Disclose
Sharyn L. MacDonald, MBChB, Christchurch, New Zealand (Presenter) Nothing to Disclose
Georgeann McGuinness, MD, New York, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the applications and limitations of HRCT in detecting and characterizing diffuse lung disease through the discussion of expert analysis of unknown cases. 2) Apply correct usage of the HRCT lexicon to specific findings, to better elucidate pathophysiology and to refine differential considerations, by observing experts in HRCT approach unknown cases. 3) Develop diagnosis and management algorithms by working through problematic cases with the expert discussants. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

ABSTRACT
Participants

Sub-Events

RCS18A Lung Cancer in the Radiogenomic Era-Implications for Imaging

Participants
Lawrence H. Schwartz, MD, New York, NY (Presenter) Committee member, Celgene Corporation; Committee member, Novartis AG; Committee member, ICON plc; Committee member, BioClinica, Inc

LEARNING OBJECTIVES
1) To understand the clinical needs for Radiogenomic Imaging in Lung Cancer. 2) To understand what imaging modalities and quantification techniques can be used in Radiogenomic Imaging in Lung cancer. 3) To illustrate examples of successes and failures in Radiogenomic Imaging approaches in Lung Cancer.

RCS18B Qualitative Assessments of Lung Cancer for Radiogenomic Analysis

Participants
Hyun-Ju Lee, MD, PhD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To introduce the results of correlation between imaging features and genetic phenotypes of lung cancer. 2) To describe the implications of imaging traits on pathology, patient prognosis, and genetics. 3) To introduce the role of qualitative assessment for the next step high-throughput quantitative feature selection.

ABSTRACT
The way tumors look on radiological images may also reveal their underlying cancer gene expressions. Tumor imaging phenotypes can be characterized not only qualitatively by the radiologist's eyeballing, but also quantitatively by computer through image feature analysis. Radiogenomics promises the ability to assess cancer genotype though the tumor's imaging phenotype. However, to date, little attention has been paid to the sensitivity of image features to repeat scans, imaging acquisition and reconstruction techniques, reconstruction parameters and tumor segmentations. This refresher course will first familiarize the audience with quantitative image features that can be computed to characterize tumors. 2) Discuss reproducibility and reliability of image features due to, repeat CT scans, CT acquisition and reconstruction techniques, tumor segmentations.

ABSTRACT
The way tumors look on radiological images may also reveal their underlying cancer gene expressions. Tumor imaging phenotypes can be characterized not only qualitatively by the radiologist's eyeballing, but also quantitatively by computer through image feature analysis. Radiogenomics promises the ability to assess cancer genotype though the tumor's imaging phenotype. However, to date, little attention has been paid to the sensitivity of image features to repeat scans, imaging acquisition techniques, reconstruction parameters and tumor segmentations. This refresher course will first familiarize the audience with quantitative image features that can be computed to characterize tumor size, shape, edge and density texture statistics. Both phantom and in-vivo studies will be introduced to explain how repeat CT scans and CT imaging acquisition and reconstruction techniques affect the assessment of quantitative image features in lung cancer Radiogenomics studies. Last but not least, the effects of image segmentation on feature calculations will be addressed.
RSNA/ESR Emergency Symposium: Chest Emergencies (An Interactive Session)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: S402AB

AMC PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Ronald J. Zagoria, MD, San Francisco, CA, (ron.zagoria@ucsf.edu) (Moderator) Nothing to Disclose
Andras Palko, MD, PhD, Szeged, Hungary (Moderator) Medical Advisory Board, Affidea Group;

Sub-Events

MSSR42A Thoracic Injuries

Participants
Jorge A. Soto, MD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To recognize the most common vascular injuries seen in the setting of blunt thoracic trauma. 2) To understand the importance of differentiating traumatic aortic injuries from mimics, especially congenital variants. 3) To present a classification scheme that distinguishes between minor and major aortic injuries and how this classification influences patient management. 4) Illustrate with examples other important injuries resulting from chest trauma: major airways, heart, lung parenchyma, pleura and diaphragm.

ABSTRACT
Vascular injuries caused by blunt or penetrating trauma are common and highly lethal. In patients who survive the initial event, rapid evaluation with CT may be life saving. This presentation will focus on the importance of recognizing the CT signs used to diagnose major and minor aortic injuries and will introduce a classification method that helps direct patient management. Other important injuries that the radiologist needs to be aware of will also be reviewed, such as those affecting the major airways, heart and diaphragm. The emerging role of CT in the management of penetrating thoracic trauma will also be discussed. Finally, examples illustrating potential pitfalls leading to false-negative or false-positive interpretations will be highlighted.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator

MSSR42B Non-Traumatic Thoracic Emergencies

Participants
Cornelia M. Schaefer-Prokop, MD, Nijmegen, Netherlands (Presenter) Advisory Board, Riverain Technologies, LLC

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.

MSSR42C Interactive Case Discussion

Participants
Jorge A. Soto, MD, Boston, MA (Presenter) Nothing to Disclose
Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator
A New Subtype of COPD in Cigarette Smokers

**PURPOSE**
Although quantitative CT measurement of % low attenuation areas less than -950 HU (%LAA-950) is commonly used as a surrogate for emphysema, there is a subgroup of patients who meet quantitative criteria for emphysema, but who do not have visual evidence of emphysema. The purpose of this study was to determine the demographic and physiologic features of this discordant group, compared with a control group that did not have either visual or quantitative evidence of emphysema.

**METHOD AND MATERIALS**
2099 cigarette smokers enrolled in the COPDGene study underwent visual analysis by two trained research analysts, according to the Fleischner Society categorization of emphysema. From this group, we selected all subjects who had quantitative evidence of emphysema (%LAA-950>5%) but did not have visual evidence of emphysema (n=165). The control group comprised subjects with no visual or quantitative CT evidence of emphysema (n=677). All subjects underwent inspiratory and expiratory CT evaluation, with quantitative CT metrics. Expiratory air trapping was assessed quantitatively by measuring the % LAA <856 HU on expiration. Followup spirometry was obtained 5 years after the initial CT in 128 discordant subjects and in 448 controls. Differences between groups were evaluated using Chi-Square and Student t test as appropriate.

**RESULTS**
Kappa value for presence or absence of emphysema was 0.84. Compared with the control group, the discordant group were older (mean ±s.d. 62±9 vs 59±9 years, p=0.0001), more likely to be male (63% vs 38%, p<0.0001), and less likely to be African American (5% vs 21% p<0.0001). Although the FEV1 % at baseline was similar in the two groups, the FEV1/FVC ratio was significantly lower in the discordant group (0.71±.10 vs 0.77±.07 p<0.0001). On quantitative expiratory CT, the %LAA-856 was 23±12 % in the discordant group compared with 11±9% in the controls (p<0.0001). On 5 year followup, the mean decrease in FEV1 in the discordant group was 241±271 ml, compared with 178±259 ml in the control group (p=0.018).

**CONCLUSION**
Even in the absence of visual emphysema, quantitative CT densitometry identifies a subgroup of smokers with evidence of airway obstruction, who demonstrate progression in airway obstruction over time.

**CLINICAL RELEVANCE/APPLICATION**
The high proportion of LAA-950 in the discordant group may be due to sub-resolution emphysema (perhaps panlobular), or to lobular overinflation related to small airways abnormality.

**Optimal Threshold for Quantification of Air-trapping Using Non-Rigid Image Registration of Inspiration/Expiration CT Scans in COPD**

**PURPOSE**
To retrospectively investigate the optimal threshold for quantification of air trapping using non-rigid registration of inspiratory and expiratory CT scans.
METHOD AND MATERIALS

Institutional review board approval was obtained. From June 2005 to October 2010, 195 patients (166 COPD patients, 29 nonsmoker control) were included in our study. Inspiration and expiration CT scans were performed in the same CT scanner followed by non-rigid registration using an in-house software. Subtraction value per voxel between inspiration and registered expiration CT was obtained and volume fraction of air-trapping (air-trapping index, ATI), using variable thresholds (from 30 to 120 HU), was calculated. Calculated ATI using variable thresholds, expiration/inspiration ratio of mean lung density (E/I MLD), and the percent of lung voxels below -856HU on expiration CT (gas-trapping index, Exp -856) were correlated with pulmonary function parameters for small airway disease or air-trapping (FEF25-75% and RV/TLC).

RESULTS

All of ATI with variable thresholds were significantly correlated with both FEF25-75% and RV/TLC (all P<0.001). When correlated with FEF25-75%, the highest correlation coefficient was -0.656, using the threshold of 80HU. As for RV/TLC, as threshold increased, the correlation coefficient decreased. The highest correlation coefficient was 0.664, using the threshold of 30HU. When plotting the relation between subtraction thresholds and FEF25-75% and RV/TLC, threshold of 60 HU was suitable (r = -0.649 and 0.651, respectively). These correlation coefficients were comparable to the results with E/I MLD (r = -0.670 and 0.657 for FEF25-75% and RV/TLC, respectively) and Exp -856 (r = -0.604 and 0.565 for FEF25-75% and RV/TLC, respectively). When the optimal threshold of 60HU was applied, the measured ATI of 23 nonsmoker normal controls and COPD patients were 24.2% ± 16.8 and 65.7% ± 17.7 (P<0.001).

CONCLUSION

Optimal threshold for quantification of air-trapping using non-rigid registration of inspiration and expiration CT scans in COPD patients is 60 HU with significant correlation with FEF25-75% and RV/TLC, and is comparable to E/I MLD and Exp -856.

CLINICAL RELEVANCE/APPLICATION

Quantification of air-trapping using optimal subtraction threshold of 60 HU using non-rigid image registration of inspiration and expiration CT scans may be useful in assessing small airway dysfunction in COPD patients.

SSK05-03 Impact of Endobronchial Coiling on Segmental Bronchial Lumen in Treated and Untreated Lung Lobes: Correlation with Changes in Lung Volume, Clinical and Pulmonary Functional Tests

Wednesday, Dec. 2 10:50AM - 11:00AM Location: S404CD

Participants
Christopher Kloth, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Wolfgang M. Thaiss, MD, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Hendrik Dtt, Forchheim, Germany (Abstract Co-Author) Employee, Siemens AG
Juergen Hetzel, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (Abstract Co-Author) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Marius Horger, MD, Tuebingen, Germany (Presenter) Nothing to Disclose

PURPOSE

To assess the impact of endobronchial coiling on crosssectional area of segment bronchi and corresponding lobe volumes both at end-inspiration and end-expiration in patients with chronic obstructive lung disease (COLD) grade IV (GOLD) by using quantitative chest-CT.

METHOD AND MATERIALS

From January 2010 to December 2014 30 patients (female=15, median age=65.36y; range 48-76y) underwent chest-CT both before and after endobronchial coiling for lung volume reduction (LVR). Two thin-slice (0.6mm) non-enhanced image data sets were acquired both at end-inspiration and end-expiration. Clinical response was defined as an increase in the walking distance (6MWT) after LVR-therapy. Additionally, we used also PFT measurements with forced expiratory volume in 1 second (FEV1), ratio of residual volume over total lung capacity (RV/TLC) and single-breath diffusion capacity for carbon monoxide (DL COSB) for correlation.

RESULTS

In the treated segment bronchi, the cross-sectional area of the lumen showed a significant reduction (p<0.05) in inspiration and a tendency to an increased lumen in expiration (p>0.05). In the other ipsilateral lobe, the segment bronchial lumens showed no significant changes. In the contralateral lung, we found at inspiration a strong tendency towards an increased lumen (p=0.06). The lung volumes of the treated lobes directly correlated with the treated segment bronchial lumen in expiration (r = 0.80, p < 0.001). Clinical correlation with 6 minutes walking test (6MWT) and pulmonary function test (PFT) showed only in responders a statistically significant decrease of volume in the treated lobe. Responders showed a increase of the 6 MWT (p < 0.0001) and non-responders a significant decrease of the 6MWT (p < 0.0078). The responder subgroup showed an increase of FEV1, TLC and VC however not statistically significant.

CONCLUSION

Endobronchial coiling causes a significant decrease in the crosssectional area of treated segmental bronchi in inspiration and also a slight increase in expiration accompanied by a volume reduction whereas in the non-treated lung lobes a slightly opposite tendency was observed. 6MWT and PFT minimally, but statistically significant improved after LVR.

CLINICAL RELEVANCE/APPLICATION

Our data support the current understanding of coiling effects which claim that they stabilize and stiffen the lung parenchyma thus compensating for the loss of elasticity in the interstitium and reducing bronchial motility/collapsing.

SSK05-04 Lung Morphology Assessment of Cystic Fibrosis Using Non Contrast Proton MRI with Submillimeter Details at 1.5 Tesla
The aim of the study was to assess the concordance between CT and non-contrast proton MRI for evaluation of structural cystic fibrosis (CF) changes using a respiratory-gated PETRA, a T1-VIBE and a T2-HASTE sequences.

**METHOD AND MATERIALS**

All consecutive CF patients under stable condition were enrolled from July 2014 to January 2015 in a single institution. All patients or their parents gave written informed consent. Patients had to complete both CT and MRI the same day. The Helbich-Bhalla score was used to assess CF severity. Concordance between CT and MRI was assessed using intraclass correlation coefficient (ICC) and Bland-Altman analysis. Intra and inter-observer reproducibility were assessed.

**RESULTS**

24 CF patients were enrolled (mean age=22.6±9.6, ranging from 9 to 48-year-old). Mean Helbich-Bhalla score at CT was 13.6±5.5. The concordance in overall Helbich-Bhalla score was very good using PETRA (ICC=0.99) while it was found good using VIBE and HASTE sequences (ICC=0.69 and 0.62, respectively). Bland-Altman plots showed that agreement between CT and PETRA was independent from the magnitude of score (mean difference (MD)=-0.3 [-1.7; 1.3]), whereas there was systematic underestimation using VIBE (MD=-4.9 [-0.5; -9.3] and HASTE (MD=-5.6 [-0.4; -10.9]). Intra and interobserver reproducibility were very good for the whole imaging modalities (ICC=0.86-0.98).

**CONCLUSION**

In this pilot study, the Helbich-Bhalla score using PETRA matched closely with that of CT and showed higher level of concordance than either conventional T1-weighted or T2-weighted sequences. Further improvement in respiratory synchronization and acquisition time are expected, whereas future combination with functional information is warranted.

**CLINICAL RELEVANCE/APPLICATION**

Implication for patient care - PETRA is a clinically available sequence which provides assessment of lung structural-CF alterations with submillimeter details - Using lung MRI, non-invasive structural assessment of CF may no longer be restricted due to radiation concern for routine follow-up or under treatment.

**SSK05-05 Different Progression of CT Defined Emphysema Depending of Trends in Smoking Habit in the ITALUNG Screening Trial**

**Wednesday, Dec. 2 11:10AM - 11:20AM Location: S404CD**

**Participants**

Chiara Rimei, Pisa, Italy (Presenter) Nothing to Disclose
Barbara Conti, Pisa, Italy (Abstract Co-Author) Nothing to Disclose
Laura Tosi, Pisa, Italy (Abstract Co-Author) Nothing to Disclose
Francesca Carozzi, Firenze, Italy (Abstract Co-Author) Nothing to Disclose
Antonio Palla, Pisa, Italy (Abstract Co-Author) Nothing to Disclose
Fabio Falaschi, MD, Pisa, Italy (Abstract Co-Author) Nothing to Disclose

**Purpose**

To evaluate with low dose computed tomography (LDCT) densitometric analysis, changes in pulmonary emphysema over 2 years, in subjects with different trends in smoking habit enrolled in the ITALUNG trial of lung cancer screening.

**METHOD AND MATERIALS**

284 subjects (male 69.7%; mean age 60.2±4.2) enrolled in the active arm of ITALUNG trial of lung cancer screening underwent to LDCT examination at first (T1) and third (T3) annual screening round.LDCT evaluated parameters were: total lung volume (mL); % of Relative Areas (RA) at [-910], [-950], [-960] Hounsfield Units (HU); 15th percentile density (PD15, g/L). Lung function tests (VC, FVC, FEV1, FEV1/VC, FEV1/FVC, FRC, RV, TLC, RV/TLC and DLCO) were performed.Four subgroups were identified based on the trends in smoking habit during the 2 years of follow-up: persistent current smokers, former smokers, quitters and re-starter. A predictive model for longitudinal variation of CT parameters during the study was applied, considering as independent variables: age, sex, smoking variation, lung function tests and total lung volume.

**RESULTS**

Longitudinally, an increase of the median value of %RA was observed: %RA-960 = 9.8 at T1 and 10.2 at T3, (p<.0001); %RA-950=13 at T1 and 13.5 at T3 (p<.0001); %RA-910=29.2 at T1 and 29.5 at T3 (p<.0003).On the contrary, PD15 g/l decreased (33.4 at T1 and 30 at T3, p<.0001). No functional tests and diffusion capacity demonstrated significant evolution in the 2 years of follow-up except FEV1/FVC (p=0.031).In the 142 current smokers, in the 93 former smokers and in the 42 quitters PD15 g/l...
decreased respectively from 38.2±20 at T1 to 39.21±17.4 at T3 (p<.00504), from 24.2±21.5 at T1 to 20±18.6 at T3 (p=0.0063), from 36.6±12.4 at T1 to 26.8±16.2 at T3 (p<.0001). On the contrary in the 7 re-starter PD15 g/l increased without statistical relevance (38.6±23.4 at T1 and 48.4±18.6 at T3, p=0.1897).

CONCLUSION
LDCT densitometric analysis allows a short-term evaluation of progression of pulmonary emphysema in screened subjects. The different trends in smoking habit during the follow-up seems to independently determine the lung density change with the major decrease in quitters and former smokers, possibly dependent to the absence of inflammatory smoking induced effects.

CLINICAL RELEVANCE/APPLICATION
The short-term progression of emphysema can be evaluated by LDCT analysis in asymptomatic subjects and differ depending of trends in smoking habit in the period of follow-up.

PURPOSE
To investigate the association of quantitative CT (QCT) with spirometric measurements in healthy volunteers with COPD high risk factors between non-smoking group and smoking group.

METHOD AND MATERIALS
Seventy-four healthy volunteers were examined by PFT, inspiratory and expiratory CT. Inclusion criteria: 1. age>45y; 2. cigarette>10 pack*year; or chronic cough,sputum or dyspnea symptom;or emphysema on CT; 3. spirometry: FEV1%pred<95% and FEV1/FVC>70%; 4. informed consent acquired. The subjects were classified into 2 groups: non-smoking group(n=40) and smoking group(n=34). QCT parameters contained trachea volume, total lung volume (TLV) and emphysema index of threshold of lung area with attenuation lower than -950 HU (EI-950) on inspiratory CT; air trapping, defined as the percentage of attenuation area lower than -856 HU (LAA-856) on expiratory CT. To evaluate the correlation between QCT parameters and PFT values, Spearman correlation analysis was used. Compare the difference between non-smoking group and smoking group, t-test was used.

RESULTS
The TLV showed good correlation with FEV1, FVC and TLC(r=0.575, P<0.001;r=0.590, P<0.001;r=0.714, P<0.001) for all subjects. For non-smoking group, there were strong correlation between TLV and FEV1, FVC, TLC(r=0.498, P=0.001;r=0.580, P=0.001;r=0.757, P=0.001). However, there was no correlation between TLV and FEV1, FVC for smoking group. In addition, there was a correlation between total lung capacity (TLC) and EI-950 (r=0.236, P=0.043), between TLC and LAA-856 (r=0.265, P=0.026), respectively. For non-smoking group, the TLC had strong correlation with LAA-856(r=0.526, P=0.001); But, there was no statistical difference between TLC and EI-950 or LAA-856 for smoking group. Compared with smoking group, TLV (4.79±0.98 L vs. 3.75±1.06 L ) and trachea volume(62.3±13 cm3 vs.43.3±18 cm3) were reduced significantly in non-smoking group. Smoking group [(2.69±0.33 )L and (3.51±0.45) L] showed higher FEV1 and FVC vs. non-smoking group[ (2.28±0.52)L and 2.95±0.69](P<0.001).

CONCLUSION
There were different correlations and features between PFT and CT volume in non-smoking group and smoking group for subjects with COPD high risk factors.

CLINICAL RELEVANCE/APPLICATION
Assessment of healthy volunteers with COPD high risk factors by QCT indicate that non-smoking group and smoking group have different features, which could guide clinical management.

PURPOSE
We aimed to evaluate the change of airway remodelling and emphysema in COPD exacerbations as determined by quantitative CT measurement. We aslo study the relationship between COPD exacerbation frequency and quantitative CT measures of airway remodelling and emphysema.

METHOD AND MATERIALS
Volumetric CT was acquired for 80 patients who visited the emerency department for AECOPD. All images were reconstructed with 1mm slice and retrospectively analyzed using a software program with fully-automated 3D airway extraction and emphysema analysis. Total lung emphysema index were calculated automatically at the threshold of -950HU. Airway parameters including wall thickness(WT), luminal diameter(LD) and wall area percentage(WA%) were measured in the six segmental bronchus as follows, RB1, RB4, RB10, LB1 and LB10. The frequency of COPD exacerbation in the prior year was determined by using a questionnaire.
analysis was performed to examine the change of airway remodelling and emphysema in COPD exacerbations and the relationship of exacerbation frequency with quantitative CT measurements.

RESULTS

Emphysema index alteration was not influenced by the frequency of COPD exacerbation in the same patient. There was no significant correlations between emphysema index alteration and COPD exacerbation frequency ($r=0.46, p=0.06$). However, the wall area percentage (WA%) and wall thickness (WT) were measured in the six segmental bronchus were associated with COPD exacerbation frequency ($r=0.74, p=0.02$; $r=0.65, p=0.03$, respectively). No significant correlations was found between luminal diameter (LD) and COPD exacerbation frequency ($r=0.53, p=0.08$).

CONCLUSION

Quantitative CT can identify the change of small airway and emphysema index in COPD exacerbations. The small airway alteration was associated with COPD exacerbations frequency.

CLINICAL RELEVANCE/APPLICATION

Quantitative CT can identify the change of small airway and emphysema of COPD exacerbations which may contributed to individual treatment.

SSK05-08  Meta-analysis of Repeatability of CT Lung Density Measures

Wednesday, Dec. 2 11:40AM - 11:50AM Location: S404CD

Participants

Sean B. Fain, PhD, Madison, WI (Presenter) Research Grant, General Electric Company Research Consultant, Marvel Medtech, LLC Heather Chen-Mayer, PhD, Gaithersburg, MD (Abstract Co-Author) Nothing to Disclose Alfonso Rodriguez JR, MS, Madison, WI (Abstract Co-Author) Nothing to Disclose Jened Sieren, Coralville, IA (Abstract Co-Author) Consultant, Vida Diagnostics, Inc Matthew K. Fuld, PhD, Iowa City, IA (Abstract Co-Author) Researcher, Siemens AG Bernice E. Hoppel, PhD, Vernon Hills, IL (Abstract Co-Author) Employee, Toshiba Corporation David A. Lynch, MBCh, Denver, CO (Abstract Co-Author) Research support, Siemens AG; Scientific Advisor, PAREXEL International Corporation; Consultant, Boehringer Ingelheim GmbH; Consultant, Gilead Sciences, Inc; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Veracyte, Inc. Frank N. Ranallo, PhD, Madison, WI (Abstract Co-Author) Grant, General Electric Company Philip F. Judy, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE

To determine the clinically relevant change of lung density CT metrics.

METHOD AND MATERIALS

The most established measures of lung parenchymal density are "RA950" and "Perc15". The RA950 is defined here as the relative lung area (or lung voxels) at total lung capacity (TLC) with CT attenuation below -950 Hounsfield units (HU). The Perc15 is defined as the HU value at which 15 percent of all voxels have a lower density. These measures are the most common, based on studies comparing to tissue histology in resected lung and established in longitudinal studies of emphysema progression. Literature review was conducted on recent clinical studies involving repeat scans of non-diseased or stable subjects to determining bias and repeatability. A meta-analysis was performed on the repeatability coefficient (RC) inclusive of recent studies that met three major criteria: 1) The study was performed using 16 or 64 slice architectures with 3D volumetric scanning similar to the specifications. 2) The study performed CT in subjects for at least two time points in identical CT scanners with ≤ 4 months separating the two time points to mitigate the degree of possible disease progression. 3) The Perc15 and/or RA950 metrics were used to assess lung parenchymal density.

RESULTS

Most studies show that performing volume adjustment (VA) to compensate for the state of the lung inflation will improve the RC. Mean RCs were determined from the meta-analysis using the random effects model, shown in a summary Forest plot (Fig. 1), for before and after VA. Each study reported limits of agreement (LOA), defined as 1.96SDbias, from which the RC can be calculated. The RC is deemed the Smallest Real Difference (SRD), a reference for making clinical decisions.

CONCLUSION

Result of the meta-analysis suggests that without lung VA, a decrease in Perc 15 of at least 18 HU, is required for detection of an increase in the extent of emphysema, with 95% confidence. With lung VA, this SRD value is narrowed down to 11 HU. The RC is deemed the Smallest Real Difference (SRD), a reference for making clinical decisions.

CLINICAL RELEVANCE/APPLICATION

Volume adjustment should be considered to improve repeatability and increase precision for longitudinal studies of emphysema progression in COPD using lung density CT.

SSK05-09  Quantitative Analysis of Pulmonary Peripheral Vessels Using CT in Healthy Subject and COPD Patients

Wednesday, Dec. 2 11:50AM - 12:00PM Location: S404CD

Participants

Sang Min Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose Joon Beom Seo, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose Hyun Jung Koo, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose Namkug Kim, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Stockholder, Coreline Soft, Inc Jangpyo Bae, MS, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose Yeon-Mok Oh, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
PURPOSE
To analyze peripheral vascular changes at CT of COPD with new method and correlate them with emphysema index (EI) and pulmonary function tests.

METHOD AND MATERIALS
Non-contrast, inspiration volumetric CT of 30 healthy subjects (M:F = 25:5; 50.6 ± 7.6 yrs) and 73 COPD patients (M:F = 71:2; 64.3 ± 6.6 yrs) were included. Using in-house software, all pulmonary vessels were extracted automatically. Three imaging planes, which are 1cm, 2cm and 3cm distant from lung surface, respectively, were generated. The numbers of all vessels in each plane and per cm² (No, No_rel, respectively) were counted. The mean area of each vessel and the percentage of vessel area at image plane (Ar, Ar%, respectively) were measured. The results were compared between two groups and correlated with emphysema index (EI) and PFT.

