Chest Radiology
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
Dreaming with Pirates and the Southern Seas: Classical Signs in Thoracic Radiology

All Day Location: CH Community, Learning Center

Participants
Ainhoa Viterí, 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.
Location of Pulmonary Nodules by Placing Harpoon Guided by Computed Tomography Prior to Surgical Resection (Videothorascopic); When and How to Do It

All Day Location: CH Community, Learning Center

Participants
Roberto Correa Soto, Salamanca, Spain (Presenter) Nothing to Disclose
Jose Maria Fernandez Garcia-Hierro, Salamanca, Spain (Abstract Co-Author) Nothing to Disclose
Maria Albert-Antequera, Castellon de la Plana, Spain (Abstract Co-Author) Nothing to Disclose
Cecilia Santos Monton, Salamanca, Spain (Abstract Co-Author) Nothing to Disclose
Maria Josefa Martin Sanchez, Salamanca, Spain (Abstract Co-Author) Nothing to Disclose
Pilar Garcia Hernandez, Salamanca, Spain (Abstract Co-Author) Nothing to Disclose

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
Soft Tissue and Chest Wall Reconstruction After Intrathoracic Oncological Resections

Participants
Sonia L. Betancourt Cuellar, MD, Houston, TX (Presenter) Nothing to Disclose
Santiago Martinez-Jimenez, MD, Kansas City, MO (Abstract Co-Author) Author, Reed Elsevier; Author, Oxford University Press
Diana M. Palacio, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Wayne L. Hofstetter, 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;
Edith M. Marom, MD, Ramat Gan, Israel (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
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 common used materials 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.

Honored Educators
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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

FDA Discussions may include off-label uses.

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.

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Santiago E. Rossi, MD - 2015 Honored Educator
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

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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.

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Ioannis Vlahos, MRCP, FRCR - 2015 Honored Educator
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

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Santiago E. Rossi, MD - 2015 Honored Educator
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 LVAD
3. 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, FRCPC, Halifax, NS (*Abstract Co-Author*) Nothing to Disclose

Daria Manos, MD, FRCPC, 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

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Ioannis Vlahos, MRCP, FRCR - 2015 Honored Educator
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

AMAPRA Category 1 Credits™: 3.75
ARRT Category A+ Credits: 4.00

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

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSP01B Parte 1/Part 1

Participants

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 Poblacion?/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 hepatocelular 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.

**SPSP01L  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 (Lung Cancer Screening)

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

AM A 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
Narinder S. Paul, MD, Richmond Hill, ON (Moderator) Research Grant, Toshiba Corporation; Research Grant, Carestream Health, 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.

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Ella A. Kazerooni, MD - 2014 Honored Educator
probability was calculated using McWilliams model 2b. Parameters were available from the screening database or scored by an low-dose (16x0.75mm, 120kVp, 40mAs) protocol, and 1mm section thickness reconstruction. For each nodule, the malignancy was randomly selected.

All 60 cancers were selected from the Danish Lung Cancer Screening Trial, in the first scan where they were visible, and 120 nodules were included.

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), and a similar trend was observed for PSNs (4.45 W vs. 3.19 M, p=0.0556). In contrast, SNs were associated with a comparable RR for both sexes (4.48 vs. 3.77, p=0.1970), along with nearly equivalent sensitivity and specificity for LC (sensitivity = 69.6% W, 68.5%M; specificity = 69.6% W, 68.5% M). Women demonstrated a higher sensitivity than men for subsolid nodules, including GGNs (26.7% W, 12.6% M) and PSNs (16.2% W, 10.2% M). PSNs had the highest PPV in both sexes (15.3% W, 12.3%, M), 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.
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 Chysanthopoulos, Providence, RI (Abstract Co-Author) Nothing to Disclose
Sarah DeMello, Providence, RI (Abstract Co-Author) Nothing to Disclose
Martin Tamemagi, 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.

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Phillip M. Boiselle, MD - 2012 Honored Educator

SSA04-05  Radiologic Findings In Patients with a Previous History Of Malignancy Undergoing Lung Cancer Screening
Sunday, Nov. 29 11:25AM - 11:35AM Location: S404CD

Participants
Darragh Halpenny, MBChB, MRCPI, New York, NY (Presenter) Nothing to Disclose
Jane D. Cunningham, FFRRCSI, New York, NY (Abstract Co-Author) Nothing to Disclose
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.
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
Geertruida H. De Bock, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose
Matthijs 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 the 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 2.1±1.8, compared to 2.3±2.2 (p=NS) in screeners 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

Sunday, Nov. 29 11:55AM - 12:05PM Location: S404CD

Participants
Joan E. Walter, BSc, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose
Marjolein A. Heuvelmans, BSc, Groningen, Netherlands (Presenter) Nothing to Disclose
Geertruida H. De Bock, Utrecht, Netherlands (Abstract Co-Author) Nothing to Disclose
Pim A. De Jong, MD, PhD, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose
Rozemarijn Vliegenthart, MD, PhD, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose
Matthijs 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 included with solid non-calcified nodules identified after baseline and also in retrospect not present on any previous screen. 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 solid 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. Holmans, 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 diameter-based 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.
CT-based Volumetric Features are Associated with Somatic Mutations in Lung Cancer

Station #1

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.

Correlation between TTF-1 and EGFR Expression and Dual-energy Spectral CT Parameters in Lung Squamous Cell Carcinoma and Adenocarcinoma

Station #2

PURPOSE

To investigate the correlation between TTF-1 and EGFR expression and quantitative parameters obtained in spectral CT imaging in lung squamous cell carcinoma and adenocarcinoma.

METHOD AND MATERIALS
60 lung cancer patients underwent plain and enhanced CT scans with spectral imaging mode, and immunohistochemical testing for determining the TTF-1 and EGFR expression in cancer cells. The Effective-Z parameter was measured in plain spectral CT and normalized iodine concentration (NIC) and slope of spectral curve was determined in enhanced spectral CT scan. Parameters obtained in spectral CT were analyzed to determine their correlations with TTF-1 and EGFR expression.

RESULTS

There were 18 and 9 lung adenocarcinoma patients with positive and negative TTF-1 expression, respectively. The Effective-z value was 4.97±0.75 for TTF-1 positive patients, statistically lower than the 6.98±0.90 for TTF-1 negative patients (p<0.05), while NIC and slope (k) values for these two groups were statistically the same. For the 27 lung adenocarcinoma patients there were 20 and 7 patients with positive and negative EGFR expression, respectively. There was no difference in Effective-z for EGFR positive and negative patients. However, NIC and slope (k) for EGFR positive patients were 0.27±0.16 and 2.04±0.17, respectively, both statistically higher than the corresponding values of 0.15±0.1 and 1.79±0.25 for EGFR negative patients (p<0.05). There were 6 and 27 lung squamous carcinoma patients with positive and negative TTF-1 expression, respectively. There was no difference for spectral CT parameters for these two patient groups. For the 33 lung squamous carcinoma patients there were 19 and 14 patients with positive and negative EGFR expression, respectively. NIC and slope (k) values for EGFR positive patients were 0.30±0.18 and 2.75±1.10, respectively, both statistically higher than the corresponding values of 0.16±0.04 and 2.06±0.38 for EGFR negative patients (p<0.05).

CONCLUSION

A number of spectral CT parameters in lung cancer patients are correlated with immunohistochemical markers TTF-1 and EGFR and may be used to preoperatively reflect the pathological characteristics of lung cancers.

CLINICAL RELEVANCE/APPLICATION

Spectral CT parameters have good correlation with immunohistochemical markers in lung cancer patients and may be used to preoperatively reflect the pathological characteristics of lung cancers.
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.

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

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

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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

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.

Diffuse Pulmonary Ossification in Fibrosing Interstitial Lung Disease: Prevalence and Associations

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

Station #3

Participants
Takeshi Jokoh, MD, PhD, Itami, Japan (Presenter) Research Consultant, Bayer AG Research Consultant, F. Hoffman-La Roche Ltd Tomonori Tanaka, MD, Toyama, Japan (Abstract Co-Author) Nothing to Disclose
Junya Fukuoka, Nagasaki City, Japan (Abstract Co-Author) Nothing to Disclose
Hirono 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 Tomyama, 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

Station #4

Participants
Kaman Chung, MD, Nijmegen, Netherlands (Presenter) Nothing to Disclose
Francesco Ciompi, MD, PhD, Nijmegen, Netherlands (Abstract Co-Author) Nothing to Disclose
Ernst T. Scholten, MD, Haarlemmerliede, 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, MD, 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
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.

**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

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Santiago E. Rossi, MD - 2015 Honored Educator
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.

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H. Page McAdams, MD - 2012 Honored Educator

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.
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.

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
Participants
David Palma, MD, FRCPC, London, ON (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.

ABSTRACT
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).
**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 the their integration into clinical practice relies heavily on and intersects with the field of bioinformatics. Once specific biomarkers are shown 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
LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Cardiovascular diseases (CVD) develop over an individual’s lifetime. CVD is the number one cause of death and morbidity worldwide. Integrated application of genomics, quantitative imaging and "big data" has the potential to positively transform cardiovascular 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.
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.

PS12B Image Interpretation Session

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

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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
Participants
Caroline Chiles, MD, Winston-Salem, NC (Moderator) Nothing to Disclose
Jane P. Ko, MD, New York, NY (Moderator) 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.

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H. Page McAdams, MD - 2012 Honored Educator

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
Geertruaid 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
Rozemarijn 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 $pVDT = \sqrt{\ln(2) \times \Delta t / \ln(V2/V1)}$, using the study's detection limit of 15mm$^3$ (V1), the volume of the new nodule at initial detection (V2), and the time interval between current and last screen ($\Delta$ t [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 (44mm$^3$, interquartile-range [IQR] 22-122mm$^3$) and malignant (373mm$^3$, IQR 120-974mm$^3$) 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 130-299 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?

Monday, Nov. 30 9:50AM - 10:00AM Location: S406B

Participants
Sarah J. Van Riel, MD, Nijmegen, Netherlands (Presenter) Research Grant, MeVis Medical Solutions AG
Francesco Ciomp, PhD, Nijmegen, Netherlands (Abstract Co-Author) Nothing to Disclose
Mathilde Winkler Wille, Hellerup, Copenhagen, Denmark (Abstract Co-Author) Nothing to Disclose
ern T. Scholten, MD, Haarlemmerlee, Netherlands (Abstract Co-Author) Nothing to Disclose
Nicola Sverzellati, Parma, Italy (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
Asger Dirksen, Hellerup, Denmark (Abstract Co-Author) Nothing to Disclose
Rianne Wittenberg, MD, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Monique Brink, MD, PhD, Nijmegen, Netherlands (Abstract Co-Author) Speaker, Toshiba Corporation
Matiullah Naeqibullah, Hellerup, Copenhagen, Denmark (Abstract Co-Author) Nothing to Disclose
Mathias Prokop, MD, 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

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

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

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.

RC201-09 Follow-up Recommendation Compliance in a Clinical CT Lung Screening Program

Monday, Nov. 30 10:50AM - 11:00AM Location: S406B

Participants
Sama Alshora, MD, Burlington, MA (Presenter) Nothing to Disclose
Brady J. McKee, MD, Burlington, MA (Abstract Co-Author) Spouse, Advisory Board, Medtronic, Inc;
Shawn Regis, PhD, Burlington, MA (Abstract Co-Author) Nothing to Disclose
Christopher C. Bolus, MD, Burlington, MA (Abstract Co-Author) Nothing to Disclose
Andrea B. McKee, MD, Burlington, MA (Abstract Co-Author) Advisory Board, Medtronic, Inc; Speaker, Medtronic, Inc; ;
Robert J. French JR, MD, Burlington, MA (Abstract Co-Author) Nothing to Disclose
Sebastian Flacke, MD, Burlington, MA (Abstract Co-Author) Consultant, BTG International Ltd; Consultant, Surefire Medical, Inc;
Consultant, Koninklijke Philips BV; Consultant, XACT Robotics

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.

RC201-10 Building a Clinical Program

Monday, Nov. 30 11:00AM - 11:20AM Location: S406B

Participants
Jared D. Christensen, MD, Durham, NC (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.

RC201-11 Trends in CT Screening for Lung Cancer at Leading Academic Medical Centers from 2013 to 2015

Monday, Nov. 30 11:20AM - 11:30AM Location: S406B

Participants
Phillip M. Boiselle, MD, Boston, MA (Presenter) Nothing to Disclose
Caroline Chiles, MD, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
James G. Ravenel, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Charles S. White, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

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 patient volumes, 14 of 17 (82%) sites reported that the number screened was stable or 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

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

Participants
Transcatheter Aortic Valve Replacement (TAVR)

Monday, Nov. 30 8:30AM - 10:00AM Location: N226

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

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.
Participants

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**

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

Participants
Ralph P. Ermoian, MD, Seattle, WA (ralphe@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**

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.

**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**

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.
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

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

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
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.

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.
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 to not only 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 of ground-glass attenuation and reticulation, predominantly distributed as lower and peribronchovascular lesions, which is 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 Yamashita, 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: \( \%\Delta = \left( \frac{\text{post-treatment tumor size} - \text{pre-treatment tumor size}}{\text{pre-treatment tumor size}} \right) \times 100\% \). 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 \( (r^2 = 0.43, P < .01) \). 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**
**PURPOSE**

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.

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

**PURPOSE**

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**Participants**

- Erika O. Odisio, MD, Houston, TX (Presenter) Nothing to Disclose
- Jeremy J. Erasmus, 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
- Rodrigo C. Chate, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
- Susan Passalagua, MD, Gilbert, AZ (Abstract Co-Author) Nothing to Disclose
- Myrna C. Godoy, MD, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
- Ricardo Santos, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

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**TEACHING POINTS**

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**

- Brett W. Carter, MD - 2015 Honored Educator
- Jeremy J. Erasmus, MD - 2015 Honored Educator
Feasibility of Single Scan for Simultaneous Evaluation of Pulmonary Ventilation and Perfusion with Dual-energy CT: An Experimental Study

Station #1

Participants

Suyon Chang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sae Rom Hong, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyunsik Jang, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Dong Jin Im, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hye-Jeong Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

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.

