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CH001-EB-X

Chronic Lung Consolidation: Diagnostic Approach

All Day Room: NA Hardcopy Backboard

Participants
Adriana S. Morales Cardenas, MD, Bogota, Colombia (*Presenter*) Nothing to Disclose
Carlos J. Cogollo, MD, Bogota, Colombia (*Abstract Co-Author*) Nothing to Disclose
Maria C. Perez Alvarado, MD, Bogota, Colombia (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

asmoralesca@gmail.com

TEACHING POINTS

The term consolidation is defined as a "homogeneous increase in pulmonary parenchymal attenuation that obscures the margins of vessels and airway walls" according to the Fleischner Society Glossary of Terms for Thoracic Imaging. Nowadays there is no accepted and universal definition of "chronic consolidation"; In general terms, it's been accepted to designate this term to a consolidation that last for more than 4 weeks after the diagnosis. When confronted with this finding the first imaging approach is usually with high resolution CT (HRCT) of the lung with a broad differential diagnosis. The main purpose of this educational exhibit is to list the characteristic findings for a diagnostic approach such as: key signs of consolidation, associated findings, pattern of distribution, among others.

TABLE OF CONTENTS/OUTLINE

Introduction Definition Epidemiology and CT findings of chronic consolidation Differential diagnosis of chronic consolidation according to etiology: Infectious: Invasive and semi-invasive aspergillosis, tuberculosis Neoplasic: Lepidic predominant adenocarcinoma (LPA) of lung, primary and secondary lymphoma Inflammatory: Organizing pneumonia, chronic eosinophilic pneumonia, sarcoidosis, granulomatosis with polyangiitis and alveolar proteinosis Conclusions Bibliography

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CH002-EB-X

Thoracic Metastasis: Where Are You From? Radiologic Overview According to Distant Primaries

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Participants
Mo In Ha, MD, Ansan, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ki Yeol Lee, MD, PhD, Ansan , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Cherry Kim, MD, Ansan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun-Young Kang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yu-Whan Oh, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hwan Seok Yong, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Metastasis, the spread of cancer cells from a primary tumor to thorax, is the leading cause of mortality in cancer patients. This is partially due to the limited therapeutic options and the short time window that would allow a successful treatment of clinically detectable metastases. It is essential for the radiologists to know the various imaging features of thoracic metastases. In this exhibit, I will review patients' CT and MRI findings with metastatic disease, giving the results of biopsy focusing on radiologic manifestations based on the pathologic and radiologic analysis of primary sites. We retrospectively reviewed CT and/or MR images of 230 patients with thoracic metastatic lesions from thyroid cancer (n=45), colorectal cancer (n = 20), hepatocellular carcinoma (HCC) (n = 37), and stomach cancer (n = 47), choriocarcinoma (n=11), ovary cancer (n=23), etc.

TABLE OF CONTENTS/OUTLINE

1. to review pathologic peculiarities of thoracic metastases compared to those of primary lesions 2. to find and categorize the various CT or MRI findings of thoracic metastases that correlate with the type of primary cancer 3. to analyze pathophysiology between metastatic and primary lesion 4. to provide tips for diagnosis of thoracic metastasis from hidden or known primary lesion

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CH003-EB-X

Clinical and Radiologic Findings of Pulmonary Tuberculosis in the Immunocompromised Hosts: What Radiologists Should Know

All Day Room: NA Hardcopy Backboard

Participants
Mo In Ha, MD, Ansan, Korea, Republic Of (*Presenter*) Nothing to Disclose
Cherry Kim, MD, Ansan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ki Yeol Lee, MD, PhD, Ansan , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yu-Whan Oh, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun-Young Kang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hwan Seok Yong, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Soo Y. Ham, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Ho Hwang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Wook Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. To update and describe radiologic findings of pulmonary tuberculosis (PTB) in each immunocompromised situation 2. To review pathogenetic and pathologic peculiarities of pulmonary tuberculosis (PTB) in the immunocompromised hosts 3. To outline the imaging spectrum of PTB in the immunocompromised hosts 4. To suggest the diagnostic tips of PTB in the immunocompromised hosts