RESULTS
At imaging plane 1cm apart from the surface, the No, No_rel and Ar% in COPD patients were significantly smaller than healthy subjects (No: 2265 ± 650 vs. 2597 ± 741; No_rel: 1.08 ± 0.35/cm² vs. 1.27 ± 0.40/cm²; Ar%: 4.84 ± 1.61 vs. 5.75 ± 1.88). In addition, No_rel and Ar% at all planes showed significant negative correlation with EI (1cm: r = -0.344, -0.353; 2cm: r = -0.438, -0.414; 3cm: r = -0.423, -0.412, respectively), FEV1 (1cm: r = 0.224, 0.211; 2cm: r = 0.222, 0.231; 3cm: r = 0.226, 0.208, respectively), FEV1/FVC (1cm: r = 0.287, 0.276; 2cm: r = 0.260, 0.274; 3cm: r = 0.270, 0.281, respectively) and DLco (1cm: r = 0.351, 0.347; 2cm: r = 0.306, 0.325; 3cm: r = 0.282, 0.325, respectively).

CONCLUSION
In COPD patients, number of pulmonary vessels and vessel area percent are significant smaller than those in healthy subjects. Quantified number per cm² and area percent of vessels significantly correlated with FEV1, FEV1/FVC and DLco.

CLINICAL RELEVANCE/APPLICATION
Detailed analysis of analysis of peripheral vascular changes is possible using volumetric CT and dedicated software. It may be helpful in the understanding of vascular changes in COPD.
Comparison of Xenon Ventilation CT with Pulmonary Function Tests for Pre and Post Pulmonary Lobectomy Patients with Primary Lung Cancer

Participants
Smita Patel, MBBS, Ann Arbor, MI (Moderator) Nothing to Disclose

Sub-Events

Purpose
We previously reported that Xenon ventilation CT using dual-energy CT is useful to evaluate pulmonary function for those who have COPD (chronic obstructive pulmonary disease). It has also been reported that analysis of preoperative Xenon ventilation CT can predict postoperative pulmonary function with accuracy comparable to that of CT volumetry. However, postoperative Xenon ventilation CT for assessing pulmonary function has not been previously reported. The purpose of this study was to assess postoperative pulmonary ventilation using Xenon ventilation CT for patients who underwent pulmonary lobectomy due to primary lung cancer.

Method and Materials
Institutional review board approval and written informed consent were obtained. Twenty patients with lung cancer (mean age: 69.7 ± 6.7 years, range: 60-85 years) underwent Xenon Ventilation CT and pulmonary function tests before and after lung surgery (3 and 12 postoperative months). Xenon ventilation images were obtained by three-material decomposition method for preoperative and postoperative exams, and compared each other. Mean Xenon enhancement values were also calculated and compared to pulmonary function test results.

Results
We could successfully obtain Xenon ventilation images for all subjects. Xenon ventilation images showed postoperative hypoventilation in all patients. This hypoventilation was seen not only ipsilateral but also contralateral of the operated lung. Mean Xenon enhancement values of 3 postoperative months were significantly lower than those of preoperative (17.1 vs. 23.2 HU, p<0.01). In three COPD cases, postoperative pulmonary ventilation was better than those of preoperative exams, suggesting effect of lung volume reduction due to lobectomy.

Conclusion
Xenon ventilation CT is useful to evaluate pulmonary function in patients who underwent lung surgery. It can assess pulmonary function on both the operated and the contralateral side separately, which cannot be assessed by pulmonary function test. Because of postoperative bilateral hypoventilation identified by Xenon ventilation CT and effect of lung volume reduction surgery for those with COPD, prediction of postoperative pulmonary function should be considered more complicatedly.

Clinical Relevance/Application
Xenon ventilation CT can identify the location of hypoventilation which conventional pulmonary function test cannot perform, leading optimal treatment for those who underwent pulmonary lobectomy.

Lobular Geographic Pattern in Nonfatal Drowning at Multidetector CT of the Lung

Participants
Kyung Won Doo, Busan, Korea, Republic Of (Presenter) Nothing to Disclose
Hyoung-ju Bae, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jong Woon Song, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seulbi Lee, Pusan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

Purpose
Lung injury is very common consequence in patient of submersion accident, and usually occurred with radiologic abnormality. The aim of this study was to identify the characteristic image findings of nonfatal drowning in multidetector computed tomography.

Method and Materials
The study included 21 patients who had experienced nonfatal drowning and had chest CT within 24 hours of episodes. Chest CT scans were reviewed by two radiologists with respect to the presence and distribution of parenchymal abnormalities including ground-glass opacity(GGO), consolidation and crazy-paving appearance, and decision was reached by consensus. The 'lobular
geographic pattern of GGO was also assessed, which was defined as multifocal areas of GGO mainly centered in secondary pulmonary lobule and margined by septal anatomy.

RESULTS

Among 21 patients, 16 patients (76.2%) showed lung abnormalities on chest CT. Twelve (75%) patients showed 'lobular geographic' pattern of GGO. All patients (n=16) showed bilateral ground glass opacities and distribution of GGO was predominantly in the dependent area (n=12). Other CT findings included consolidation(n=9) and crazy-paving appearance(n=11). Radiographic opacities resolved within 2 weeks (1-14 days, mean 6.9 days) in 10 patients (62.5%). One ventilated patient died on 13 days after admission, and others (n=5) showed residual opacities on chest radiographs discharged with clinical improvement or transferred to another hospital. Duration of hospitalization varied from 2 to 20 days (mean = 9.1 days).

CONCLUSION

The "lobular geographic" pattern of GGO is is very likely corresponds to nonfatal drowning. The common CT findings were bilateral GGO, consolidation, and crazy-paving appearance predominantly in the dependent area of both lungs. These radiological findings, although non-specific, can lead to an appropriate diagnosis, particularly when presented with the "lobular geographic" pattern.

CLINICAL RELEVANCE/APPLICATION

Multidetector CT can demonstrate characteristic radiologic finding in nonfatal drowning and may be useful to differentiate from respiratory distress by any other manner in nearly drowned patients.

CH228-SD-WEA3  The Usefulness of Low Dose Digital Tomosynthesis for the Evaluation of Major Airway Stenosis and Luminal Diameter Measurement

Station #3

Awards
Trainee Research Prize - Fellow

Participants
Eun Young Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Myung Jin Chung, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hye Sun Hwang, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Tae Jung Kim, MD, PhD, Seongnam, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Kyung S. Lee, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE

To compare the utility of the low dose chest digital tomosynthesis (DTS) for detection and localization of major airway stenosis and the agreement for luminal diameter measurements of major airway with that of chest radiography (CXR)

METHOD AND MATERIALS

In this study, 42 patients (21 patients with, and 21 control patients without major airway disease) underwent chest DTS, CXR and CT with less than 2 weeks interval. DTS was performed with low dose modification (0.06 mSv for standard patient). Two radiologists reviewed CXR and DTS in a random order and were instructed about the airway assessment that divided into two parts. In the first part, were asked to determine the presence of stenosis in major airway and then recorded the location and diameter of stenotic segment. In the second part, measured and recorded of luminal diameters in 7 point (trachea, Rt. main, Lt, main, Rt. upper lobar, bronchus intermedius, Lt. upper lobar and Lt. lower lobar bronchus) of the major airway. CT coronal images served as the reference standard. Wilcoxon's matched-pairs signed ranks test and Bland-Altman plot were used for statistical analysis.

RESULTS

Total 30 segments of airway stenosis were observed in 21 patients on chest CT coronal images. The overall sensitivity and specificity in detection and localization of airway stenosis were 86.7%, 100% for DTS and 48.1%, 80% for CXR. The accuracy of DTS and chest radiography were 92.3% and 63.5%, respectively. In DTS, non-measurable segment was not found. The mean measurement difference ranged from -0.5 to -0.1 mm for luminal diameter of 7 point of major airway including stenotic segment on DTS and -1.1 to -0.2 mm on CXR. The mean measurement difference was -1.4 to -0.2 mm for patients group and 0.1 to 1.2 mm for control group on DTS.

CONCLUSION

DTS show higher performance for detection and localization of major airway stenosis compared with chest radiography. And regarding measurement agreement, compared to the DTS that non-measurable segment was not found, a relatively large proportion of airway segments were judges as not measurable in CXR. Also the measurement accuracy and precision for the measured segments were higher in DTS than CXR even with chest radiography comparable low dose.

CLINICAL RELEVANCE/APPLICATION

In terms of detection, localization and evaluation of the severity extent (assessment of the extent of narrowing) of major airway stenosis, the chest DTS is more informative than CXR.

CH229-SD-WEA4  3D Lung Motion Assessments on Inspiratory/Expiratory Thin-Section Area-Detector CT (ADCT): Capability for Pulmonary Functional Loss and Clinical Stage Evaluation of Smoking-Related COPD in Comparison with Lung Destruction and Air Trapping

Station #4

Participants
Hisanobu Koyama, MD, PhD, Kobe, Japan (Presenter) Nothing to Disclose
Yoshifuru Ohno, MD, PhD, Kobe, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
RESULTS
obstruction on a segmental basis in CTPA was also analyzed and compared with LSIM, using LPS as the reference.

METHOD AND MATERIALS
Our institutional review board approved this study and written informed consent was obtained from each patient. Forty-four consecutive smokers and COPD patients prospectively underwent inspiratory and expiratory CT. A 3D motion vector map was generated from these CTs, and regional motion magnitudes were measured at the horizontal axis (X-axis), the ventrodorsal axis (Y-axis), and the craniocaudal axis (Z-axis). All mean magnitudes within the entire lung (MMLX, MMLY, and MMLZ) were normalized by expiratory CT lung volume. Moreover, CT-based functional lung volume (FLV) on inspiratory CT and air trapping lung volume (ATLV) on expiratory CT were assessed quantitatively. To evaluate the capability for pulmonary function loss assessment, all MMLs were correlated with pulmonary function tests. Then, discrimination analysis was performed to determine the concordance capability for clinical stage, and correct classification capabilities were compared by means of McNemar’s test.

RESULTS
Multiple regression analysis showed MMLY (standardized coefficient = 0.657, p<0.001) and FLV (standardized coefficient = 0.375, p=0.019) were independent parameters with percentage of predicted forced expiratory volume in 1 second. Correct classification capabilities using patient characteristics and MMLs (68.2 [30/44] %) were significantly higher than those obtained by patient characteristics, FLV, and ATLV (54.5 [24/44] %), p=0.031).

CONCLUSION
3D lung motion parameter assessment is better for smoking-related COPD assessment and lung parenchymal destruction and/or air trapping evaluations.

CLINICAL RELEVANCE/APPLICATION
3D lung motion parameters have the potential to improve correct classification capabilities rather than lung parenchymal destruction and/or air trapping evaluations at the CT assessment of smoking-related COPD.

CH230-SD-WEA5 Diagnostic Accuracy of Lung Subtraction Iodine Mapping CT for the Evaluation of Pulmonary Perfusion in Patients with Chronic Thromboembolic Pulmonary Hypertension: Correlation with Lung Perfusion Scintigraphy

Station #5

Participants
Masashi Tamura, Shinjuku-Ku, Japan (Presenter) Nothing to Disclose
Yoshitake Yamada, MD, Shinjuku-ku, Japan (Abstract Co-Author) Nothing to Disclose
Takashi Kawakami, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Masaharu Katoaka, Shinjuku-ku, Japan (Abstract Co-Author) Nothing to Disclose
Yu Iwabuchi, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Hiroaki Sugiyama, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Tadaki Nakahara, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Masahiro Hashimoto, Shinjuku-Ku, Japan (Abstract Co-Author) Nothing to Disclose
Shigeo Okuda, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Seishi Nakatsuka, MD, Shinjuku-Ku, Japan (Abstract Co-Author) Nothing to Disclose
Fumiya Sano, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Takayuki Abe, Shinjuku-Ku, Japan (Abstract Co-Author) Nothing to Disclose
Yuichiro Maekawa, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Keiichi Fukuda, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Masahiro Jinzaki, MD, Tokyo, Japan (Abstract Co-Author) Support, Toshiba Corporation; Support, General Electric Company

PURPOSE
The purpose of this study was to assess the diagnostic performance of lung subtraction iodine mapping (LSIM) computed tomography (CT) by image registration and subtraction techniques for the segment-based evaluation of pulmonary perfusion in patients with known or suspected chronic thromboembolic pulmonary hypertension (CTEPH), using lung perfusion scintigraphy (LPS) as the reference.

METHOD AND MATERIALS
From December 2013 to March 2015, consecutive 50 patients with the ability to follow breath-holding instruction who had known or suspected CTEPH (age, 60.7±16.7 years) were included in this study. Non-contrast chest CT and CT pulmonary angiography (CTPA) were performed on a 320-detector row CT system. Then, based on a non-rigid registration followed by subtraction of non-contrast images from contrast-enhanced images, color-coded LSIM images were generated. LPS was performed using an integrated SPECT/CT system within the interval of 2 months and served as the reference standard. LSIM images were evaluated for the detection of pulmonary perfusion defects on a segment-by-segment basis in a blinded manner. The severity of pulmonary vascular obstruction on a segmental basis in CTPA was also analyzed and compared with LSIM, using LPS as the reference.

RESULTS
CTPA and the reconstruction of LSIM were successful in all 50 patients. The sensitivity, specificity, accuracy, positive predictive and negative predictive values of LSIM for detection of segmental perfusion defects were 95% (734/773), 84% (107/127), 93% (841/900), 97% (734/754) and 73% (107/146), respectively, whereas the values of CTPA were 65% (505/773), 61% (78/127), 65% (583/900), 91% (505/554) and 23% (78/346), respectively. Generalized estimating equations analysis revealed significantly better performance of LSIM than CTPA regarding the sensitivity (P <0.0001) and no significant difference of the specificity between LSIM and CTPA (P = 0.237).

CONCLUSION

LSIM is a feasible technique for segment-based evaluation of the pulmonary perfusion in CTEPH patients, and provides significantly higher sensitivity compared with CTPA, using LPS as the reference.

CLINICAL RELEVANCE/APPLICATION

LSIM, generated by unenhanced CT and CTPA, could assess anatomy and perfusion simultaneously and help guide treatment strategy for balloon pulmonary angioplasty and pulmonary endarterectomy in CTEPH.

Does FDG PET/CT Have Value in Detecting Recurrence of Esophageal Carcinoma?

Participants
Sonia L. Betancourt Cuellar, MD, Houston, TX (Presenter) Nothing to Disclose
Patricia M. de Groot, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Marcelo K. Benveniste, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Carol C. Wu, MD, Houston, TX (Abstract Co-Author) Author, Reed Elsevier
Diana M. Palacio, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Wayne L. Hofstetter, Houston, TX (Abstract Co-Author) Nothing to Disclose
Edith M. Marom, MD, Ramat Gan, Israel (Abstract Co-Author) Nothing to Disclose

PURPOSE

The purpose of this study was to determine the utility of FDG-PET/CT in detecting recurrent disease in patients with esophageal cancer after surgical resection.

METHOD AND MATERIALS

Subjects in this retrospective study were 125 consecutive esophageal cancer patients who were surgically treated between 3/31/2003 and 4/30/2012 and had routine follow up FDG PET/CT examinations. The number and sites of FDG avid lesions were retrospectively analyzed and were correlated with histological assessment and/or continued progression by imaging.

RESULTS

Of the 125 patients who met the inclusion criteria, 50 patients were confirmed to have recurrence in 62 sites, 53-1097 days postsurgery (median: 416 days). Recurrence was detected in 57% and 20% of patients within the first 12 and 24 months respectively after surgery. Forty-one patients (66%) had recurrence in distant organs (most commonly liver [20, 48 %]), 16 (26%) lymph node metastases and 5 (8%) had recurrence at the anastomotic site. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of FDG-PET/CT for diagnosing recurrence at the anastomosis is 83%, 32%, 16%, 98% and 75%, for lymph nodes metastasis was 100%, 90%, 61%, 100%, and 92%. For metastases to distant organs was 100%, 96%, 93%, 96%, and 97%.

CONCLUSION

FDG PET/CT is accurate in detecting recurrence in patients after resection of esophageal cancer when recurrence is to metastatic lymph nodes or distant organs but has very low specificity and positive predictive value in the evaluation of anastomotic recurrence.

CLINICAL RELEVANCE/APPLICATION

This study clarifies the role of FDG-PET/CT in detecting recurrence in patients with esophageal cancer.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Sonia L. Betancourt Cuellar, MD - 2014 Honored Educator
Edith M. Marom, MD - 2015 Honored Educator
Influence of Radiation Dose and Iterative Reconstruction Algorithms for Quantification of Emphysema and Airways: A Phantom Study

**Participants**

Smita Patel, MBBS, Ann Arbor, MI (Moderator) Nothing to Disclose

**Sub-Events**

**CH232-SD-WEB1**

**Influence of Radiation Dose and Iterative Reconstruction Algorithms for Quantification of Emphysema and Airways: A Phantom Study**

**Station #1**

**Participants**

- Ji Yung Choo, MD, PhD, Ansan, Korea, Republic Of (Presenter) Nothing to Disclose
- Ki Yeol Lee, MD, PhD, Ansan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
- Sung-Joon Park, MD, Ansan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
- Chang Sub Ko, Ansan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
- Jaehyung Cha, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
- Eun-Young Kang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
- Yu-Whan Oh, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate the influence of radiation dose and iterative reconstruction algorithms for quantification of emphysema and airways through a phantom study.

**METHOD AND MATERIALS**

Computed tomography (CT) was performed on an airway phantom (CTP674 Lung Phantom (The Phantom Laboratory, Salem, NY, USA)) with variable tube current from low dose to usual dose (30 to 100mAs, per 5mAs) and variable reconstruction algorithms (FBP, IDose1~6, IMR R1 and IMR S1). Measurements of each dataset were compared: emphysema volume, airway measurements of the lumen and wall area as well as average wall thickness. Emphysema volume was measured by air columns (30, 10, 5mm in diameter) and airway measures were evaluated by 4 tubes with different angles and wall thickness. We use the in house software, A-view for quantification. The optimal option of radiation dose and reconstruction algorithm were evaluated by the difference between the measures and object value of phantom with response surface analysis by SAS version 9.4.

**RESULTS**

In quantitative analysis of emphysema, the critical value of radiation dose and reconstruction algorithms are 85.9/2.7, 85.0/2.7, 89.3/2.8 in 30, 10, 5 mm column. Minimal difference between the measures and the object value of phantom is noted at 55, 65, 60mAs, respectively. And the measures by IMR-S1 are the most accurate in all 3 columns. In airway measures, the influence of radiation dose was not significant (Pr F value >0.05). Whereas, reconstruction algorithm influenced to the airway measures. Luminal diameter, wall thickness, wall area are measured accurately by IDose 3, IDose 6 and by IMR-S1, respectively.

**CONCLUSION**

In conclusion, emphysema volume was influenced by radiation dose and reconstruction algorithms, significantly. IMR-S1 and 55-65mAs can be applied for quantification of emphysema. However, airway measures have no tendency according to the radiation dose and reconstruction algorithms.

**CLINICAL RELEVANCE/APPLICATION**

As radiation exposure is becoming a bigger issue in the clinical field, low radiation dose is essential even in quantification for COPD. However, as many factors including radiation dose and noise affect the quantitative parameters, proper or standardized parameters for longitudinal work up for quantification of emphysema and airways is not be established accurately yet. We can suggest proper low radiation dose and reconstruction algorithm for longitudinal follow up studies of quantification for COPD.

Early Clinical Evaluation of Lung Perfusion Images Using Lung Subtraction in Patients with Chronic Thromboembolic Pulmonary Hypertension (CTEPH): Comparison with Lung Perfusion Scintigraphy

**Station #2**

**Participants**

- Toshiya Kariyasu, Mitaka-Shi, Japan (Presenter) Nothing to Disclose
- Kenichi Yokoyama, MD, Mitaka-Shi, Japan (Abstract Co-Author) Nothing to Disclose
- Masamichi Imai, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
- Yayoi Tsukahara, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
- Makako Yoshikawa, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
- Hisae Shiga, Mitaka, Japan (Abstract Co-Author) Nothing to Disclose
- Masanaka Watanabe, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
- Yoshiaki Nitatori, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
- Kazunori Kuroki, MD, Yokohama, Japan (Abstract Co-Author) Nothing to Disclose
- Toru Sato, Mitaka-Shi, Japan (Abstract Co-Author) Nothing to Disclose
- Michiko Tadokoro, MD, Kochi, Japan (Abstract Co-Author) Nothing to Disclose
- Masamichi Koyanagi, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
- Mika Tsuboi, Tokyo, Japan (Abstract Co-Author) Employee, Toshiba Corporation
Lung subtraction (in which contrast medium is extracted by nonlinear position matching and the contrast and noncontrast volume data are subtracted) allows CT numbers in the lungs to be displayed as color maps. We assessed the usefulness of this method by generating lung perfusion images using lung subtraction in patients with CTEPH and comparing the perfusion defects in these images against the findings of lung perfusion scintigraphy.

**METHOD AND MATERIALS**

22 subjects with CTEPH (3 men, 19 women; mean age 66.7 years, mean BMI 22.9) underwent lung subtraction and lung perfusion scintigraphy between July 2014 and March 2015. A 320-row CT scanner (Aquilion ONE VISION Edition, Toshiba) was used with scan parameters of 100 kV, 100 rows, AEC, SD25, and 0.275 s/rot. Contrast medium was injected as fractional doses at 17.3 mgI/kg/s over 20 s, followed by a 40:60 contrast medium:saline mixture injected over 10 s. Scanning was started 25 s after injection. Two radiologists and 1 resident (blinded to the clinical history) read the lung perfusion images obtained by lung subtraction and lung perfusion scintigraphy and classified the findings into 3 classes (class 1, normal perfusion; class 2, partial perfusion defect; class 3, total perfusion defect). The results were analyzed by the K test.

**RESULTS**

No complications occurred, and the entire lung fields could be evaluated regardless of body size. Of the 396 segments in the 22 subjects, evaluation was hindered by artifacts due to contrast medium or pulsation in 9 segments (3 cases in the right lower lobe, 6 cases in the left upper lobe). On the other hand, artifacts due to large differences in inhalation between the contrast and noncontrast volume didn't occur. Lung perfusion images showed good correlation with lung perfusion scintigraphy ([K] =0.70). In lung subtraction for detecting poor perfusion, the sensitivity, specificity, positive predictive value, and negative predictive value were 93%, 79%, 90%, and 85%, respectively. The exposure dose was less than 2 mSv in all cases.

**CONCLUSION**

Lung perfusion images obtained by lung subtraction showed good correlation with lung perfusion scintigraphy, indicating that this method is clinically useful.

**CLINICAL RELEVANCE/APPLICATION**

Lung perfusion images obtained by lung subtraction is feasible for evaluation of pulmonary perfusion and is comparable to pulmonary perfusion scintigraphy.

**CH235-SD-** Automated CT-based Quantitative Stratification of COPD Patients **WEB4**

**Participants**

Sushravya Raghunath, PhD, Rochester, MN (Presenter) Nothing to Disclose
Shivinasa Rajagopalan, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Ronald Kanowski, BS, Rochester, MN (Abstract Co-Author) License agreement, ImBio, LLC
Tobias Peikert, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Brian J. Bartholmai, MD, Rochester, MN (Abstract Co-Author) License agreement, ImBio, LLC; Scientific Advisor, ImBio, LLC; Scientific Advisor, Bristol-Myers Squibb Company

**PURPOSE**

Chronic Obstructive Pulmonary Disease (COPD) is characterized by airflow limitation due to combination of parenchymal emphysema and air-trapping which are correlated with increased frequency of exacerbations. Quantitative population analysis of inspiratory and expiratory CT using Computer Aided Lung Informatics for Pathology Evaluation and Rating (CALIPER) can facilitate the automated identification of sub-cohort of unique radiologic characteristics of clinical relevance.

**METHOD AND MATERIALS**

We identified patients with COPD as the final diagnosis in Lung Tissue Research Consortium (LTRC) database who also had inspiratory and expiratory CT scans (N = 216). Using CALIPER, the lung parenchymal voxels in the CT is classified into one of the parenchymal textures such as mild, moderate and severe low attenuation areas (LAA), normal, groundglass, reticular and honeycombing. The change in the parenchymal patterns between the inspiratory and expiratory scans across the upper/middle/lower regions for each patient was computed using dissimilarity metric. The population was further clustered using unsupervised affinity propagation algorithm to identify unique cohorts.

**RESULTS**

The unsupervised natural clustering yielded six subgroups of patients with unique pattern of inspiratory-expiratory parenchymal characteristic. The FEV1 % predicted values, 6MWD, SGRQ scores, BODE scores, bronchial thickening score and RV/TLC ratio (reflecting extent of air-trapping vs hyperinflation) correlate significantly across these groups.

**CONCLUSION**

CALIPER analysis of inspiratory-expiratory scans takes ~2 mins per case and population stratification takes a few seconds compared to state-of-the-art methods using registration (several hours per case). The proposed methodology enables stratification and identification of patients with unique radiologic characteristics that correlate with physiologic tests and survival indices. CALIPER based population analysis of COPD using inspiratory-expiratory pair CT could be a useful clinical and research tool for assessing population disease landscape.

**CLINICAL RELEVANCE/APPLICATION**

COPD is a heterogeneous complex disease with varied therapeutic options ranging from bronchodilators to lung volume resection surgery. CALIPER based stratification using inspiratory-expiratory CT is a potential objective tool to quantify, characterize and stratify population data for clinical staging, management and study of therapy response.

**CH236-SD-** Does Ultra-low Dose Chest-CT with Tin-filtration Allow Depicting Pulmonary Nodules and Parenchymal Lung Changes?
PURPOSE
The purpose of this prospective study was to compare standard-low-dose chest CT with an ultra-low-dose protocol for follow-up of pulmonary nodules and lung-pathologies evaluating image quality and diagnostic accuracy.

METHOD AND MATERIALS
One-hundred patients (64 male, 36 female; median age 56 years; range 20-80y) who were referred to our department for follow-up of pulmonary nodules or lung consolidations underwent chest CT with both standard-low-dose protocol and ultra-low-dose protocol on a third-generation dual-source CT at 100kVp,16mAs and 100kVp,46mAs, respectively. Images were reconstructed with iterative reconstruction algorithms (ADMIRE). One reader measured image noise. Two blinded readers evaluated lung-nodules and -pathologies and determined overall image quality (4-point Likert-scale). Interclass correlation coefficient (ICC) between the two protocols was calculated. The study was approved by ethical committee.

RESULTS
The mean volume CT dose index CTDIvol of the standard chest protocol (mean 2.41mGy, SD +/-0.87mGy) was significant higher compared to the ultra-low-dose protocol (mean0.06mGy, SD +/-0.03mGy). The overall image quality score was lower for all images scanned with ULD-protocol using iterative reconstruction techniques, but all images were diagnostic. Inter-observer agreement for image quality was substantial for both ADMIRE strength levels (kADMIRE3=0.86 and kADMIRE5=0.836). Image noise has been significantly reduced using ADMIRE5 compared to ADMIRE3 (52.42% for ultra-low-dose, p=0.001). ICC for lung pathology detection was high for both IR (atelectasis: ICC = 0.812 vs. 0.889; consolidations: ICC = 0.857 vs. 0.891, interstitial lung changes: ICC = 0.780 vs. 0.807). ICC for solid pulmonary nodule detection was 0.806 using ADMIRE3 and 0.824 using ADMIRE5, respectively. ICC for sub-solid pulmonary nodule detection was 0.391 using ADMIRE3 and 0.436 using ADMIRE5, respectively.