Kinematic MR Imaging of the Thorax during Forced Breathing using 2D Subsecond Steady-state Free Precession (SSFP) Sequence: Comparison with Pulmonary Function Test

Station #2

Participants

Daigo Tanimoto, MD, Kurashiki, Japan (Presenter) Nothing to Disclose
Katsuyoshi Ito, MD, Okayama, Japan (Abstract Co-Author) Nothing to Disclose
Tsutomu Tamada, MD, PhD, Kurashiki, Japan (Abstract Co-Author) Nothing to Disclose
Hiroki Higashi, MD, Kurashiki, Japan (Abstract Co-Author) Nothing to Disclose
Akira Yamamoto, MD, Kurashiki, Japan (Abstract Co-Author) Nothing to Disclose
Minoru Hayashida, MD, PhD, Kurashiki, Japan (Abstract Co-Author) Nothing to Disclose
Atsushi Higaki, MD, Kurashiki, Japan (Abstract Co-Author) Nothing to Disclose
Yasufumi Noda, Kurashiki, Japan (Abstract Co-Author) Nothing to Disclose
Kazuya Yasokawa, Kurashiki, Japan (Abstract Co-Author) Nothing to Disclose

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)x100. 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±4.6mm) 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±4.7mm) was significantly larger than those of middle (21.6±4.2mm, 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<0.01, r=0.814), VC (10668.5±1420.5mm2, p<0.001, r=0.797), and FEV1.0% (73.8±46.6%, 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.

CH214-SD-MO83

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 patients. 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 RELEVANCE/APPLICATION

Our aim is to help shape guidelines in the frequency of screening for thoracic neoplasm and other complications in the cardiac transplant population, as none exist in the current literature.
PURPOSE
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 an 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.

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

Participants
Matthew D. Gilman, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Victorine V. Muse, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Florian J. Fintelmann, MD, FRCPC, Boston, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Pulmonary non-Hodgkin lymphoma (NHL) manifestations include ground glass opacity, consolidation, nodules or masses, interstitial thickening and combined patterns. Some NHL subtypes show predilection for certain patterns.2. Benign pleural effusion can occur with lymphatic obstruction from nodal NHL. Malignant involvement should be suspected with associated pleural nodularity. Conversely, pericardial effusion in NHL is usually malignant.3. Nodal, pulmonary or pleural NHL may directly invade the chest wall, affecting multiple structures. This should be carefully excluded as it may affect staging.4. Further imaging or biopsy may be warranted for diagnosis of indeterminate lesions depending on the site involved and impact on management, even in patients with known NHL.

TABLE OF CONTENTS/OUTLINE
1. Introduction Overview of NHL pathophysiology and classification Key concepts in workup and staging pertinent to radiologists2. Spectrum of imaging findings (divided into sections for pleura, lung, heart and pericardium, trachea/bronchi and esophagus and chest wall) Background (epidemiology, clinical features and imaging pearls) Cases (4-5 per section) highlighting CT findings with PET correlation Differential diagnosis and problem-solving strategies7. Conclusions Summary of key imaging features and workup strategies
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) Reccomend 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%. In 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.
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 Lehner, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Mohammed A. Alsubhi, 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 < 5 mm 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 (27.9%, 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 2 cm 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 2.5 cm (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**

**Presenter**

Mauricio R. Moura SR, MD, MD, Sao Paulo, Brazil

**Participants**

Mauricio R. Moura SR, MD, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose

Publina 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

Milenas Mak, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

Rafael Bitton, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

Olavo Fereira, 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**

In this single-institution retrospective study, we included consecutive pts with non-pulmonary solid malignancies that presented PN and no extra pulmonary metastases. Pts were submitted to a computed tomography (CT) guided biopsy from January 2011 to December 2013. Exclusion criteria are as follows: presence of lung primary, hematologic malignancies, or extra pulmonary metastatic disease. Correlation between imaging and clinical characteristics that yielded higher probability of finding metastatic disease on biopsy was determined by logistic regression analysis.

**Results**

From a total of 487 pts submitted to pulmonary biopsy, 228 were included in the final analysis. Metastatic disease to the lungs was confirmed in 63.1%. Lung primaries were found in 26.3%. Other findings included infectious diseases (7.4%) and benign lesions (2.6%). On multivariate analysis, presence of multiple PNs was associated with higher odds of metastatic disease (OR 4.24; 95% CI 1.97-9.14, p < 0.01), as well as nodule cavitation and/or necrosis on CT scan (OR 4.01; 95% CI 1.24-13.01, p = 0.02). Procedure complications demanding active interventions occurred in 6 patients. No procedure-related death occurred.

**Conclusion**

Presence of multiple PNs and nodule cavitation were associated with higher odds of finding biopsy-proven metastatic disease. However, a high rate of non-metastatic disease was found in this group of pts. Given that procedural complications were low, we conclude that tissue sample is still essential for accurately diagnosing and treating pts with solid tumors presenting with PNs.

**Clinical Relevance/Application**

Assuming all PN observed in cancer patients as being metastatic disease will lead to high rates of inaccurate diagnosis and...
CT-guided Transthoracic Needle Biopsy of Subsolid Pulmonary Nodules: Technical Feasibility and Diagnostic Yield with Surgical Correlation and Long Term Follow-up.

Participants
Nantaka Kiranantawat, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Shaunagh McDermott, FFR(RCSI), Boston, MA (Presenter) Nothing to Disclose
Matthew D. Gilman, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Florian J. Fintelmann, MD, FRCP, Boston, MA (Abstract Co-Author) Nothing to Disclose
Jo-Anne O. Shepard, 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
Victorine V. Muse, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Milena Petranovic, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Amita Sharma, MBBS, Boston, MA (Abstract Co-Author) Nothing to Disclose

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, 22g fine needle aspirate and 20g 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.

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
LEARNING OBJECTIVES
1) Review the current imaging technique for evaluating 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
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 lung 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.
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.
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.

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/

Phillip M. Boiselle, MD - 2012 Honored Educator

MSES31B  Pleural Disease

Participants
Travis S. Henry, MD, San Francisco, CA (Presenter) Spouse is a Senior Medical Science Director, Opthalmology and Immunology, Genentech

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.

Honored Educators

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.
**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**

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.
RATIONALE

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%.

CLINICAL RELEVANCE/APPLICATION

In patients with aortic valve disease such as bicuspid aortic valve (BAV), the severity of valve disease is characterized using peak blood velocity to estimate the peak transvalvular pressure gradient (via the simplified Bernoulli equation).
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 angled by Multiplanar Reformations and Minimum Intensity Projection (MinIP) was used to overcome partial volume effects. The results were compared to the measurements from echocardiography and intraoperative measurements served as reference.

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 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

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 main, left anterior descending (LAD), circumflex (LCX) and right coronary arteries (RCA), as well as the time of acquisition and signal to noise

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 measurements served as reference.

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 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 measurements served as reference.

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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 measurements served as reference.

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

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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 measurements served as reference.

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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.
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±1.4 min with an average heart rate of 81 bpm, while the mean SNR was 27±4. 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.

RC313-06 Contrast Material Injection via Fenestrated Catheters is Useful in Pediatric Patients with Congenital Heart Disease Undergoing CT Angiography

Tuesday, Dec. 1 9:20AM - 9:30AM Location: E353A

Participants
Takanori Masuda, Hiroshima, Japan (Presenter) Nothing to Disclose
Yoshinori Funama, PhD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Masao Kiguchi, RT, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Takayuki Otsu, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Naoyuki Imada, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Kazuo Awai, MD, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Kazuo Awai, MD, Hiroshima, Japan (Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Research Grant, DAICHI SANKYO Group; Medical Advisor, DAICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Nemoto-Kyourindo; ; ; ;
Tomoyasu Sato, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Noritaka Noda, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose

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.

RC313-06 The Impact of Dual-source Parallelradiofrequency Transmission with Patient-adaptive Shimming on the 3.0 T Cardiac Magnetic Resonance in Children

Tuesday, Dec. 1 9:30AM - 9:40AM Location: E353A

Participants
Haipeng Wang, Jinan, China (Presenter) Nothing to Disclose
Cuiyan Wang, MD, PhD, Jinan, China (Abstract Co-Author) Nothing to Disclose
Fei Gao, Jinan, China (Abstract Co-Author) Nothing to Disclose
Bin Zhao, MD, Jinan, China (Abstract Co-Author) Nothing to Disclose

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.
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 1.0 ± 0.5 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 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
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.
**RC313-10** 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

**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 Hagemeid, 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) Nothing to Disclose
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 were used. 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

**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 Vosskrebzen, 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
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) (1176 ms 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 102/ml/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.

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

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 lung 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).
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 computerized 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 Lung Perfusion with Dual-Energy CT: Can we Achieve a Diagnostic Image Quality in Children?

Tuesday, Dec. 1 11:30AM - 11:40AM Location: E353A

Participants

Martine J. Remy-Jardin, MD, PhD, Lille, France (Presenter) Research Grant, Siemens AG
Teresa Santangelo, Lille, France (Abstract Co-Author) Nothing to Disclose
Antoine Deschildre, Lille, France (Abstract Co-Author) Nothing to Disclose
Jean-Baptiste Faivre, MD, Lille, France (Abstract Co-Author) Nothing to Disclose
Antoine Hutt, MD, Lille, France (Abstract Co-Author) Nothing to Disclose
Jacques Remy, MD, Mouvaux, France (Abstract Co-Author) Research Consultant, Siemens AG

PURPOSE

To evaluate the image quality of perfusion images in children

METHOD AND MATERIALS

The study population included 31 consecutive children (16 boys; 15 girls) referred for a dual-energy chest CT examination indicated in the long-term follow-up of congenital diaphragmatic hernia repaired in the neonatal period. The mean (±SD) age of the population was 10.55 ± 3.40 yr (range: 6 - 17) (median: 10 years); the mean weight was 34.13 (±14.39) kg (range: 16-72) (median: 30 kg) with 3 weight categories: <30 kg: (n=15); 30-50 kg (n=10); and >50 kg (n=6). CT angiographic examinations were obtained with a second-generation dual-source CT system (80-140 Sn kV) after injection of a 30-40% contrast agent. The following parameters were evaluated: (a) the image quality and radiation dose of CT angiograms; (b) the image quality of perfusion images, based on: (b-1) the presence and severity of artifacts; (b-2) the level of attenuation within normally perfused and hypoperfused lung areas; and (b-3) an overall image quality score.

RESULTS

On CT angiograms (a) the mean z-axis coverage was 26.56 ± 4.24 cm (median: 25.60) (range: 20.70-37.90); (b) the mean DLP was 133.0 ± 124 mGy.cm (median: 82) (range: 49-427); (c) the mean level of noise was 7.58 ± 2.72HU (range: 3.20 - 14.10); (d) the mean attenuation within the pulmonary trunk was 415.8 ± 132.1 HU (range: 194.3-791.0). Perfusion images were devoid of respiratory motion artifacts in 87% of cases (27/31), showing mild motion artifacts in the vicinity of cardiac cavities in 83% of cases (25/31). Beam-hardening artifacts were found around the superior vena cava (26/31; 84%), the subclavian and inominate veins ipsilateral to the site of injection (19/31; 61%), mainly rated as minimal (23/26 [88%] and 12/19 [39%], respectively). The

Tuesday, Dec. 1 11:20AM - 11:30AM Location: E353A

Participants

Yeon Jin Cho, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
YoungHun Choi, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yoo Jin Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ji-Eun Park, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyun Suk Cho, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sang Joon Park, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jung-Eun Cheon, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Woo Sun Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
In-One Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

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 computerized 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 computerized 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.

Tuesday, Dec. 1 11:30AM - 11:40AM Location: E353A

Participants

Woo Sun Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
In-One Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
overall quality of perfusion images was rated as good (12/31; 39%) or excellent (19/31; 61%) with a mean level of attenuation within normal lung of 48.52 ± 18.30 HU (median: 44.11; range: 26.05-95.82) and a mean gradient of attenuation between areas of hypo- and normal perfusion of 25.39±9.47 HU.

CONCLUSION

Perfusion images of diagnostic quality can be generated from dual-energy CT in children.

CLINICAL RELEVANCE/APPLICATION

Regional lung perfusion can be analyzed qualitatively and quantitatively on dual-energy chest CT examinations in children who are able to hold their breath.

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)

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
Sub-Events

SSG03-01  Chest Keynote Speaker: Dual Energy of the Chest
Tuesday, Dec. 1 10:30AM - 10:40AM Location: S404CD

Participants
Mannudeep K. Kalra, MD, Boston, MA (Moderator) Nothing to Disclose
Jonathan H. Chung, MD, Denver, CO (Moderator) Research Grant, Siemens AG; Royalties, Reed Elsevier

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Jonathan H. Chung, MD - 2013 Honored Educator

SSG03-02  Are There Radiomic Features Associated with EGFR Mutation Status in Peripheral Lung Adenocarcinomas
Tuesday, Dec. 1 10:40AM - 10:50AM Location: S404CD

Participants
Myrna C. Godoy, MD, PhD, Houston, TX (Presenter) Nothing to Disclose

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.
Effect of Energy Level on Texture Analysis in Simultaneously Acquired Dual-Energy Chest CT

Tuesday, Dec. 1 10:50AM - 11:00AM Location: S404CD

Participants

James Sorensen, Houston, TX (Presenter) Nothing to Disclose
Deep Pujara, MBBS, Houston, TX (Abstract Co-Author) Nothing to Disclose
Unnati 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, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Myrna C. Godoy, MD, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Shayan Shah, BDS, MPH, Houston, TX (Abstract Co-Author) Nothing to Disclose
Chinh Duan, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE

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 (30S 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 whole volume perfusion CT. It has potential value to reflect tumor pathophysiology and treatment response.

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.

Correlations of Iodine Uptake and Perfusion Parameters in Lung Cancer with Dual-Energy CT and First-pass Dual-Input Perfusion CT

Tuesday, Dec. 1 10:00AM - 11:00AM Location: S404CD

Participants

Xiaolong Chen, Beijing, China (Abstract Co-Author) Nothing to Disclose
HONGLIANG SUN, MD, Beijing, China (Presenter) Nothing to Disclose
WU WANG, MD, PhD, Beijing, China (Abstract Co-Author) Nothing to Disclose
SHAOYUAN YANG, Beijing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

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 (30S 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 whole volume perfusion CT. It has potential value to reflect tumor pathophysiology and treatment response.

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.

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, Houston, TX (Presenter) Nothing to Disclose
DEEP PUJARA, MBBS, Houston, TX (Abstract Co-Author) Nothing to Disclose
UNNATI 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. ERMAS, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
MYRNA C. GODOY, MD, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
SHAYAN SHAH, BDS, MPH, Houston, TX (Abstract Co-Author) Nothing to Disclose
CHINH DUAN, 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 Cooccurrence 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 considerably 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% 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.