TABLE OF CONTENTS/OUTLINE

1. The pathogenetic and pathologic peculiarities of PTB in the immunocompromized hosts (1) Primary and recurrent (post-primary) infection (2) Traditional and new concept of radiologic finding of PTB (3) PTB and TNF-a antagonist 2. Clinical and radiologic findings of PTB in the immunocompromised hosts (1) PTB in HIV infection - TB-Associated Immune Reconstitution Inflammatory Syndrome (TB-IRIS) (2) PTB in Diabetes Mellitus (3) PTB in Chronic Interstitial Pneumonia (4) PTB in Systemic lupus Erythematosus (5) PTB in Elderly (6) PTB in Solid Organ Transplantation (7) PTB in Patients with Cancer (8) PTB in End Stage Renal Disease 3. When the radiologists need to consider PTB preferentially than other infections in immunocompromised patients? - We suggest diagnostic tips, taking into account of clinical and radiologic manifestations for early recognition.

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CH005-EB-X

Non-Thrombotic Pulmonary Embolism: What the Radiologist Wants to Know

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Participants
Dario L. Balaguera Suarez, MD, Bogota D.C., Colombia (*Presenter*) Nothing to Disclose
Aura Lucia Rivera Bernal, Bogota, Colombia (*Abstract Co-Author*) Nothing to Disclose
Lorena Acosta Hernandez I, MD, Bogota, Colombia (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

dlbalaguera@gmail.com

TEACHING POINTS

To learn the different forms of non-thrombotic pulmonary embolism. To know the multiple clinical presentations and the characteristic findings of each one of the presentation forms. To identify the differential diagnoses appropriately. To know the different forms of management for each type of embolism. To establish an appropriate pronostic for each patology.

TABLE OF CONTENTS/OUTLINE

Types of non-thrombotic pulmonary embolism: - Mercury Embolism. - Fatty Embolism. - Tumor embolism. - Silicone Embolism. - Amniotic fluid embolism. - Septic embolism. Clinical Presentation. Review of imaging findings: - Conventional radiography. - Computed tomography. Differential Diagnosis. Outcomes.

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CH006-EB-X

Subtraction CT for Imaging Pulmonary Embolism Perfusion Defects

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Participants
Dagmar J. Grob, MSc, Nijmegen, Netherlands (*Presenter*) Research Grant, Toshiba Medical Systems Corporation
Luuk J. Oostveen, DIPLPHYS, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mathias Prokop, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG; Speakers Bureau, Bracco Group; Speakers Bureau, Toshiba Medical Systems Corporation; Research Grant, Toshiba Medical Systems Corporation;
Cornelia M. Schaefer-Prokop, MD, Nijmegen, Netherlands (*Abstract Co-Author*) Advisory Board, Riverain Technologies, LLC
Ioannis Sechopoulos, PhD, Atlanta, GA (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Toshiba Medical Systems Corporation; Speakers Bureau, Siemens AG; Scientific Advisory Board, Fischer Medical
Monique Brink, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation

For information about this presentation, contact:

Dagmar.Grob@radboudumc.nl

TEACHING POINTS

Pulmonary iodine maps derived from dual-energy CT have been successfully used for the assessment of acute pulmonary embolism. This technique, in addition to current clinical and imaging markers, can improve risk stratification for treatment, especially for subsegmental embolism. An alternative method to obtain pulmonary iodine maps is the use of subtraction CT. The concept of subtraction CT involves the subtraction of an unenhanced CT scan from an enhanced CT scan, after motion correction. The motion correction software can register the two CT scans with a mean residual error of about 2.3 mm. This accuracy is sufficient for detecting clinically relevant perfusion defects caused by pulmonary embolism. This software solution can be implemented more easily than dual source dual-energy CT hardware, and has shown a better subjective image quality in a preliminary study comparing the two techniques. Therefore, subtraction is a feasible and convenient alternative to dual-energy for CT pulmonary perfusion maps.