CONCLUSION
Our work suggests that with tin-filtration in combination with IR ultra-low-dose protocols do not significantly influence the accuracy of the detection of lung consolidations, but has a lower sensitivity for the detection of small nodules and therefore is only recommended for reason of infection.

CLINICAL RELEVANCE/APPLICATION
With tin-filtration in combination with IR ultra-low-dose protocols do not significantly influence the accuracy of the detection of lung consolidations, and can therefore be used for the reason of infection.
**LEARNING OBJECTIVES**

1) Contrast the differences between pediatric and adult epidural intracranial hemorrhages. 2) Develop an expanded understanding of traumatic pediatric subdural hemorrhage. 3) Identify the clinical significance and imaging characteristics of subdural hygroma. 4) Describe the CT and MRI features of subdural hemorrhage arising from abusive and accidental trauma. 5) Identify pediatric subarachnoid hemorrhage, recognize its significance, and differentiate it from pseudo-subarachnoid hemorrhage.

**ABSTRACT**

The presence of post-traumatic hemorrhage within the pediatric intracranial extra-axial compartments should be viewed as a proxy for underlying brain injury. This live RSNA activity will review the coverings of the brain and the compartments that may be involved in accumulating post-traumatic hemorrhage. The session will address hemorrhage within the epidural space, subdural compartment, and subarachnoid space. The focus will be upon hemorrhages within the subdural compartment, their clinical significance in the pediatric population, origin, imaging characteristics, and the features of subdural hemorrhage more commonly observed with accidental and inflicted head trauma. The complimentary nature of non-enhanced CT (NECT) and MRI in characterizing and estimating age of the pediatric subdural hemorrhage will be emphasized. The value of serial imaging will be discussed.

**LEARNING OBJECTIVES**

1) Interpret chest radiographs in newborns with congenital pulmonary abnormality. 2) Plan further imaging assessment in the newborn with congenital pulmonary abnormality. 3) Recognise imaging findings and plan further imaging investigation in an older child with congenital pulmonary abnormality.

**ABSTRACT**

This session will address the radiographic findings and further imaging in congenital chest abnormalities including cystic adenomatoid malformation, congenital lobar emphysema and different forms of sequestration. The imaging findings of tracheo-esophageal fistula, of chylothorax and of different types of diaphragmatic hernia will also be addressed. There will be an emphasis on the imaging findings that affect management and some controversies around imaging and management will be reviewed.

**LEARNING OBJECTIVES**

1) Describe the most common ventral wall abnormalities in neonates, including omphalocele, gastroschisis, bladder extrophy, and prune-belly syndrome. 2) Compare and contrast the clinical characteristics of these defects. 3) Identify the imaging features of each of these ventral wall abnormalities. 4) Understand the treatment of these defects, and be familiar with their imaging implications in older children.

**ABSTRACT**

Neonatal ventral wall abnormalities encompass a broad group of rare congenital defects such as omphalocele, gastroschisis, bladder extrophy, and prune-belly syndrome. Although these congenital abnormalities are varied in terms of pathophysiology, clinical findings, and treatment, their similarities allow them to be easily confused by radiologists. This is especially problematic as children with ventral wall abnormalities have very high rates of associated gastrointestinal, musculoskeletal, urogenital, and cardiovascular problems, and so often require fairly extensive medical imaging expertise. This activity will compare and contrast the clinical characteristics of ventral wall abnormalities, illustrate the important imaging features of each, and familiarize the attendee with how these abnormalities are treated.
**SSM05**

**Chest (Vascular/ Radiation Dose Reduction)**  
Wednesday, Dec. 2 3:00PM - 4:00PM Location: S404CD

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**SSM05-01  Dual Energy Pulmonary CT Angiography with a 3rd Generation Dual Source CT System Using 5.4g of Iodine in Comparison to a Second Generation DSCT Scan with 32g of Iodine: A Feasibility Study**

Wednesday, Dec. 2 3:00PM - 3:10PM Location: S404CD

**Awards**  
Trainee Research Prize - Resident

**Participants**  
Edith M. Marom, MD, Ramat Gan, Israel (Moderator) Nothing to Disclose  
Brett W. Carter, MD, Houston, TX (Moderator) Author, Reed Elsevier; Consultant, St. Jude Medical, Inc; 

**Sub-Events**

**PURPOSE**  
To compare objective and subjective image quality between a dual-energy (DE) CT pulmonary angiography (CTPA) protocol using a 5.4g of iodine load versus standard CTPA protocols using a 32g iodine load.

**METHOD AND MATERIALS**  
This prospective IRB-approved study included 150 in-patients/emergency patients with suspected pulmonary embolism (78 male; mean age 65±17 years). Fifty patients who were examined on a 3rd generation dual-source CT (DSCT) with a newly optimized DE CTPA protocol had chronic renal insufficiency (estimated glomerular filtration rate <60ml/min/1.73mSquared) and thus received a low contrast media injection of 5.4g iodine. Each of these fifty patients were either examined with a standard CTPA protocol or a standard DE CTPA receiving an iodine load of 32g. For the DE CTPA virtual monochromatic spectral (VMS) datasets at 40-100keV were reconstructed. The optimal mean photon energy was determined, and subjective and objective image quality were evaluated and compared between these datasets. Comparisons between the groups were analyzed with two-way ANOVA or Wilcoxon-Rank-Sum Test depending on the distribution of the data.

**RESULTS**  
For the main pulmonary arteries the 50keV and for the peripheral pulmonary arteries the 40keV dataset provided the highest contrast-to-noise-ratio (CNR) for both DE CTPA protocols, with significantly higher CNR values for the standard DE CTPA protocol (p<0.05). These 40/50keV VMS datasets resulted in significantly higher CNRs if compared to the standard CTPA protocol for both the main and peripheral pulmonary arteries, again for both DE CTPA protocols (p<0.05). Subjective image quality did not significantly differ for both DE CTPA protocols when compared to the standard CTPA protocol (p>0.05).

**CONCLUSION**  
DE CTPA utilizing image reconstruction at 40/50keV allows for a significant reduction in iodine load while improving vascular signal intensity and maintaining CNR which is especially important in patients with chronic renal insufficiency.

**CLINICAL RELEVANCE/APPLICATION**  
Dual-energy CTPA allows for reducing the contrast media amount by 83%, while maintaining diagnostic image quality. This is of particular importance in patients with chronic renal insufficiency.

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**SSM05-02  Clinical Severity of Chronic Thromboembolic Pulmonary Hypertension: Assessment on Lung Perfused Blood Volume Images Acquired by Dual Energy CT**

Wednesday, Dec. 2 3:10PM - 3:20PM Location: S404CD

**Participants**  
Hidenobu Takagi, MD, Sendai, Japan (Presenter) Nothing to Disclose  
Hideki Ota, MD, PhD, Sendai, Japan (Abstract Co-Author) Nothing to Disclose  
Koichiro Sugimura, MD,PhD, Sendai, Japan (Abstract Co-Author) Nothing to Disclose  
Junya Tomina, PhD, Sendai, Japan (Abstract Co-Author) Nothing to Disclose  
Hioki Shimokawa, MD, PhD, Sendai, Japan (Abstract Co-Author) Nothing to Disclose  
Ko Ikajima, MD, PhD, Sendai, Japan (Abstract Co-Author) Nothing to Disclose  

**Awards**  
Trainee Research Prize - Resident

**PURPOSE**  
To evaluate whether the degree of perfusion defects assessed on lung perfused blood volume (LPBV) images acquired by dual-energy CT allows to estimate the clinical severity of chronic thromboembolic pulmonary hypertension (CTEPH).

**METHOD AND MATERIALS**  
This prospective IRB-approved study included 150 in-patients/emergency patients with suspected pulmonary embolism (78 male; mean age 65±17 years). Fifty patients who were examined on a 3rd generation dual-source CT (DSCT) with a newly optimized DE CTPA protocol had chronic renal insufficiency (estimated glomerular filtration rate <60ml/min/1.73mSquared) and thus received a low contrast media injection of 5.4g iodine. Each of these fifty patients were either examined with a standard CTPA protocol or a standard DE CTPA receiving an iodine load of 32g. For the DE CTPA virtual monochromatic spectral (VMS) datasets at 40-100keV were reconstructed. The optimal mean photon energy was determined, and subjective and objective image quality were evaluated and compared between these datasets. Comparisons between the groups were analyzed with two-way ANOVA or Wilcoxon-Rank-Sum Test depending on the distribution of the data.

**RESULTS**  
For the main pulmonary arteries the 50keV and for the peripheral pulmonary arteries the 40keV dataset provided the highest contrast-to-noise-ratio (CNR) for both DE CTPA protocols, with significantly higher CNR values for the standard DE CTPA protocol (p<0.05). These 40/50keV VMS datasets resulted in significantly higher CNRs if compared to the standard CTPA protocol for both the main and peripheral pulmonary arteries, again for both DE CTPA protocols (p<0.05). Subjective image quality did not significantly differ for both DE CTPA protocols when compared to the standard CTPA protocol (p>0.05).

**CONCLUSION**  
DE CTPA utilizing image reconstruction at 40/50keV allows for a significant reduction in iodine load while improving vascular signal intensity and maintaining CNR which is especially important in patients with chronic renal insufficiency.

**CLINICAL RELEVANCE/APPLICATION**  
Dual-energy CTPA allows for reducing the contrast media amount by 83%, while maintaining diagnostic image quality. This is of particular importance in patients with chronic renal insufficiency.
BACKGROUND

Our study included 57 patients (mean age 59±15 years, M:F 25:32, mean weight 77±19 kg) who had pulmonary embolism on chest CT. All CT exams were performed on single or dual-source MDCT scanners capable of DECT. Virtual monochromatic (40-60keV) and PBV images were used for assessment. Images evaluated for enhancement in pulmonary arteries, the location of filling defects and their characteristics (occlusive vs non-occlusive). Pulmonary abnormalities were evaluated synchronously on virtual monochromatic and PBV images for location, shape, size, enhancement, and likely diagnosis. The presence of right heart strain (RHS) and diameter of pulmonary trunk were recorded. The CTDI vol, DLP were recorded. Data were analyzed using ANOVA and student’s t-test.

RESULTS

Mean CTDI vol was 8±2 mGy (range: 5-16). Mean pulmonary trunk diameter was 26±5 mm (15-44). Optimal/excellent enhancement in subsegmental pulmonary arteries was seen in 89% of cases. RHS was predicted in 40% of cases (23/57). Occlusive PEs (OPEs, present in 47/57 patients) were seen most commonly at segmental level (53%). Discordant pulmonary infarctions (characterized by PBV defects larger than size of radiographic opacity on lung window) were seen in 30% of cases, and were mostly associated with segmental OPEs (28% of OPEs cases). Mismatched defects (defects seen on PBV without abnormality on lung window) were seen in 14% of cases, and were always associated with segmental OPEs (28% of total OPEs). Size-concordant infarctions and defects (size of PBV abnormality equal to radiographic abnormalities) were seen in 21% and 15% of OPEs cases, respectively. In total, 66% of total OPEs were associated with infarction or defects. Infarcts or PBV defects were noticed in 70% of expected RHS cases (size of PBV abnormality equal to radiographic abnormalities) were seen in 21% and 15% of OPEs cases, respectively. In total, 66% of total OPEs were associated with infarction or defects. Infarcts or PBV defects were noticed in 70% of expected RHS cases.

CONCLUSION

Presence of pulmonary infarction or perfusion defect on pulmonary blood volume images is a good predictor for presence of occlusive lobar or segmental pulmonary embolism as well as right heart strain.

CLINICAL RELEVANCE/APPLICATION

Presence of occlusive pulmonary emboli requires interpretation of PBV images to rule out any perfusion defects.
SSM05-04 Do We Really Need Bolus Tracking for Chest CT Angiography?: Assessment of Fixed Delay Prolonged Bolus (FDPB) Contrast Injection Protocol, for Optimal Vascular Enhancement

Wednesday, Dec. 2 3:30PM - 3:40PM Location: S404CD

Participants
Alexi Otrakji, MD, Boston, MA (Presenter) Nothing to Disclose
Shaunagh McDermott, FFR(RCSI), Boston, MA (Abstract Co-Author) Nothing to Disclose
Efren J. Flores, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Jo-Anne O. Shepard, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Mannudeep K. Kalra, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Subba R. Digumarthy, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess the feasibility of fixed delay prolonged bolus(FDPB) contrast injection during routine chest CT for evaluation of mediastinal and pulmonary vessels as compared to CT pulmonary angiography(CTPA) done with triggered bolus tracking(BT) techniques.

METHOD AND MATERIALS
Of the 100 patients included in our study, 50 patients underwent routine chest CT with FDPB(M: F 29:21, mean age 59±18 years, mean weight 77±15kg) and 50 weight matched patients had CTPA using BT(4 cc/second, 370 mg%, 80ml), M: F 23:27, mean age 57±17 years, mean weight 77±15 kg. Patients weighing more than 90 kg and who got contrast injection via central venous catheter were excluded. The FDP injection involved administration of 25ml of contrast (370 mg%) at rate of 1ml/second followed by 55ml contrast at rate of 2.2ml/second with scanning at 57 second fixed delay. All CT scans were performed on (128-slice Siemens Definition Edge MDCT) using automatic kV selection technique(Care kV). All exams were assessed subjectively for vascular abnormalities (in pulmonary arteries, aorta, and heart), and artifacts. HU values in main pulmonary arteries and aorta, CTDI vol and DLP were recorded. Data were analyzed using student’s t-test.

RESULTS
Mean CTDI vol was 5±1.3 mGy for FDPB. Mean HU for FDPB in main pulmonary artery and ascending aorta were 311±79 and 305±49, respectively, with corresponding values of 371±110 and 219±88 for CTPA-BT. Optimal/excellent contrast enhancement at segmental level was seen in 92% of cases for FDPB compared to 86% for CTPA-BT examinations(p=0.9). The inability to rule out central pulmonary emboli was noticed in 3% of cases for FDPB and CTPA-BT. FDPB resulted in significantly superior enhancement in heart and thoracic aorta in all patients compared to CTPA-BT. Contrast streak artifacts were also substantially lower on FDPB than on CTPA-BT(p<0.001). For FDPB, 5% of cases revealed incidental pulmonary emboli compared to 9% of cases for CTPA-BT at segmental level.

CONCLUSION
Fixed delay prolonged contrast injection protocol can provide optimal contrast enhancement in pulmonary arteries, heart, and aorta compared to the bolus tracking technique. The prolonged injection results in substantially less artifacts.

CLINICAL RELEVANCE/APPLICATION
Fixed delay prolonged bolus of chest CT has the potential to be as the only chest contrast enhanced CT protocol for the evaluation of vascular and non-vascular chest abnormalities.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Subba R. Digumarthy, MD - 2013 Honored Educator

SSM05-05 Observer Performance at Varying Dose Levels and Reconstruction Methods for Detection of Indeterminate Pulmonary Nodules

Wednesday, Dec. 2 3:40PM - 3:50PM Location: S404CD

Participants
Joel G. Fletcher, MD, Rochester, MN (Presenter) Grant, Siemens AG; 
David L. Levin, MD, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Rebecca M. Lindell, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Darin B. White, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Ronald S. Kuzo, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Maria Shiung, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Adam Bartley, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Shuai Leng, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
David R. Holmes II, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Alicia Toledano, DSc, Washington, DC (Abstract Co-Author) President, Biostatistics Consulting, LLC
Rickey Carter, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Cynthia H. McCollough, PhD, Rochester, MN (Abstract Co-Author) Research Grant, Siemens AG

PURPOSE
https://www.rsna.org/Honored-Educator-Award/
To estimate the ability to detect indeterminate pulmonary nodules ≥ 5 mm (IPNs) at varying dose levels using standard filtered back projection (FBP) and iterative reconstruction (sinogram-affirmed iterative reconstruction; SAFIRE) using a two-stage study design.

METHOD AND MATERIALS

In stage 1, CT projection data from 44 chest CT exams performed using automatic exposure control [70 Quality ref. mAs (QRM)] were collected. IPNs were identified by two thoracic radiologists who did not participate in the reader study. Using a validated noise insertion tool to simulate reduced doses, 10 datasets were reconstructed for each patient (FBP and SAFIRE at 5 dose levels each (2.5, 5, 10, 30, and 70 QRM); 440 total cases). In each reading session, 3 thoracic radiologists randomly evaluated each patient’s data once using thin 1 mm axial and MIP images. Using a dedicated computer workstation, readers tightly circumscribed all IPNs, gave a confidence score (0 - 100), and graded image quality. A successful interpretation was defined as ≥ 2 readers localizing all “essential” IPNs (or no non-lesion localizations in negative cases), where an essential IPN was identified by the reference standard and ≥ 2 readers at 70 QRM FBP. Sample size calculations (p=0.8, p=0.9, alpha=0.05 (one sided)) determined ≥ 37 cases to pass through stage I. JAFROC analysis was also performed on a per-lesion basis using a non-inferiority limit of -0.1.

RESULTS

Dose levels of ≥ 5 QRM (or 2.5 QRM using SAFIRE) met stage 1 criteria for correct interpretation. Using non-inferiority criteria, the JAFROC figure of merit was also non-inferior for all configurations except for 2.5 QRM FBP. At 5 QRM, pooled sensitivities and specificities were nearly identical between FBP and SAFIRE (FBP: 87% [95% CI: 70-95%] and 88% [74-95%), SAFIRE: 86% [69-94%] and 91% [75-97%]; respectively). Diagnostic image quality was greater for SAFIRE images at 10 - 70 QRM (p<0.05).

CONCLUSION

CT images reconstructed at dose levels corresponding to 5 - 30 QRM (and at 2.5 QRM when using SAFIRE) performed similar to 70 QRM FBP in this pilot study for detection of IPNs. Further study is needed to confirm this large potential for dose reduction.

CLINICAL RELEVANCE/APPLICATION

Whether or not iterative reconstruction is used, the radiation dose for screening or surveillance chest CT can be substantially lowered without compromising observer performance.

SSM05-06 The Usefulness of a Dictionary Learning Post-processing Technique for Improving Image Quality of Low-Dose Chest CT

Wednesday, Dec. 2 3:50PM - 4:00PM Location: S404CD

Participants

Yoshinori Kanii, MD, Tsu, Japan (Presenter) Nothing to Disclose
Yasutaka Ichikawa, MD, Matsusaka, Japan (Abstract Co-Author) Nothing to Disclose
Ryohei Nakayama, PhD, Kusatsu, Japan (Abstract Co-Author) Nothing to Disclose
Motono Nagata, MD, PhD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
Masaki Ishida, MD, PhD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
Kakuya Kitagawa, MD, PhD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
Shuichi Murashima, MD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
Hajime Sakuma, MD, Tsu, Japan (Abstract Co-Author) Departmental Research Grant, Siemens AG; Departmental Research Grant, Koninklijke Philips NV; Departmental Research Grant, Bayer AG; Departmental Research Grant, Guerbet SA; Departmental Research Grant, DAIICHI SANKYO Group; Departmental Research Grant, FUJIFILM Holdings Corporation; Departmental Research Grant, Nihon Medi-Physics Co, Ltd

PURPOSE

Low-dose CT is widely used for lung cancer screening. In low-dose conditions, however, CT images are prone to have increased noise and low-contrast detectability. Recently, our group developed a super-resolution (SR) technique based on a dictionary for enhancing image quality in MR angiography. The purpose of this study was to improve the image quality of low-dose CT by expanding the concept of the SR technique.

METHOD AND MATERIALS

Chest CT was acquired with 64-slice CT (Discovery CT750HD) by using a standard current of 200-300mA and a reduced current of 20mA in 12 patients who were referred for chest CT. We developed an image improvement method that consists of (1) generation of a dictionary representing the relationship between standard- and low-dose patches adopted from standard- and low-dose CT projection (FBP) and iterative reconstruction (sinogram-affirmed iterative reconstruction; SAFIRE) using a two-stage study design. This procedure was repeated for all 12 patients. Image noise was evaluated as the standard deviation of CT intensity in the descending aorta. Qualitative assessment of image quality was performed for the mediastinum and lung by using a 5-point scale (5=excellent, 1=very poor) by two observers. In addition, image quality of abnormal lung structures (nodules or consolidation) were also assessed on a 5-point scale as well.

RESULTS

Image noise on low-dose CT was significantly reduced by using the dictionary learning method (20.4±7.9 HU vs 48.5±13.7 HU, p=0.0005). For image quality of the lung and mediastinum, low-dose CT generated by the dictionary learning method was rated significantly better than original low-dose CT (lung, score 2.8±0.6 vs 1.9±0.7, p=0.0039; mediastinum, score 2.9±0.8 vs 2.3±0.8, p=0.0078). Image quality of abnormal lung structures was also significantly improved by using the new technique (score 3.4±0.6 vs 2.7±0.6, p=0.0273).

CONCLUSION

The dictionary learning post-processing method can provide significantly improved image quality and reduced image noise on low-dose chest CT.

CLINICAL RELEVANCE/APPLICATION

Substantial improvement of image quality can be achieved by using the dictionary learning-based method on low-dose chest CT, leading to more accurate interpretation, while minimizing radiation dose.
PURPOSE

The purpose of this study was to determine the utility of FDG-PET/CT in detecting recurrent disease in patients with esophageal cancer after surgical resection.

METHOD AND MATERIALS

Subjects in this retrospective study were 125 consecutive esophageal cancer patients who were surgically treated between 3/31/2003 and 4/30/2012 and had routine follow up FDG PET/CT examinations. The number and sites of FDG avid lesions were retrospectively analyzed and were correlated with histological assessment and/or continued progression by imaging.

RESULTS

Of the 125 patients who met the inclusion criteria, 50 patients were confirmed to have recurrence in 62 sites, 53-1097 days postsurgery (median: 416 days). Recurrence was detected in 57% and 20% of patients within the first 12 and 24 months respectively after surgery. Forty-one patients (66%) had recurrence in distant organs (most commonly liver [20, 48%]), 16 (26%) lymph node metastases and 5 (8%) had recurrence at the anastomotic site. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of FDG-PET/CT for diagnosing recurrence at the anastomosis is 83%, 32%, 16%, 98% and 75%, for lymph nodes metastasis was 100%, 90%, 61%, 100%, and 92%. For metastases to distant organs was 100%, 96%, 93%, 96%, and 97%.

CONCLUSION

FDG PET/CT is accurate in detecting recurrence in patients after resection of esophageal cancer when recurrence is to metastatic lymph nodes or distant organs but has very low specificity and positive predictive value in the evaluation of anastomotic recurrence.

CLINICAL RELEVANCE/APPLICATION

This study clarifies the role of FDG-PET/CT in detecting recurrence in patients with esophageal cancer.
A search of the electronic medical record was performed to identify patients with a diagnosis of hypothyroidism who received a noncontrast chest CT scan. Consecutive patients without known thyroid gland dysfunction and with normal thyroid function tests who received a noncontrast chest CT scan were selected as a euthyroid control group. The mean CT attenuation value of the thyroid gland in Hounsfield units (HU) was determined for each patient using the standard workstation region-of-interest measurement tool.

RESULTS

210 patients (69% female; 31% male; mean age 66 years) with medically established hypothyroidism and 50 euthyroid patients (72% female; 28% male; mean age 65 years) were available for analysis. Mean CT attenuation values of ≤50 HU and ≤70 HU were highly predictive of hypothyroidism (specificity 100% [95% CI: 92-100%; P=0.01] and 98% [95% CI: 89-100%; P=0.001], respectively). The sensitivity of a mean CT attenuation value of ≤100 HU for detecting hypothyroidism was 74% [95% CI: 71-77%; P=0.006]. Overall, lower mean CT attenuation values predicted a higher relative risk for hypothyroidism.

CONCLUSION

Low mean CT attenuation (≤70 HU) of the thyroid gland on noncontrast chest CT is highly predictive of hypothyroidism.

CLINICAL RELEVANCE/APPLICATION

Hypothyroidism is an established treatable risk factor for cardiovascular disease. Many cases of hypothyroidism are subclinical. Hypothyroidism can be detected with high specificity on screening and diagnostic noncontrast chest CT scans, which can be used to augment the comprehensive cardiovascular risk assessment afforded by this examination.

SSM06-03 Generalized Mucositis-related Bronchiolitis in the Setting of Allogeneic Stem Cell Transplantation: A Potential Mimic of Lower Respiratory Tract Infection

Wednesday, Dec. 2 3:20PM - 3:30PM Location: S406B

Participants
Christopher Kloth, Tuebingen, Germany (Presenter) Nothing to Disclose
Ulrich Grosse, MD, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Stefan Wirths, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Sergios Gatidis, MD, Tubingen, Germany (Abstract Co-Author) Nothing to Disclose
Wolfgang Bethge, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Konstantin Nikolau, MD, Tuebingen, Germany (Abstract Co-Author) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Marius Horger, MD, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE

To describe a little known therapy-related small airway phenomenon presumably caused by mucosal irritation in patients undergoing allogeneic stem cell transplantation (allo-SCT).

METHOD AND MATERIALS

Retrospective database search at our institution identified 739 hematological patients who underwent chemotherapy+allo-SCT between September 2004 and March 2014. After excluding infectious pulmonary complications, 75 patients (female=24; male=51; median age=47y) with signs of generalized bronchiolitis (GB) on chest-HRCT were identified. CT was performed proximate to chemotherapy-onset; 92% had follow-up-CT (mean, 1.9weeks). The presence of centrilobular nodules/bronchial wall thickening(BWT)/tree-in-bud(distributed diffuse vs. focal)/ground-glass-opacity(GGO)/ airspace opacification/luminal impactions/air-trapping was correlated with occurrence and duration of oral mucositis and therapy characteristics. Intensity of tree-in-bud and centrilobular nodules was graded absent(grade=0), moderate(grade=1) and marked(grade=2).

RESULTS

Overall incidence of GB among allo-SCT-patients was 10.7%. GB was diagnosed at the time point of transplantation with a mean duration of CT-findings of 4 weeks(±2.7). Tree-in-bud (17%[grade 2] and 83%[grade 1]) and BWT was present in 100%. Centrilobular nodules were found in 45.5% of patients (20% [grade 2], 24% [grade 1] and 56% [none]) being always diffusely distributed. Air-trapping/mosaic pattern were found in 13% and 16%, respectively. Resolution of GB was spontaneous. GB and its severity correlated with the temporal course and grade of oral mucositis; frequency and degree was not significantly influenced by the chemotherapy regimen. The incidence of GB in HRCT was statistically significant higher in patients with oral mucositis (p=0.035).