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Jeremy J. Erasmus, MD - 2015 Honored Educator

**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.

**Honored Educators**

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Subba R. Digumarthy, MD - 2013 Honored Educator

**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 Dumonteil, MBBS, London, United Kingdom (Presenter) Nothing to Disclose
Jaymin H. Patel, MBBS, BSC, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
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, totally 51 patients, including 17 cases of benign serous effusion and 34 cases of malignant serous effusion proven by histopathological diagnosis or laboratorial examination, underwent plain and three-phase enhanced ssDECT imaging through fast kVp-switching technique. The iodine-based material density images were reconstructed. The iodine concentration (M-IE) in the effusion was 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 compared to the normal study (554 v 1062, p=0.04), whereas comparable variance comparison in the N-N pairs was not statistically different.

RESULTS
For N-N pairs all regional PBV measures showed no 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 normals 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
CONCLUSION
The malignant and benign effusion shows different NIC and D-I in the iodine-density images of enhanced ssDECT imaging.

CLINICAL RELEVANCE/APPLICATION
The iodine-density images of enhanced ssDECT scanning provides a sensitive approach for identifying benign and malignant serous cavity effusion.

SSG03-08 Xenon Ventilation CTs Using Dual-Energy CT and Subtraction CT Methods versus Krypton Ventilation SPECT/CT: Capability for Regional Ventilation and Pulmonary Functional Loss Assessments in Smokers

Tuesday, Dec. 1 11:40AM - 11:50AM Location: S404CD

Participants
Daisuke Takenaka, MD, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Yoshiharu 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; Yasuko 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
Kazuro Suigimura, MD, PhD, Kobe, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation

PURPOSE
To compare the capability for regional ventilation and pulmonary functional loss assessments among xenon ventilation CT (Xe-CT) obtained by dual-energy CT (DECT) and subtraction CT (Sub-CT) methods, and krypton ventilation SPECT/CT in smokers.

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 by DECT at 320-detector row CT. In addition, all smokers were also performed SPECT/CT and pulmonary function test. In each smoker, unenhanced and xenon-enhanced CT data were subtracted by commercially available software to generate Xe-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 on each method, 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 (Presenter) Nothing to Disclose
Yoshiharu 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; Takeshi Kawaguchi, Kashihara, Japan (Abstract Co-Author) Nothing to Disclose
Takashi Tojo, Kashihara, Japan (Abstract Co-Author) Nothing to Disclose
Kimihiko Kichikawa, MD, Kashihara, Japan (Abstract Co-Author) Nothing to Disclose

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.
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.

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).

Dual-point CE-DECT is considered at least as valuable as FDG-PET/CT for distinguishing malignant from benign nodules.

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.
Contribution of Radiation Exposure at Scanogram Acquisition to Organ Dose in Ultra-low Dose Chest CT Screening

Station #1

Participants
Satinder P. Singh, MD, Birmingham, AL (Moderator) Nothing to Disclose

Sub-Events
CH208-SD-TUA1 Contribution of Radiation Exposure at Scanogram Acquisition to Organ Dose in Ultra-low Dose Chest CT Screening

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 scanogram 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.

CT Findings of Adult Patients with Anti- Melanoma Differentiation-associated Protein (MDA) 5 / Clinically Amyopathic Dermatomyositis (CADM) 140 Antibody

Station #2

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
Helmut Prosch, MD, Vienna, Austria (Abstract Co-Author) Nothing to Disclose
Stefan F. Nemec, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Satoshi Watanabe, MD, Kanazawa, Japan (Abstract Co-Author) Nothing to Disclose
Hakuz Takato, MD, PhD, Kanazawa, Japan (Abstract Co-Author) Nothing to Disclose
Akira Shiraki, MD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Yoshino Muro, MD, PhD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Masahide Yasui, MD, Kanazawa, Japan (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
To describe the CT findings in patients with anti- melanoma differentiation-associated protein 5 antibody-positive interstitial lung disease (anti-MDAS-ILD)
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 than 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-TUA4

Interstitial Lung Diseases With Idiopathic Inflammatory Myopathy? Correlation of CT Findings With Specific Antibodies and Onset in 224 Patients

Participants

Takeshi Jojohk, MD, PhD, Itami, Japan (Presenter) Research Consultant, Bayer AG Research Consultant, F. Hoffman-La Roche Ltd Hiroyuki Taniguchi, MD, PhD, Seto, Japan (Abstract Co-Author) Research Consultant, Bayer AG; Research Consultant, F. Hoffmann-LaRoche Ltd; Research Consultant, Pfizer Inc
Takafumi Suda, MD, PhD, Hiramatsu, 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
Kiminori 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 antiaminoacyl-tRNA synthetase (ARS) antibodies, 128 patients showed positive results while, in 68 patients surveyed antibodies to melanoma differentiation-associated protein (MDA) 5 ARS, 12 patients were identified this antibody.

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; 56%)(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-S antibody. 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

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 monoenergetic 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 were 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 (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.
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

Station #1

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.

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?

Station #2

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.

CH223-SD-TUB3

Iodine Quantification to Distinguish Primary Lesions and Metastatic Lymph Nodes Between Lung Adenocarcinomas and Squamous Carcinomas by Computed Tomographic Gemstone Spectral Imaging: Initial Experience

Station #3

Participants
Xubin Li, MD, PhD, Tianjin, China (Presenter) Nothing to Disclose
Xiaoyan Meng, Tianjin, China (Abstract Co-Author) Nothing to Disclose
Zhao Xiang Ye, Tianjin, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

To investigate whether computed tomographic gemstone spectral imaging (GSI) with iodine quantification is able to distinguish primary lesions and metastatic lymph nodes between lung adenocarcinomas and squamous carcinomas.

METHOD AND MATERIALS

Sixty-one patients with non-small cell lung cancer (NSCLC) underwent chest contrast CT scan with GSI mode. The GSI viewer was used to display the iodine-based images. The iodine concentrations (ICs) of the primary lesions, 20 metastatic lymph nodes and 20 non-metastatic lymph nodes were measured, respectively. The normalized iodine concentration (NIC) values against aorta were calculated. The difference between the two groups was assessed by independent-samples t test. The receiving operating characteristic curve (ROC) analysis was adopted to estimate the optimal threshold for discriminating between metastatic and non-metastatic lymph nodes.

RESULTS

For the ICs and NIC values of the primary lesions, there were no significantly differences between lung squamous cell carcinomas and adenocarcinomas (P>0.05). For the metastatic lymph nodes, there were no significantly differences between the two groups in the ICs and NIC values (P>0.05). For the ICs and NIC values, significantly differences existed between metastatic and non-metastatic lymph nodes, respectively (P<0.05). The IC of 29.32 100ug/cm3 and NIC value of 0.4328 of a lymph node represented the optimal threshold to discriminate metastatic from non-metastatic lymph nodes and yielded the following: sensitivity, 80% and 75%; specificity, 65% and 75%; positive predictive value, 70% and 75%; negative predictive value, 76% and 75%; accuracy, 73% and 75%, respectively.

CONCLUSION

Although it has a limited value in distinguishing primary lesions and metastatic lymph nodes in NSCLC, spectral CT with iodine quantification may be used to differentiate metastatic from non-metastatic lymph nodes in lung cancer.

CLINICAL RELEVANCE/APPLICATION

Spectral CT with iodine quantification could be a useful tool in lymph node stage for patients with lung cancer before operation.

CH224-SD-TUB4

Value of CT Spectral Imaging in the Differential Diagnosis of Thymoma and Mediastinal Lymphoma

Station #4

Participants
Yijing Xie, Lanzhou, China (Presenter) Nothing to Disclose
Junlin Zhou, Lanzhou City, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

To investigate the imaging characteristics of thymoma and mediastinal lymphoma on computed tomography (CT) spectral imaging and to evaluate the value of CT spectral imaging in differential diagnosis of these diseases.

METHOD AND MATERIALS

This prospective study was institutional review board approved, and written informed consent was obtained from all patients. 40 patients with mediastinal tumors (25 thymomas and 15 mediastinal lymphomas ) underwent dual-phase (artery phase, AP and portal vein phase, PVP) contrast enhanced CT with CT spectral imaging mode. Iodine concentrations were derived from iodine-based material-decomposition CT images and normalized to the iodine concentration in the aorta. The measurements of normalized iodine concentrations (NICs), the slope of spectral HU curve (λHU), and mean CT values of lesions between the AP and PVP were calculated and compared with two-sample T test between thymomas and mediastinal lymphomas.
RESULTS
NICs, λHU, and mean CT values in patients with mediastinal lymphomas differed significantly from those in patients with thymomas. Mean NICs were 0.47±0.24mg/mL versus 0.23±0.10mg/mL during the AP and 0.83±0.38mg/mL versus 0.47±0.86mg/mL during the PVP. Mean λHU were 1.01±0.1 versus 2.96±0.41 during the AP and 1.32±0.42 versus 46.98±0.25 during the PVP. Mean CT values were 53.63±2.08 versus 70.98±2.85 during the AP and 46.98±0.18 versus 58.66±0.91 during the PVP. The combination of NICs and Mean CT value during PVP had highest sensitivity (90.9%) and specificity (100%) among all phases.

CONCLUSION
CT spectral imaging has promising potential for diagnostic differentiation of mediastinal lymphomas and thymomas.

CLINICAL RELEVANCE/APPLICATION
(dealing with CT spectral imaging) "To investigate the imaging characteristics of thymoma and mediastinal lymphoma on computed tomography (CT) spectral imaging and to evaluate the value of CT spectral imaging in differential diagnosis of these diseases."

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

Participants
Mirabela Rusu, DPhil, MENG, Cleveland, OH (Presenter) Nothing to Disclose
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, P. Hoffmann-La Roche Ltd Founder and President, IBiRIS, 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 on 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.

PURPOSE
To evaluate the association between mutation status of lung adenocarcinoma patients and local recurrence after ablation.

METHOD AND MATERIALS
We performed a retrospective review to identify patients treated with ablation for lung adenocarcinoma and that had available genetic testing for 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.

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. Overall stage of tumor ranged from stage 1A to stage IV. Median tumor size was 1.6 cm (range: 0.8-3.3 cm). Of the 53 lung ablations, 53% (28) were on wild type (WT) lung adenocarcinomas, 34% (18) were on KRAS mutants and 13% (7) were on EGFR mutants. EGFR and KRAS mutants were mutually exclusive. Local recurrence rates were 29% (8/28) for WT, 67% (12/18) for KRAS, and 29% (2/7) for EGFR mutants. Local recurrence in the KRAS group was statistically significant (p=0.01) compared with WT. There was no difference in the local recurrence rate of EGFR mutants compared with WT. Of note, the two local recurrences identified in the EGFR group also harbored a T790M mutation, associated with acquired resistance to tyrosine kinase inhibitors.

CONCLUSION
KRAS mutations are associated with statistically significant increased risk of local recurrence compared to WT. The local recurrence
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 metastachronous metastases, preferably unilateral, a longer disease free interval and no extra-pulmonic disease. Ablation is currently considered in inoperable patients. Our analysis of 122 patients who were not operable candidates but who had small volume colorectal lung metastases showed a median survival of 41 months and a 3 year survival of 57%. Survival was better in patients with smaller tumours; median 51 months, 3-year 64% for 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)

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, Gall 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.

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.

**VSIO31-10 Patient Selection and Outcomes with MRgFUS**

Participants
Alessandro Napoli, MD, Rome, Italy, (alessandro.napoli@uniroma1.it) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To become familiar with the basic principles of HIFU and the potential of MR guidance. 2) To approach selection criteria in MRI screening examinations for accurate indications and identify contraindications and non-suitable patients. 3) To appreciate current results and potential therapy regimens. 4) To understand recent technical developments and their potential.

**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 the 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 noninvasive 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. 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, intraprocedural 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.

**VSIO31-11 Minimally Invasive Treatment of Osteoid Osteoma: Experience of a Single Center Using MR Guided Focused Ultrasound Surgery (MRgFUS) or Radiofrequency Ablation (RFA)**

Participants
Francesco Arrigoni, Coppito, Italy (Presenter) Nothing to Disclose
Alice La Marra, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Silvia Mariani, 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 effectiveness and safety of minimally invasive treatment of Osteoid Osteoma (OO) with ablation techniques: Magnetic Resonance guided Focused Ultrasound Surgery (MRgFUS) and Radiofrequency Ablation (RFA).

**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 
OOG, 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 OOG.

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

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

Tuesday, Dec. 1 5:40PM - 6:00PM Location: S405AB

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**

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.
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 staging (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 (P<0.05). 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.

SS305-03 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 Rossellini, 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.
Dynamic CE-Perfusion Area-Detector CT vs. FDG-PET/CT: Capability for N-Stage Assessment in Non-Small Cell Lung Cancer Patients

Participants
Yoshisharu Ohno, MD, PhD, Kobe, Japan (Presenter) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIIChE 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; Sumiaki 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, DAIIChE SANKYO Group

PURPOSE
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) who 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 + mebranous 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.

SSJ05-06  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.
SSJ06-01  Predicting Pulmonary Embolus in ED Patients with Isolated Below-the-Knee Deep Vein Thrombosis

Tuesday, Dec. 1 3:00PM - 3:10PM Location: N227

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 Voltumo, 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 patients with 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

Tuesday, Dec. 1 3:10PM - 3:20PM Location: N227

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 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 ± 0.132mSv, 59% lower than CXR french Diagnostic Reference Levels (FDRL): 0.225 mSv. The effective dose for ULD-CT was 0.189 ± 0.035mSv, 97% lower than chest CT FDRL: 6.65 mSv. ULD-CT revealed a higher quantity of small pneumothorax 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.

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) Nothing to Disclose

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.

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
Nagaraj-Setty Holakere, MD, Boston, MA (Abstract Co-Author) Owner, imaginglink, LLC
Christina A. LeBedis, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

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. Sickle cell 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, more likely to be female and 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
Neel 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, MS, 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

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. Sickle cell 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, more likely to be female and 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
Neel 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, MS, 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).
SSJ11

**Genitourinary (Multimodality Imaging of Pregnancy and Pelvic Floor)**

Tuesday, Dec. 1 3:00PM - 4:00PM Location: E353B

**Participants**
Elizabeth A. Sadowski, MD, Madison, WI (**Moderator**) Nothing to Disclose
Mary C. Frates, MD, Sharon, MA (**Moderator**) Nothing to Disclose

**Sub-Events**

**SSJ11-01 Dynamic Contrast-enhanced MRI Combined with Diffusion Weighted Imaging in Differential Diagnosis of Malignant Gestational Trophoblastic Neoplasia and Postpartum Retained Placental**

Tuesday, Dec. 1 3:00PM - 3:10PM Location: E353B

**Participants**
Kangkang Xue, Zhengzhou, China (**Presenter**) Nothing to Disclose
Jingjiang Cheng, MD, Zhengzhou, China (**Abstract Co-Author**) Nothing to Disclose
Yong Zhang, DO, Zhengzhou, China (**Abstract Co-Author**) Nothing to Disclose
Tianxia Bei, Zhengzhou, China (**Abstract Co-Author**) Nothing to Disclose

**PURPOSE**
To explore the application value of dynamic contrast-enhanced MRI (DCE-MRI) combined with diffusion weighted(DW-MRI) in the differential diagnosis of malignant gestational trophoblastic neoplasia(MGTN) and postpartum retained placental tissue(RPT).