TABLE OF CONTENTS/OUTLINE

Background on subtraction CT: Image acquisition, radiation dose and software algorithms How to read subtraction perfusion maps: opportunities and limitations Differences between dual-energy CT and subtraction CT within the same patient: lessons learned. Other clinical applications for subtraction CT Conclusion

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CH007-EC-X

Pay High Attention to High Attenuation: A Pictorial Essay of High Attenuation Lung Lesions

All Day Room: NA Custom Application Computer Demonstration

Participants
Cecilia S. Goldman, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Carlos Roberto B. Vasconcelos JR, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Pedro J. Pereira, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Ricardo Guerrini, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marcio V. Sawamura, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Hye J. Lee, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Adriano S. Seabra, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Vitor C. Zanetta, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

goldceci@hotmail.com

TEACHING POINTS

1- To review the differential diagnosis of high-attenuation thoracic lesions in the lung parenchyma, bronchial tree and vascular structures. 2- To discuss valuable signs to differenciate between non clinically significant lesions and life threatning conditions. 3- To illustrate from the most common to the lesser known image patterns

TABLE OF CONTENTS/OUTLINE

Introduction Pulmonary Alveolar Microlithiasis Pulmonary Dendriform Ossification Tuberculosis Metastasis Silicosis Pulmonary Valvopathy Amiodarone Lung Pulmonary Cement Embolism After Vertebroplasty Embolization of fractured central venous catheter Amyloidosis Pulmonary Artery Bullet Embolism

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CH008-EB-X

Let´s Go Spelunking: Lung Cavities Beyond TBC

All Day Room: NA Hardcopy Backboard

Participants
Javier M. Martinez Martinez, MD, Pilar, Argentina (*Presenter*) Nothing to Disclose
Karen M. Palacio, MD, Pilar, Argentina (*Abstract Co-Author*) Nothing to Disclose
Manuel Conde Blanco, MD, Derqui, Argentina (*Abstract Co-Author*) Nothing to Disclose
Maria C. Ferrario, MD, Ingeniero Maschwitz, Argentina (*Abstract Co-Author*) Nothing to Disclose
Jonathan Rosenvasser, MD, Pilar, Argentina (*Abstract Co-Author*) Nothing to Disclose
Silvia I. Fernandez, MD, Pilar, Argentina (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

JAMARTIN@cas.austral.edu.ar

TEACHING POINTS

To review lung cavity pathophysiology and its relation to imaging findings. To discuss Tuberculosis pulmonary and extrapulmonary findings associated with lung cavities. To explain the imaging findings in lung cavitaties which contribute to establish an accurate diagnosis. To emphasize the importance of an integral approach, including patient history and extrapulmonary images, in order to identify key associated findings. To review lung cavity mimics and learn how to recognize their distinctive characteristics.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Lung cavity pathophysiology 3. Common TBC findings 4. Lung cavities causes Infectious Bacterial Fungal Non-tuberculous Mycobacterial Neoplastic and Metastases Pulmonary infarct Rheumatological and miscellaneous diseases Rheumatoid arthritis Granulomatosis with polyangiitis Mixed connective tissue disease Sarcoidosis Langerhans cell histiocytosis 5. Lung cavity mimics 6. Conclusion

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CH009-EB-X

The Radiologist's Contribution to the Multidisciplinary Pre-Lung Transplant Evaluation: A Breath of Fresh Air

All Day Room: NA Hardcopy Backboard

Participants
Antonio M. Aguilera, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose
Jessica L. Smith, MD, Fishers, IN (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

anaguile@iu.edu

TEACHING POINTS

1. The pre-lung transplant workup requires a multi-disciplinary approach which includes contributions from pulmonology, cardiology, dentistry, and social work, in addition to radiology. 2. There is heterogeneity amongst institutions as to which exams are utlized for pre-transplant evaluation. Examples of commonly performed imaging includes: CT chest, abdomen, and pelvis, esophagram, quantitative V/Q, echocardiogram, bone densitometry, and mammograms. 3. We will review the transplant-specific indications for these imaging studies. 4. The aim of this exhibit is to familiarize radiologists with the different types of imaging and their correlative indications as it pertains to the pre-transplant evaluation.

TABLE OF CONTENTS/OUTLINE

List and description of the roles of the multidisciplinary pre-transplant team. Review common indications and contraindications to lung transplantation Review transplant-specific indications for commonly utilized imaging studies. Single institution review of pre-transplant imaging evaluation via a case-based approach.