CONCLUSION

GB is frequent during chemotherapy for allo-SCT and is characterized by even distribution of tree-in-bud/ BWT/ centrilobular nodules, mild clinical symptoms and spontaneous resolution.

CLINICAL RELEVANCE/APPLICATION

Severe pulmonary complications occur in patients undergoing allo-SCT. Treatment strategy depends primarily on differentiation between infectious and non-infectious genesis. In the setting of respiratory symptoms lower respiratory tract infection must be suspected. However, knowledge of potential mimics is essential for accurate patient management. At this point, mucosal barrier injury (mucositis) represents a potential differential diagnosis.

SSM06-04 Dual-input Perfusion of Lung Lesions with 320-detector-row CT: Its Reproducibility, Value in differentiating Malignant from Benign Lesions and Correlation with Lesion Micro-vessel Density

Wednesday, Dec. 2 3:30PM - 3:40PM Location: S406B

Participants
Hui Liu, Shanghai, China (Presenter) Nothing to Disclose
Jiang Lin, MD, PhD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Jiajia Yao, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Xiulian Lu, Shanghai, China (Abstract Co-Author) Nothing to Disclose
PURPOSE
To investigate the reproducibility of dual-input CT perfusion (DI-CTP) of lung lesions with 320-detector-row CT, its value in differentiation of malignant and benign lesions and the correlation between CTP parameters and micro-vessel density (MVD).

METHOD AND MATERIALS
116 patients with various lung lesions confirmed by pathology underwent DI-CTP. There were 95 malignant and 21 benign lesions. The pulmonary trunk and the descending aorta were selected as input arteries for measuring contributions from pulmonary and bronchial circulation to the lesions. Pulmonary flow (PF), bronchial flow (BF), and perfusion index (PI) were calculated by two independent radiologists. Intraclass correlation coefficient (ICC) and Bland-Altman statistics were used to evaluate intra- and inter-observer agreement. 94 lesions had immunohistochemical staining with CD34. DI-CTP parameters were compared between malignant and benign lesions. Correlation between DI-CTP and MVD was studied.

RESULTS
Both intra- and inter-observer agreements were good to excellent (ICC>0.90). PF and PI of benign lesions were higher than those of malignant lesions. BF of malignant lesions was higher than that of benign lesions. Statistically significant differences of BF, PF and PI were found between malignant and benign lesions (P<0.05) with the area under the PI ROC curve being 0.936, the largest of the three perfusion parameters. There was statistically significant difference in MVD between benign and malignant lesions (P<0.05). BF, PF and TPF values were positively correlated with MVD (P<0.05).

CONCLUSION
DI-CTP is reproducible and reflects the angiogenesis of lung lesions. It can provide additional information for differential diagnosis of malignant from benign lung lesions.

CLINICAL RELEVANCE/APPLICATION
DI-CTP is reproducible and reflects the angiogenesis of lung lesions. It can provide additional information for differential diagnosis of malignant from benign lung lesions.

SSM06-05 The Effectiveness of Digital Tomosynthesis for the Nodule Detection in Danger Zone vs Non-Danger Zone: Phantom Study

Wednesday, Dec. 2 3:40PM - 3:50PM Location: S406B

Participants
Eun Young Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Joo Sung Sun, MD, Suwon-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Taehee Kim, MD, PhD, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seon Young Park, MD, Suwon-si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Kyung Joo Park, MD, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare the effectiveness of digital tomosynthesis (DT) with dual-energy subtraction radiography (DES) and chest radiography (CXR) for detecting simulated pulmonary nodules (SPN) according to the nodule size and location.

METHOD AND MATERIALS
Four different sizes (5, 8, 10 and 12mm in a diameter) of SPNs (1~4 nodules/1 exam) were inserted into 8 different area of lung phantom classified as danger or non-danger zone (Fig 1). Three modalities of DT, DES, and CXR were all performed at the same time for every 96 examinations. Additional 96 examinations 3 modalities without nodule (normal control) were performed. Finally, a total of 192 examinations were prepared for each set of modality. Three sets of image data were randomly arranged and three observers independently reviewed all images in a random order. Three observers were asked to identify nodule and score confidence with 4 scales. Also asked to measure largest diameter of each nodule and record interpretation time. The jackknife alternative free-response receiver operating characteristic (JAFROC) was used to analyze overall diagnostic performance for each modality.

RESULTS
FROC analyses revealed significantly better performance (P<0.05) of DT than CXR and DES for the detection of pulmonary nodules. The observer-averaged figure of merit (FOM) was 0.78, 0.77 and 0.95 for CXR, DES, and DT, respectively. The TPF increased with an increase in size of the nodules. Except the smallest nodules (5 mm), the TPF for DT was about 1.5 times higher than CXR and DES (0.99 vs 0.677 and 0.670) in danger zone but there was a little difference in non-danger zone (0.988, 0.889, and 0.905 for DT, CXR and DES). The mean interpretation time for DT (mean±SD, 30 ± 11 s) was higher (P<0.05; Wilcoxon test) than for CXR (28 ± 12 s) and DES (30 ± 11 s).

CONCLUSION
The DT significantly improved the diagnostic performance to detect pulmonary nodules than CXR and DES, especially nodules located in danger zone that easily obscured by superimposed vascular structure and bone structure.

CLINICAL RELEVANCE/APPLICATION
DT seems to be a superior modality for work up of pulmonary nodule with higher image quality and boosts its ability for nodule located in danger zone that easily obscured by superimposed bone and vascular structure on CXR and DES.

SSM06-06 Lung Nodule Classification using Learnt Texture Features on a Single Patient Population

Wednesday, Dec. 2 3:50PM - 4:00PM Location: S406B

Participants
Lyndsey C. Pickup, MEng, DPhil, Oxford, United Kingdom (Presenter) Employee, Mirada Medical Ltd
Aamibika Talwar, MA, MBCHIR, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose
Shameema Stalin, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the reproducibility of dual-input CT perfusion (DI-CTP) of lung lesions with 320-detector-row CT, its value in differentiation of malignant and benign lesions and the correlation between CTP parameters and micro-vessel density (MVD).
PURPOSE

To validate the use of texture features and a machine learning approach to generate a "probability-of-malignancy" score for lung nodules.

METHOD AND MATERIALS

A database with 705 distinct pulmonary nodules (PNs) was created with contrast CTs from 139 patients in a selected geographical region. All patients with reported PNs from Jan-Apr 2013 were included; those with unavailable scans or malignancy status (by histology or 2-year stable follow-up) were excluded. The dataset contained 328 benign nodules, 7 primary cancers, and 370 metastases. 522 image texture features in 2D/3D were extracted from each PN and its borders (contoured using Mirada XD, Mirada Medical Ltd). These included Haralick, Gabor and Laws features, fractal dimensions, plus combinations and difference features, with dimensionality reduction using principal component analysis. A greedy algorithm selected maximally discriminative features one by one, and mapped feature responses to malignancy probabilities using a Support Vector Regressor (LibSVM). For robust analysis, the dataset was partitioned into distinct thirds: one for training, one for cross-validation (setting SVR parameters, using a simplex method), and one for testing (reporting AUC). For each feature set, 100 different splits were evaluated, with the mean AUC on each split being compared. A leave-one-out validation result was also computed, for ease of comparison to other work. The work was repeated on a dataset excluding patients undergoing chemotherapy at the time of the scan, leaving 160 malignant and 230 benign nodules.

RESULTS

A mean AUC of 0.872 (std 0.020) was obtained by the feature set selected. The best single feature was the standard deviation of a Gabor filter response on the nodule boundary, and the peak mean AUC overall was obtained with 40 features. The leave-one-out AUC was 0.905, and this increase is to be expected because leave-one-out is less robust to overfitting than the three-fold approach. For the chemo-free population, the AUC was 0.942.

CONCLUSION

This texture feature model is successful at discriminating malignant and benign nodules over a large selection of nodules drawn from a single patient population. Future work should include more primary cancers.

CLINICAL RELEVANCE/APPLICATION

Differentiating malignant and benign pulmonary nodules is a common clinical problem in which software may help support clinical decisions and guide patient management.
Controversy Session: Current USPSTF Lung Cancer Screening: Inclusive or Exclusive

Wednesday, Dec. 2 4:30PM - 6:00PM Location: S404AB

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Ella A. Kazerooni, MD, Ann Arbor, MI (Moderator) Nothing to Disclose

Sub-Events

SPSC45A USPSTF Lung Cancer Screening: Pro

Participants
Ella A. Kazerooni, MD, Ann Arbor, MI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) List the major risk factors for lung cancer. 2) Describe the potential advantages of the inclusivity of USPSTF lung cancer screening eligibility criteria. 3) Understand the spectrum of lung cancer risk among patients meeting the USPSTF criteria. 4) Recognize how personalized risk assessment can facilitate shared decision making for patients meeting USPSTF criteria.

ABSTRACT

1. List the major risk factors for lung cancer. 2. Describe the potential advantages of the inclusivity of USPSTF lung cancer screening eligibility criteria. 3. Understand the spectrum of lung cancer risk among patients meeting the USPSTF criteria. 4. Recognize how personalized risk assessment can facilitate shared decision making for patients meeting USPSTF criteria.

URL

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Ella A. Kazerooni, MD - 2014 Honored Educator

SPSC45B USPSTF Lung Cancer Screening: Con

Participants
Doug Arenberg, Ann Arbor, MI, (darenber@umich.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the rationale for the USPSTF lung cancer screening criteria. 2) Understand the importance of identifying risk among those referred for lung cancer screening. 3) Identify the impact of lung cancer risk on the balance of harms and benefits of lung cancer screening. 4) Describe the clinical and demographic traits that increase one’s risk for lung cancer.

ABSTRACT
Chest Thursday Case of the Day
Thursday, Dec. 3 7:00AM - 11:59PM Location: Case of Day, Learning Center

Participants
Alvaro Huete Garin, MD, Santiago, Chile (Presenter) Nothing to Disclose
Kristopher W. Cummings, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Javiera C. Araya Campos, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose
Cylen Javidan-Nejad, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Juan-Carlos Diaz, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose
Francisca C. Araya, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) To analyze interesting chest cases. 2) To understand appropriate differential diagnosis. 3) To understand the clinical significance of the diagnosis presented.
Contemporary Imaging of Lung Cancer

Thursday, Dec. 3 8:30AM - 10:00AM Location: N227

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Jeremy J. Erasmus, MD, Houston, TX (Moderator) Nothing to Disclose

Sub-Events

RC601A Non-small Cell Lung Cancer Staging: Concepts and Controversies

Participants
Ioannis Vlahos, MRCP, FRCR, London, United Kingdom (Presenter) Research Consultant, Siemens AG Research Consultant, General Electric Company

LEARNING OBJECTIVES
1) Summarize the origins, basis and rationale of the current TNM classification of lung cancer. 2) Discuss the strengths and limitations of the current system and how to practically address these 3) Highlight areas where current radiology, oncological, surgical and pathological best practice and evolving knowledge in these areas are progressing beyond the current staging system.

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Ioannis Vlahos, MRCP, FRCR - 2015 Honored Educator

RC601B Contemporary Concepts in Small Cell Lung Cancer

Participants
Fergus V. Gleeson, MBBS, Oxford, United Kingdom (Presenter) Consultant, Alliance Medical Limited; Consultant, Blue Earth Diagnostics Limited; Consultant, Polarean, Inc;

LEARNING OBJECTIVES
1) To learn the clinical manifestations, staging and prognostic factors of small cell lung cancer. 2) To become familiar with the role of PET-CT in the investigation and management of small cell lung cancer. 3) To review unusual presentations of small cell lung cancer and their investigation and treatment.

ABSTRACT
Small cell lung cancer, SCLC, accounts for approximately 15% of all lung cancers, with its overall incidence decreasing, although it is increasing in women, with the male to female incidence ratio now 1:1. Small cell lung cancer has a more rapid doubling time than non-small cell lung cancer, with most patients presenting with hematogenous metastases, and only approximately one-third presenting with limited-stage disease confined to the chest. Small cell lung cancer uncommonly presents with a solitary pulmonary nodule, and the disease does not appear to have benefited from Lung Cancer Screening. There are multiple neurologic and endocrine paraneoplastic syndromes associated with small cell lung cancer, with marked improvement on treatment of the underlying tumor. Historically SCLC was staged according to the Veteran's Administration Lung Group's 2 stage classification of 1) extensive-stage disease or 2) limited-stage disease, and this classification used to guide therapy. More recently it has been recommended that SCLC is staged according to the International Association of the Study of Lung Cancer (IASLC) and the AJCC Cancer Staging Manual 7th edition, using the same staging system for NSCLC and SCLC. Whilst contrast enhanced CT scan of the chest and abdomen remain routine as the initial method for staging SCLC, FDG PET-CT now plays a more important role in staging and management. SCLC is a highly metabolic disease, and PET-CT both upstages and downstages disease, potentially altering management.

RC601C PET Imaging of Lung Cancer: Beyond Standard Metabolic Assessment

Participants
Eric M. Rohren, MD, PhD, Houston, TX (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Review advanced image processing and metabolic parameters in FDG-PET/CT. 2) Discuss non-FDG radiotracers and their potential applications in non-small cell lung cancer. 3) Illustrate the application and clinical use of advanced metabolic imaging biomarkers derived from FDG-PET/CT using case examples.

ABSTRACT
Assessment of non-small cell lung cancer with PET is typically performed using F-18 fluorodeoxyglucose (FDG). The uptake and retention of FDG by the tumor is taken to be a measure of metabolism, which in turn can provide useful information on staging, grading, and prognosis. Advances in the field of PET/CT imaging may provide additional information for the evaluation and care of patients with lung cancer. Advanced semi-quantitative analyses including total lesion glycolysis (TLG) and metabolic tumor volume...
(MTV) have been employed to capture additional information from FDG-PET/CT studies, which in some cases is additive to standard metabolic parameters such as SUVmax. New tracers are under development, with some nearing approval in the U.S. and elsewhere. These include tracers targeting proliferation, receptor expression, and protein catabolism, investigating molecular events and processes beyond glucose metabolism.

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Eric M. Rohren, MD, PhD - 2015 Honored Educator

RC601D MRI: Advances in Nodule Characterization and Lung Cancer Staging

Participants
Kyung S. Lee, MD, PhD, Seoul, Korea, Republic Of, (kyungs.lee@samsung.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To review most popular MRI techniques that are used in thoracic MR imaging. 2) To demonstrate how effective MR imaging is in nodule characterization and lung cancer staging, particularly focused on diffusion-weighted imaging (DWI) and diffusion-weighted whole-body imaging with background body signal suppression (DWIBS).

ABSTRACT
Diffusion-weighted MR imaging helps characterize lung nodule, and enables staging and prognosis prediction in lung cancer. Diffusion-weighted whole-body imaging with background body signal suppression (DWIBS) is known to be specific in nodal staging and effective in whole body MR imaging. Both whole body MRI and PET-CT may be used in extra-thoracic lung cancer staging, but each modality has its own and different merits in lung cancer staging. Whole body MRI-PET may be the future oncologic imaging modality.

URL

RC601E CT Perfusion Imaging in Lung Cancer

Participants
Friedrich D. Knollmann, MD, PhD, Sacramento, CA, (fkollmann@ucdavis.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To identify suitable indications for the use of CT perfusion imaging in lung cancer. 2) To apply CT perfusion imaging to lung tumors. 3) To recognize important features of a valid CT perfusion imaging protocol. 4) To interpret the results of a CT perfusion study in lung tumors.

ABSTRACT
CT perfusion (CTP) imaging has become a tenable proposition with the advent of multislice CT. Preliminary data have indicated a potential role in the assessment of treatment response in lung cancer, but the method is not widely used. In this course, the rationale for using CT perfusion imaging as a quantitative imaging biomarker in lung cancer is discussed. A review of CT protocols includes factors that have impeded a wider adoption of the method in the clinical sphere, such as the reproducibility of measurements, and validation efforts. Solutions to these problems, such as improved anatomic coverage with wider detectors and table motion, reduced radiation exposure with iterative reconstruction, advanced postprocessing with dual blood supply algorithms, motion registration and correction, and volumetric perfusion analysis are addressed. With these methods, tumor classification, assessment of tumor response, and prognostic testing are promising applications of CTP imaging.

RC601F Thoracic Oncologic Imaging: Treatment Effects and Complications

Participants
Brett W. Carter, MD, Houston, TX (Presenter) Author, Reed Elsevier; Consultant, St. Jude Medical, Inc; 

LEARNING OBJECTIVES
1) Understand the role of imaging in the evaluation of patients who have been treated for thoracic malignancies. 2) Recognize the manifestations of radiation therapy in the chest and be able to differentiate expected changes from residual or recurrent disease. 3) Identify intrathoracic complications from radiation therapy, chemotherapy, and surgery.

ABSTRACT
Imaging plays an important role in the evaluation of patients who have been treated with radiation therapy, chemotherapy, and/or surgery for intrathoracic malignancies such as lung cancer, esophageal cancer, malignant pleural mesothelioma, and thymoma. Following thoracic radiation therapy, radiation pneumonitis (1-6 months following therapy) and radiation fibrosis (6-12 months following therapy) are typically identified in the lungs. However, complications such as esophagitis, esophageal ulceration, and radiation-induced cardiovascular disease may develop. Patients treated with chemotherapy may develop pulmonary and cardiovascular complications such as drug toxicity, organizing pneumonia, thromboembolic disease, vasculitis, and cardiomyopathy. Knowledge of the spectrum of expected treatment-related changes, potential treatment complications and the appearance of tumor recurrence is critical in order to properly monitor patients, identify iatrogenic complications, and avoid misinterpretation.

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Brett W. Carter, MD - 2015 Honored Educator
LEARNING OBJECTIVES
1) Understand how respiration impacts radiotherapy imaging and delivery and how to implement strategies to mitigate these issues.
2) Understand types and magnitude of geometric changes in thoracic anatomy during radiotherapy, and determine approaches to correct for discrepancies between the planned and delivered dose to the patient.

ABSTRACT
Radiotherapy is in widespread use for both early and advanced stage lung cancer, as a sole modality and also in combination with other modalities such as chemotherapy. Due to the potential for both acute and late toxicities in organs adjacent to treated regions, modern techniques seek to limit the extent of the high dose volume. The purpose of this session is to develop an understanding for how geometric and anatomic changes during radiotherapy can be managed. The focus will be on solutions readily available in the clinic today, particularly with respect to imaging modalities and planning solutions.

LEARNING OBJECTIVES
1) Understand the opportunities for targeting and avoidance based on functional imaging in lung. 2) Discuss the technical details of functional targeting for tumor and functional avoidance in normal tissue for lung cancer in the pre-treatment and adaptive settings.

ABSTRACT
Radiation therapy continues to play an important role in the treatment of lung cancer although many opportunities remain to improve local control and survival as well as reduce toxicity, especially in advanced stage lung cancer. The use of functional imaging and biomarkers to predict tumor burden and response as well as measure and predict normal tissue toxicity has begun to increase in the community. This session aims to summarize the different modalities and types of information available to perform functional targeting or avoidance of tumor and normal tissue in lung cancer, including imaging (such as PET and SPECT) and other data (such as blood-based biomarkers). The session will also highlight the technical details associated with the use of functional data for treatment planning, treatment response, and adaptation.
Radiomics Mini-Course: Oncologic Applications

Thursday, Dec. 3 8:30AM - 10:00AM Location: S103AB

Participants
Sandy Napel, PhD, Stanford, CA (Director) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc; Scientific Advisor, EchoPixel, Inc

Sub-Events

RC625A  Breast Cancer with PET-CT

Participants
Richard L. Wahl, MD, Saint Louis, MO (Presenter) Research Consultant, Nihon Medi-Physics Co, Ltd;

LEARNING OBJECTIVES
1) Describe the FDG pet uptake characteristics before therapy of 'triple - negative' breast cancers vs other subtypes.

ABSTRACT

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Richard L. Wahl, MD - 2013 Honored Educator

RC625B  Radiogenomics of Lung Cancer

Participants
Michael D. Kuo, MD, Los Angeles, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To discuss the principles behind lung cancer radiogenomics. 2) Highlight clinical applications of lung cancer radiogenomics.

ABSTRACT

RC625C  Brain Cancer: Radiomics, Radiogenomics, and Big Data

Participants
Rivka R. Colen, MD, Houston, TX, (rcolen@mdanderson.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Define the field of radiomics and imaging genomics. 2) Apply radiomics and imaging genomics in brain tumors. 3) Describe the use of MRI as a biomarker for genomic signatures and profiles. 4) Define role of MRI in personalized medicine for target discovery of therapeutic targets. 5) Explain the use of MRI in drug development and clinical trials. 6) Assess the research available in imaging genomics and radiomics. 7) Define and describe the integration of radiomics and imaging genomics into big data platforms.

ABSTRACT

This objective of this course is to introduce the recently emerged field of radiomics and imaging genomics (radiogenomics) in brain tumors, specifically glioblastoma (GBM). Emphasis will be on radiomics with regards to the high-dimensional, high-throughput feature extraction of imaging features from medical images, specifically MRI; the second emphasis will be on the use of imaging in relation to underlying tumor genomics, how to use MRI as a biomarker, surrogate and correlate of tumor genomics as well as the use of MRI as a genomic target discovery tool and its application in therapeutic discovery and drug development. The role of radiomics and imaging genomics in the era of big data and how we can leverage the imaging-omic data will also be discussed.
LEARNING OBJECTIVES

1) Identify the stabilizing anatomical structures of the cervical spine. 2) Appraise the indications for the various cervical spine imaging modalities. 3) Classify cervical spinal injuries based on the mechanism of injury and stability. 4) Differentiate the most common cervical spine injuries. 5) Detect subtle soft tissue and bony injuries of the cervical spine.

ABSTRACT

Imaging plays an indispensable role in detecting and classifying acetabular fractures. This live activity will focus on: A) identifying acetabular fractures on radiographs and CT, B) using an algorithm to classify the five most common acetabular fractures (that comprise approximately 90% of all), and C) mentioning clinically relevant points on imaging reports to help decision-making for better management of the patient's condition.

Handout: Ustun Aydingoz

LEARNING OBJECTIVES

1) Substantiate the advantages of multidetector computed tomography (MDCT) over Chest x-ray for the initial screening of chest trauma. 2) Identify the MDCT imaging findings of the non-vascular traumatic thoracic injuries.

ABSTRACT

Chest radiography has been the traditional screening technique to evaluate traumatic thoracic injuries. The information obtained is usually sub optimal for the diagnosis of non-vascular thoracic injuries. The benefits of MDCT for its diagnosis are discussed in this live activity. Images from our level I trauma center database are shown, including: A) Thoracic wall injuries: diaphragmatic rupture, sternum and scapular fractures, sterno-clavicular dislocation and flail chest. B) Pleuro-pulmonary injuries: contusion, laceration, hemothorax, pneumothorax, and hemothorax. C) Intrathoracic traqueo-bronchial laceration.
Pulmonary Thin-Section MR Imaging with Ultra-Short TE vs. Low- and Standard-Dose Thin-Section CTs: Capability for Lung Nodule Detection and Nodule Type Evaluation

Method and Materials

170 consecutive patients (96 males: mean age, 70 years and 74 females: mean age, 70 years) with suspected pulmonary nodules at near-by hospital were examined with chest standard- and low-dose CTs (270 mA [SDCT] and 50 mA [LDCT]) and pulmonary MR imaging with UTE. According to standard-dose CT findings, all nodules were divided into solid and part-solid nodules and ground glass nodules. In each patient, probability of presence at each pulmonary nodule was assessed on all three methods by means of 5-point visual scoring system. To determine inter-observer and inter-method agreement for nodule detection, kappa statistics with \( \chi^2 \) test were performed. Then, ROC analyses were performed to compare detection capability among all methods. Finally, detection rate was compared each other by means of Mc Nemar's test. To determine inter-observer and inter-method agreement for nodule type evaluation on each method, kappa statistics with \( \chi^2 \) test were also performed.

Results

On nodule detection, inter-observer agreements on all methods (0.81<\( \kappa \)<0.85, \( p<0.0001 \)) and inter-method agreement among all methods (0.87<\( \kappa \)<0.96, \( p<0.0001 \)) were determined as almost perfect. Area under the curves (Azs) of all methods (SDCT: Az=0.97, LDCT: Az=0.96, MRI: Az=0.96) had no significant difference (\( p>0.05 \)). In addition, detection rates of all three methods (SDCT: 92.0 \([252/274]\)%, LDCT: 91.5 \([247/270]\)%, and MRI: 91.5 \([247/270]\)%) had also no significant difference (\( p>0.05 \)). On nodule type assessment, inter-observer agreement of each method was almost perfect (0.87<\( \kappa \)<0.91, \( p<0.0001 \)). In addition, inter-method agreements among all methods were also determined as almost perfect (0.81<\( \kappa \)<0.89, \( p<0.0001 \)).

Conclusion

Pulmonary MR imaging with UTE is considered at least as valuable as low- and standard-dose CTs for lung nodule detection and nodule type evaluation.

Clinical Relevance/Application

Pulmonary MR imaging with UTE is considered at least as valuable as low- and standard-dose CTs for lung nodule detection and nodule type evaluation.
To investigate the natural courses of persistent pulmonary subsolid nodules (SSNs) with solid parts ≤5mm and the clinicoradiological predictors for their interval growth over follow-ups.

METHOD AND MATERIALS

From 2005 to 2013, natural courses of 213 persistent SSNs detected on chest CT (slice thickness ≤1.25mm) in 213 patients (mean age, 57.88 ± 10.38 years; range, 24-87 years) were evaluated in this study (median follow-up, 849 days; range, 90-2900 days). To identify significant predictors for interval growth, Kaplan-Meier analysis and Cox proportional hazard regression analysis were performed.

RESULTS

One-hundred thirty-six were pure ground-glass nodules (GGNs) (growth in 18; stable in 118) and 77 part-solid GGNs with solid parts ≤5mm (growth in 24; stable in 53). For 213 SSNs, lung cancer history (Hazard ratio (HR), 3.884; p<0.001), part-solid GGNs (HR, 3.570; p<0.001), and nodule diameter (HR, 3.576; p<0.001) were significant predictors for interval growth. In subgroup analysis, nodule diameter was an independent predictor for interval growth of both pure GGNs (HR, 6.620; p<0.001), and part-solid GGNs (HR, 2.749; p=0.037). For part-solid GGNs, lung cancer history (HR, 5.917; p=0.002) was also another significant predictor for interval growth. The frequency of interval growth of pure GGNs ≥10mm (12.9%, 30.4%, 42.0%, 42.0%, 71.0% at 1, 2, 3, 4, 5 year's follow-up) and part-solid GGNs ≥8mm (11.5%, 38.0%, 43.6%, 78.9%, 78.9%) was significantly higher than those of pure GGNs <10mm (1.9%, 4.0%, 10.9%, 13.5%, 13.5%) (p<0.001) and part-solid GGNs <8mm (11.5%, 21.5%, 21.5%, 21.5%, 21.5%) (p=0.003), respectively.