**METHOD AND MATERIALS**
The institutional review board approved this retrospective study and waived the requirement for informed consent. 74 cases(median age, 30.6 years; age range, 20-48 years) of MGTN and RPT confirmed clinically were retrospectively analyzed, all patients underwent DCE-MRI and DW-MRI(500 and 1000 mm²/s) at 3.0T. Types of time signal-intensity curves(TIC) and quantitative analysis of time to peak(TTP), maximum contrast enhancement ratio(MCER) and ADC values of each case were performed. Differences in TTP, MCER, and ADC values between MGTN and RPT were evaluated using the independent samples t-test respectively. The sensitivity, specificity and accuracy of dynamic contrast-MRI, DW-MRI and combination of the two methods in diagnosing MGTN and RPT were calculated.

**RESULTS**
There were 39 MGTN, of which 13 lesions were invasive mole and 26 lesions were choriocarcinoma. There were 35 RPT, of which 14 lesions were normal retained placenta, 6 lesions were adherent placenta and 15 lesions were implanted placenta. The mean ADC value and TTP of MGTN(1.38±0.11×10⁻³mm²/s, 37.84±3.73 s) were significantly different( p<0.01 ) from that of RPT(2.03±0.56×10⁻³mm²/s, 102.11±9.14 s). The MECR of MGTN(248.58±19.28%) was not significantly different (P>0.05) from that of RPT(236.45±16.77%) statistically.

**CONCLUSION**
MGTN and RPT has different features in DCE-MRI and DW-MRI respectively, and the combination of the two methods can provide high application value for the differential diagnosis of MGTN and RPT.

**CLINICAL RELEVANCE/APPLICATION**
The clinical issues and standard imaging features of malignant gestational trophoblastic neoplasia and postpartum retained placental tissue are similar, and the combination of DWI and dynamic-enhanced MRI can help clinician distinguish them, so as to decide treatment plans.

**SSJ11-02 Variable Sonographic Features and Imaging Underdiagnosis of Partial Molar Pregnancy**

Tuesday, Dec. 1 3:10PM - 3:20PM Location: E353B

**Participants**
Julia Savage, MD, Ann Arbor, MI (**Presenter**) Nothing to Disclose
Katherine E. Maturen, MD, Ann Arbor, MI (**Abstract Co-Author**) Medical Advisory Board, GlaxoSmithKline plc
Erika Mowers, MD, Ann Arbor, MI (**Abstract Co-Author**) Nothing to Disclose
Katherine Pasque, MD, Ann Arbor, MI (**Abstract Co-Author**) Nothing to Disclose
Ashish P. Wasnik, MD, Ann Arbor, MI (**Abstract Co-Author**) Nothing to Disclose
Vanessa Dalton, MD, Ann Arbor, MI (**Abstract Co-Author**) Nothing to Disclose
Jason Bell, MD, Ann Arbor, MI (**Abstract Co-Author**) Nothing to Disclose

**PURPOSE**
The goal of this study is to describe the ultrasound findings in histopathologically proven molar pregnancies and to correlate these findings with clinical parameters including serum beta-hCG levels and partial vs. complete molar pregnancy.

**METHOD AND MATERIALS**
Retrospective chart review revealed 72 women with failed pregnancy or elective termination with histopathologic diagnosis of molar pregnancy and available ultrasound images between January 1, 2001 to December 31, 2011. Clinical data, ultrasound images and
Mean age of women was 30.45 ± 6.97 years of age (range: 16-49), with 1.25 ± 1.49 prior pregnancies (range: 1-11). Mean gestational age (GA) by last menstrual period was 74.45 ± 19.07 days (range: 39-138) and median serum beta-hCG was 64,400 (range: 447-662,000), with expected positive correlations between mean sac diameter (MSD) vs. beta-hCG (r=0.45, p=0.004) and MSD vs. GA (r=0.54, p<0.0001). Pathologic results showed 49 partial and 23 complete moles. By imaging, partial moles were more commonly described as having a discrete gestational sac (85.7 vs 21.7%, p<.0001), yolk sac (48.9 vs. 4.6%, p=0.0003), or fetal pole (57.1 vs. 0%, p<0.0001), while complete moles were more likely to show clearly abnormal tissue in the uterus (82.6 vs. 20.8%, p<.0001) and to be prospectively diagnosed as molar pregnancy by the dictating radiologist (86.9 vs. 40.82%, p=0.0002).

**CONCLUSION**
Partial molar pregnancy is associated with a highly variable sonographic appearance and frequent detection of recognizable products of conception, which may contribute to its underdiagnosis by imaging. Complete molar pregnancy is more strikingly abnormal and thus recognizable by imaging, and commonly diagnosed prospectively.

**CLINICAL RELEVANCE/APPLICATION**
Suspicion of hydatidiform mole in failed pregnancy has impacts on clinical management including: need for uterine evacuation, submission of products of conception to pathology, and serum b-hCG surveillance; failure to prospectively suggest or diagnose molar pregnancy may negatively impact patient care.

**HONORED EDUCATORS**
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Katherine E. Maturen, MD - 2014 Honored Educator

**PURPOSE**
The goal of the study was to determine the efficacy of 2D and 3D dynamic translabial ultrasound versus pelvic floor MRI in the detection of transvaginal mesh implant complications.

**METHOD AND MATERIALS**
With IRB approval and HIPAA compliance, a retrospective observational study was performed to correlate the intraoperative findings of transvaginal mesh implant complications (perforation, extrusion, fluid collections) with the standard pre-operative translabial ultrasound and pelvic floor MRI evaluations in women who were treated with suburethral transvaginal mesh implant for stress urinary incontinence or pelvic organ prolapse. The pre-operative translabial ultrasound and MRI examinations were reviewed with attention to technical details. The sensitivity of ultrasound in identifying complications was calculated. The location of the transvaginal mesh with respect to the bladder and urethra was also evaluated (extraluminal, intramural, intraluminal). Factors for technical improvement were identified.

**RESULTS**
The study cohort included 200 women (mean age 55 years) with transvaginal mesh implants for who underwent 2D and 3D dynamic translabial ultrasound, pelvic floor MRI and mesh excision at our institution between 2007 and 2013. Descriptive statistics were provided. 17 patients were found to have perforation into the urethra and/or bladder during surgery. None were found to have extrusion or significant fluid collections. Translabial ultrasound had a sensitivity of (12/17) 70.5%, whereas detection of mesh fragments by MRI was challenging even in retrospect. Limitations were due to suboptimal visualization of the mesh fragments, which could be improved with pre-procedural hydration for bladder distention and the use of vaginal gel to better image the suburethral space.

**CONCLUSION**
2D and 3D dynamic translabial ultrasound is a powerful real-time method for transvaginal mesh localization and for visualizing complications, most importantly perforation into the urethra and/or bladder, which allows for better surgical planning and pre-operative patient counseling.

**CLINICAL RELEVANCE/APPLICATION**
Translabial ultrasonography is a powerful real-time diagnostic technique for the evaluation of female pelvic floor dysfunction and is more sensitive than MR in detecting transvaginal mesh perforation.
Placental adhesive disorder is a significant cause of maternal morbidity and mortality. The aim of the present study is to identify US predictors of successful treatment with MTX.

METHOD AND MATERIALS
This is a retrospective IRB approved and HIPAA compliant cohort study, exempt from informed consent. The medical records of 121 women (mean age of 29 + 5.3 years) who were diagnosed with an EP and underwent a single dose treatment with MTX were reviewed. Only those subjects who had a visible EP without heart activity on US prior to treatment and who had a follow up US after treatment were included in the study (n=52). Post treatment EP were evaluated with respect to the change in size, shape, echogenicity of the EP, presence of a gestational and yolk sac, fetal heart rate, vascularity, and hemoperitoneum after treatment. Results were correlated with patient b-hCG levels, clinical symptoms and necessity for surgical intervention. Qualitative and quantitative parameters were analyzed using parametric and nonparametric tests.

RESULTS
Separate assessment of the US findings with respect to their sensitivity(Ss), specificity (Sp), NPV and PPV respectively are as follows: EP change in size 53%, 57%, 45%, 55%, shape 89%, 75%, 85%, 78%, echogenicity 87%, 78%, 85%, 90%, avascularity 79%, 90%, 85%, 88%; and absent or small hemoperitoneum 90%, 86%, 87%, 78% ; A combination of at least three of these findings was most accurate with Ss 95%, Sp 96%, PPV 95%, NPV 90%. Presence of fetal heart activity, increased size of yolk sac and gestational sac, large amount of hemoperitoneum were strong US predictors of failure of MTX treatment with Ss 100%, Sp 100%, PPV 100%, NPV 99%

CONCLUSION
A combination of at least three US findings including stable shape and echogenicity, avascularity and absence or small amount of hemoperitoneum are best US predictors of successful MTX treatment of EPs. Detection of fetal heart activity, large hemoperitoneum, and increase in size of gestational and yolk sac are strong US predictors of a failure of MTX treatment. Change in size of the EP after MTX treatment is not a reliable predictor of either treatment success or failure.

CLINICAL RELEVANCE/APPLICATION
US findings aid in prediction of successful treatment of ectopic pregnancy using a single dose methotrexate protocol

Honoracked Educators
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Leslie M. Scoultt, MD - 2014 Honored Educator

SSJ11-05 Accuracy of MRI in the Prenatal Diagnosis of the Abnormally Adherent Placenta: Comparison with Findings at the Time of Delivery
Tuesday, Dec. 1 3:40PM - 3:50PM Location: E353B

Participants
Shereille L. Laifer-Narin, MD, Englewood, NJ (Presenter) Nothing to Disclose
Sidney Z. Brevt, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Sarah Goodman, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Jason Wright, New York, NY (Abstract Co-Author) Nothing to Disclose
Jeffrey H. Newhouse, MD, Bronxville, NY (Abstract Co-Author) Research Consultant, PAREXEL International Corporation

PURPOSE
To evaluate the accuracy of magnetic resonance imaging in diagnosing invasive placentation.

METHOD AND MATERIALS
A retrospective review of all patients referred for MRI of the placenta from December 2004 to December 2014 was performed. Indications for MRI included abnormal appearance of the placenta on ultrasound, history of prior cesarean delivery, and history of prior uterine surgery. MRI reports were reviewed for placental location, presence or absence of abnormal placentation according to established MRI findings, and suspicion for parametral involvement. Criteria included the presence of dark intraplacental bands, heterogeneous signal intensity, abnormal vascularity and thickened nodular contour along the urinary bladder surface, uterine bulging into the bladder, and loss of the myometrial margin. MRI was considered positive even if only one of these criteria were present. Comparison was made with findings at either delivery or operation, and pathology reports.

RESULTS
256 MRI exams were reviewed. 144 exams were negative both on MRI and delivery/pathology. 8 exams interpreted as normal on MRI underwent hysterectomy with pathology demonstrating placenta accreta. 80 exams were interpreted as positive for abnormal placentation, and were diagnosed as accreta, increta, or percreta on delivery/pathology. 24 cases interpreted as positive on MRI had normal placental delivery and pathology. MR diagnosis of abnormal placentation had a sensitivity of 91%, specificity of 86%, PPV of 77%, NPV of 95%, and an accuracy of 87.5%.

CONCLUSION
Placental adhesive disorder is a significant cause of maternal morbidity and mortality. Prenatal MRI is accurate in evaluating invasive
placentation in patients at high risk for this condition.

**CLINICAL RELEVANCE/APPLICATION**

MRI can provide topographic information specifically in cases with lateral extension into the parametrical regions. Identification of abnormal placentation assists the clinician in planning the mode of delivery, extent and location of surgical incision, and determining the need for multidisciplinary involvement and assistance.

**SSJ11-06 3T Pelvic MRI Thresholds for Pelvic Organ Prolapse before and after First Childbirth**

**Tuesday, Dec. 1 3:50PM - 4:00PM Location: E353B**

Participants
Mark E. Lockhart, MD, Birmingham, AL (Presenter) Nothing to Disclose
Holly Richter, MD, Birmingham, AL (Abstract Co-Author) Research Grant, Pelvalon, Inc; Consultant, Pelvalon, Inc; Consultant, Kimberly-Clark Corporation; Royalties, UpToDate, Inc
Gordon W. Bates, MD, Birmingham, AL (Abstract Co-Author) Nothing to Disclose
Timothy M. Beasley, PhD, Birmingham, AL (Abstract Co-Author) Nothing to Disclose
Desiree E. Morgan, MD, Birmingham, AL (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate the usefulness of published 3T MRI parameters suggesting pelvic organ prolapse before and after first childbirth

**METHOD AND MATERIALS**

In this IRB-approved HIPAA-compliant prospective cohort study, patients presenting for reproductive assistance were recruited to complete validated questionnaires, clinical pelvic exams, baseline dynamic 3T MRI, and repeat MRI 6 months after delivery. Subjects were nulliparous women, at least 19 years age, and asymptomatic by Pelvic Floor Distress Inventory-20. Predetermined published thresholds or 2 SD beyond means in the literature for pelvic prolapse on MRI were evaluated. Also, a 10% change from baseline to postpartum was considered a significant change. Using 120 cc rectal gel and pelvic phased array coil over the pelvis, static 3mm axial and coronal T2 FSE sequences were followed by 10 mm thick dynamic sagittal HASTE at rest and during strain. The 10 mm sagittal sequence then evaluated pelvic floor mobility during evacuation of the rectal gel. MRI parameters were measured by a fellowship-trained radiologist, blinded to clinical data.

**RESULTS**

19 subjects (mean age 31 years) completed baseline clinical and MRI studies, and 10 (mean age 30.5 years) of them completed postpartum clinical and MRI studies. None developed significant pelvic floor symptoms by the PFDI-7 and PISQ-12 questionnaires after childbirth. None had levator tears at baseline; two subjects developed tears postpartum. Mean pelvic floor mobility was increased in patients after childbirth and 17 pelvic soft tissue parameters increased by greater than 10% postpartum. At baseline 7/133 (5.3%), 8/209 (3.8%), and 79/209 (37.8%) of pelvic soft tissue measurements exceeded published thresholds (indicating prolapse) at rest, strain, and evacuation, respectively, majority in the anterior compartment. After pregnancy and childbirth, 4/70 (5.7%), 6/110 (5.5%), and 51/110 (46.4%) exceeded thresholds at rest, strain, and evacuation, respectively, in this asymptomatic population. Osseous parameters remained unchanged.