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CH010-EB-X

Out with the Old and in with the New: A Comparison of the 7th and 8th Editions of the TNM Staging for Lung Cancer

All Day Room: NA Hardcopy Backboard

Participants
Matthew Burgess, MBChB, Stoke on Trent, United Kingdom (*Presenter*) Nothing to Disclose
Nick A. Watson, MD, Manchester, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Hefin Jones, FRCR, Stoke-on-Trent, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ruth M. Machin, FRCR,MBBS, Stone, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

ruth.machin@uhns.nhs.uk

TEACHING POINTS

The 8th Edition of the TNM Classification of lung cancer has major revisions Increased number of size cut points for T1, and reduced upper size limits for T2 and T3 Invasion of diaphragm re-classified as T4 M1 sub-divided dependent on the presence of single or multiple extra-thoracic metastasis New group stages created

TABLE OF CONTENTS/OUTLINE

Introduction Purpose of TNM Changes due to expanded database New stages based on survival data Changes illustrated with cases from our institution T Classification Tumour size has greater importance with more size cut points T1 divided into T1a, T1b and T1c Alteration in size cut points for T2 Tumours >5cm moved from T2b to T3 Tumours >7cm re-classified as T4 New stage for minimally invasive adenocarcinoma Invasion of main bronchus T2, irrespective of distance from the carina Diaphragm invasion now T4 M classification Extra-thoracic metastases: M1b for single metastasis, M1c for multiple metastases Stage Grouping Stage IA subdivided into IA1, IA2 and IA3 with the new divisions of T1 (N0M0) Stage IIIC created for T3N3 and T4N3 Several tumours have moved stages based on the size re-classification of the T stages T3N2 tumours moved from IIIA to IIIB T3N3 tumours moved from IIIB to IIIC Stage IV subdivided into IVA and IVB. M1a and M1b assigned to IVA and M1c, to IVB

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CH011-EB-X

CT-Guided Fiducial Placement for Preoperative Localization of Small Pulmonary Nodules: How We Do It

All Day Room: NA Hardcopy Backboard

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Shaunagh McDermott, FFR(RCSI), Boston, MA (*Presenter*) Nothing to Disclose
Melissa Price, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Florian J. Fintelmann, MD, Boston, MA (*Abstract Co-Author*) Consultant, McKesson Corporation; Royalties, Reed Elsevier
Harald Ott, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jo-Anne O. Shepard, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Amita Sharma, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mcdermott.shaunagh@mgh.harvard.edu

TEACHING POINTS

After reviewing this education exhibit, the participant should understand the role of preoperative localization of small pulmonary nodules, how to assess a patient for this procedure, and understand the technique of CT guided fiducial placement. This exhibit is based on our experience of over 100 cases, with surgical and pathologic correlation.

TABLE OF CONTENTS/OUTLINE

1. Importance of preoperative localization for minimally invasive lung-sparing or robotic surgery2. Review of alternative image-guided techniques for preoperative localization of small pulmonary nodules a) Hook wire b) Microcoil c) Radiolabelled technetium d) Liquid markers - methylene blue, barium, lipiodol3. Step-by-step guide on image-guided percutaneous CT-guided fiducial placement a) Preprocedure assessment b) Procedure c) Post-procedure care and follow-up4. Potential risks of CT-guided fiducial placement and preventive measures a) Pneumothorax b) Bleeding c) Embolization/migration of fiducials5. Potential advantages of CT-guided fiducial placement over other techniques a) Fast learning curve b) Temporal and technical independence from surgical approach c) Allows biopsy at the time of the procedure d) No histologic impact

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CH100-ED-X

Beyond Pulmonary Embolism: Nonthrombotic Pulmonary Embolism as Diagnostic Challenges

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Bridgette E. McCabe, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Hongju Son, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Igor Goykhman, DO, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
John Hochhold, MD, Ambler, PA (*Abstract Co-Author*) Nothing to Disclose
Clinton Veselis, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Daniel A. Eisenberg, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mccabebr@einstein.edu

TEACHING POINTS

1. Nonthrombotic pulmonary embolism (NTPE) is defined as embolization to the pulmonary circulation caused by a wide range of substances of endogenous and exogenous biological and nonbiological origin as well as foreign bodies. 2. NTPE is an underestimated cause of acute and chronic embolism. Clinical manifestation ranges from asymptomatic to sudden death. 3. NTPE presents a diagnostic challenge because of the low specificity of clinical symptoms and imaging signs. 4. Awareness of the imaging features of NTPE facilitates correct diagnosis and appropriate patient management. 5. The purpose of this educational exhibit is: - To review the pathophysiology of pulmonary embolism - To differentiate NTPE from thrombotic pulmonary embolism - To discuss typical clinical and radiological findings in different forms of NTPE - To familiarize with the atypical radiological features of NTPE