CONCLUSION

Natural course of SSNs with solid parts ≤5mm was significantly different regarding their nodule types and nodule diameters, with which their managements can be subdivided.

CLINICAL RELEVANCE/APPLICATION

Nodule type and nodule diameter are significant predictors for interval growth of SSNs with solid parts ≤5mm, and managements of SSNs with solid parts ≤5mm can be categorized based on these predictors.

SSQ04-03 Ground Glass Nodule Detectability in Seven observers of Seventy-nine Clinical Cases: Comparison between Ultra-Low-Dose Chest Digital Tomosynthesis with Iterative Reconstruction and Chest Radiography by Receiver-Operating Characteristics Analysis

Participants

Yukihiro Nagatani, MD, Otsu, Japan (Presenter) Nothing to Disclose
Masashi Takahashi, MD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Mitsuru Ikeda, MD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Norihisa Nitta, MD, Kyoto, Japan (Abstract Co-Author) Nothing to Disclose
Katsunori Miyata, RT, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Akinaga Sonoda, MD, PhD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Jun Hanaoka, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Yasutaka Nakano, MD, PhD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Noritoshi Ushio, RT, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Kiyoshi Murata, MD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE

To compare ground glass nodules detectability (GGND) between ultra-low-dose chest digital tomosynthesis (ULD-CDT) with 2 different reconstruction algorithms and chest radiography (CR) by using low-dose computed tomography (LDCT) as the standard of reference (SOR).

METHOD AND MATERIALS

The Institutional Review Board approved this study and written informed consent was obtained. In a single visit each, 79 subjects underwent ULD-CDT at 120kV and 10mA, CR both in posterior-anterior and lateral direction and LDCT (effective dose: 0.081, 0.117 and 3.52 mSv, respectively). In each of 79 cases, 63 reconstructed coronal images were obtained using CDT (SOLONVISION Safire 17 radiography/fluoroscopy system, Shimadzu, Kyoto, Japan) with and without iterative reconstruction (IR). SOR as to GGN presence with the longest diameter (LD) of 3mm or more was determined based on LDCT images by consensus reading of two radiologists. Another seven radiologists independently recorded GGN presence and their locations by continuously-distributed rating. Receiver-operating characteristic (ROC) analysis and detection sensitivity (DS) was used to compare GGND of ULD-CDT with IR, ULD-CDT without IR and CR in total and subgroups classified by nodular LD (> or < 9mm) and CT attenuation value (CTAV) (> or < -600 Hounsfield of Unit (HU)). DS were also compared between any pairs of 4 sub-groups in each of three modalities using t-test.

RESULTS

For SOR, 105 GGNs were identified. The minimal and maximal LDS of GGNs were 3.0 and 26 mm, respectively, with a mean LD of 8.56 mm. In total as well as any sub-group, GGND at ULD-CDT with IR was higher than either that at ULD-CDT without IR or CR, as area under ROC curve was 0.66 ± 0.02, 0.59 ± 0.01 and 0.52 ± 0.01, respectively (p<0.05). DS at ULD-CDT with IR in more attenuated GGNs (CTAV > -600 HU) was higher than that in less attenuated GGNs (47.5 ± 8.1% vs 26.6 ± 6.7%) (p<0.05). DS at ULD-CDT with IR in larger GGNs (LD > 9mm) was higher than that in smaller GGNs (44.6 ± 7.7% vs 22.1 ±5.4%) (p<0.05).
SSQ04-04  Breath-hold Lung MR Imaging for Nodule Detection: Combination of 3D mDixon and Black-blood Fat-saturated HASTE Sequences

Thursday, Dec. 3 11:00AM - 11:10AM Location: E351

Ryotaro Kamei, MD, Fukuoka, Japan (Presenter) Nothing to Disclose
Yuji Watanabe, MD, Fukuoka, Japan (Abstract Co-Author) Research Grant, Koninklijke Philips NV Research Grant, Bayer AG
Koji Sagiyama, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Satoshi Kawanami, MD, Fukuoka, Japan (Abstract Co-Author) Research Grant, Bayer AG; Research Grant, Koninklijke Philips NV
Hiroshi Honda, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare the diagnostic performance of breath-hold lung MR imaging as a part of whole-body PET/MR hybrid imaging with that of low-dose CT from PET/CT in the detection of nodular lesions.

METHOD AND MATERIALS
We included 21 consecutive patients who underwent diagnostic CT, PET/CT, and MR of the whole lung from August 2014 to March 2015. MR images were acquired using Ingenia 3.0T MR (Philips) or the 3.0T MR part of Ingenuity TF PET/MR (Philips). The MR protocol consisted of T1-weighted image (T1WI) with 3D modified Dixon (mDixon) sequence, and black-blood fat-saturated T2-weighted image (FS-T2WI) with Half-Fourier Acquisition Single-shot Turbo Spin-echo (HASTE) sequence. Both were performed with breath-hold, and the mean scan duration was 21.2 s for T1WI and 14.5 s (two stations) for FS-T2WI. Low-dose CT was performed under free breathing. Diagnostic CT images were used as the reference standard. The location, number, size, and characterization (solid, pure, or mixed ground-glass opacity [GGOs]) of nodular lesions were recorded. Two radiologists reviewed the MR and CT images from PET/CT in consensus, with an interval of one week. Lesion-based sensitivity and lung lobe-based specificity were calculated. Statistical analyses were performed with McNemar test and Wilcoxon signed-rank test.

RESULTS
Overall sensitivity and specificity were 64.6% (31/48) and 96.9% (62/64) for MR, and 77.1% (37/48) and 82.8% (53/64) for low-dose CT, respectively. On the MR images, 76.9% (30/39) of nodules measuring ≥5 mm were pointed out, while only 11.1% (1/9) of nodules <5 mm were detected. For nodules ≥5 mm, detection rates were 81.5% (22/27) for solid lesions and 66.7% (8/12) for GGOs. The size of solid lesions on the MR images did not differ significantly from the reference group. On the other hand, mixed GGOs tended to appear smaller on T1WI, and pure GGOs were only visible on T2WI.

CONCLUSION
Breath-hold lung MR imaging with combined use of 3D mDixon T1WI and black blood FS-T2WI HASTE provides brief examination with acceptable diagnostic accuracy and could be feasible as a part of whole-body PET/MR hybrid imaging.

CLINICAL RELEVANCE/APPLICATION
Breath-hold lung MR imaging has fair sensitivity and good specificity to detect nodular lesions. In addition to previously reported T1WI, FS-T2WI might be necessary to accurately depict GGOs.

SSQ04-05  Value of [18F]Fluorodeoxyglucose Positron Emission Tomography/Computed Tomography in Patients with Persistent Pulmonary Part-Solid Nodules Detected at CT

Thursday, Dec. 3 11:10AM - 11:20AM Location: E351

Participants
JiJuang Kim, MD, Seongnam, Korea, Republic Of (Presenter) Nothing to Disclose
Kyung Won Lee, MD, PhD, Seongnam, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
Although current National Comprehensive Cancer Network guidelines suggest [18F]fluorodeoxyglucose positron emission tomography/computed tomography (FDG-PET/CT) for the pretreatment evaluation of early stage non-small cell lung cancer, the role of FDG-PET/CT in patients with persistent pulmonary part-solid nodules is yet to be determined. The purpose of our study was to evaluate the incremental value of FDG-PET/CT in the pretreatment evaluation of non-small cell lung cancer detected as part-solid nodules at chest CT.

METHOD AND MATERIALS
From March 2011 through March 2015, 164 consecutive patients who underwent whole-body FDG-PET/CT for the pretreatment evaluation of non-small cell carcinoma detected as pulmonary part-solid nodules at chest CT were included. We analyzed the chest CT and FDG-PET/CT reports prospectively made by board-certified radiologists and nuclear medicine physicians as a part of our standard practice. The CT, FDG-PET/CT and histopathologic characteristics of the nodules were demonstrated and the incremental value of FDG-PET/CT over chest CT in the nodal or extrathoracic staging was evaluated.

RESULTS
For the pretreatment evaluation, FDG-PET/CT was performed in 164 patients with 181 part-solid pulmonary nodules (diameter; 23.4±8.2 mm, mean solid proportion; 67.8%). Among them, 156 patients with 172 nodules underwent subsequent surgical resection. All of the nodules were histopathologically confirmed as adenocarcinoma (n = 1, 91, 51 and 29 for Tis, T1a, T1b, and T2a, respectively). In the retrospective analysis of prospective CT and FDG-PET/CT interpretations, only 4 and 3 patients were suspected to have lymph node metastases, respectively. In histopathologic confirmation, 5 of 156 patients had lymph node metastases and the maximum standardised uptake value of them varied from 1.2 to 6.1. The per-patient sensitivities of CT and FDG-PET/CT in detection of lymph node metastasis were 40% and 20%, respectively, and FDG-PET/CT showed no incremental value in nodal staging. While eight incidental extrathoracic malignancies were suspected at FDG-PET/CT, further diagnostic work-up revealed them as benign.

CONCLUSION
FDG-PET/CT showed no incremental value in the pretreatment evaluation of non-small cell lung cancer detected as part-solid
In the pretreatment evaluation of non-small cell lung cancer detected as part-solid nodules at chest CT, additional imaging study with FDG-PET/CT is not necessary.

**CLINICAL RELEVANCE/APPLICATION**

In the pretreatment evaluation of non-small cell lung cancer detected as part-solid nodules at chest CT, additional imaging study with FDG-PET/CT is not necessary.

**METHOD AND MATERIALS**

IRB approved retrospective study. Chest CT dataset with 40 GGN and 10 sets with no detectable nodules, was designed. After de-identification, all datasets were presented to two thoracic radiologists (acting as reference standard) and a fellow, independently, in four different reading sessions two weeks apart from each other, using IMPAX PACS viewers. Only axial slices were analysed, no MPR or MIP reconstructions were allowed. The settings assessed were Lung Window (W 1500 UH, L -500 UH), Emphysema Window (W 800 UH, L -800 UH), Inverted Lung Window and Inverted Emphysema Window. Location, maximum diameter and TTD were recorded for each nodule. Interreader agreement for localization was analyzed with Cohen's Kappa statistics with 95% CI, diameters agreement with Lin's correlation-concordance coefficient Rho 95%CI with average bias assessed with Bland-Altman with 95% limits of agreement (LOM).

**RESULTS**

High agreement was identified in all settings with Kappa values for Lung Window (LW) 0.71 (0.53-0.78), Emphysema Window (EW) 0.72 (0.63-0.82), Inverted Lung Window (ILW) 0.71 (0.62-0.74) and Inverted Emphysema Window (IEW) 0.79 (0.73-0.88). Lin's Rho ranged from 0.85 (0.78-0.92) in LW, 0.80 (0.72-0.89) in EW, 0.89 (0.84-0.95) in ILW and 0.92 (0.88-0.96) in IEW. Bland-Altman analysis showed average bias in mm (LOM) of -0.64 (-4.19 to 2.9) in LW, -0.69 (-4.91 to 3.52) in EW, -0.29 (-3.75 to 3.17) in ILW and 0.09 (-2.83 to 3.02) in IEW. Average TTD ranged from 21.3 sec in LW to 58.1 sec in ILW, and was significantly higher in all settings in the fellow's readings versus thoracic radiologists' (p<0.01), with a reduced TTD for both groups only in IEW (p<0.01).

**CONCLUSION**

IEW provides a visual setting with high reader agreement, measurements concordance with low measurement bias, and reduced TTD for GGN detection.

**CLINICAL RELEVANCE/APPLICATION**

IEW could be used as a visual aid for identifying GGN, in a similar fashion as MIP reconstructions assist in solid nodule detection.

**METHOD AND MATERIALS**

Time-varying gaze paths were recorded while 13 radiologists interpreted 40 lung CT scans with between 3 and 5 synthetic nodules (5-mm diameter) embedded randomly within the lung parenchyma. Viewing conditions resulted in a 5° visual angle (approx. foveal limits) corresponding to a 100 pixel distance from the center of gaze. True positive (TP) gaze path segments, corresponding to all x, y, z gaze positions preceding each TP detection, were analyzed. The moment of recognition (MoR) was derived based upon analysis of gaze velocity and direction. Proceeding backwards in time from the reader's confirmation of detection, the trajectory of the gaze path was analyzed for a distinct deviation of the gaze point toward the nodule. We modeled nodule recognition as a Markov process characterized by R(d,z), the instantaneous probability of recognizing a nodule when the gaze is centered d pixels and z sections away from the target nodule.

**RESULTS**

R(d) was a decreasing function of d for all readers that was well approximated by an exponential distribution. Across readers, R(d) had a median(SD) of 84(43) and 90th percentile(SD) of 269(129) pixels. The average (SD) proportion of nodules that were recognized beyond the 100 pixel foveal limit was 51.2% (15.6%) indicating a substantial contribution of peripheral vision for lung nodules at chest CT.
nodule detection. R(z) was roughly equal at CT sections that were 0, 1, and 2 from the nodule centroid and was smaller 3 sections away, with no significant difference across readers (p = 0.99).

CONCLUSION
The momentary likelihood of lung nodule recognition appears to decrease exponentially with distance from a lung nodule center. While on average approximately half of detected nodules are recognized with peripheral vision, readers rely on their peripheral vision for nodule detection to varying degrees. Further study of search behavior and nodule recognition may lead to strategies for greater consistency and sensitivity for lung nodules detected in CT scans.

CLINICAL RELEVANCE/APPLICATION
Understanding the process of lung nodule detection in CT scans is important to assuring that radiologists maximize their effectiveness in diagnosing lung disease.

RESULTS
GGN visibilities were similar between ULDS and LDS (2.746 versus 2.774) (p=0.131), as -626±110 Hounsfield of Unit (HU) at ULDS, -619±117 HU at LDS and -614±120 HU at SDS. Dimensions were larger at ULDS than those at LDS and SDS (p<0.01) (88.1±73.7, 82.4±69.3 and 80.2±66.9, respectively), whereas, MCTD were similar among three dose levels (ULDS/SDS) in dimension and MCTD (r= -0.40, p<0.01 and r= -0.31, p<0.05). Dimensions were larger at ULDS than those at LDS and SDS (RVC#(ULDS/SDS): 100(ULDS-SDS)/SDS) and between LDS and SDS (RVC#(LDS/SDS): 100(LDS-SDS)/SDS).

CONCLUSION
In larger GGNs at ULDS, nodular exaggerating effect in association with decreased SSDE exceeded nodular obscuration deficit due to reduced MCTD by enhanced smoothing effect, and paradoxically may result in visibilities comparable to LDS.

CLINICAL RELEVANCE/APPLICATION
ULDS is optimal for larger GGN detection, whereas, higher dose scanning such as LDS could be desirable as quantification tool in follow-up examination of detected GGNs.

SSQ04-09  A New Quantitative Radiomics Approach for Non-Small Cell Lung Cancer (NSCLC) Prognosis

Thursday, Dec. 3 11:50AM - 12:00PM Location: E351

Participants
Jingdian Song, PhD, Shenyang, China (Presenter) Nothing to Disclose
Caixun Yang, Beijing, China (Abstract Co-Author) Nothing to Disclose
Yu Dongdong, Beijing, China (Abstract Co-Author) Nothing to Disclose
Feng Yang, Beijing, China (Abstract Co-Author) Nothing to Disclose
Jie Tian, PhD, Beijing, China (Presenter) Nothing to Disclose

PURPOSE
To determine if computed tomographic (CT) phenotypic features of Non-Small Cell Lung Cancer (NSCLC) have the predictive ability of auxiliary diagnosis for pathological type, TNM stage by a quantitative radiomics approach.

METHOD AND MATERIALS

Association of Focal Radiation Dose Adjusted on Body Cross Sections with Ground Glass Nodules Visibility and Quantification on Computed Tomography Images Using AIDR 3D: Comparison Among Ultra-Low-Dose, Low-Dose and Standard-Dose Scanning

Thursday, Dec. 3 11:40AM - 11:50AM Location: E351

Participants
Yukihiro Nagatani, MD, Otsu, Japan (Presenter) Nothing to Disclose
Hiroshi Moriya, MD, Fukushima-City, Japan (Abstract Co-Author) Nothing to Disclose
Satoshi Nonuma, MD, PhD, Tenn, Japan (Abstract Co-Author) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD, Suita, Japan (Abstract Co-Author) Nothing to Disclose
Yoshishahi Ohno, MD, PhD, Kobe, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Elsia Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
Mitsuhiro Koyama, MD, Suita, Japan (Abstract Co-Author) Nothing to Disclose
Sadayuki Murayama, MD, PhD, Nishiara-Chō, Japan (Abstract Co-Author) Nothing to Disclose
Kiyohisa Murata, MD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare the visibility, dimension and density of ground glass nodules (GGNs) on computed tomography (CT) images using AIDR 3D between ultra-low-dose scanning (ULDS) and low-dose scanning (LDS) and assess the association of size specific dose estimate (SSDE) with difference in the measured values between ULDS as well as LDS, and standard dose scanning (SDS).

METHOD AND MATERIALS
This was part of the ACTive Study, a multi-center research project in Japan. The Institutional Review Board of each institution approved this study, and written informed consent was obtained. In a single visit, 50 subjects underwent chest CT (64-row helical mode) using identical 320-row scanners with different tube currents: 240 (SDS), 120 (LDS), and 20 mA (ULDS). GGN visibility was assessed by 3-grade scales (1: obscure to 3: definitely visible) using SDS as standard of reference and compared between ULDS and LDS using t-test. Dimension and mean CT density (MCTD) of 71 larger GGNs with the diameter of 5mm or more and SSDE based on antero-posterior and lateral body width were determined as the average value of two-times measurements in cross sections including GGN center. Measured values were compared using Friedman and Wilcoxon signed rank test among ULDS, LDS and SDS. Pearson's correlation analyses were performed to assess the association of SSDE with relative value change between ULDS and SDS (RVC#(ULDS/SDS): 100(ULDS-SDS)/SDS) and between LDS and SDS (RVC#(LDS/SDS): 100(LDS-SDS)/SDS).

RESULTS
GGN visibilities were similar between ULDS and LDS (2.746 versus 2.774) (p=0.67). SSDE had mild negative correlation with RVC# (ULDS/SDS) in dimension and MCTD (r= -0.40, p<0.01 and r= -0.31, p<0.05). Dimensions were larger at ULDS than those at LDS and SDS (p<0.01) (88.1±73.7, 82.4±69.3 and 80.2±66.9, respectively), whereas, MCTD were similar among three dose levels (p=0.131), as -626±110 Hounsfield of Unit (HU) at ULDS, -619±117 HU at LDS and -614±120 HU at SD.

CONCLUSION
In larger GGNs at ULDS, nodular exaggerating effect in association with decreased SSDE exceeded nodular obscuration deficit due to reduced MCTD by enhanced smoothing effect, and paradoxically may result in visibilities comparable to LDS.
The proposed method has been evaluated on a clinical dataset including 973 patients with NSCLC and a public dataset including 819 patients from the LIDC-IDRI database labelled by benign or malignancy. The proposed method consists of three phases: feature set extraction, key features selection and production. First we extracted a set of features, consisting of 3D features, Gabor features, texture features. Then a unified feature selection framework for general loss functions based on a generalized sparse regularizer was used for key feature selection. Then 25 key features were selected, the the key features were used to certify their prognostic ability.

RESULTS

A score of 83.21% accuracy for lung nodule classification on 819 patients from the LIDC-IDRI dataset was obtained by the features such as Gabor 'Entropy', wavelet 'Sum Entropy' and 'Gray Level Nonuniformity'. 83.80% pathology prediction accuracy between adenocarcinoma and squamous cell carcinoma was gained from the clinical dataset by the features such as 'Maximum 3D Diameter' and run length 'Long Run Emphasis'. And 84.40% diagnosis accuracy for the early phase cancer (T1, T2) and terminal cancer (T3, T4) classification in TNM staging was achieved by 'Energy' and run length 'Long Run High Gray Level Emphasis'.

CONCLUSION

Based on the key features selected from a predefined feature set we may provide a credible aided diagnosis for a tumor whose pathology type and TNM staging are unknown. The radiomics key features will be further expanded in larger data samples, which may provide more predictive information for clinical practice. Radiomics has a big potential to aid clinical diagnosis and treatment for NSCLC.

CLINICAL RELEVANCE/APPLICATION

By the new quantitative radiomics method a credible diagnosis of pathological type could be obtained, it may avoid invasive frozen section and anesthesia in the clinical surgery. TNM staging is an important reference for the assessment of tumor stage and now is always determined by doctor's subjective experience. The proposed radiomics method could provide a more objective and efficient clinical staging strategy.
SSQ05

Chest (Diffuse Lung Disease/Functional Imaging)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S404CD

CH  BQ  CT  MR

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

FDA  Discussions may include off-label uses.

Participants
Yoshiharu Ohno, MD, PhD, Kobe, Japan (Moderator) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA; Hiroto Hatabu, MD, PhD, Boston, MA (Moderator) Research Grant, Toshiba Corporation Research Grant, AVE, Ltd Research Grant, Canon Inc

Sub-Events

SSQ05-01  Distribution and Associated High-Resolution CT findings Predict Survival in Chronic Hypersensitivity Pneumonitis

Thursday, Dec. 3 10:30AM - 10:40AM Location: S404CD

Participants
Jonathan H. Chung, MD, Denver, CO (Presenter) Research Grant, Siemens AG; Royalties, Reed Elsevier
Tilman Koelsch, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Xi Zhan, MD, PhD, Beijing, China (Abstract Co-Author) Nothing to Disclose
David A. Lynch, MBChB, Denver, CO (Abstract Co-Author) Research support, Siemens AG; Scientific Advisor, PARAXEL International Corporation; Consultant, Boehringer Ingelheim GmbH; Consultant, Gilead Sciences, Inc; Consultant, F. Hoffman-La Roche Ltd; Consultant, Veracyte, Inc
Evans R. Fernandez Perez, Denver, CO (Abstract Co-Author) Nothing to Disclose

PURPOSE

It is unknown if the presence of air-trapping and disease distribution on chest CT, which may be a clue to the diagnosis, predicts mortality among patients with chronic hypersensitivity pneumonitis (CHP).

METHOD AND MATERIALS

The earliest CT chest scans from subjects with HP were scored. Fibrotic HP on CT was defined as presence of reticulation with associated traction bronchectasis and/or bronchiolectasis. The predominant zonal and axial distribution of lung disease, the presence or absence as well as total percentage of lung involvement (to the nearest 5%) for air-trapping was scored. The most likely diagnosis with level of confidence (possible, probable, or definite) was also determined. A Cox proportional hazards (PH) model was used to identify independent predictors in time-to-death analysis.

RESULTS

Of 82 subjects, 60 (73%) had fibrotic HP, and 22 (27%) had non-fibrotic HP on chest CT. The most common patterns were HP (43, 52%), UIP (19, 23%), NSIP (11, 13%), and other (9, 10%). Compared to other CT patterns, the HP pattern was most often zonally diffuse or upper and axially diffuse or peripheral (p<0.01). Compared with survivors, patients who died had lower FVC% predicted, were more likely to have pulmonary fibrosis, and were less likely to have ground-glass opacity on CT. In a Cox PH model, the presence of UIP pattern of fibrosis, axially diffuse disease, and absence of air-trapping/mosaic perfusion were independent predictors of survival (Hazard ratios 2.82 [p-value 0.02], 2.46 [p-value 0.01], and 0.39 [p-value 0.01]; respectively).

CONCLUSION

Chest CT has prognostic value in the setting of CHP.

CLINICAL RELEVANCE/APPLICATION

Chest CT may be a valuable biomarker in HP, aside from diagnosis and follow-up.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jonathan H. Chung, MD - 2013 Honored Educator

SSQ05-02  Prevalence of Pulmonary Fibrosis in Asymptomatic 1st Degree Relatives of Patients with Familial Pulmonary Fibrosis (FPF)

Thursday, Dec. 3 10:40AM - 10:50AM Location: S404CD

Participants
Jonathan H. Chung, MD, Denver, CO (Presenter) Research Grant, Siemens AG; Royalties, Reed Elsevier
Anna Peljto, Aurora, CO (Abstract Co-Author) Nothing to Disclose
Tasha Fingerlin, Denver, CO (Abstract Co-Author) Nothing to Disclose
Marvin I. Schwarz, MD, Denver, CO (Abstract Co-Author) Nothing to Disclose
The purpose of this study was to determine the prevalence and pattern of HRCT pulmonary fibrosis in asymptomatic 1st degree relatives of patients with FPF.

METHOD AND MATERIALS
HRCT scans of 250 1st degree relatives of patients with FPF were scored by two thoracic radiologists using a variation of a sequential reading method previously described (Washko GR, et al. N Engl J Med. 2011 Mar 10;364(10):897-906). CT scans were scored for ground glass opacity (GGO), reticular opacity (RO), honeycomb (HC), emphysema (EM) and consolidation (CON) were quantified. The area percent of abnormal lung (AbN) and fibrosis (FIB) were calculated. The survival measure of disease-free survival of patients with pulmonary fibrosis was compared between patients with lower baseline extent and stable or decreased extent of those regional patterns (all p<0.001). Univariable analyses including age, sex, smoking, baseline and change of FVC%pred, DLCO%pred, and SpO2% were performed. The association of baseline extent and 1-year change of regional disease patterns at thin-section CT (TSCT), which is measured with texture-based automated quantification system, can predict survival of IPF patients.

RESULTS
222 of the 250 CT scans were considered technically adequate. In 15.3% (34/222), pulmonary fibrosis was present (definite or probable). In an additional 3.2% (7/222), presence of pulmonary fibrosis was scored as equivocal. In those with pulmonary fibrosis, an average of 6% (+/-7%) of the lung was involved. Honeycomb in these subjects was present in 14.7% (5/34), while ground-glass opacity was present in 23.5% (8/34). The extent of honeycombing was very small and on average closest to 0% in all subjects with honeycombing. The extent of ground-glass opacity was on average 9% (+/-8%). A high confidence pattern was identified in 38.2% (13/34) of subjects with pulmonary fibrosis: 6 UIP, 3 NSIP, 2HP, and 1 asbestosis.

CONCLUSION
Pulmonary fibrosis is common in asymptomatic relatives of patients with FPF.

PULMONARY FIBROSIS IS COMMON IN ASYMPTOMATIC RELATIVES OF PATIENTS WITH FPF.