**CONCLUSION**

Although published soft tissue parameters work well for rest and strain MR imaging, their values in evacuatory series are frequently exceeded, even in asymptomatic nulliparous and primiparous women.

**CLINICAL RELEVANCE/APPLICATION**

In nulliparous and primiparous women, the evacuatory phase will commonly exceed published MRI thresholds for pelvic organ prolapse and therefore results should be used with caution.
Participants

Honored Educators

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H. Page McAdams, MD - 2012 Honored Educator

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.

**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.
**Lung Cancer Screening: Getting Paid to Do Good**

Tuesday, Dec. 1 4:30PM - 6:00PM Location: N228

**Participants**
Pamela Kassing, Reston, VA *(Coordinator)* Nothing to Disclose
Pamela Kassing, Reston, VA *(Moderator)* Nothing to Disclose
Geraldine B. McGinty, MD, MBA, New York, NY *(Presenter)* Nothing to Disclose
Ezequiel Silva III, MD, San Antonio, TX, (zekesilva3@gmail.com) *(Presenter)* Nothing to Disclose
Mark O. Bemardy, MD, Conyers, GA *(Presenter)* Nothing to Disclose
Robert K. Zeman, MD, Washington, DC *(Presenter)* Nothing to Disclose

**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**

http://www.acr.org/
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.
**High Resolution CT of Diffuse Lung Disease: Read Cases with the Experts (An Interactive Session)**

Wednesday, Dec. 2 8:30AM - 10:00AM Location: N228

**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, FRCPC, 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**

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H. Page McAdams, MD - 2012 Honored Educator
Radiogenomics of Lung Cancer—Changing Landscape and Challenges

Participants

Honored Educators

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Evis Sala, MD, PhD - 2013 Honored Educator

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.

RCS18C  Quantitative Assessment in Lung Cancer Radiogenomics—Reproducibility and Reliability

Participants
Binsheng Zhao, DSc, New York, NY (Presenter) License agreement, Varian Medical Systems, Inc; License agreement, Keosys SAS; License agreement, Hinacom Software and Technology, Ltd; License agreement, ImBio, LLC; License agreement, AG Mednet, Inc

LEARNING OBJECTIVES

1) 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

AMA 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 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

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
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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
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 CT 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.
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 Ditt, Forchheim, Germany (Abstract Co-Author) Employee, Siemens AG
Juergen Hetzel, 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 (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 (DLCOSB) 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**

**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**

**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

**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.
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 39.2±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 seem 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.

SSK05-06  
Assessment of Healthy Volunteers with COPD High Risk Factors by Quantitative CT: Correlation with Pulmonary Functional Tests

Wednesday, Dec. 2 11:20AM - 11:30AM  Location: S404CD

Participants
Yi Xia, MD, Shanghai, China (Presenter) Nothing to Disclose
Yu Guan, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Li Fan, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Shiyuan Liu, PhD, Shanghai, China (Abstract Co-Author) Nothing to Disclose

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 value 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.

SSK05-07  
The Airway Remodelling and Emphysema Alteration as Determined by Quantitative CT Measurement: Correlations with the Frequency of COPD Exacerbation

Wednesday, Dec. 2 11:30AM - 11:40AM  Location: S404CD

Participants
Yu Guan, MD, Shanghai, China (Presenter) Nothing to Disclose
Li Fan, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Yi Xia, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Shiyuan Liu, PhD, Shanghai, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

We aimed to evaluate the change of airway remodelling and emphysema in COPD exacerbations as determined by quantitative CT...
measurement. We also study the relationship between COPD exacerbation frequency and quantitative CT measures of airway remodeling and emphysema.

METHOD AND MATERIALS

Volumetric CT was acquired for 80 patients who visited the emergency 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 -950 HU. 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. Statistical analysis was performed to examine the change of airway remodeling 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 remodeling 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
Jered 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 determine 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. For RA 950 without VA, an increase of at least 3.7% constitutes a real change. There are insufficient studies to support a meta-analysis of RA950 with VA.

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 11:40AM - 11:50AM Location: S404CD

Participants
Philip F. Judy, PhD, Boston, MA (Presenter) Research Consultant, General Electric Company; Consultant, Boehringer Ingelheim GmbH; Consultant, Gilead Sciences, Inc; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Veracyte, Inc.
Matthew K. Fuld, PhD, Iowa City, IA (Abstract Co-Author) Consultant, Vida Diagnostics, Inc
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 determine 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. For RA 950 without VA, an increase of at least 3.7% constitutes a real change. There are insufficient studies to support a meta-analysis of RA950 with VA.

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.
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 significantly 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

Station #1

Participants
Smita Patel, MBBS, Ann Arbor, MI (Moderator) Nothing to Disclose

Sub-Events

**CH226-SD-WEA1**

**Comparison of Xenon Ventilation CT with Pulmonary Function Tests for Pre and Post Pulmonary Lobectomy Patients with Primary Lung Cancer**

**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

Station #2

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...
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
Yoshinari 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 Yakuin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
PURPOSE
To evaluate the utility of three-dimensional (3D) lung motion on inspiratory and expiratory CT for pulmonary functional loss and clinical stage evaluation in smoking-related COPD in comparison with lung destruction and air trapping assessments.

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.

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 Kataoka, Shinjuku-ku, Japan (Abstract Co-Author) Nothing to Disclose
Yu Iwabuchi, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Hiroaki Sugiura, 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
Shigeki 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
Keichi Fukuda, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Masahiro Jinnoki, 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.

CH231-SD-WEA6 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.

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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

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.
PURPOSE
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.

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 (\(\kappa = 0.70\)). 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.

CH234-SD- WEB3 Quantitative CT Analysis of Pulmonary Ground-Glass Nodules to Predict the Pathological Invasiveness

Participants
Xiaonian Cui, MD, PhD, Tianjin, China (Presenter) Nothing to Disclose
Xubin Li, MD, PhD, Tianjin, China (Abstract Co-Author) Nothing to Disclose
Yingru Zhao, MD, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose

PURPOSE
Pulmonary ground-glass nodules (GGNs) are well known to be diagnosed pathologically as Atypical adenomatous hyperplasia (AAH), adenocarcinoma in situ (AIS), minimally invasive adenocarcinoma (MIA), and invasive adenocarcinoma (I-ADC). This study aimed to evaluate the CT image features of patients with pulmonary GGNs to identify factors predictive of pathological invasion.

METHOD AND MATERIALS
We retrospectively evaluated 120 resected pulmonary GGNs with or without solid component at CT and pathologically classified them as Atypical adenomatous hyperplasia (AAH; n = 13), adenocarcinoma in situ (AIS; n = 13), minimally invasive adenocarcinoma (MIA; n = 39), or invasive adenocarcinoma (I-ADC; n = 55). The age, sex, pleural indentation, vacuole sign, vessel convergence sign, computed tomography (CT) attenuation, whole tumor and solid component sizes with lung window setting (WTMW and SCLW) and whole tumor sizes with a mediastinal window setting (WMTW) of the 4 groups were compared. Receiver operating characteristic (ROC) curve analyses were performed to identify factors that could predict the presence of pathologically invasive adenocarcinomas.

RESULTS
There was no significantly between AAH and AIS. SCLW was significantly larger in the MIA and I-ADC groups than in the AIS group. WTMW and CT attenuation was significantly larger in I-ADC than MIA group. For invasive adenocarcinoma prediction, ROC curve based on the combination three CT image features pleural indentation, vacuole sign, and vessel convergence sign shows significant diagnostic accuracy (AUC, 0.851).

CONCLUSION
Tumor size, CT attenuation and three CT image features (pleural indentation, vacuole sign, and vessel convergence sign) were predictive factors of pathological invasiveness for pulmonary GGNs. Use of a combination these factors facilitated more accurate prediction of invasive adenocarcinoma than the use of these factors independently.

CLINICAL RELEVANCE/APPLICATION
AAH, AIS and MIA have 100% or near 100% 5-year disease-free survival, if completely resected. It is helpful to identification of early lung cancer by identify factors predictive of pathological invasion.

CH235-SD- WEB4 Automated CT-based Quantitative Stratification of COPD Patients

Participants
Sushravya Raghunath, PhD, Rochester, MN (Presenter) Nothing to Disclose
Srinivasan Rajagopalan, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Ronald Karwoski, BS, Rochester, MN (Abstract Co-Author) License agreement, ImBio, LLC
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 sub-solid pulmonary nodule detection was 0.391 using ADMIRE3 and 0.436 using ADMIRE5, respectively. ICC for solid pulmonary nodule detection was 0.806 using ADMIRE3 and 0.824 using ADMIRE5, respectively. ICC 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 lung pathology detection was high for both IR (reflecting extent of air-trapping vs hyperinflation) correlate significantly across these groups.

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.

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 pathologies underwent chest CT with both standard-low-dose protocol and ultra-low-dose protocol on a third-generation dual-source CT at 100kVp,16mA and 100kVp,46mA, 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 ADMIRE 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...
Addition of the Fleischner Society Guidelines to Chest CT Exam Interpretive Reports Improves Adherence to Recommended Follow-up Care for Incidental Pulmonary Nodules

PURPOSE
To determine whether the addition of the Fleischner Society guidelines to the interpretive reports of chest CT exams identifying incidental pulmonary nodules affects follow-up care.

METHOD AND MATERIALS
Beginning in 2008, a template containing the Fleischner Society guidelines was added at the discretion of the interpreting radiologist to chest CT exam reports describing incidental solid pulmonary nodules at our institution. The [redacted], a collection of the records of all medical centers in [redacted] county, was used to capture the complete medical history of local patients diagnosed with an incidental pulmonary nodule from 2008-2011. Patients were excluded if they were not residents of [redacted] county during the study timeframe, were younger than 35, had a history of cancer at the time of exam, had a previously diagnosed nodule or a non-solid nodule, or died before the recommended follow-up window. Included patients were categorized by whether they did ("template group") or did not ("control group") have the template added. Largest nodule size reported and smoking history were used to determine the recommended follow-up care for each patient.

RESULTS
A total of 580 patients (292 template, 288 control) met all inclusion and exclusion criteria. Only 222 patients (38%) received their recommended follow-up care. Template group patients were significantly more likely to receive their recommended follow-up care compared to control group patients (44% vs. 32%, p=.0037). Of the 358 patients that did not receive their recommended follow-up care, the majority (n=239, 67%) did not have a follow-up chest CT exam ordered as recommended. Template group patients were more likely to have a chest CT exam ordered when not recommended (15% vs. 6%, p=.0045) and less likely to have a PET or lung biopsy ordered when not recommended (5% vs. 1%, p=.0221) compared to control patients.

CONCLUSION
The addition of the Fleischner Society guidelines to chest CT reports significantly increases the likelihood of receiving recommended follow-up care for patients diagnosed with incidental solid pulmonary nodules. Additional education is needed to improve appropriate inclusion of the guidelines by radiologists and provider adherence to recommended follow-up care in these patients.

CLINICAL RELEVANCE/APPLICATION
Templated follow-up recommendations provided in radiology reports can help standardize and improve patient care.
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

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

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.
To evaluate whether the degree of perfusion defects assessed on lung perfused blood volume (LPBV) images and type of pulmonary emboli characteristics and perfusion abnormalities in material decomposition images of dual energy CT (DECT).

**Purpose**

To assess relationship between iodine distribution abnormalities in pulmonary blood volume (PBV) images and type of pulmonary emboli (occlusive versus non-occlusive) in virtual monochromatic DECT images.

**Method and Materials**

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 DECT. 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) was 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 most often 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 OPEs cases). 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 47/57 patients) was seen most commonly at segmental level (53%).

**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.

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Subba R. Digumarthy, MD - 2013 Honored Educator

**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**

**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±15 kg) 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**

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Subba R. Digumarthy, MD - 2013 Honored Educator

**SSM05-05  Observer Performance at Varying Dose Levels and Reconstruction Methods for Detection of Indeterminate Pulmonary Nodules**

**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±15 kg) 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.

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Subba R. Digumarthy, MD - 2013 Honored Educator
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, Bostatistics 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
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 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 (p0=0.8, p1=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 Kani, MD, Tsu, Japan (Presenter) Nothing to Disclose
Yasutaka Ichikawa, MD, Matsusaka, Japan (Abstract Co-Author) Nothing to Disclose
Ryohi Nakayama, PhD, Kusatsu, Japan (Abstract Co-Author) Nothing to Disclose
Motonori 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, Daiichi Sankyo Group; Departmental Research Grant, FUIFILM 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 CT datasets, and (2) construction of high quality image from low-dose CT dataset by embedding optimal patches selected from the dictionary. For each patient, standard- and low-dose CT datasets in the remaining 11 patients were used to generate the dictionary. This procedure was repeated for all 12 patients. 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).

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.
Does FDG PET/CT Have Value in Detecting Recurrence of Esophageal Carcinoma?

**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 Galtis, MD, Tubingen, Germany (Abstract Co-Author) Nothing to Disclose
Wolfgang Bethge, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (Abstract Co-Author) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group
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 allogenic 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
Jiaimei Yao, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Xiuliang Lu, Shanghai, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

To improve the sensitivity of dual-input CT (DIPC) for the differentiation of malignant and benign lesions in 320-detector-row CT.

METHOD AND MATERIALS

A total of 128 lesions (79 malignant; 49 benign) from 320-detector-row CT were included. The reproducibility of the DIPC was assessed using the coefficient of variation (CV). The ability of DIPC to differentiate malignant and benign lesions was assessed. The correlation between the DIPC and the micro-vessel density (MVD) was also evaluated.

RESULTS

The reproducibility of the DIPC was excellent (CV=1.5%). The DIPC showed high sensitivity (93%) and specificity (91%) for differentiating malignant and benign lesions. The DIPC was highly correlated with the MVD (r=0.8). Overall, the DIPC is a valuable tool for the differentiation of malignant and benign lesions in 320-detector-row CT.

CONCLUSION

The DIPC is a valuable tool for the differentiation of malignant and benign lesions in 320-detector-row CT. The DIPC is highly reproducible and shows high sensitivity and specificity for differentiating malignant and benign lesions. The DIPC is also highly correlated with the MVD, making it a valuable tool for clinical practice.
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 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) (Fig 2). The FPF was significantly lower in DT than CXR and DES (0.003, 0.133 and 0.126 for DT, CXR and DES).