TABLE OF CONTENTS/OUTLINE

1. Pathophysiology of pulmonary embolism and clinical manifestations 2. Radiological findings of acute and chronic thrombotic pulmonary embolism 3. Review of causes/types of NTPE - Biological materials - Nonbiological materials - Foreign Bodies 4. Typical clinical and radiological as well as atypical radiological findings of NTPE on multiple variable imaging modalities

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CH102-ED-X

The Linx Device: A Novel Approach in the Treatment of GERD

All Day Room: NA Digital Education Exhibit

Participants
Peter C. O'Connor, DO, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Matthew S. Hartman, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Nicholas Cleveland, Erie, PA (*Abstract Co-Author*) Nothing to Disclose
Don N. Nguyen, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Jawad M. Qureshi, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Kamyar Ilkhanipour, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

peter.oconnor@ahn.org

TEACHING POINTS

1) Review the pathophysiology and radiographic findings of GERD. 2) Educate the radiologist on the Linx device and its intra-operative and radiographic appearance. 3) Recognize potential post-operative complications.

TABLE OF CONTENTS/OUTLINE

Review the pathophysiology of gastroesophageal reflux disease (GERD) including imaging findings. Review the current medical and surgical treatment options for GERD as well as the indications and side-effects. Introduce the Linx device as a treatment option for GERD. Explain the role of the radiologist in the pre-operative work up. Review the imaging findings including complications: -Intra-operative -Fluoroscopy -Plain Film -CT Summary

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CH103-ED-X

Congenital Aortopathies: What the Radiologist Should Know

All Day Room: NA Digital Education Exhibit

Participants
Brian Goldner, MD, Portland, OR (*Presenter*) Nothing to Disclose
Jessica Kushner, MS, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Cristina Fuss, MD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

goldner@ohsu.edu

TEACHING POINTS

1) Congenital aortopathies, also known as heritable connective tissue disorders, are a group of vascular disorders that predispose to aortic aneurysms and dissection. 2) The most common genetic congenital aortopathies include both syndromic and non-syndromic conditions. These include are bicuspid aortic valve, familial thoracic aortopathy, Turner syndrome, Marfan Syndrome, Loeys-Dietz Syndrome and Smooth Muscle Dysfunction Syndrome (ACTA2-related aortopathy.) 3) Patients with congenital aortopathies may be predisposed to non-vascular findings including musculoskeletal, abdominal visceral, bronchial, and ophthalmologic abnormalities.

TABLE OF CONTENTS/OUTLINE

Review of the shared genetic and molecular basis for congenital aortopathies Review of clinical and ophthalmologic manifestations Review of imaging findings with case examples Cardiovascular pathology including aortic aneurysms/dissections, peripheral arterial aneurysms, bicuspid aortic valve, and pulmonary arterial enlargement Common cardiac/vascular surgical repairs and complications Pulmonary findings Musculoskeletal manifestations Visceral organ anomalies Summary

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CH104-ED-X

Breathe New Life into Your Chest CT Exams Using Advanced Acquisition and Post-Processing Techniques

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Nikkole Weber, Rochester, MN (*Presenter*) Nothing to Disclose
Lori Peterson, ARRT, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Chi Wan Koo, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Brian J. Bartholmai, MD, Rochester, MN (*Abstract Co-Author*) License agreement, ImBio, LLC Scientific Advisor, ImBio, LLC
Cynthia Walfoort, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Ahmed Halaweish, PhD, Rochester, MN (*Abstract Co-Author*) Employee, Siemens AG
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG
Joel G. Fletcher, MD, Rochester, MN (*Abstract Co-Author*) Grant, Siemens AG; ;

For information about this presentation, contact:

weber.nikkole@mayo.edu

TEACHING POINTS

Advanced acquisition techniques such as dual-energy CT, tin filtration and high pitch, dual source spiral scanning offer beneficial options for chest CT scanning Reconstruction parameter choices can have considerable qualitative and quantitative impact in thoracic imaging Post processing techniques can reduce interobserver variability and provide useful quantitative information that cannot be determined visually