Clinical Relevance/Application
HRCT screening of asymptomatic relatives of patients with FPF should be considered.
**SSQ05-04 Parallel Bands of Lung Involvement Along the Direction of Ribs: A New Sign of Systemic Sclerosis on Volume-rendered Computed Tomography of the Chest**

**Participants**
Hanan Sherif, MD, Doha, Qatar (Abstract Co-Author) Nothing to Disclose
Ahmed-Emad Mahfouz, MD, Doha, Qatar (Abstract Co-Author) Nothing to Disclose
Maysa A. Mohamed, MBBS, Doha, Qatar (Abstract Co-Author) Nothing to Disclose
Ahmed Sayedin, MBBCh, Doha, Qatar (Presenter) Nothing to Disclose

**PURPOSE**
To differentiate between systemic sclerosis-related interstitial lung disease and usual interstitial pneumonia on volume-rendered computed tomography (CT) of the chest.

**METHOD AND MATERIALS**
The multi-detector CT examinations of the chest of 50 patients with systemic sclerosis and 50 patients with usual interstitial pneumonia have been post-processed to obtain volume-rendered images of the lungs. On these images, normally aerated lung parenchyma has been encoded blue and increased attenuation of lung parenchyma has been encoded white. The images have been randomized and provided to an experienced radiologist to note the presence or absence of parallel bands of increased attenuation of the lung parenchyma along the direction of the ribs (the parallel-band sign). Statistical analysis has been done by the chi-square test.

**RESULTS**
The parallel-band sign has been seen in 32 patients with systemic sclerosis-associated interstitial lung disease and in none of the patients with usual interstitial pneumonia. The parallel-band sign has sensitivity of 64.0%, specificity of 100.0%, positive predictive value of 100.0%, negative predictive value of 73.5%, and accuracy of 82.0% for the diagnosis of systemic sclerosis-associated interstitial lung disease on volume-rendered CT of the chest.

**CONCLUSION**
Lung involvement in systemic sclerosis-related interstitial lung disease may take the characteristic distribution of parallel bands at the surface of the lungs along the direction of the ribs. The parallel-band sign differentiates systemic sclerosis-related interstitial lung disease from usual interstitial pneumonia with high specificity on volume-rendered CT of the chest.

**CLINICAL RELEVANCE/APPLICATION**
The use of the parallel-band sign may help differentiate systemic sclerosis-associated interstitial lung disease from usual interstitial pneumonia, particularly if the interstitial lung disease precedes other manifestations of systemic sclerosis such as skin involvement, cardiac disease, or esophageal dilatation.

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**SSQ05-05 Regional Variation in Ventilation in the Asthmatic Human Lungs Using Magnetic Resonance Imaging and Computed Tomography**

**Participants**
Wei Zha, PhD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Stan Kruger, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Robert V. Cadman, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
David Mummy, MS, MBA, Madison, WI (Presenter) Nothing to Disclose
Nizar Jarjour, Madison, WI (Abstract Co-Author) Nothing to Disclose
Ronald L. Sorkness, Madison, WI (Abstract Co-Author) Nothing to Disclose
Scott K. Nagle, MD, PhD, Madison, WI (Abstract Co-Author) Stockholder, General Electric Company Research Consultant, Vertex Pharmaceuticals Incorporated
Sean B. Fain, PhD, Madison, WI (Abstract Co-Author) Research Grant, General Electric Company Research Consultant, Marvel Medtech, LLC

**PURPOSE**
To investigate regional patterns of ventilation abnormalities in asthmatics with both automated and manual methods.

**METHOD AND MATERIALS**
A total of 83 asthmatic subjects (normal/moderate/severe: n=14/49/20) underwent hyperpolarized (HP) 3He magnetic resonance imaging (MRI), spirometry, and computed tomography (CT). The right and left lungs were segmented from proton MRI using a region-growing algorithm written in MATLAB and further separated into the lung lobes (right upper-RUL, middle-RML and lower-RLL; left upper-LUL and lower-LLL) by a deformable registration to lobar segmentation derived from CT (VIDA Diagnostics, IA). 3He was registered to proton using a rigid registration method. Ventilation defects were identified independently using both manual segmentation and an automated approach which corrected for B1 inhomogeneity, excluded pulmonary vasculature and determined defects adaptively. A linear mixed-effects model was used to perform the pairwise comparison of percent defect volume (PDV) amongst lobes. Spearman correlation was used to evaluate the association between PDV and spirometry. A p<0.05 is considered significant.

**RESULTS**
The automated defect quantification took ~3min versus 20min per study for manual segmentation. The two method yielded similar whole lung PDV (p=0.12). The whole lung PDV measured by both methods correlated inversely with the percent predicted forced
exhalation volume in 1 second (% FEV1) (manual/automated: ρ = -0.41, p = 0.0002/p = -0.24, p = 0.040) and % FEV1 over forced vital capacity (p = -0.46, p = 0.0001/p = -0.32, p = 0.0045). Both methods found PDV was significantly larger in the RML (automated: 8.21±13.64%) than all other lobes (all p < 0.013). The RUL (5.52±8.83%) was less ventilated than the RLL (3.55±4.24%) and LLL (2.62±3.82%) with p < 0.047. The automated method also suggested a more defected RUL than LUL (3.26±4.76%) with ρ = 0.011 whereas the difference was not significant by manual measurements.

CONCLUSION

Compared to manual assessment, the automated approach provides comparable PDV measurements and similar association to spirometric measures. Both methods suggest the RML is most affected in asthmatic lungs and that the RUL is measurably more defected than RLL and LLL.

CLINICAL RELEVANCE/APPLICATION

The automated defect quantification can facilitate the application of HP 3He MRI as a potential tool for guiding bronchoscopic assessment of cellular and molecular markers of asthma progression.

SSQ05-06  Lobar Analysis of Hyperpolarised Xenon MR Lung Imaging (Xe-MRI) in Chronic Obstructive Pulmonary Disease (COPD)

Thursday, Dec. 3 11:20AM - 11:30AM Location: S404CD

Participants

Tahreema N. Matin, MBBS, Oxford, United Kingdom (Presenter) Nothing to Disclose
Mitchell Chen, DPhil, MBBS, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose
Xiaojun Xu, MSc, DPhil, MBBS, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose
Tom Doel, DPhil, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose
Najib Rahman, MSc, DPhil, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose
Vicente Grau, PhD, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose
Annabel Nickol, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose
Fergus V. Gleeson, MBBS, Oxford, United Kingdom (Abstract Co-Author) Consultant, Alliance Medical Limited; Consultant, Blue Earth Diagnostics Limited; Consultant, Polarean, Inc;

PURPOSE

To determine lobar ventilation and apparent diffusion coefficient (ADC) values acquired using hyperpolarised xenon MR lung imaging (Xe-MRI) in subjects with chronic obstructive pulmonary disease (COPD), and to correlate these with quantitative CT (QCT) and pulmonary function tests (PFTs).

METHOD AND MATERIALS

Eighteen patients with COPD (stage II - IV GOLD criteria classification) underwent Xe-MRI at 1.5T, QCT and PFTs. Whole lung and lobar Xe-MRI parameters were obtained using semi-automated segmentation of multi-slice Xe-MRI ventilation images and Xe-MRI diffusion-weighted images (b = 20.855 sec/cm²) following co-registration to CT using in-house software. Percentage predicted PFT results were established. Whole lung and lobar QCT-derived emphysema was calculated from percentage of lung tissue with density of < -950 HU. Pearson's correlation coefficients were used to evaluate the relationship between imaging measures and PFTs.

RESULTS

Lobar Xe-MRI percentage ventilated volume and lobar Xe-MRI average ADC showed significant correlation with lobar QCT percentage emphysema (r = 0.61, p < 0.001 and r = 0.72, p < 0.001 respectively). Whole lung Xe-MRI average ADC showed significant correlation with the PFTs: percentage predicted transfer factor of the lung of carbon monoxide (TLCO) (r = -0.69, P < 0.03) and percentage predicted functional residual capacity (FRC) (r = 0.65, P < 0.007). Whole lung QCT percentage emphysema showed a similar significant correlation with percentage predicted TLCO (r = 0.71, P < 0.001) and percentage predicted FRC (r = 0.48, P < 0.05).

CONCLUSION

This is the first study to generate lobar analysis of Xe-MRI ventilation and ADC. The excellent correlation of whole lung Xe-MRI average ADC with PFTs and lobar Xe-MRI derived measures with lobar QCT percentage emphysema provide supportive evidence for employment of this technique in patients with COPD. This is particularly relevant for those undergoing regional treatments, where Xe-MRI has the potential to accurately guide treatment options or predict post-treatment lung function.

CLINICAL RELEVANCE/APPLICATION

The potential clinical value of Xe-MRI regional lung assessment is becoming increasingly relevant with the possibility of regional lung treatments e.g. lung volume reduction surgery, endobronchial valve placement and radiotherapy. The excellent correlation of Xe-MRI with QCT-derived measures of COPD and PFTs suggests it may be of value in patients considered for these treatments.

SSQ05-07  MR Perfusion Parameters and Apparent Diffusion Coefficient in Lung Cancer: Relation to Microvessel Density Based on Surgical Specimen

Thursday, Dec. 3 11:30AM - 11:40AM Location: S404CD

Participants

Chin A Yi, MD, PhD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Jae-Hun Kim, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyeok-Jun Won, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE

Microvessel density is a direct biomarker of tumor angiogenesis. Perfusion parameters of dynamic contrast-enhanced MRI (DCE-MRI) and apparent diffusion coefficient (ADC) of diffusion-weighted MR imaging (DWI) can be measured as a quantitative, non-invasive, and repetitive method for the estimation of tumor angiogenesis in the lung cancer. The purpose of this study was to correlate MR perfusion parameters and ADC with microvessel density in lung cancers patients who underwent surgical resection.

METHOD AND MATERIALS
Ninety three patients (53 men, 40 women; age range, 40-79 years) with non-small cell lung cancers underwent diffusion-weighted and dynamic contrast-enhanced MR imaging before surgery. Surgical specimens were obtained and microvessel density was measured with immunohistochemistry staining for CD 31. Perfusion parameters (Ktrans; volume transfer coefficient, ve; fraction of extravascular extracellular space, vp; fraction of plasma space, T0; the time lag between bolus arrival times of arterial input function and tissue concentration) and ADC were measured and compared with quantitative histologic microvessel density by using the Pearson correlation test.

RESULTS
The significant positive correlations were found between microvessel density and Ktrans (r=0.22, P=0.03) and vp (r=0.29, P < .01). An inverse correlation was found between T0 and microvessel density (r=-0.34, P < .01), whereas no significant correlation was found between ADC and microvessel density.

CONCLUSION
Perfusion parameter such as Ktrans, ve, and T0 showed significant correlation with microvessel density in lung cancers, whereas no correlation was found between ADC and microvessel density.

CLINICAL RELEVANCE/APPLICATION
Perfusion parameter such as Ktrans, ve, and T0 may play a role as indirect biomarkers indicating the extent of microvessel density in lung cancers.

SSQ05-08 Pulmonary Perfusion Phase Imaging using Self-Gated Fourier Decomposition MRI Reveals Perfusion Inhomogeneities in Patients with Cystic Fibrosis

Thursday, Dec. 3 11:40AM - 11:50AM Location: S404CD

Participants
Simon Veldhoven, MD, Wurzburg, Germany (Presenter) Nothing to Disclose
Daniel Stab, St Lucia, Australia (Abstract Co-Author) Nothing to Disclose
Andreas M. Weng, Wurzburg, Germany (Abstract Co-Author) Nothing to Disclose
Andreas Kunz, Wurzburg, Germany (Abstract Co-Author) Nothing to Disclose
Andre Fischer, DipPhys, PhD, Wurzburg, Germany (Abstract Co-Author) Nothing to Disclose
Clemens Wirth, MD, Wuerzburg, Germany (Abstract Co-Author) Nothing to Disclose
Helge Hebestreit, MD, Wuerzburg, Germany (Abstract Co-Author) Nothing to Disclose
Thorsten A. Bley, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Herbert Koestler, PhD, Wuerzburg, Germany (Abstract Co-Author) Research support, Siemens AG

PURPOSE
Fourier Decomposition (FD) MRI provides site-resolved functional lung imaging without application of contrast media. Perfusion and ventilation-weighted images are reconstructed using a Fourier analysis of a non-triggered time series of morphologic lung images. In this work, we demonstrate that perfusion-weighted data also carries information regarding the pulmonary perfusion phase.

METHOD AND MATERIALS
Lung perfusion measurements were performed using SENCEFUL, an advancement of the FD technique, obtaining morphologic image series by cardiac and respiratory self-navigation of data sampled in quasi-random fashion. Signal variations over the cardiac cycle allow for determining perfusion-weighted images (perfusion amplitude) and the perfusion phase, which indicates the phase shift in the lungs in relation to a reference voxel in a central vessel (e.g. pulmonary trunk). Pulmonary perfusion amplitude and phase measurements on 3 volunteers and 3 cystic fibrosis patients were performed on a 1.5T system. A 2D FLASH sequence providing a DC signal acquisition for self-navigation was used.

RESULTS
Perfusion amplitude maps of the healthy subjects revealed homogeneous lung perfusion. In the perfusion phase maps, the perfusion-induced signal changes exhibited similar behavior in all lung parts. In contrast, the maps of the cystic fibrosis patients showed areas with reduced perfusion and a significantly higher phase dispersion. The attached image example of a 27 year old cystic fibrosis patient shows reduced perfusion e.g. in the upper lobes and the perfusion phase map reveals an higher phase dispersion when compared to the healthy volunteer. Similar results were found in the other examined volunteers and cystic fibrosis patients.

CONCLUSION
Signal intensities in lung MRI are pulsatile as a function of the cardiac triggered inflow. While a balanced perfusion phase in healthy volunteers indicates a homogeneous pulse wave velocity throughout the lungs, results in patients with cystic fibrosis show regionally varying delays.

CLINICAL RELEVANCE/APPLICATION
Based on a time series’ FD, the maps describe a new contrast in pulmonary MRI. First measurements revealed that perfusion phase maps of cystic fibrosis patients differ from those of healthy subjects. Hence, the perfusion phase may contain valuable diagnostic information. Detailed examination of the diagnostic capabilities of FD based perfusion phase MRI is subject to future work.

SSQ05-09 Functional Evaluation of Chronic Lung Allograft Dysfunction with Novel Computed Tomography Lung Deformation Algorithms

Thursday, Dec. 3 11:50AM - 12:00PM Location: S404CD

Participants
Miho Hori, MSc, Toronto, ON (Presenter) Research Grant, Toshiba Corporation
Tomohito Saito, MD, PhD, Toronto, ON (Abstract Co-Author) Nothing to Disclose
Joanne Moseley, Toronto, ON (Abstract Co-Author) Royalties, RaySearch Laboratories AB; Shafiq Keshavjee, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose
PURPOSE
Lung transplantation is the destination therapy for end stage chronic lung disease. Chronic lung allograft dysfunction (CLAD) limits the 5-year survival after lung transplantation (Tx). It is important to diagnose and distinguish the CLAD subtypes: Bronchiolitis Obliterans Syndrome (BOS) and Restrictive Allograft Syndrome (RAS). CLAD diagnosis with conventional techniques is limited, deformable registration provides qualitative and quantitative assessment of focal and global lung function. The purpose of this study is to determine the utility of using deformable registration CT data in the diagnosis of CLAD.

METHOD AND MATERIALS
A retrospective study of 30 patients post bilateral Tx followed with PFT and low dose lung CT (conventional tests) scheduled every 3mths. The study cohort had confirmed diagnosis, based on conventional tests and pathology: No-CLAD (n=10); BOS (n=10); RAS (n=10). The CT data was assessed qualitatively and quantitatively using finite element based image registration software (MORFEUS) to document changes in lung deformation between baseline and disease onset. Surface vector analysis was performed and indicated expansion (+) or contraction (-) of regional lung volume; the mean and percentage change for inward and outward vectors was compared using the Mann-Whitney U test.

RESULTS
Qualitative analysis: Upper lobe deformation; No-CLAD 20% (2/10); BOS 20% (2/10) and RAS 70% (7/10). Quantitative analysis: mean vector change from baseline (% change from baseline); for the right (R) and left (L) lungs. No-CLAD: R= +4.0mm (55%); L= +3.2mm (59%). BOS: R= +3.8mm (61%); L= +3.4mm (57%). RAS: R= -8.6mm (71%); L= -9.9mm (74%).

CONCLUSION
Deformable lung registration can quantitatively detect and distinguish between No-CLAD/BOS and RAS.

CLINICAL RELEVANCE/APPLICATION
Lung deformation analysis is a promising technique in evaluating the subtypes of CLAD and in assessing regional change when conventional techniques are limited.
**CHS-THA**

**Chest Thursday Poster Discussions**

Thursday, Dec. 3 12:15PM - 12:45PM Location: CH Community, Learning Center

AMA PRA Category 1 Credit ™: .50

**FDA** Discussions may include off-label uses.

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**Participants**

Carol C. Wu, MD, Houston, TX (Moderator) Author, Reed Elsevier

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**Sub-Events**

**CH238-SD-THA1**  
**Intraoperative Ultrasound-guided Resection of Subsolid Pulmonary Nodules**  
Station #1

**Participants**

Ivan Vollmer, MD, Barcelona, Spain (Presenter) Nothing to Disclose
Lara Pijuan, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Rafael Aguilo, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Mariana N. Benegas Urteaga, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Angel Gayete Cara, MD, PhD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Marcelo Antonio Sanchez Gonzalez, MD, Barcelona, Spain (Abstract Co-Author) Research Grant, F. Hoffmann-La Roche Ltd

**PURPOSE**

To evaluate the utility of ultrasonography for guiding the resection of subsolid pulmonary nodules. To evaluate the correlation between CT, ultrasound, and pathological images of subsolid pulmonary nodules.

**METHOD AND MATERIALS**

We resected 14 subsolid nodules (8 non-solid, 6 partial solid) in 12 patients (6 men, 6 women) with mean age of 63.5 years (range 54-72 years). 8 patients had previous history of cancer. All nodules were detected in chest CT scans performed for follow-up of non-thoracic malignancies or in patients with suspicion of non-neoplastic lung disease.

**RESULTS**

We performed ultrasound-guided resection of all 14 nodules, practicing 2 lobectomies, 8 segmentectomies, and 2 atypical resections. In all cases ultrasound was able to detect the lesions after complete collapse of the lung. There were no complications of the procedure. The mean diameter of the lesions were: 11.5 mm by CT, 11.36 mm by US, and 10.21 mm by pathology. Also, we found good correlation between distinctive findings in our subsolid nodules as solid part, bronchus inside the nodules or cavitation. Pathological results were: 5 adenocarcinomas in situ, 1 focal interstitial fibrosis, 2 atypical adenomatous hyperplasia, 2 minimally invasive adenocarcinoma, 3 invasive adenocarcinoma, and 1 ciliated muconodular papillary tumour.

**CONCLUSION**

Ultrasound is a good method for guiding the resection of subsolid nodules and have a good correlation with CT and pathology.

**CLINICAL RELEVANCE/APPLICATION**

Intraoperative ultrasound can help to detect nonsolid pulmonary nodules during surgery without complications associated to others techniques as how-wire marking (pneumothorax, pain, dislodgment...) or lipiodol or radiotracer marking (pneumothorax, and diffusion of the marker).

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**CH239-SD-THA2**  
**Evaluation of Clinical Usefulness of Super-High-Resolution CT with 0.25-mm Slice Thickness * 128 Detector Rows in the Chest**  
Station #2

**Participants**

Hirobumi Nagasawa, RT, Tokyo, Japan (Presenter) Nothing to Disclose
Masahiro Suzuki, Chuo-Ku, Japan (Abstract Co-Author) Nothing to Disclose
Keichii Nomura, MS, Kashiwa, Japan (Abstract Co-Author) Nothing to Disclose
Tomohiko Aso, RT, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Shinsuke Tsukagoshi, MS, Otawara, Japan (Abstract Co-Author) Employee, Toshiba Corporation
Ryutarou Kakinuma, MD, PhD, Chuo-Ku, Japan (Abstract Co-Author) Nothing to Disclose
Noriyuki Moriyama, MD, PhD, Chuo-Ku, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate the clinical usefulness of chest images acquired by Quarter-pixel Detector CT (QDCT) in which the channel pitch and row pitch of the detector is both one-half that of conventional MDCT.

**METHOD AND MATERIALS**

Basic evaluation using phantoms and interpretation evaluation using images of lung cancers were performed to assess the clinical usefulness of QDCT as compared against conventional Multi-Detector row CT (MDCT).

**Method 1 Basic evaluation**

Bronchial phantoms (internal diameters: 0.8, 0.6, 0.47 mm) were scanned and the internal diameters were calculated based on the FWHM values of each profile. The scan conditions were 120 kV, 0.25 mm * 128 rows, 200 mA, 1.5 s/rot., and PF 0.80 for QDCT and 120 kV, 0.5 mm * 80 rows, 200 mA, 1.5 s/rot., and PF 0.81 for MDCT. The CTDIvol values were also compared.

**Method 2 Image interpretation**
evaluationThe subjects were 10 patients with ground-glass opacities from among 108 patients who underwent lung cancer CT screening. The scan conditions were the same as for method 1. The detectability of the peripheral blood vessels and bronchi at 160 locations (800 datasets in total) was visually evaluated by 5 pulmonologists (blinded and working independently) using a 5-grade scale. The Wilcoxon rank sum test was used for analysis.

RESULTS
Results 1 Basic evaluationThe calculated internal diameters (mm) obtained from QDCT and MDCT images were 0.83 and 1.24, respectively, for a true value of 0.8, 0.63 and 0.77 for a true value of 0.6, and 0.51 and measurement impossible for a true value of 0.47. The CTDV0l (mGy) values were 24.8 and 29.4, respectively.
Results 2 Image interpretation evaluationThe mean (median) values of the results of 5-grade assessment were 3.66 (4.0) ± 0.84 for QDCT and 2.89 (3.0) ± 0.75 for MDCT. The Wilcoxon rank sum test results showed P=0.000 (<0.05), indicating superior detectability for QDCT.

CONCLUSION
The QDCT provides super-high-resolution images that are useful for diagnosis in the chest with the same exposure dose as MDCT.

CLINICAL RELEVANCE/APPLICATION
Improving the spatial resolution of CT allows more accurate measurement and clearer visualization of small structures in the chest, which should lead to new imaging techniques for improved diagnosis.

CH240-SD-THA3 Automatic Segmentation of Pulmonary Nodules: Evaluation using the LIDC/IDRI Database

Participants
Djamal Boukerroui, PhD, Oxford, United Kingdom (Presenter) Employee, Mirada Medical Ltd
Lyndsey C. Pickup, MEng, DPhil, Oxford, United Kingdom (Abstract Co-Author) Employee, Mirada Medical Ltd
Timor Kadir, Oxford, United Kingdom (Abstract Co-Author) Employee, Mirada Medical Ltd

PURPOSE
An end-goal of lung nodule segmentation is the measurement of volume and doubling time when multiple time scans are available. Therefore, segmentation reproducibility is very important. We report the performance of a number of automatic segmentation methods and compared to inter-reader variability.

METHOD AND MATERIALS
We have developed three segmentation methods that operate from a single click-point initialisation. All are based on a model of nodule intensity followed by an automatic post processing in order to separate the nodules from surrounding tissues. We used the publicly available database LIDC/IDRI for testing. In the 1,012 available scans, we selected 884 nodules that were segmented by 4 radiologists. We also excluded nodules where there was disagreement on the type of nodule by selecting only nodules that are classified as solid at least by 3 experts. "Ground truth" segmentation were created using the STAPLE algorithm on the remaining 706 nodules. Dice overlap measures were used to assess the accuracy of the result.

RESULTS
Good segmentation results are obtained by our automatic methods. For the best single threshold method, the first quartile, median, and third quartile were, Q1=76.4%, Q2=83.5% and Q3=89.3%. The values for the automatic adaptive thresholding method, were Q1=77.9%, Q2=84.6% and Q3=89.7%. The values for the third method, based on a local level-set approach were, Q1=78.1%, Q2=84.4% and Q3=88.9%. The variability of manual contours was assessed by comparing one expert against all 3 others. The values for the manual contours were Q1=72.8%, Q2=79.8% and Q3=85.4%.

CONCLUSION
Automatic segmentation methods performed well compared to the "Ground truth" while a greater degree of variability was observed between the expert contours when compared to each other. We also found that the automatic post processing is the critical step in obtaining accurate results.

CLINICAL RELEVANCE/APPLICATION
Measurement of volume and change in volume are important factors when assessing nodules longitudinally. Automatic segmentation methods can offer significant time savings over manual segmentation whilst providing high levels of consistency.

CH241-SD-THA4 Which is the Appropriate b Value Selection at Chest Computed Diffusion-Weighted Imaging for Improving Pulmonary Nodule/Mass Differentiation?

Participants
Hisanobu Koyama, MD, PhD, Kobe, Japan (Presenter) Nothing to Disclose
Yoshishita Ohno, MD, PhD, Kobe, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
Shinichiro Seki, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Masao Yui, Otawara, Japan (Abstract Co-Author) Employee, Toshiba Corporation
Katsusuke Kyotani, RT, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Takeshi Yoshikawa, MD, Kobe, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation
Sumiaki Matsumoto, MD, PhD, Kobe, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation;
Hitoshi Yamagata, PhD, Otawara, Japan (Abstract Co-Author) Employee, Toshiba Corporation
Kazuro Sugimura, MD, PhD, Kobe, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group

PURPOSE
The QDCT provides super-high-resolution images that are useful for diagnosis in the chest with the same exposure dose as MDCT.
Computed diffusion-weighted imaging (cDWI) is the newly proposed method and to generate DWI with arbitrary b values. Therefore, the choice of b value is clinically important, and may have an influence to diagnostic performance of cDWI. The purpose of this study is to determine an appropriate b value selection for improving pulmonary nodule/mass differentiation at chest cDWI.

**METHOD AND MATERIALS**

One hundred seventy-six patients (121 men and 55 women, mean age: 69.5 years) with 208 pulmonary nodules/masses (mean diameter: 29.5 mm) underwent DWI with b values at 0, 500 and 1000 s/mm² by 1.5 T MR system. According to pathological and/or follow up examinations, these pulmonary lesions were divided into malignancy (n=166) and benign (n=42). By our propriety software, cDWIs with six different b values from 600 (cDWI600) to 1600 (cDWI1600) s/mm² were computationally generated from actually acquired DWIs (aDWI) with b values at 0 and 500 s/mm². Then, lesion to spinal cord ratio (LSR) on each DWI was calculated for quantitative diagnosis of pulmonary lesion. For differentiation from malignant and benign, the feasible threshold value was determined by ROC based positive test, and differentiation capabilities of each cDWI and aDWI were determined. Finally, differentiation capabilities were compared by McNemar's test.