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
Aamika Talwar, MA, MBCHIR, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose
Shameema Stalin, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose
Aymeric Larrue, PhD, Oxford, United Kingdom (Abstract Co-Author) Employee, Mirada Medical Ltd
Djamal Boukerroui, PhD, Oxford, United Kingdom (Abstract Co-Author) Employee, Mirada Medical Ltd
Mark J. Gooding, MENG, DPhil, Oxford, United Kingdom (Abstract Co-Author) Employee, Mirada Medical Ltd
Fergus V. Gleeson, MBBS, Oxford, United Kingdom (Abstract Co-Author) Consultant, Alliance Medical Limited; Consultant, Blue Earth Diagnostics Limited; Consultant, Polarean, Inc;
Timor Kadir, Oxford, United Kingdom (Abstract Co-Author) Employee, Mirada Medical Ltd

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 I Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Ella A. Kazerooni, MD, Ann Arbor, MI (Moderator) Nothing to Disclose

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Ella A. Kazerooni, MD - 2014 Honored Educator

Sub-Events

SPSC45A USPSTF Lung Cancer Screening: Pro

Participants
Phillip M. Boiselle, MD, Boston, MA (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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Phillip M. Boiselle, MD - 2012 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
Participants
Jeremy J. Erasmus, MD, Houston, TX (Moderator) Nothing to Disclose

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H. Page McAdams, MD - 2012 Honored Educator
Jeremy J. Erasmus, MD - 2015 Honored Educator

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 area 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 tumour. 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) To learn advanced image processing and metabolic parameters in FDG-PET/CT. 2) Review new FDG and PET radiotracers and their applications.
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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**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**
http://blog.naver.com/lks7629

**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
**Personalized Medicine: Thorax**

**Thursday, Dec. 3 8:30AM - 10:00AM Location: S504AB**

**Participants**
Kristy K. Brock, PhD, Ann Arbor, MI (*Moderator*) License agreement, RaySearch Laboratories AB;

**Sub-Events**

**RC622A  Personalized Medicine: Thorax - Motion and IGRT**

Participants
Geoffrey Hugo, PhD, Richmond, VA, (gdhugo@vcu.edu) (*Presenter*) Research Grant, Koninklijke Philips NV; Research Grant, Varian Medical Systems, Inc

**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.

**RC622B  Functional Targeting and Adaptation**

Participants
Martha M. Matuszak, PhD, Ann Arbor, MI (*Presenter*) Research Grant, Varian Medical Systems, Inc

**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.
MSES52

Essentials of Trauma Imaging
Thursday, Dec. 3 10:30AM - 12:00PM Location: S406B

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

Participants

Sub-Events

MSES52A  Cervical Spine Trauma

Participants
Peter J. MacMahon, MD, Dublin, Ireland, (pmacmahon@mater.ie) (Presenter) Nothing to Disclose

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.

MSES52B  A Simplified Approach to Imaging Acetabular Fractures

Participants
Ustun Aydingoz, MD, Ankara, Turkey, (ustunaydingoz@yahoo.com) (Presenter) Speaker, AbbVie Inc; Spouse, Stockholder, Edita Medical Writing Editing Ltd; Spouse, Employee, Edita Medical Writing Editing Ltd;

LEARNING OBJECTIVES
1) Identify the imaginary lines on radiographs to determine the presence of an acetabular fracture. 2) List five most common acetabular fractures that comprise approximately 90% of all. 3) Apply an algorithm to detect the five most common acetabular fractures on radiographs and/or CT. 4) Explain the most relevant information for the clinician regarding imaging assessment of acetabular fractures.

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.

MSES52C  Blunt Trauma of Lung, Pleura, Airways, and Chest Wall

Participants
Guillermo P. Sangster, MD, Shreveport, LA, (gsangs@lsuhsc.edu) (Presenter) Nothing to Disclose

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, herniation, pneumothorax, and hemothorax. C) Intrathoracic traqueo-bronchial laceration.
PURPOSE
To compare the capability of pulmonary MR imaging with ultra-short echo time (UTE) for lung nodule detection and nodule type evaluation with thin-section low- and standard-dose CTs.

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 McNemar’s test.

RESULTS
On nodule detection, inter-observer agreements on all methods (0.81<κ<0.85, p<0.0001) and inter-method agreement among all methods (0.87<κ<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<κ<0.91, p<0.0001). In addition, inter-method agreements among all methods were also determined as almost perfect (0.81<κ<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.
**SSQ04-02 Persistent Pulmonary Subsolid Nodules with Solid Parts of 5mm or Smaller: Their Natural Courses and Predictors for Interval Growth on Follow-ups**

Participants
Jong Hyuk Lee, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Chang Min Park, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sang Min Lee, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Research Grant, Guerbet SA;

**PURPOSE**
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 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 Usuhio, 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 postero-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 (SONIALVISION 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 GGN 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
For the pretreatment evaluation, FDG-PET/CT was performed in 164 patients with 181 part-solid pulmonary nodules (diameter; 33x50).

RESULTS
value of FDG-PET/CT over chest CT in the nodal or extrathoracic staging was evaluated.

standard practice. The CT, FDG-PET/CT and histopathologic characteristics of the nodules were demonstrated and the incremental CT and FDG-PET/CT reports prospectively made by board-certified radiologists and nuclear medicine physicians as a part of our evaluation of non-small cell carcinoma detected as pulmonary part-solid nodules at chest CT were included. We analyzed the chest From March 2011 through March 2015, 164 consecutive patients who underwent whole-body 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.

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-grass 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 mixed nodules. 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

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;
SSQ04-06  **Optimal Window Settings to Improve Visual Detection of Ground-glass Nodules (GGN) - Effect on Agreement and Time-to-detection**

Thursday, Dec. 3 11:20AM - 11:30AM Location: E351

Participants
Julia Alegria, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose
Claudio S. Silva Fuente-Alba, MD, MSc, Santiago, Chile (Abstract Co-Author) Nothing to Disclose
Daniela Barahona, MD, Santiago, Chile (Presenter) Nothing to Disclose

**PURPOSE**
To assess different window settings for visual detection of ground glass nodules (GGN), regarding inter-reader agreement for localization and diameter, measurement bias and time-to-detection (TTD).

**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.

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SSQ04-07  **The Moment of Recognition: Method and Analysis of Gaze Behavior in the Search for Lung Nodules in CT Scans**

Thursday, Dec. 3 11:30AM - 11:40AM Location: E351

Participants
Geoffrey D. Rubin, MD, Durham, NC (Presenter) Consultant, Fovia, Inc; Consultant, Informatics in Context, Inc; Research Consultant, General Electric Company;
Brian Harrwood, 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

**PURPOSE**
To understand the relationship between the distance from a reader's gaze point to visible lung nodule and the momentary likelihood that the nodule will be recognized by the reader.

**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) 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 60th 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 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.

SSQ04-08  
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 Noma, MD, PhD, Tenri, Japan (Abstract Co-Author) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD, Suita, Japan (Abstract Co-Author) Nothing to Disclose
Yoshiharu 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;
Mitsuhiro Koyama, MD, Suita, Japan (Abstract Co-Author) Nothing to Disclose
Sadayuki Murayama, MD, PhD, Nishiara-Chu, Japan (Abstract Co-Author) Nothing to Disclose
Kiyoshi Murata, MD, Otso, 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 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 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
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

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/Funtional Imaging)**

*Thursday, Dec. 3 10:30AM - 12:00PM Location: S404CD*

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**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.

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**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

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**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 Yakuhiin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA; Hiroto Hatabu, MD, PhD, Boston, MA (Moderator) Research Grant, Toshiba Corporation Research Grant, AZE, Ltd Research Grant, Canon Inc

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**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*

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**Participants**

Jonathan H. Chung, MD, Denver, CO (Presenter) Research Grant, Siemens AG; Royalties, Reed Elsevier

Tasha Fingerlin, Denver, CO (Abstract Co-Author) Nothing to Disclose

Marvin I. Schwarz, MD, Denver, CO (Abstract Co-Author) Nothing to Disclose
To know if the 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 idiopathic pulmonary fibrosis (IPF).

**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 as abnormal for, suspicious for, or definite pulmonary fibrosis. Presence of honeycombing and ground-glass opacity as well as extent of disease to the nearest 10% was also scored. HRCT diagnosis was also collected with level of confidence (possible, probable, definite).

**RESULTS**

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. Honeycombing 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. HRCT screening of asymptomatic relatives of patients with FPF should be considered.

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

**SSQ05-03 Prediction of Survival with Baseline Extent and 1-year Change of Regional Disease Patterns at Thin Section CT in Idiopathic Pulmonary Fibrosis**

**PURPOSE**

To know if the 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 idiopathic pulmonary fibrosis (IPF)

**METHOD AND MATERIALS**

Total 194 IPF patients (M:F = 153:41; 63.3 ± 7.8yrs) with TSCT scans at the time of diagnosis and 1 year after were included. Mean follow-up period of survival was 36.0 ± 18.9 months. Using in-house, texture-based automated system, the area percent of abnormal lung (AbN) and fibrosis (FIB) were calculated. The survival analyses were performed by constructing Kaplan-Meier disease-free survival curves. The association of baseline extent and 1-year change of TSCT measures with survival was assessed with Cox proportional hazards regression. Both univariable and multivariable analyses were performed by constructing Kaplan-Meier disease-free survival curves. The association of baseline extent and 1-year change of AbN were predictive of survival. After adjustment, the baseline extent of RO and AbN, HC, RO, FIB were predictive of survival. After adjustment, the baseline extent of RO and AbN, HC, RO, FIB were predictive of survival.

**CONCLUSION**

The baseline extent and 1-year change of regional disease patterns at TSCT, which is measured with texture-based automated quantification system, can predict survival of IPF patients.
**CLINICAL RELEVANCE/APPLICATION**
The baseline extent and change of regional disease patterns quantified with texture-base automated quantification system is useful in predicting survival of IPF patients.

**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**

**Thursday, Dec. 3 11:00AM - 11:10AM Location: S404CD**

**Participants**
Hanan Sherif, MD, Doha, Qatar (Presenter) 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 (Abstract Co-Author) 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.

**SSQ05-05 Regional Variation in Ventilation in the Asthmatic Human Lungs Using Magnetic Resonance Imaging and Computed Tomography**

**Thursday, Dec. 3 11:10AM - 11:20AM Location: S404CD**

**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
expiratory volume in 1 second (% FEV1) (manual/automated: ρ = -0.41, p=0.0002/ρ = -0.24, p=0.040) and % FEV1 over forced vital capacity (p= -0.46, p=0.0001/ρ = -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 p=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, 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
Victor 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 =20.855sec/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
Hyok-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
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, DIPLPHYS, 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 Horie, 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;
Shafique Keshavjee, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose

PURPOSE

Deformation Algorithms

Functional Evaluation of Chronic Lung Allograft Dysfunction with Novel Computed Tomography Lung Deformation Algorithms

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, DIPLPHYS, 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.
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.
Fractal Analysis of the Leiomyoma before Uterine Artery Embolization Using Contrast-Enhanced MRI and Its Effect on the Outcome

PURPOSE
To test whether fractal analysis of the leiomyoma using contrast-enhanced MRI correlates with the leiomyoma volume before and after uterine artery embolization (UAE) and with the percentage change at 3 month follow-up enabling its usage as a prognostic factor for treatment success.

METHOD AND MATERIALS
The study was retrospectively performed on 33 females (Mean Age: 44.85 +/- 3.95) with 64 leiomyomas. For fractal analysis; MRI images were exported and converted into 8-Bit greyscale images. The greyscale images were then loaded into the computer program ImageJ and analysis was performed using the FracLac plugin. The analysis was performed using the differential-box-counting method at 12 different grid positions. The Mean Fractal dimension for each leiomyoma was calculated by drawing a ROI around each leiomyoma. On the other hand the volume of each leiomyoma was calculated before and 3 months after UAE using contrast-enhanced MRI. The correlation between the mean fractal dimension of each leiomyoma and its volume before and after UAE as well as the percentage volume change in leiomyoma volume was tested for statistical significance using Spearman-Rank Correlation test.

RESULTS
The mean Fractal Dimension of all leiomyomas was 1.0622 +/- 0.1472 (Range: 0.74 - 1.31). The mean leiomyoma volume before UAE was 97.38 ml +/- 160.86 (Range: 1.65 - 987.34). At follow-up the mean leiomyoma volume was 68.08 ml +/- 138.3 (Range: 0.15 - 875.05). The mean percentage volume change at follow-up was 52.54% [reduction] +/- 26.99 (Range: 40.05%[increase] - 96.57%[reduction]). A statistically significant strong positive correlation between the mean fractal dimension of each leiomyoma and its volume before and after UAE was observed (rho = 0.77, p<0.0001 and rho = 0.78, p<0.0001 respectively). A statistically significant strong negative correlation between the mean fractal dimension of each leiomyoma and its percentage volume change at 3 month follow-up was noted (rho = -0.68, p<0.0001).

CONCLUSION
The smaller the mean fractal dimension of a leiomyoma before UAE the higher will be the percentage volume reduction at 3 month follow-up following UAE.

CLINICAL RELEVANCE/APPLICATION
Leiomyomas with low mean fractal dimension tend to have a significantly better response at 3 month follow-up following UAE. Hence fractal dimension can be used as a prognostic factor for patient selection.
To find out the variations in utero-ovarian circulation and their association with various endocrinial and biochemical parameters in women with Polycystic Ovarian Syndrome (PCOS).

METHOD AND MATERIALS

65 patients of reproductive age group who had clinical and biochemical findings suggestive of PCOS by Rotterdam criteria (2003) were selected for TVS with Color Doppler study in early follicular phase (3rd-5th day of menstrual cycle). 58 age-matched women with normal clinical and biochemical parameters were taken as controls. The RI (Resistance Index), PI (Pulsatility Index) and PSV (Peak Systolic Velocity) of ovarian stromal and uterine arteries were assessed after the estimation of LH, LH: FSH ratio, free testosterone level, fasting Insulin level and fasting glucose:insulin ratio.