**RESULTS**

Differentiation capability of cDWI800 was highest (sensitivity [SE], 77.7% [129/166]; specificity, 73.8% [31/42]; and accuracy [AC], 76.9% [160/208]) in this study. In addition, SE of cDWI800 was significantly higher than those of cDWI600 (SE, 74.1% [123/166], p<0.05), cDWI1400 (SE, 71.1% [118/166], p<0.05), and cDWI1600 (SE, 68.7% [114/166], p<0.05), and AC of cDWI800 was also significantly higher than that of cDWI1600 (AC, 69.7% [145/208], p<0.05). On the other hand, there were no significant difference of differentiation capability among cDWI800, cDWI1000, cDWI1200 and aDWI1000 (p>0.05).

**CONCLUSION**

On diagnosis of pulmonary nodules/masses, cDWI would be better to be generated from aDWI with 500s/mm² as b value at 800-1200s/mm², and considered at least as valuable as aDWI with 1000 s/mm².

**CLINICAL RELEVANCE/APPLICATION**

On diagnosis of pulmonary nodules/masses, computed DWI would be better to be generated from actually acquired DWI with 500s/mm² as b value at 800-1200s/mm², and considered at least as valuable as actually acquired DWI with 1000 s/mm².

**CH242-SD-THAS**

**Volume of Normal Lung on CT Correlates with Right Ventricular Function and the Prognosis of Patients with Chronic Fibrosing Interstitial Pneumonitis**

**Station #5**

**Participants**

Tae Iwasawa, MD, PhD, Yokohama, Japan (Presenter) Travel Grant, The joint project from JSPS/CAPES under the Japan-Brazil Research Cooperative Program and Grants-in-Aids for Scientific Research
Shingo Kato, Boston, MA (Abstract Co-Author) Nothing to Disclose
Akimasa Sekine, Yokohama, Japan (Abstract Co-Author) Nothing to Disclose
Tomohisa Baba, MD, Yokohama, Japan (Abstract Co-Author) Nothing to Disclose
Takashi Ogura, MD, Yokohama, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Impairment of right ventricular (RV) function is common in patients with chronic fibrosing interstitial pneumonitis (chronic fibrosing IP). The correlations between the findings on computed tomography (CT) and RV function measured on magnetic resonance imaging (MRI) were evaluated, and their prognostic significance was assessed.

**METHOD AND MATERIALS**

Consecutive cardiac MRIs from 2011 to 2013 of patients with chronic fibrosing IP who were followed for at least 6 months were analyzed. Patients with collagen disease, pulmonary arterial thromboembolism, previous thoracic surgery, cardiomyopathy, severe valvular heart disease, and known coronary heart disease were excluded. MRI was acquired with a 1.5-T unit, and the RV ejection fraction (RVEF) was measured on axial cine MRI. Multi-detector CT images with slice thickness of 0.5 mm obtained within 6 months of MRI were also analyzed. The volume of each CT pattern (Normal, Ground-glass opacity, Consolidation, Emphysema, and Fibrosis) was measured using a custom-developed system based on histograms of pre-designated samples. All lung volumes were expressed as percent of total CT lung volume. RVEF and each CT volume were compared using Spearman's correlation coefficients. Cox regression analysis was used to examine the prognostic significance of these parameters.

**RESULTS**

A total of 55 consecutive patients (44 males, 11 females; mean ± SD age, 70.0 ± 8.0 y) with chronic fibrosing IP were included. In 22 patients, the pathological pattern was confirmed by surgical biopsy. The median interval between CT and MRI was 1 month. The median clinical follow-up period was 26 months (range, 4-55 months). The median RVEF was 51.2% (range, 30.0-63.6%). The median clinical follow-up period was 26 months (range, 4-55 months). The median RVEF was 51.2% (range, 30.0-63.6%).

The volume of each CT pattern was compared and the patients were divided into normal (N), ground-glass opacity (GG), consolidation (CO), emphysema (EM), and fibrosis (FI). The correlations between the findings on computed tomography (CT) and RV function measured on magnetic resonance imaging (MRI) were evaluated, and their prognostic significance was assessed.

**Multivariate Cox regression analysis identified Normal CT volume as a significant predictor of overall survival (p=0.001).**

**CONCLUSION**

Decreased normal lung volume on CT was correlated with RV systolic dysfunction and the prognosis of patients with chronic fibrosing IP.

**CLINICAL RELEVANCE/APPLICATION**

Quantification of the normal lung volume on CT is recommended for the patients with chronic fibrosing IP, because it was correlated with RV systolic dysfunction and the prognosis.

**CH243-SD-THA6**

**Patterns of Metastasis and Recurrence in Thymic Epithelial Tumors: Longitudinal Imaging Review in Correlation with Histologic Subtypes**

**Station #6**

**Participants**

Iwasawa, Takashi, Yokohama, Japan (Presenter) Travel Grant, The joint project from JSPS/CAPES under the Japan-Brazil Research Cooperative Program and Grants-in-Aids for Scientific Research
Tomohisa Baba, Boston, MA (Abstract Co-Author) Nothing to Disclose
Sekine, Akimasa, Yokohama, Japan (Abstract Co-Author) Nothing to Disclose
Ogura, Tae, Yokohama, Japan (Abstract Co-Author) Nothing to Disclose
Kato, Takashi, Yokohama, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

The purpose of this study is to determine an appropriate b value selection for improving pulmonary nodule/mass differentiation at chest cDWI.
PURPOSE

Determine the patterns of metastasis and recurrence in thymic epithelial tumors based on the review of the longitudinal imaging studies, and correlate the patterns with WHO histologic classifications.

METHOD AND MATERIALS

The study included 77 patients (39 males, 38 females, median age: 55) with pathologically-confirmed thymomas (n=62) and thymic carcinomas (n=15), who were followed with cross-sectional imaging after surgery. All cross-sectional imaging studies during the disease follow-up, consisting of a total of 835 scans (median number of scans per patient: 8) for the entire cohort, were retrospectively reviewed to identify metastasis or recurrence. The anatomic sites of involvement and the time of involvement measured from surgery were recorded and correlated with histologic subtypes.

RESULTS

Metastasis or recurrence was noted in 24 (31%) of the 77 patients. The patients with metastasis or recurrence were significantly younger than those without (median age: 46 vs. 60, respectively; p<0.001). Metastasis or recurrence was more common in thymic carcinomas than thymomas (p=0.002), and was more common in high-risk thymomas (B3 and B2) than in low risk thymomas (B1, AB, A)(p=0.02). The most common site of involvement was pleura (17/24, 71%), followed by lung (9/24, 38%) and thoracic lymph nodes (9/24, 38%). Abdomino-pelvic involvement was noted in 12 patients, most commonly in the liver (n=8). Lung parenchymal metastasis was more common in thymic carcinomas than thymomas (p<0.001). Time from surgery to the development of metastasis or recurrence was shortest in thymic carcinoma, followed by high-risk thymomas, and was longest in low-risk thymoma (median time in months: 25.1, 68.8, and not reached, respectively; log-rank p=0.0015).

CONCLUSION

The patterns of metastasis and recurrence of thymic epithelial tumors differ significantly across histological subgroups, with thymic carcinomas more commonly having metastasis with shorter length of time after surgery. The knowledge of different patterns of tumor spread may contribute to further understanding of biological and clinical behaviors of these tumors.

CLINICAL RELEVANCE/APPLICATION

The knowledge of the distinct patterns of metastasis and recurrence according to the histologic subtypes of thymic epithelial tumors contributes to optimize radiologic evaluation and follow-up.
PURPOSE
High contrast native lung tissue imaging is difficult due to the low proton density and high susceptibility in lungs. T2* of lung tissue changes with change in lung tissue density due to pulmonary disease. Here, we studied the feasibility of 3D breath-hold (BH) high contrast complete native lung tissue imaging and quantitative T2* mapping using dual echo stack of radials MRI.

METHOD AND MATERIALS
An optimized 3D dual echo stack of radials sequence was used for imaging the entire lung in a single breathhold along the coronal and axial directions in 10 healthy human volunteers at end expiration on a 3T scanner. The following scan parameters were employed: FOV = 38 cm, resolution: 3×3×9 mm3, TR/TE1/TE2 = 4.2/0.09/1.6 ms, SENSE (z) = 2 (coronal). Scan time ranged between 18-23 seconds. T2* was calculated from the ratio of the two images acquired at different TEs while subtraction of the two consecutive echo images provided suppression of longer T2 species. Post-processing was performed to separate the lung tissue from vessels and surrounding wall using thresholding to yield T2* in lung parenchyma.

RESULTS
The mean/std of T2* in the entire lung obtained from coronal imaging of the 10 subjects was 0.765±0.03ms while from axial imaging was 0.77±0.024ms. The coefficient of variation (CV = 100 x std/mean) was 3.9% and 3%, respectively. There was no significant difference in the T2* values obtained from coronal and axial scans (p=0.64). Subtraction of the two echo images provided suppression of longer T2 species and clearer visualization of the lung parenchyma.

CONCLUSION
The excellent agreement between results from coronal and axial scans allows for combining the two scans to provide accurate T2* maps with isotropic 3mm (effective) resolution. The low CV indicates good agreement of lung T2* values in healthy volunteers and can allow differentiation from patients with altered lung T2* due to pulmonary fibrosis or emphysema. Thus, high native contrast and quantitative complete lung imaging can be performed in two breathholds. BH imaging at the resolution used provided sufficient SNR and motion robustness to determine accurate T2* values.

CLINICAL RELEVANCE/APPLICATION
T2* mapping and dual echo subtracted images could provide quantitative and complimentary information regarding lung tissue changes in fibrosis or emphysema. Here we describe and evaluate a single breathhold complete chest coverage 3D MRI sequence.
RESULTS
As the lower lobes slides up to the middle lobe and lingula during the expiration, the up and down movement of the vessels of the lower lobe is larger than those of the middle lobe and lingula. Since the vasculature of the middle lobe and lingula shows the same movement of right atrium and left ventricle, the right and left pulsatory movement of the vasculature of the middle lobe and lingula is differentiated from the smaller pulsatory movement of the lower lobe. Alpha blending of thick slab ray sum with vascular segmented images prevented the small vasculatures from being obscured and preserved its depth relationship with the pulmonary vasculature. The A6 and V6b of the right lowerlobe are identified 84%, 70% and those of the left lower lobe are identified 64%, 31%. The A4, A5, V4 and V5 of the middle lobe are identified 64%, 50%, 86% and 78% and those of lingula are identified 92%, 92%, 86% and 71%.

CONCLUSION
Comparing the reference images obtained from the MDCT data, it is possible to identify the overlapping vessels of the hilum by using two kinds of movement: the up and down respiratory movement and the right and left cardiac pulsatory movement.

CLINICAL RELEVANCE/APPLICATION
As the identification of each vessel is useful in the analysis of a chest radiograph, FPD-SR is recommended as a substitute for routine chest radiographic examination.

CH246-SD-THB3  Differential Diagnosis in Mediastinal Solid Tumors using Volumetric Perfusion CT with Time-density Curve Analysis
Station #3
Participants
Torahiko Yamanouchi, Fukuoka, Japan (Presenter) Nothing to Disclose
Satoshi Kawanami, MD, Fukuoka, Japan (Abstract Co-Author) Research Grant, Bayer AG; Research Grant, Koninklijke Philips NV
Takeshi Kamitani, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Yuzo Yamasaki, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Yuko Tanaka, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Michinobu Nagao, MD, Fukuoka-City, Japan (Abstract Co-Author) Research Grant, Bayer AG Research Grant, Koninklijke Philips NV
Hidetake Yabuuchi, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Hiroshi Honda, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
To clarify the hemodynamic characteristics of mediastinal solid tumors using volumetric perfusion CT.

METHOD AND MATERIALS
We investigated 25 consecutive patients with mediastinal solid tumor (19 thymic epithelial tumors, four germ cell tumors, and two sarcomas, 17 males, eight females, ages 51.0 ± 12.6yrs). All volumetric data were acquired using 320-detector row CT with intravenous iodinated contrast media (24.5mgI/sec/kg for 10sec, followed by 20mL saline bolus). We applied single-input maximum slope method at the region of interest in the aorta and the target tumor. The maximum slope of each target tumor was calculated and perfusion color maps were produced. The correlation between radiological and pathological results was obtained in all cases. Among the thymic epithelial tumors, we also compared the WHO histological classification subgroups (AB, B1, B2, and C).

RESULTS
The mean arterial perfusion of the 19 thymic epithelial tumors was 85.1±49.8 (mL/min/100 mL), which was significantly higher than that of other tumors: 36.5±26.4 (mL/min/100 mL) (P<0.05). Among the WHO histological classification subgroups of thymic epithelial tumors, the mean arterial perfusion values were as follows: AB = 103.9±61.9; B1 = 64.8±13.2; B2 = 82.6±27.6; C = 80.3±24.7 (mL/min/100mL), showing no significant differences among the subgroups.

CONCLUSION
Almost all 19 of the thymic epithelial tumors demonstrated a rapid perfusion slope. The hemodynamic characteristics of thymic epithelial tumors showed no correlation with the subtypes of histological classification, but a significant increase was observed in the maximum slope of the thymic epithelial tumors compared to the other mediastinal solid tumors.

CLINICAL RELEVANCE/APPLICATION
Mediastinal CT perfusion analyses can contribute additional information to the differentiation of mediastinal solid tumors, especially thymic epithelial tumors with low to moderate peak enhancement. The improved differentiation may avoid unnecessary CT-guided biopsies prior to surgical resection.

CH247-SD-THB4 The Moment of Recognition: Method and Analysis of Gaze Behavior in the Search for Lung Nodules in CT Scans
Station #4
Participants
Geoffrey D. Rubin, MD, Durham, NC (Abstract Co-Author) Consultant, Fovia, Inc; Consultant, Informatics in Context, Inc; Research Consultant, General Electric Company;
Brian Harrawood, MS, Durham, NC (Abstract Co-Author) Nothing to Disclose
Sandy Napel, PhD, Stanford, CA (Abstract Co-Author) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc;
Scientific Advisor, EchoPixel, Inc;
Justus E. Roos, MD, Durham, NC (Abstract Co-Author) Nothing to Disclose
Kingshuk Choudhury, PhD, Durham, NC (Abstract Co-Author) Nothing to Disclose
Lucas Eber, MD, Durham, NC (Presenter) Nothing to Disclose

PURPOSE
To understand the relationship between the distance from a reader's gaze point to visible lung nodule and the momentary likelihood
In asthmatics at risk of severe outcomes.

PDV measured via HP gas MRI (He or Xenon) may provide a valuable prognostic tool for identifying and guiding therapy interventions.

CONCLUSION

0.61). In asthmatic subjects, PDV was associated with ER (p = 0.004, ROC area under curve (AUC) = 0.69), with HOSP (p = 0.12, AUC = 0.62), as was FEV1/FVC %P (ρ = -0.54, p < 10^-4). In asthmatic subjects, PDV was associated with RA-856 HU (ρ = 0.26, p = 0.04), and with spirometric measures of forced expiratory volume in one second (FEV1) percent predicted (%P) (p = -0.32, p = 0.001) and FEV1 divided by forced vital capacity (FEV1/FVC) %P (p = -0.54, p < 10^-4). In asthmatic subjects, PDV was associated with ER (p = 0.004, ROC area under curve (AUC) = 0.69), with HOSP (p = 0.0002, AUC = 0.78), and with differences in treatment intensity (p = 0.0006). For comparison, FEV1 %P was tested as a predictor of ER (p = 0.59, AUC = 0.53) and HOSP (p = 0.12, AUC = 0.62), as was FEV1/FVC %P (p = 0.04, AUC = 0.64; p = 0.16, AUC = 0.61).

CONCLUSION

PDV measured via HP gas MRI (He or Xenon) may provide a valuable prognostic tool for identifying and guiding therapy interventions in asthmatics at risk of severe outcomes.
Correlation between Functional and Anatomical Characteristics of NSCLC in Patients Undergoing Whole-Body MRI with Diffusion-weighted Imaging and PET-CT before Surgery

Station #6

Participants

Mario Ciliberto, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Lucio Calandriello, MD, Rome, Italy (Presenter) Nothing to Disclose
Anna Rita Larici, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Annemilia del Ciello, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Lucia Leccisotti, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Alessandro Giordano, Roma, Italy (Abstract Co-Author) Nothing to Disclose
Lorenzo Bonomo, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE

To assess the possible correlation between functional parameters, namely apparent diffusion coefficient (ADC) derived by whole body MRI (WB-MRI) with diffusion-weighted imaging (DWI), and metabolic volumetric and non-volumetric parameters (SUV, MTV, TLG) derived by PET-CT, and longest diameter (LD) of primary tumor in NSCLC patients.

METHOD AND MATERIALS

Twenty-two patients with histologically proven NSCLC (19 adenocarcinoma, 3 squamous-cell carcinoma; pathological stage: Ia–IIa non-N2) underwent WB-MRI with DWI (b values= 0–1000 s/mm²) and PET-CT prior to surgery. A nuclear medicine physician calculated SUV (SUVmax and SUVmean), MTV and TLG and a radiologist calculated ADC (ADCmean and ADCmin) of primary tumors. ADCmean was assessed as the mean value of all the ADC values calculated on every slide displaying the tumor while ADCmin represented the minimal value of all pixels detected on the whole lesion volume. LD of the primary tumor was measured on the pathological specimen. Correlation between PET parameters, ADC and LD was assessed with Pearson's correlation coefficient.

RESULTS

A significant negative correlation was found between ADCmin and SUVmax (r=−0.59; p=0.003), ADCmin and SUVmean (r=−0.61; p=0.002), ADCmean and TLG (r=0.61; p=0.002). LD significantly correlated with ADCmin (r=−0.49; p=0.019), SUVmax (r=0.53; p=0.01), SUVmean (r=0.49; p=0.018), MTV (r=0.78; p<0.001) and TLG (r=0.83; p<0.001).

CONCLUSION

The correlation between ADCmin and PET parameters corroborates the existence of a relationship between tumor glucose metabolism and tumor cellularity which might improve the characterization and the comprehension of biological properties of NSCLC. The correlation between functional parameters and lesion dimension highlights the presence of a relationship between morphological and functional characteristics of NSCLC.

CLINICAL RELEVANCE/APPLICATION

WB-MRI with DWI provides functional information comparable to PET-CT with possible implications in the assessment of response to therapy and prognosis in NSCLC patients.
**SPSH55**

**Hot Topic Session: Cancer Screening: Breast Tomosynthesis, CT Colonography, Lung Cancer**

Thursday, Dec. 3 3:00PM - 4:00PM Location: E451A

**BR**  **CH**  **GI**  **CT**  **OI**

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

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**Participants**

Paul P. Cronin, MD, MS, Ann Arbor, MI *(Moderator)* Nothing to Disclose

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**Sub-Events**

**SPSH55A**  **Imaging in Breast Cancer Screening**

Participants

Elizabeth S. Burnside, MD, MPH, Madison, WI *(Presenter)* Stockholder, NeuWave Medical Inc

**LEARNING OBJECTIVES**

1) To review the foundation and evolution of scientific investigation that supports evidence-based breast cancer screening. 2) To critically evaluate the methodologies currently being used to construct screening guidelines. 3) To understand the outcomes by which successful screening programs are measured. 4) To review and assess the current controversies of breast cancer screening.

**ABSTRACT**

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**SPSH55B**  **Imaging in Lung Cancer Screening**

Participants

Ella A. Kazerooni, MD, Ann Arbor, MI *(Presenter)* Nothing to Disclose

**Honored Educators**

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Ella A. Kazerooni, MD - 2014 Honored Educator

**SPSH55C**  **Imaging in Colon Cancer Screening**

Participants

David H. Kim, MD, Madison, WI *(Presenter)* Consultant, Viatronix, Inc; Co-founder, VirtuoCTC, LLC; Medical Advisory Board, Digital ArtForms, Inc; Stockholder, Cellectar Biosciences, Inc

**LEARNING OBJECTIVES**

1) Be able to compare/contrast image-based screening by CT colonography (CTC) against the other screening options for colorectal cancer. 2) Be familiar with the major trials that establish the performance profile of CTC. 3) Understand the rationale for the selective polypectomy strategy at CT colonography.
Participants
Jeanne B. Ackman, MD, Boston, MA (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) To learn what it takes to build a thoracic MR practice. 2) To understand how to create simple mediastinal, pleural, lung, and pulmonary MRA protocols which answer most clinical questions. 3) To become more comfortable interpreting these various types of thoracic MRI.

ABSTRACT
Despite MRI's long-demonstrated advantages in tissue contrast and diagnostic specificity and its absence of radiation, MRI remains an underutilized imaging modality in the thorax. The aim of this course is to cover the basics needed to build a thoracic MR practice and to perform and interpret thoracic MRI, whether of the thymus, the rest of the mediastinum, the pleura, or the lung. Fast and robust examination protocols, applicable and ready to use on currently available MR equipment, will be suggested. Clinical indications for thoracic MRI and commonly encountered lesions will be discussed. Performance and interpretation of pulmonary MRA for pulmonary embolism detection will also be covered.

Sub-Events

RC701A  Non-Vascular Thoracic MRI: Building a Clinical Program

Participants
Jeanne B. Ackman, MD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
To understand the challenges, multifaceted approach, and benefit of building a clinical non-vascular thoracic MR practice.

ABSTRACT
There are many challenges to building a clinical non-vascular thoracic MR practice, many of which can be surmounted by: 1) identifying a knowledgeable and capable radiologist within your practice to take this initiative and build a team of interested colleagues to move forward2) educating technologists, referring physicians, trainees, and colleagues as to its performance, interpretation, and benefits,3) building a few simple MR protocols which can answer most clinical questions,4) regularly sharing MR cases to enhance the knowledge of your group,5) patience and recognition of the fact that those in your group insufficiently trained in thoracic MRI may not at first be comfortable with protocling, interpreting, and recommending these examinations; these colleagues will need to be convinced of MR's benefits and, if interested, will be open to learning what they need to learn to maximize the benefits that can be achieved for patient care as a result of MR's higher tissue contrast, diagnostic specificity, and lack of ionizing radiation.

RC701B  Basic Thymic MRI

Participants
Jeanne B. Ackman, MD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
The attendee will learn about basic Thymic MR protocoling and interpretation which will help distinguish: 1) Thymic cysts from solid thymic lesions. 2) Normal thymus and thymic hyperplasia from thymic tumors. 3) Low-risk thymomas from high-risk thymomas and lymphoma. 4) Invasive from non-invasive thymic masses.

ABSTRACT
It can be difficult by CT to distinguish between thymic cysts and solid lesions, thymic hyperplasia from thymic tumors, and thymoma from lymphoma. The purpose of this brief lecture is to cover the basics of thymic MR protocoling and interpretation in an effort to achieve these objectives and prevent unnecessary thymectomy.

RC701C  Practical Mediastinal and Pleural Imaging

Participants
Constantine A. Raptis, MD, Saint Louis, MO (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Discuss the key components of an MRI protocol tailored to investigate mediastinal pathology. 2) Review the imaging findings of commonly seen mediastinal pathologies which can be characterized with MRI. 3) Identify sequences which can be helpful in investigating pleural abnormalities. 4) Explore the MRI appearance of pleural fluid collections and soft tissue lesions.

ABSTRACT

RC701D  MRI of the Lung: Why...When...How?
LEARNING OBJECTIVES

1) to provide basic protocol suggestions for clinical lung MRI and 2) to make familiar with variations of this protocol for typical questions such as parenchymal, vascular or malignant diseases of the lung.

ABSTRACT

Frequently, customized lung imaging protocols are already available with the MR equipment. If not, setting up a protocol tree for lung imaging with MRI is straightforward using standard sequences for different pathologies: T2-w. fast spin echo (FSE) for infiltrates/soft lesions (1), T2-w. FSE with fat suppression for lymph nodes/bone lesions (2), Steady state free precession (SSFP) for respiratory motion/lung vasculature (3) and T1-w. 3D gradient echo (3D-GRE) for nodules/masses and airways (4). Optional sequences comprise MR angiography, dynamic contrast enhancement (DCE) for lung/tumor perfusion and diffusion weighted imaging (DWI) for lymph nodes/lesion characterization. The examination times range from 15' (standard) to 25' (all options).

RC701E How to Perform and Interpret Pulmonary MRA

Participants
Mark L. Schiebler, MD, Madison, WI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Protocol a pulmonary MRA exam. 2) Determine what GBCA to use. 3) Problem solve common pulmonary MRA artifacts. 4) Correctly interpret Pulmonary MRA exams.

Active Handout: Mark L. Schiebler

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 intimal tear' 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.
Participants

LEARNING OBJECTIVES

Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

RC713A Fetal Ear and Orbital Anomalies

Participants
Maria A. Calvo-Garcia, MD, Cincinnati, OH (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify major fetal external ear and orbital malformations. 2) Apply useful search patterns during US and fetal MRI evaluation of external ear and orbital anomalies.

ABSTRACT

Assessment of the fetal face is an important part of the sonographic structural survey. Craniofacial abnormalities occur as an isolated phenomenon or in the context of syndromes, chromosomal abnormalities or environmental insults. Along the course of this presentation we will review the standard facial anatomic survey with US and the main embryologic steps involved in the development of the face. Subsequently we will discuss major malformations involving the external ear and orbits and their expected association. The presentation will include clinical cases evaluated with US and fetal MRI and their postnatal correlations.

RC713B Fetal Chest Anomalies

Participants
Teresa Victoria, MD, PhD, Philadelphia, PA, (victoria@email.chop.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss the most common fetal lung masses. 2) To identify imaging algorithms and patterns that can be helpful in reaching a diagnosis.

ABSTRACT

Accurate diagnosis of fetal lung lesions is crucial for appropriate counseling and management of the abnormalities in hand. During the lecture, the normal appearance of the fetal chest will be briefly done, in order to approach a review of the most common pulmonary lesions encountered during the fetal period. Diagnostic clues that will guide accurate diagnosis will be discussed. Rare lung lesions and their imaging diagnostic approach will also be discussed.

RC713C Fetal GI Anomalies

Participants
Erika Rubesova, MD, Stanford, CA (Presenter) Researcher, Siemens AG

LEARNING OBJECTIVES

1) After the presentation, the learners should be able to recognize the normal appearance of developing fetal bowel, as well as the most common and uncommon presentations of congenital bowel anomalies on ultrasound and MRI. They will become familiar with the specific information provided by each of the two modalities. The course will present a review of bowel anomalies of the fetus and will be illustrated by representative cases with the objective for the learners to understand the systematic approach of image analysis that can lead to the accurate diagnosis or limited list of differential diagnoses.

ABSTRACT

Diagnosis of fetal bowel anomalies usually presents on ultrasound as bowel dilatation or echogenic bowel. Echogenic bowel is associated with multiple other congenital conditions such as chromosomal anomalies, viral infections or cystic fibrosis. Dilatation of bowel may have various etiologies and systematic review of the findings including bowel wall thickening, number of distended bowel loops or the increased echogenicity of the content may help to localize bowel obstruction and narrow the list of differential diagnosis. Fetal MRI adds precious information to the ultrasound thanks the larger field of view, better tissue contrast but mainly thanks to high T1 signal intensity of meconium. Meconium is formed in the entire bowel and accumulates in the rectum that acts as a reservoir. While meconium is seen in the small bowel and colon in the second trimester, it is mainly seen in the fetal colon after 30 weeks of gestational age. Meconium acts as intraluminal contrast, similar to a barium enema. Systematic review of the distribution of meconium and analysis of the bowel caliber in comparison to normal values for gestational age helps to establish or narrow the list of differential diagnoses of fetal gastrointestinal abnormalities. In this presentation, we will review the advantages and limitations of ultrasound and MRI for diagnosis of fetal anomalies, we will discuss and illustrate, by representative cases, the approach to the most common and some more rare or atypical congenital bowel anomalies on ultrasound and MRI, in order to establish a single or short list of differential diagnoses.
Handout: Erika Rubesova

**LEARNING OBJECTIVES**

1) To learn why structured reporting is important in the practice of lung cancer screening with CT. 2) To learn what the LUNGRADS structured reporting categories are and what management is associated with each category. 3) To understand how to evaluate lung nodules for reporting in the LUNGRADS coding scheme. 4) To learn basic practice audit variables to collect and follow to evaluate a lung cancer screening CT program.

**ABSTRACT**

Lung cancer is the leading cause of cancer death in the US for both men and women, exceeding the number of deaths from cancers of the breast, colon, and prostate combined. For each of these cancers, there are well established screening tests. Screening for current and former smokers with LDCT is the only method ever proven to reduce lung cancer mortality in this high risk population and it has also been shown to be cost effective. In December 2013 the USPSTF gave lung cancer screening with CT a grade ;B; recommendation for high risk older current and former smokers. To prepare radiologists to practice lung cancer screening with CT, the ACR Committee on Lung Cancer Screening formed a working group to develop LUNGRADS, which made it #39;s version 1.0; debut in 2014. Similar to BIRADS which is in ;, LUNGRADS provides practicing radiologists with a tool to use for categorizing abnormalities found on lung cancer screening CT exams, with management recommendations for each category. In this course we will review why structured reporting and management is important in lung cancer screening CT. As a public health screening tool, performing the exams with high quality, using standardized reporting and following standard management algorithms is important to minimize overdiagnosis, overutilization of diagnostic testing and interventional procedures ranging from percutaneous biopsy to bronchoscopy and surgery. The LUNGRADS categories try to follow BIRADS approach to coding when possible, recognizing that there are differences in screening for lung cancer and breast cancer. Exams are coded as incomplete (category 0), negative; for clinically active cancer (category 1), benign (category 2), probably benign (category 3) and suspicious (category 4). Additional modifiers such as ;S; can be used for clinically significant or potentially clinically significant findings (non lung cancer). Details of using this coding system and metrics to evaluate a screening practice will be discussed.

**Sub-Events**

**RC801A Development**

Participants
Ella A. Kazerooni, MD, Ann Arbor, MI (Moderator) Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**ABSTRACT**

See course abstract

**Honored Educators**

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Ella A. Kazerooni, MD - 2014 Honored Educator

**RC801B Benign and Prob Benign**

Participants
Ann N. Leung, MD, Stanford, CA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To review the CT findings and types of abnormalities that are classified under the 'Benign' and 'Probably Benign' categories.

**RC801C Suspicious/Malignant**

Participants
James G. Ravenel, MD, Charleston, SC (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**ABSTRACT**
**RC801D  Significant Other Findings**

Participants
Reginald F. Munden, MD, DMD, Houston, TX (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
See learning objectives under main course title

**ABSTRACT**
View abstract under main course title

**RC801E  Practice Metrics and Audit**

Participants
William C. Black, MD, Lebanon, NH, (William.C.Black@Hitchcock.Org) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
View learning objectives under main course title.

**Active Handout:** William C. Black

**RC801F  Panel Discussion**

Participants
PURPOSE

BRAF mutations are found in 2% of non-small cell lung cancers (NSCLC) and are associated with responsiveness to treatment with targeted medical therapy. The purpose of this study is to identify computed tomography (CT) imaging features associated with BRAF mutation in lung cancer.

METHOD AND MATERIALS

The institutional review board approved this study. Patients presenting from 4/2/2004 - 6/3/2013 with BRAF mutated NSCLC were studied. Stage matched patients with NSCLC without BRAF mutation were used as controls. Thoracic CTs, performed at diagnosis, were retrospectively reviewed by 2 radiologists in consensus. Features assessed included: size, contour, consistency of the primary tumor, adjacent parenchymal changes (peri-lesional halo, obstructive changes, pleural tail); presence of thoracic lymphadenopathy, pleural effusion, pleural metastases and lymphangitic spread.

RESULTS

188 patients with NSCLC were included: 47 (25%) patients had a BRAF mutation. 141 (75%) had non-BRAF mutated NSCLC: 47 EGFR mutations, 47 KRAS mutations, and 47 lesions without documented mutation. In each group, 30% patients were stage 1, 6% were stage 2, 26% were stage 3 and 38% were stage 4. BRAF patients were more likely to be older (p = 0.014), male (p = 0.011) and have a smoking history (p < 0.001) when compared to EGFR patients. There were no other demographic differences between the groups. BRAF lesions were most frequently solid: 37 (79%), spiculated 22 (47%) and peripheral 37 (79%), however no imaging feature of the primary tumor was significantly different between BRAF and non-BRAF groups. Some ancillary imaging features were significantly associated with BRAF mutations when the BRAF group was compared to patients with KRAS mutations. BRAF patients were more likely to have a pleural effusion than KRAS patients 11 (23%) vs 3 (6%) p = 0.033. In addition, BRAF patients were more likely to have pleural metastases than KRAS patients 5 (11%) vs 0 (0%), p = 0.045.

CONCLUSION

On CT evaluation, NSCLC with BRAF mutation is most frequently solid, spiculated and peripheral. No feature of the primary tumor can be used to differentiate BRAF lesions from other genetically distinct forms of NSCLC.

CLINICAL RELEVANCE/APPLICATION

The results provide the first description of the radiologic characteristics of BRAF mutated lung cancer, detection of which is important to identify patients who may benefit from targeted therapy.
RESULTS

Of 115 patients, 107 were tested for KRAS mutation (81 -ve, 26 +ve) and 113 tested for EGFR mutation (85 -ve, 28 +ve). CTs were from a variety of scanners, but all were contrast-enhanced, with soft-tissue reconstructions, and slice-thickness of 1.25 - 5 mm. Mean tumor diameter was 5.7 cm (range 1.2 - 14.9 cm) and mean volume was 44.9 cm³ (range 0.4 - 338 cm³). No single feature was found to be strongly predictive for either mutation, but when collected in a Random Forest classifier these features predicted the presence of KRAS mutations with a sensitivity and specificity of 42% and 89%, respectively, with a PPV of 55% and NPV of 83%. For EGFR mutation, sensitivity and specificity were 50% and 76%, with a PPV of 41% and NPV of 82%. In total, KRAS and EGFR mutation status was correctly assessed in 76% and 70% of cases, respectively.

CONCLUSION

Texture analysis was able to correctly identify EGFR and KRAS mutation status in the majority of patients. Given the limitations of obtaining histologic samples in patients with multiple lesions or tumor heterogeneity, texture analysis may improve genotyping accuracy in these patients.

CLINICAL RELEVANCE/APPLICATION

Non-invasive genotyping with texture analysis may be of particular benefit to patients with NSCLC being considered for targeted therapy.

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Jeremy J. Erasmus, MD - 2015 Honored Educator
Brett W. Carter, MD - 2015 Honored Educator

SST03-03  Decoding Tumor Phenotype for ALK, ROS1, and RET Fusions in Lung Adenocarcinoma Using a Radiomics Approach

Friday, Dec. 4 10:50AM - 11:00AM Location: E451B

Participants

Hyun Jung Yoon, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Insku Sohn, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ho Yun Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jae-Hun Kim, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yoon-La Choi, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyeseung Kim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Kyungh S. Lee, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jhingook Kim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE

To identify the clinicoradiologic predictors of tumors for ALK (anaplastic lymphoma kinase), or ROS1 (c-ros oncogene 1), or RET (rearranged during transfection) fusion-positive in patients with lung adenocarcinoma.

METHOD AND MATERIALS

A total of 539 pathologically confirmed lung adenocarcinomas were included this retrospective study. Baseline clinicopathologic characteristics were retrieved from the patients' medical records. ALK/ROS1/RET fusion status was also reviewed. Qualitative and quantitative CT and PET imaging characteristics were evaluated. Of all clinicoradiologic features, significant features for ALK/ROS1/RET fusion-positive prediction model were extracted, and sensitivity, specificity, positive and negative predictive value were calculated for each of two discrimination tasks such as fusion-positive vs. fusion-negative tumor. We further performed comparison task between ALK vs. ROS1/RET fusion-positive tumors in clinicoradiologic features to identify clinicoradiologic similarity between the two groups.

RESULTS

Of 539 patients, 47 were ALK + lung cancers (47/539, 8.7%), 17 were ROS1/RET fusion-positive (17/539, 3.2%), and 475 were fusion-negative for those genes (475/539, 88.1%). ALK/ROS1/RET fusion status was mutually exclusive. ALK ROS1/RET fusion-positive predicting model was combination of age, tumor stage, solidity, SUVmax, mass, kurtosis, inverse variance on 3-voxel distance with a sensitivity, specificity, positive and negative predictive value of 0.73, 0.70, 0.71 and 0.69, respectively. In comparison task between ALK vs. ROS1/RET fusion-positive, all clinicoradiologic features were not significantly different except...
tumor stage, central location, SUVmax, homogeneity on 1-, 2- and 3-voxel distance, and sum mean on 2-voxel distance.

CONCLUSION
ALK/ROS1/RET fusion-positive lung adenocarcinomas possess certain clinical and imaging features, enabling good discrimination of fusion-positive from fusion-negative lung adenocarcinomas. ROS1/RET fusion-positive tumors share most clinicoradiologic features with ALK fusion-positive tumors.

CLINICAL RELEVANCE/APPLICATION
ROS1/RET + lung adenocarcinomas share clinicoradiologic characteristics with ALK + tumor and it may help to identify cases for ROS1/RET testing targeted Crizotinib even in case of ALK - condition.

SST03-04  Pseudo-progression in NSCLC with anti-PD-1/PD-L1 Antibodies: An Early Onset Event

Participants
Caroline Caramella, MD, Villejuif, France (Presenter) Nothing to Disclose
Sany Ammari, Villejuif, France (Abstract Co-Author) Nothing to Disclose
Francesco Facchinetti, Villejuif, France (Abstract Co-Author) Nothing to Disclose
Christophe Massard, Villejuif, France (Abstract Co-Author) Nothing to Disclose
Anas Gazzah, Villejuif, France (Abstract Co-Author) Nothing to Disclose
David Planchard, Villejuif, France (Abstract Co-Author) Nothing to Disclose
Benjamin Besse, Villejuif, France (Abstract Co-Author) Nothing to Disclose

PURPOSE
Immune-checkpoint inhibitors directed against PD-1 (PD-1i) or PD-L1 (PD-L1i) are emerging as a standard of care for non-small cell lung cancer (NSCLC). Radiological and clinical evaluation of their activity is still challenging. In particular, signs of disease progression can be followed by long-term disease control.

METHOD AND MATERIALS
Data from advanced NSCLC patients included in phase I-II clinical trials were retrospectively collected in a single center. CT-scans were performed every 6 weeks and at 4 weeks if progression was suspected. All CT-scans were centrally reviewed by two senior radiologists. A pseudo-progression (pseudo-PD) was defined as a Disease Progression that was not confirmed at 4 weeks evaluation (i.e. tumoral stabilization or regression).

RESULTS
From 12/2012 to 12/2014, 44 patients were included in 3 phase I (n=13) and 2 phase II (n=31) clinical trials evaluating 2 PD-1i and 2 PD-L1i. 38 patients (86%) had a stage IV NSCLC, 6 (14%) local recurrences. There were 14 Squamous Cell Carcinomas, 27 Adenocarcinomas (ADC) and 3 other histologies. PD-1i and PD-L1i were administered to 18 and 26 patients respectively. At 3 months, 20 patients had a PD confirmed at 4 weeks, 9 a Stable Disease (SD), 9 a Partial Response (PR), 2 a Complete Response (CR) and 4 a pseudo-PD. All pseudo-PD patients received a PD-L1i and had PD-L1 positive ADC. Median time to radiological or clinical PD was 33 days (range 7-81), and subsequent response was 84 days (range 40-125). Signs of PD were: 1) appearance of pre-vascular lymph nodes, 2) increase of subcutaneous lesions, 3) significant increase of lung and pleural lesions and new contralateral carcinomatous lymanghtis 4) new pulmonary lesion. Of note, either PR or CR was later achieved for all lesions but the pre-vascular lymph nodes, which remained stable. For case 3), radiological behavior was accompanied by early-onset (7 days after the first infusion) worsening of dyspnea and asthenia, followed by clinical improvement. All 4 patients are still treated, with a median time of 169 days.

CONCLUSION
Pseudo-progression during immunotherapy is frequent (9%) and has to be individualized since these patients may derive a significant benefit, despite initial radiological and sometimes clinical worsening.

CLINICAL RELEVANCE/APPLICATION
The emergence of immunotherapy leads to a new radiological paradigm in tumoral evaluation, the concept of pseudoprogression being a frequent event.

SST03-05  Benefit of Motion Correction for Blood Flow Estimates in CT Perfusion Imaging of Lung Cancer

Participants
Lisa L. Chu, MD, San Francisco, CA (Presenter) Nothing to Disclose
Robert J. Knebel, MD, Sacramento, CA (Abstract Co-Author) Nothing to Disclose
Aryan Shay, Sacramento, CA (Abstract Co-Author) Nothing to Disclose
Kai-Yin See, MD, Sunnyvale, CA (Abstract Co-Author) Nothing to Disclose
Jonathan Santos, BS, Sacramento, CA (Abstract Co-Author) Nothing to Disclose
Ramsey Badawi, PhD, Sacramento, CA (Abstract Co-Author) Stockholder, Johnson & Johnson Consultant, Toshiba Corporation
David Gandara, MD, Sacramento, CA (Abstract Co-Author) Nothing to Disclose
Friedrich D. Knollmann, MD, PhD, Sacramento, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE
CT perfusion imaging to assess the treatment response in advanced lung cancer can be compromised by respiratory motion during image acquisition. The purpose of this study was to determine whether the use of an original motion correction method can improve the reproducibility of blood flow measurements in CT perfusion imaging.

METHOD AND MATERIALS
The institutional review board approved this dual-institution prospective study. Twenty random adult patients with non-resectable...
pathologically proven non-small cell lung cancer treated with systemic therapy gave written informed consent to undergo CT perfusion of their tumor over a period of 50 seconds after intravenous contrast injection. A motion correction method which consisted of manually outlining the tumor margins and then applying a rigid manual landmark registration algorithm followed by the non-rigid Diffeomorphic Demons algorithm was applied on all CT perfusion images. The non-motion-corrected and motion-corrected images were then analyzed with commercially available perfusion analysis software which accounted for tumor dual blood supply. Two observers each performed the analysis twice, and the intra-observer and inter-observer variability of each method was assessed with Bland-Altman statistics.

RESULTS
The 95% limits of agreement of intra-observer reproducibility for observer 1 improved from -84.4%; 65.3% before motion correction to -33.8%; 30.3% after motion correction (r = 0.86 and 0.97, before and after motion correction, respectively, p < 0.0001 for both). The 95% limits of agreement of intra-observer reproducibility for observer 2 improved from -151.1%; 95.7% before motion correction to 48.5%; 36.0% after motion correction (r = 0.87 and 0.95, before and after motion correction, respectively, p < 0.0001 for both). The 95% limits of inter-observer reproducibility improved from -168.2%; 153.8% before motion correction to -17.3; 25.3% after motion correction (r = 0.65 and 0.97, before and after motion correction, respectively, p < 0.0001 for both).

CONCLUSION
The use of a motion correction method significantly improves the reproducibility of CTP estimates of tumor blood flow in lung cancer.

CLINICAL RELEVANCE/APPLICATION
Respiratory motion is an important compromising factor in measuring lung tumor blood flow. Use of an original motion correction method significantly improves reproducibility of blood flow measurements in lung cancer at perfusion CT.

SST03-06 The Value of Diffusion-weighted Imaging in differentiating Metastatic from Non-metastatic Lymph Nodes in Patients with Lung Cancer: A Meta-analysis

Friday, Dec. 4 11:20AM - 11:30AM Location: E451B

Participants
Guangxiang Chen, Luzhou, China (Presenter) Nothing to Disclose
Maohua Wang, Luzhou, China (Abstract Co-Author) Nothing to Disclose
Ting Zheng, Luzhou, China (Abstract Co-Author) Nothing to Disclose
Guangcai Tang, Luzhou, China (Abstract Co-Author) Nothing to Disclose
Fugang Han, Luzhou, China (Abstract Co-Author) Nothing to Disclose
Guojian Tu, Luzhou, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To perform a meta-analysis to evaluate the diagnostic performance of the diffusion-weighted imaging(DWI) in differentiating metastatic from non-metastatic lymph nodes in patients with lung cancer.

METHOD AND MATERIALS
Systematic and comprehensive literature searches of the PubMed, Embase, Web of Science, Cochrane Library, China Biomedicine(CBM), China National Knowledge Infrastructure(CNKI) and Wanfang databases were performed to identify eligible original studies. Methodological quality of included studies was assessed by QUADAS-2(quality Assessment of Diagnostic Accuracy Studies). Meta-analysis were performed to pool sensitivity and specificity, calculate positive likelihood ratio(PLR), negative likelihood ratio(NLR), diagnostic odds ratios(DORs) and construct summary receiver operating characteristic(SROC) curve. Homogeneity of included studies, potential threshold effect and publication bias were investigated.

RESULTS
A total of 24 studies with 24 datasets met the inclusion criterion, including 4,176 patients with a total of 12,907 lymph nodes. The pooled diagnostic sensitivity was 0.78 (95% CI: 0.74-0.81) and the pooled diagnostic specificity was 0.88 (95% CI: 0.86-0.89). The PLR, NLR, and DOR were 7.11 (95% CI: 4.39-11.52), 0.24 (95% CI: 0.18-0.33), and 31.14 (95% CI: 17.32-55.98), respectively. The overall area under the curve (AUC) was 0.90. The Deeks’ funnel plot symmetry tests revealed that no publication bias was found (bias = -0.15, P = 0.887). A notable heterogeneity was observed and patient selection, type of lung cancer, number of enrolled lymph nodes, reference standard, b value and type of scanner were the sources of heterogeneity. There was no significant threshold effect.

CONCLUSION
DWI is a valuable, noninvasive, and non-radiative MRI modality with good diagnostic performance for distinguishing metastatic from non-metastatic lymph nodes in patients with lung cancer.

CLINICAL RELEVANCE/APPLICATION
Our meta-analysis revealed that DWI is a valuable, noninvasive, and non-radiative MRI modality with good diagnostic performance for distinguishing metastatic from non-metastatic lymph nodes in patients with lung cancer. In the future, larger-scale prospective studies with respect to DWI for the diagnosis of lymph node metastasis are still necessary to evaluate and confirm its clinical value. Furthermore, the optimization of DWI acquisition protocol, standard image processing and analysis are crucial to routine clinical application of DWI in detecting lymph node metastasis in patients with lung cancer.
Higher diagnostic confidence due to better soft tissue contrast of PET/MR compared to PET/CT. Our findings suggest that diagnostic accuracy of PET/MR is comparable to PET/CT in T and N staging of MPM but has significant

CONCLUSION

PET/CT vs. PET/MR was excellent for the evaluation of T as well as N stage (ICC=0.974 and ICC=0.963, respectively). Diagnostic quality (very good to non-diagnostic; 1-4). Inter-observer agreement of T and N stages (Cohen's kappa) and interclass correlation coefficient (ICC) between PET/CT vs. PET/MR was calculated. Two independent readers evaluated images for T and N stage, confidence level (sure to unsure; 1-3) and subjective overall image quality (very good to non-diagnostic; 1-4). Inter-observer agreement of T and N stages (Cohen's kappa) and interclass correlation coefficient (ICC) between PET/CT vs. PET/MR was calculated.

RESULTS

Median follow-up was 13.9 months (range 0-48 months). Actuarial local control (Kaplan-Meier-Plot) after 1, 2, 3, 4 years was 94%, 91%, 91%, 87%, respectively. Actuarial progression-free survival after 1, 2, 3, 4 years was 73%, 62%, 45%, 29%, respectively. Local relapse / tumor persistence as detected by CT or 18F-FDG-PET/CT was found in 4 patients: directly after SBRT in one patient (sarcoma), 5, 8 and 31 months after SBRT in the other patients. Regional and/or distant out of volume progression was found in 9 patients (in 4/8 pts. with NSCLC): 0, 0, 1, 1, 3, 8, 14, 28 und 31 months after SBRT. 2 patients died during follow-up, 1 due to tumor progression (NSCLC), 1 due to pulmonary embolism (head and neck cancer). Clinical asymptomatic pneumonia 12.5%. Grade 2 toxicity 8%.

CONCLUSION

Our preliminary data show a long term local control of 87% in the treated pulmonary lesions without severe side effects. Systemic progression is a major challenge, especially in patients with NSCLC.

CLINICAL RELEVANCE/APPLICATION

Critical is the correct patient selection for this treatment option.

SST03-08 Diagnostic Accuracy of PET/MR in Comparison to PET/CT in Local Thoracic Staging of Malignant Pleural Mesothelioma

Friday, Dec. 4 11:40AM - 11:50AM Location: E451B

Participants

Katharina Martini, Zurich, Switzerland (Presenter) Nothing to Disclose
Andreas A. Meier, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Isabelle Schmitt-Opitz, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Walter Weder, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Patrick Veit-Halbach, MD, Zurich, Switzerland (Abstract Co-Author) Research Grant, Bayer AG; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, General Electric Company
Rolf A. Stahel, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Thomas Frauenfelder, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose

PURPOSE

To investigate the diagnostic accuracy of PET/MR for local staging of malignant pleural mesothelioma (MPM) compared to PET/CT.

METHOD AND MATERIALS

In a prospective clinical trial 22 consecutive patients (median age 66 years; range 40-76 years; 1 female, 21 male) with known MPM, who underwent PET/CT and PET/MR exams for either staging or re-staging/follow-up were evaluated. Imaging was conducted using a tri-modality PET/CT-MR set-up (Discovery PET/CT 690, 3T Discovery MR 750w, both GE Healthcare, Waukesha, WI, USA). Two independent readers evaluated images for T and N stage, confidence level (sure to unsure; 1-3) and subjective overall image quality (very good to non-diagnostic; 1-4). Inter-observer agreement of T and N stages (Cohen's kappa) and interclass correlation coefficient (ICC) between PET/CT vs. PET/MR was calculated.

RESULTS

Inter observer agreement for evaluation of T and N stage in PET/CT images was excellent (k=0.871 and k=0.869, respectively), whereas PET/MR imaging showed substantial agreement in T and N staging (k=0.744 and k=0.749, respectively). The ICC of PET/CT vs. PET/MR was excellent for the evaluation of T as well as N stage (ICC=0.974 and ICC=0.963, respectively). Diagnostic confidence was scored significantly higher in PET/MR compared to PET/CT (mean score = 1.16 and 1.48, respectively; p<0.001). Image quality was diagnostic for all image series.

CONCLUSION

Our findings suggest that diagnostic accuracy of PET/MR is comparable to PET/CT in T and N staging of MPM but has significant higher diagnostic confidence due to better soft tissue contrast of PET/MR compared to PET/CT.
CLINICAL RELEVANCE/APPLICATION

PET/MR can be used in local staging of malign pleural mesothelioma and has the benefit to have a higher diagnostic confidence compared to PET/CT.

**SST03-09  Locally Advanced Esophageal Squamous Cell Carcinoma: Multidetector CT for Restaging and Assessment of Treatment Response after Neoadjuvant Therapy**

Friday, Dec. 4 11:50AM - 12:00PM Location: E451B

**Participants**
- Shi Yanjie, MD, Beijing, China (Presenter) Nothing to Disclose
- Chen Ying, Beijing, China (Abstract Co-Author) Nothing to Disclose
- Xiaoting Li, Beijing, China (Abstract Co-Author) Nothing to Disclose
- Zhilong Wang, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
- Ying-Shi Sun, MD, PhD, Beijing, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To assess the diagnostic accuracy of multidetector CT (MDCT) for restaging and determine the feasibility of CT for assessment of treatment response in esophageal squamous cell carcinoma after neoadjuvant therapy.

**METHOD AND MATERIALS**
This retrospective study was approved by our institutional review board, and a waiver of informed consent was remitted. We studied 135 consecutive patients with esophageal squamous cell carcinoma who had pre-resection CT after neoadjuvant treatment. The CT staging of the patients was either T1-2 with N1-3 or T3-4 with N0-N3 without metastases before therapy according to the 7th edition of the AJCC/TNM classification. Results of CT restaging after therapy were compared with the final pathological staging. Tumor regression grade (TRG) from CT was determined by two radiologists using the Response Evaluation Criteria in Solid Tumors (RECIST) method. According to CT restaging, the patients with T0-2 and N0 (cohort 1) were defined as response, T3-4 and N1-3 (cohort 2) were defined as non-response and the response of patients with T3-4 and N0 or T0-2 and N1-3 (cohort 3) was not determined.

**RESULTS**
The accuracy of CT for T stage of patients with esophageal cancer after neoadjuvant therapy was 45% (61/135) and 47% (64/135), respectively by two radiologists (kappa value=0.718). Sensitivity and specificity were as follows: Observer 1, T0 21%/100%, T1-2 42%/96%, T3 69%/46%, T4 50%/84%; Observer 2, T0 42%/100%, T1-2 55%/93%, T3 54%/54%, T4 57%/85%. Accurate N stage were noted 59% and 56%, by two radiologists (kappa value=0.753). TRG from CT was predicted correctly in only 27% (37/135). There were no significant trends toward better survival for lower TRG (P=0.286). There was significant difference in survival among cohort 1(19 patients), cohort 2 (46) and cohort 3 (70). The survival of responding patients was better than that of non-responders.

**CONCLUSION**
Restaging by CT did not accurately predict pathological stage in esophageal squamous cell carcinoma after neoadjuvant treatment. Comparing with TN stage before and after therapy, CT can evaluate the response in about one half of patients, but the treatment response of the remaining half of patients was not determined using CT.

**CLINICAL RELEVANCE/APPLICATION**
The TNM staging of esophageal carcinoma will directly affect overall treatment options and their prognosis. Currently, chest CT is still routinely applied for restaging and monitoring treatment therapy.