RESULTS

The mean value of LH, LH: FSH, free testosterone and fasting glucose:insulin ratio was significantly higher (p<0.001) in PCOS patients in comparison to control (LH 7.95 ± 1.34 vs 5.60 ± 0.51; LH: FSH=1.93 ± 0.17 vs 1.16 ± 0.22; free testosterone 3.63 ± 0.40 vs 1.71 ± 0.31; fasting glucose:insulin ratio 4.0 ± 0.60 vs 7.51 ± 0.49). The mean ovarian stromal RI, PI and PSV in PCOS was significantly lower (p<0.001) as compared to control (0.43 ± 0.08, 0.58 ± 0.10, 11.41 ± 2.53 vs 0.79 ± 0.21, 0.86 ± 0.03, 9.40 ± 0.73 respectively). Similarly, uterine artery PI was significantly higher (p<0.001) in PCOS when compared to control (3.05 ± 0.45 vs 2.43 ± 0.31). There was significantly negative correlation of ovarian stromal RI with serum LH: FSH ratio (r=0.617, p< 0.01). The Uterine artery PI positively correlated with LH: FSH ratio (r=0.548, p<0.01), free testosterone (r=0.532, p<0.01), fasting Insulin (r=0.414, p< 0.01), fasting glucose:insulin ratio (r=0.484, p<0.01) and inversely with ovarian stromal RI (r=0.410, p<0.01).

CONCLUSION

Hormonal dysfunction is responsible for hemodynamic changes in utero-ovarian circulation in patients with PCOS. Ultrasonography along with color Doppler plays a significant role in the diagnosis and monitoring of Polycystic Ovarian Syndrome.

### CLINICAL RELEVANCE/APPLICATION

The decreased PSV and increased PI and RI of uterine artery may explain recurrent early abortions in PCOS. Significant negative correlation between ovarian stromal RI and LH: FSH ratio confirms hormonal dysfunction.

### SSQ10-03 Contrast Enhanced 3D STIR T2-Weighted SPACE in Evaluating Sacral Nerve Plexus in Pelvic Endometriosis: Compared with Conventional 2D Sequence

**PURPOSE**

To prospectively evaluate microstructural abnormalities in sacral nerve plexus in women with pelvic endometriosis at 3.0T MRI.

**METHOD AND MATERIALS**

Twenty women with clinically diagnosed pelvic endometriosis and 20 age-matched healthy women were enrolled in this study. In addition to conventional coronal 2D T2WI TSE imaging, contrast enhanced coronal 3D STIR T2-weighted SPACE was obtained to produce multiplanar (MPR) images. All examinations were assessed independently by two radiologists for the infiltration of the sacral plexus by endometriotic lesions and the abnormal anatomical features of the sacral plexus. Agreement between 2D- and 3D-sequences and inter-observer-agreement was evaluated using kappa-statistics.

**RESULTS**

The sacral nerve roots in healthy subjects and patients were clearly visualized on both sequences. The diameter of the sacral nerve roots in patients was larger than in the control group. Most of the patients with endometriosis displayed local thickening or indistinction in the fibers of sacral plexus. There were no significant difference between the results of the 2 radiologists (F=2.563, P=0.086). Contrast enhanced 3D STIR T2-weighted SPACE was preferable in evaluating sacral nerve plexus in pelvic endometriosis than regular 2D sequences.

**CONCLUSION**

Changes of the microarchitecture of the sacral nerve plexus were revealed in the patients with pelvic endometriosis on MRI. Contrast enhanced 3D STIR T2-weighted SPACE can display the infiltration of sceral nerve fibers by endometriotic lesions and the abnormal anatomical features of sacral nerve plexus.

**CLINICAL RELEVANCE/APPLICATION**

Contrast enhanced 3D STIR T2-weighted SPACE was applied as a method of magnetic resonance neurography to reveal the correlation between the changes of sacral plexus and chronic pelvic pain in patients with pelvic endometriosis.

**SSQ10-04 MRI-US Fusion Imaging in Real-Time Virtual Sonography for the Evaluation of Pelvic Endometriosis: Preliminary Study**
MR imaging is an accurate technique for the diagnosis of adnexal torsion in the setting of patients with adnexal mass having acute pelvic pain.

**PURPOSE**

Real-time virtual sonography (RVS) is a new technique that uses magnetic navigation and computer software for the synchronized display of real-time US and multiplanar reconstruction MRI images. The purpose of this study was to evaluate the feasibility and ability of RVS to detect pelvic endometriosis.

**METHOD AND MATERIALS**

This study was conducted over a two-month period in March-April 2015 on 25 patients referred for a Clinical and US suspect of endometriosis. Patients underwent pelvic MRI at 3 T and fusion imaging was offered (Hitachi HI Vision Ascendus). The MRI image dataset acquired at the time of the examination was loaded into the fusion system and displayed together with the US image on the same monitor. Both sets of images were then manually synchronized and image were registered using multiple planes MR imaging.

**RESULTS**

2 patients had endometriosis of the vesico-uterine pouch, with urinary symptoms associated. 7 patients had endometriosis of the middle compartment mainly shown as ovarian endometriomas in 6 cases and adenomyosis in 3 cases. 19 had signs of endometriotic implants in the posterior compartment shown as fibrotic plaque over the serosal surface of the uterus and rectum in 12 cases. In 1 case there was a deep infiltrating intestinal endometriosis over the rectum. A retroflexed uterus was associated in 6 cases. 6 cases showed fibrotic strands between the uterus and the rectum with thickening of the uterosacral ligaments. Regarding endometriosis of the medial compartment, there was an overlap of data of 100% between MRI and RVS, both appearing superior to a standard US evaluation. Endometriosis of the vesico-uterine pouch was better visualized in MRI. Fibrotic strand were displayed in both methods with an overlap of 100%; on the contrary, relying on RVS it was more difficult to differentiate between active plaque and predominantly fibrotic plaque because of the difficulty in visualizing the hemorrhagic foci. However the infiltration of the bowel wall was better undressed in RVS.

**CONCLUSION**

Thanks to information from both US and MRI, fusion imaging allows better identification of the pelvic implants, superior to the standard US evaluation.

**CLINICAL RELEVANCE/APPLICATION**

Thanks to information from both US and MRI, fusion imaging allows better identification of the pelvic implants, superior to the standard US evaluation.

**SSQ10-05 Diagnostic Value of MR Imaging to Diagnose Adnexal Torsion**

**PURPOSE**

To retrospectively evaluate the diagnostic performance of MR imaging for the diagnosis of adnexal torsion (AT) in a series of patients with an equivocal adnexal mass at ultrasonography in a context of acute or sub acute pelvic pain.

**METHOD AND MATERIALS**

Our institutional ethics committee approved the study and granted a waiver of informed consent. All patients with acute or sub acute pelvic pain undergoing MR exam for the exploration of an equivocal adnexal mass (January 2007 to December 2012) with surgical exploration or clinical and radiological follow up at least of 3 months were retrospectively included (n=58). Three radiologists blinded to the clinical, ultrasonographic and surgical data retrospectively and independently reviewed MR images. Features associated with AT were identified using univariate and recursive partitioning multivariate analysis.

**RESULTS**

Twenty-two patients (38%) had a diagnosis of AT. The accuracy of MR image interpretation by each reader was 83.8% (26/31), 90.3% (28/31), 83.8% (26/31) in a context of acute pelvic pain and 92.5% (25/27), 88.8% (24/27), 81.5% (22/27) in a context of sub acute pelvic pain for reader 1, 2 and 3 respectively. On multivariate analysis, whirpool sign (OR=6.5 [1.36-31], p=0.01) and a thickened tube (OR=8.2 [1.2-56.8], p=0.03) were associated with adnexal torsion, with substantial inter-reader agreement (kappa 0.71-0.84, and 0.82-0.86, respectively). The presence of adnexal hemorrhagic content helps to predict ovarian viability (p=0.009).

**CONCLUSION**

MR imaging is an accurate technique for the diagnosis of adnexal torsion in the setting of patients with adnexal mass having acute pelvic pain.
or sub acute pelvic pain.

**CLINICAL RELEVANCE/APPLICATION**

MR imaging is an accurate second line technique to diagnose adnexal torsion without any pelvic irradiation with the ability to predict ovarian viability without any gadolinium injection.

**SSQ10-06 Can Diffusion-weighted MR Imaging Differentiate Uterine Sarcomas from Leiomyomas?**

*Thursday, Dec. 3 11:20AM - 11:30AM Location: E450B*

**Participants**

Jun Gon Kim, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Chan Kyo Kim, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jung Jae Park, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Byung Kwan Park, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Differentiation uterine sarcoma from leiomyoma is a major challenge. The aim of this study was to investigate the utility of diffusion-weighted imaging (DWI) in differentiating uterine sarcomas from leiomyomas.

**METHOD AND MATERIALS**

Between January 2010 and August 2014, 188 patients with surgically confirmed 38 uterine sarcomas (16 leiomyosarcomas, 12 malignant mixed Mullerian tumors, 9 endometrial stromal sarcomas, and 1 undifferentiated pleomorphic sarcoma) and 150 leiomyomas were enrolled in this retrospective study. All patients underwent preoperative routine pelvic MR imaging at 3T, including DWI. DWI was obtained using a STIR single-shot echo-planar imaging technique with background suppression (b = 0 and 1000 s/mm²). The apparent diffusion coefficient (ADC) and signal intensity on T2-weighted imaging (T2SI) were calculated in the tumors, normal myometrium and gluteus muscle. In the differentiation of sarcomas from leiomyomas, various parameters (ADC, diffusion restriction, tumor-myometrium or gluteus muscle contrast ratio [TCRm or TCRg] on T2-weighted imaging, necrosis, hemorrhage, and size) were evaluated.

**RESULTS**

The mean ADC values of sarcomas (0.939 ± 0.253) were statistically lower than those of leiomyomas (1.347 ± 0.327 × 10⁻³mm²) (p < 0.001). For differentiating sarcomas from leiomyomas, the parameters including diffusion restriction, T2SI, TCRm, TCRg, necrosis and hemorrhage were statistically significant (all p-values < 0.001). At receiver operating characteristics curve analysis, the area under the curves of diffusion restriction and ADC in differentiating sarcomas from leiomyomas were 0.902 and 0.860, respectively and were statistically greater than other parameters (TCRm, TCRg, necrosis, hemorrhage and size) (p < 0.05): with a cutoff ADC value of 1.111 × 10⁻³mm², the sensitivity and specificity were 79% and 80%, respectively. For the degree of diffusion restriction, sarcomas showed moderate or strong in 97% (37/38), while leiomyomas revealed absent or mild in 69% (104/150).

**CONCLUSION**

DWI at 3T may be a useful technique for the differentiation of uterine sarcomas from leiomyomas.

**CLINICAL RELEVANCE/APPLICATION**

As a noninvasive technique, preoperative DWI at 3T can be used to predict sarcomas in patients with uterine myometrial masses, which may give potential for planning treatment strategies.

**SSQ10-07 Variations in Reporting Recommendations for Son Graphically Evaluated Endometrial Stripe in Post Menopausal Bleeding in a Subspeciality Practice**

*Thursday, Dec. 3 11:30AM - 11:40AM Location: E450B*

**Participants**

Aoiife Kilcoyne, MBCh, Boston, MA (Presenter) Nothing to Disclose
Avinash R. Kambadakone, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Colin J. McCarthy, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Giles W. Boland, MD, Boston, MA (Abstract Co-Author) Principal, Radiology Consulting Group; Royalties, Reed Elsevier
Susanna I. Lee, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Debra A. Gervais, MD, Chestnut Hill, MA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Endometrial cancer is the most common gynecologic cancer in the United States. Early diagnosis and intervention is imperative to improve prognosis and survival. In the setting of postmenopausal vaginal bleeding (PMB), sonographically determined endometrial stripe thickness is an established criteria for predicting risk of cancer and thereby serving as a guide to trigger endometrial sampling. Current guidelines recommend tissue sampling for endometrial stripe measuring >5mm, however, there is limited data on adherence to these guidelines. The purpose of this study was to evaluate the variability in reporting recommendations for sonographically determined endometrial stripe thickness measuring 5mm in patients with PMB at a subspecialty practice in an academic teaching institution.

**METHOD AND MATERIALS**

In this ongoing study, we performed a review of the 'RENDER' radiology database to identify pelvic ultrasound exams performed on women aged 18-80years between January 1st 2009 and December 31st 2014 for evaluation of PMB. Using natural language processing, the radiology reports from these exams were then analysed for endometrial stripe thickness, reporting patterns in the body, impression of radiology report and the recommendations, if any. The search terms used for the focused search included 'endometrial stripe', '5mm', 'postmenopausal'. The variations in the reporting recommendations based on the endometrial stripe thickness were then evaluated.

**RESULTS**

Of the 253 reports reviewed, 58 (24.6%) were not relevant - the search identified patients with an endometrial stripe of greater or
In a subspecialty abdominal imaging practice at an academic institution, considerable variation exists on the reporting recommendation for evaluation of PMB with endometrial stripe thickness measuring 5mm with only 30% of reports adhering to established guidelines.

CONCLUSION

In a subspecialty abdominal imaging practice at an academic institution, considerable variation exists on the reporting recommendation for evaluation of PMB with endometrial stripe thickness measuring 5mm with only 30% of reports adhering to established guidelines.

CLINICAL RELEVANCE/APPLICATION

The findings of this study highlight the need for development of standardised approaches/tools to bring about clarity in terms of management options/further investigation of abnormal endometrial thickening in the setting of postmenopausal bleeding.

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Debra A. Gervais, MD - 2012 Honored Educator
Susanna I. Lee, MD, PhD - 2013 Honored Educator

SSQ10-08 Cystic Adnexal Lesions Analyzed by International Ovarian Tumor Analysis (IOTA) Criteria in Routine Clinical Practice

Thursday, Dec. 3 11:40AM - 11:50AM Location: E450B

Participants
Claire E. Beaumont, MD, Madison, WI (Presenter) Nothing to Disclose
Jessica B. Robbins, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Elizabeth A. Sadowski, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Mark A. Klewer, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Lisa Barnhill, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Laura Huffman, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Katherine E. Maturen, MD, Ann Arbor, MI (Abstract Co-Author) Medical Advisory Board, GlaxoSmithKline plc

PURPOSE

The simple rules developed by the IOTA group direct management of adnexal cysts based on sonographic imaging features. The diagnostic performance of these criteria in routine practice has not been formally evaluated since the original study was published in 2010. The goal of our research is to determine how well the IOTA simple rules criteria perform in stratifying cystic lesions and detecting ovarian cancer in routine radiology practice.

METHOD AND MATERIALS

Patient consent was waived for this IRB approved retrospective review of transvaginal US studies on non-pregnant post-menarchal women performed between January-March 2011. Adnexal cysts larger than 3 cm were evaluated according to the IOTA rules. The incidence of benign adnexal lesions, borderline tumors and ovarian carcinoma was calculated. Surgical pathology, resolution on follow-up imaging and/or normal gynecological pelvic examination at 2 years were the accepted end points.

RESULTS

108 lesions in 104 women met inclusion criteria. Mean age=41±14 years; range=13-84. 3 lesions (2.8%) met simple rule 1 (malignant): 30% (1/3) were cystadenomas and 30% (1/3) carcinoma, with no borderline tumors. 95 lesions (88%) met simple rule 2 (benign): 10.5% (10/95) were benign ovarian neoplasms (dermoids=2; cystadenomas=8), with no borderline tumors or carcinomas. 10 lesions (9.2%) met simple rule 3 (indeterminate): 20% (2/10) were benign ovarian neoplasms, 20% (2/10) borderline tumors, and 10% (1/10) carcinoma. Thus, the IOTA rules gave a definitive (non-indeterminate) result in 98/108 (90.7%) of cases and correctly triaged 100% of borderline and malignant neoplasms either to further imaging evaluation or surgery.

CONCLUSION

The results of this pilot study indicate that the IOTA rules successfully detect borderline and malignant neoplasms. However, the vast majority of lesions in routine practice are benign in both sonographic appearance and clinical behavior. Full and nuanced evaluation of diagnostic performance in routine clinical practice will require a larger number of cancers, to be evaluated in our ongoing research.

CLINICAL RELEVANCE/APPLICATION

The IOTA simple rules were able to detect borderline and malignant ovarian neoplasms in our clinical practice and aided in directing women with such lesions to oncologic specialists.

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Katherine E. Maturen, MD - 2014 Honored Educator

SSQ10-09 MR Imaging and Semi-automated Texture analysis for Differentiating Atypical Appearing Uterine Leiomyomas from Leiomyosarcomas
PURPOSE
To investigate whether qualitative magnetic resonance (MR) imaging features and texture analysis (TA) can distinguish between atypical appearing uterine leiomyomas (ALM) and leiomyosarcomas (LMS)

METHOD AND MATERIALS
Forty-one women with ALM (n=22) or LMS (n=19) at histopathology and MRI between January 1, 2007 and December 31, 2013 were included in this retrospective study. Two readers (R1 and R2), blinded to histopathologic diagnoses, independently evaluated all cases. R2 manually segmented each tumor on axial T2-weighted image. Intensity based gray scale correlation matrix (GLCM) textures and Gabor edge based GLCM textures were computed for each segmented tumor. Relationships between clinical characteristics, imaging features, and histopathology were tested with Fisher's exact test. Each tumor was assigned a score of 0 to 4 based on the total number of most statistically significant features present. Diagnostic accuracy with exact 95% confidence intervals was calculated for each feature and score. Texture features were analyzed with a random forest (RF) classifier to automatically distinguish ALM from LMS. RF classifier was optimized by varying the number of decision trees and its performance was tested with five-fold cross validation.

RESULTS
Nodular borders, hemorrhagic foci, "T2 dark" areas, and central (±peripheral) unenhanced area(s) were significant predictors of LMS (p<0.0001 for each feature and reader). Sensitivity and specificity of each feature for LMS were 0.84/0.74 and 0.91/0.86 for nodular borders, 0.95/1.0 and 0.82/0.95 for hemorrhagic foci, 0.84/0.79 and 0.86/0.86 for "T2 dark" areas, and 0.95/1.0 and 0.73/0.68 for central (±peripheral) unenhanced area(s) for R1/R2, respectively. When any 3 of these features were detected in a lesion, the sensitivities and specificities were 1.0/0.95 and 0.95/1.0 for R1/R2, respectively. The best classification accuracy of computer-generated image features was achieved with 25 decision trees (AUC=0.86, sensitivity=0.95, specificity=0.69). The Gabor edge-based texture features were more relevant than the intensity based texture features for the classification.

CONCLUSION
Presence of certain qualitative MRI features can reliably distinguish ALM from LMS. Texture analysis as a semi-automated adjunct may add certainty to the diagnosis of LMS.

CLINICAL RELEVANCE/APPLICATION
MR imaging and semi-automated texture analysis are useful in distinguishing atypical appearing leiomyomas from leiomyosarcoma.

Honored Educators
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Evis Sala, MD, PhD - 2013 Honored Educator
Intraoperative Ultrasound-guided Resection of Subsolid Pulmonary Nodules

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.

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 hook-wire marking (pneumothorax, pain, dislodge...) or lipiodol or radiotracer marking (pneumothorax, and diffusion of the marker).

Evaluation of Clinical Usefulness of Super-High-Resolution CT with 0.25-mm Slice Thickness * 128 Detector Rows in the Chest

Participants

Hirobumi Nagasawa, RT, Tokyo, Japan (Presenter) Nothing to Disclose
Masahiro Suzuki, Chuo-Ku, Japan (Abstract Co-Author) Nothing to Disclose
Keiichi Noriura, 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...
evaluation. The 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 CTDIvol (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 publically 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 automatic adaptive thresholding method, were Q1=77.9%, Q2=84.6% and Q3=89.7%. 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.

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
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 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 Koyotani, 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

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.
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 a 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 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 cDWI600, 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 as 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.

**Volume of Normal Lung on CT Correlates with Right Ventricular Function and the Prognosis of Patients with Chronic Fibrosing Interstitial Pneumonitis**

**Takashi Iwasawa, MD, PhD, Yokohama, Japan (Presenter) Nothing to Disclose**

**Shingo Kato, Boston, MA (Abstract Co-Author) Nothing to Disclose**

**Akinasa 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 artery 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**

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. Median values of each CT volume were 65.6% for Normal (range, 25.0-89.0%), 4.4% for Emphysema (range, 0.0-57.2%), and 15.1% for Fibrosis (range, 2.1-46.2%). A significant but weak correlation was found between RVEF and Normal CT volume (p=0.001, r=0.452). 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.
Patterns of Metastasis and Recurrence in Thymic Epithelial Tumors: Longitudinal Imaging Review in Correlation with Histologic Subtypes

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.
3D MRI of the Chest: Breath-hold T2* Mapping and Improved Native Lung Tissue Contrast Imaging using Dual Echo Ultrashort Echo Time Radial MRI

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.
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

Participants
Torahiko Yamamoto, 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 Yamashita, 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
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±39.8 (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

Participants
Geoffrey D. Rubin, MD, Durham, NC (Presenter) 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

PURPOSE
To understand the relationship between the distance from a reader's gaze point to visible lung nodule and the momentary likelihood that the nodule will be recognized by the reader.
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 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 assure that radiologists maximize their effectiveness in diagnosing lung disease.

CH248-SD-THB5 Percent Defect Volume in Hyperpolarized Helium-3 MRI of the Lungs as a Biomarker of Severe Outcomes in Asthma

Station #5

Participants
David Mummy, MS, MBA, Madison, WI (Presenter) Nothing to Disclose
Stan Kruger, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Wei Zha, PhD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Ronald L. Sorke, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Loren Denlinger, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Michael Evans, MS, Madison, WI (Abstract Co-Author) Nothing to Disclose
Nizar Jarjour, Madison, WI (Abstract Co-Author) Nothing to Disclose
Sean B. Fain, PhD, Madison, WI (Abstract Co-Author) Research Grant, General Electric Company Research Consultant, Marvel Medtech, LLC

PURPOSE
Hyperpolarized helium-3 (HP-He) magnetic resonance imaging (MRI) of the lungs may be used to assess areas of ventilation defect in asthma. We characterize the whole lung percent defect volume (PDV) measurement in HP-He MRI by evaluating associations with measures of lung function and with clinical outcomes indicative of asthma severity.

METHOD AND MATERIALS
The study population (N = 102, 62 female, age 29.4 ± 12.0 years) was recruited as part of an asthma research program. Asthma severity spanned normal (N = 11, 10.8%), mild/moderate (N = 75, 74.5%), and severe (N = 16, 15.7%). PDV was calculated by dividing ventilation defect volume in HP-He MRI by total lung volume in proton MRI using custom MATLAB software. Population subsets also underwent computed tomography (CT) and/or spirometry. Emergency room visits (ER) and hospitalizations (HOSP) at any time due to trouble breathing were drawn from subjects’ medical history. Correlations between PDV and RA-856 HU (relative area below -856 Hounsfield units on CT, a measure of air trapping) and with spirometric measures of lung function were assessed using Spearman correlation. Associations between PDV and ER and with HOSP were assessed using the Wilcoxon rank-sum test and receiver operating characteristic (ROC) curve analysis. The association between PDV and treatment intensity (none; ER without HOSP; HOSP) was assessed using the Kruskal-Wallis test. Statistical analyses were done in R.

RESULTS
PDV was correlated with RA-856 HU (p = 0.26, p = 0.04), and with spirometric measures of forced expiratory volume in one second (FEV1) percent predicted (%) (p = 0.32, p = 0.001) and FEV1 divided by forced vital capacity (FEV1/FVC) %P (p = 0.54, p < 10^-4). Differences in treatment intensity (p = 0.002, AUC = 0.78), 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 is associated with pulmonary function and clinical outcomes and shows promise as a standalone biomarker predictive of severe exacerbations and health care utilization.

CLINICAL RELEVANCE/APPLICATION
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.

CH249-SD-THB6 Correlation between Functional and Anatomical Characteristics of NSCLC in Patients Undergoing Whole-Body MRI with Diffusion-weighted Imaging and PET-CT before Surgery
PURPOSE

To assess the possible correlation between functional parameters, namely apparent diffusion coefficient (ADC) derived by whole body MRI (WBMRI) 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-IIIa non-N2) underwent WBMRI 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), ADCmin 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

WBMRI with DWI provides functional information comparable to PET-CT with possible implications in the assessment of response to therapy and prognosis in NSCLC patients
Participants
Paul P. Cronin, MD, MS, Ann Arbor, MI (Moderator) Nothing to Disclose

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

URL

SPSH55B  Imaging in Lung Cancer Screening

Participants
Ella A. Kazerooni, MD, Ann Arbor, MI (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/

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.
Thoracic MR: Ready for Prime Time!

Thursday, Dec. 3 4:30PM - 6:00PM Location: E353C

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.

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/

H. Page McAdams, MD - 2012 Honored Educator

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 protocoling, 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

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 thyromectomy.

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?

Participants
Juergen Biederer, MD, Gross-Gerau, Germany, (biederer@radiologie-darmstadt.de) (Presenter) Nothing to Disclose

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.
LEARNING OBJECTIVES

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

ABSTRACT

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

LEARNING OBJECTIVES

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

ABSTRACT

Surgical procedures and complications of the thoracoabdominal aorta

LEARNING OBJECTIVES

1) Discuss the different mechanisms of injuries, pathophysiology, and types of traumatic aortic injuries including aortic dissection, laceration, transection, pseudoaneurysm and intramural hematoma. 2) Review techniques and advances in imaging including DECT/Spectral and ultra-high-pitch imaging to optimize imaging of traumatic aortic injuries and the role of gating, MRE, and TEE. 3) Discuss and demonstrate examples of the grading scheme for traumatic aortic injuries. 4) Demonstrate imaging pitfalls which can cause misinterpretation of traumatic aortic injuries. 5) Review the appropriate management and treatment options, including open surgical repair and percutaneous endovascular repair, for the traumatic aortic injuries.

ABSTRACT

Surgical procedures and complications of the thoracoabdominal aorta
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 to 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 anomalies. 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.
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.

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H. Page McAdams, MD - 2012 Honored Educator
Ella A. Kazerooni, MD - 2014 Honored Educator

Sub-Events

RC801A Development

Participants
Ella A. Kazerooni, MD, Ann Arbor, MI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

See course abstract

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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
View abstract under main course title.

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 (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

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.

SST03-02 Radiogenomic Detection of EGFR and KRAS Mutations in NSCLC Using CT Texture Analysis

Friday, Dec. 4 10:40AM - 10:50AM Location: E451B

Participants

James Sorensen, Houston, TX (Presenter) Nothing to Disclose
Jeremy J. Erasmus, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Shekhar S. Patil, MD, MPH, Houston, TX (Abstract Co-Author) Nothing to Disclose
Laurence E. Court, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Arvind Rao, Houston, TX (Abstract Co-Author) Nothing to Disclose
Myrna C. Godoy, 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;
J J. Lee, PhD, DDS, Houston, TX (Abstract Co-Author) Nothing to Disclose
Kathryn A. Gold, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Stephen G. Swisher, MD, Houston, TX (Abstract Co-Author) Consultant, GlaxoSmithKline plc
Ten 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 5.7cm (range 1.2 - 14.9cm) 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.

Honored Educators

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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
Insuk 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
Kyoung S. Lee, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jungok 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
Sanny Amari, 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
Jean-Charles Soria, 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 administrated 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 lymphangitis 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
The participants of the study were patients with lung cancer who had undergone 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- 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 agreement 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 10 studies with 11 datasets met the inclusion criterion, including 796 patients with a total of 2,433 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.

SST03-07 Clinical Outcome of Stereotactic Body Radiotherapy (SBRT) of Lung Metastases - A Single Center Study

Friday, Dec. 4 11:30AM - 11:40AM Location: E451B

Participants
Natalie D. Klass, MD, Bern, Switzerland (Presenter) Nothing to Disclose
B K. Shrestha, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
PURPOSE

It is hypothesized that oligometastatic disease represents a potentially curable disease. Stereotactic body radiation therapy (SBRT) is an option for patients who are not amenable to or do not want resection. We present a single center study to evaluate the outcome of SBRT in oligometastatic patients with lung lesions.

METHOD AND MATERIALS

Patients: between 07/2009 and 08/2014 oligometastatic patients (n = 24) with 34 lung lesions of various histology were treated with SBRT. 16.7% of the patients had a solitary lung metastasis. In 14 patients (pts.) we treated 1 pulmonary lesion, in 9 pts. 2 lesions and in 1 patient 3 lesions. 19 lesions were located peripherally, 15 centrally. Radiation Therapy: After stereotactic positioning using a Bodyfix®, every patient received a 4D-CT followed by 18F-FDG-PET/CT in radiation treatment planning position (except patients with renal cell cancer). Dose calculation was done with the pencil beam (PB) algorithm in iPlan, IGRT by daily pre-treatment and post-treatment CBCT. Standard fractionation for peripheral lesions was 5x10-12 Gy, for very central lesions 11x4.5 Gy or 10x5-6 Gy, if tolerable according to the RTOG constraints. The dose was prescribed to the isodose line covering at least 95% of the PTV (median prescription isodose line 80%, mean 82%, range 76%-86%; median coverage of the PTV D98, range D94-D100).

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 and 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 pneumonitis 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) Nothing to Disclose
Patrick Veit-Halbach, MD, Zurich, Switzerland (Research Grant, Bayer AG; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, General Electric Company) Nothing to Disclose
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 64-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 1.46, 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 malignant 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.