TABLE OF CONTENTS/OUTLINE

1. Advanced acquisition techniques Dual-energy CT 100 kV with tin filtration High-pitch dual-source spiral CT 2. Reconstruction techniques and impact on visual quality or quantitative analysis High resolution reconstructions using large matrix sizes Sharp vs. smooth reconstructions and impact of edge enhancement in pulmonary imaging Different strengths of iterative reconstruction 3. Advanced post-processing techniques a. Detection CAD (Computer-Aided Detection) c. Characterization CANARY (Computer-Aided Nodule Analysis and Risk Yield) CALIPER (Computer-Aided Lung Informatics for Pathology Evaluation and Rating) 4. Future developments needed to improve current workflows, acquisitions and post processing

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CH105-ED-X

Pitfalls in MRI of Thymic Masses

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Participants
Mark M. Hammer, MD, Boston, MA (*Presenter*) Nothing to Disclose
Maria F. Barile, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Constantine A. Raptis, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Sanjeev Bhalla, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mmhammer@bwh.harvard.edu

TEACHING POINTS

1) Describe the key sequences used to distinguish benign thymic lesions from thymomas. 2) List reasons why a thymoma may be misinterpreted as a thymic cyst. 3) Describe atypical features of benign thymic cystic lesions that may simulate thymoma.

TABLE OF CONTENTS/OUTLINE

1. Overview of thymic MRI protocol 2. Thymoma Misinterpreted as a Cyst a. Apparent lack of enhancement i. Optimize imaging parameters ii. Patient cooperation iii. Small foci of enhancement missed b. True hypoenhancement i. Check T2 hyperintensity ii. T2 hyperintensity on STIR confused as cystic 3. Cyst Misinterpreted as a Thymoma a. Intermediate T2 hyperintensity i. From blood/protein ii. From cardiac pulsation b. Rim enhancement from inflammation c. Septal enhancement i. Multilocular thymic cysts ii. Lymphangiomas 4. Thymic Hyperplasia Misinterpreted as a Thymoma a. Hyperplasia may enhance and appear nodular i. Use chemical shift ratio 5. Thymoma Misinterpreted as Thymic Hyperplasia a. Use chemical shift ratio on all nodular elements

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CH106-ED-X

Fat-Containing Lesions of the Chest: Beyond Hamartomas

All Day Room: NA Digital Education Exhibit

Participants
Rogerio Z. Pinetti, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Helena A. Pereira, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Katia H. Nishiyama, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Alexandre M. Silva, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Gustavo Pinto, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Roberto Blasbalg, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Elaine Yanata, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Vivian C. Silva, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

katianishiyama@yahoo.com.br

TEACHING POINTS

A fat-containing lesion is considered in the most of cases a benign lesion, and when this component can be indentified, some of the diagnosis are definitive. Pulmonary hamartoma is the most common fat-containing lesion of the chest. However, many others chest's structures may present a fat-containing lesion and different diagnosis should be remember.1) to review common and some uncommon lesions of the chest that contain fat2) to point out some lesions and sublte imaging findings that may be missed by radiologists

TABLE OF CONTENTS/OUTLINE

1) Introduction2) Fat-containg lesions: chest wall (lipoma, fat necrosis in the breast) , pleura (pleural lipoma), pulmonary parenchyma (hamartoma, lipoid pneumonia), airways (endobronchial lipoma) and mediastinum (superior vena cava's lipoma, mediastinum's lipoma, thymolipoma, teratoma, lipomatus hypertrophy of the interatrial septum, myocardium ischemia sequelae)2) Conclusion

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CH107-ED-X

Smoke: Non-Uniform Intravascular Contrast Enhancement on Chest CT

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Travis S. Henry, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Brent Little, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Leif Jensen, MD,MPH, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose
Jeffrey P. Kanne, MD, Madison, WI (*Abstract Co-Author*) Research Consultant, PAREXEL International Corporation; ; Consultant, HealthMyne, Inc
Seth J. Kligerman, MD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
Howard Mann, MD, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

travis.s.henry@gmail.com

TEACHING POINTS

Contrast opacification of vessels is often nonuniform on chest CT. Many physiologic and technical factors produce heterogeneous vessel enhancement and contrast mixing, which we term "smoke" Understanding the physiology and normal distribution of contrast is important for recognition of smoke and accurate interpretation of thoracic CT. This is arguably most important for avoiding overdiagnosis such as pulmonary embolism (PE). Smoke can be divided into two categories: Dark smoke - unopacified blood in a contrast-filled chamber mimicking thrombus (e.g. incomplete opacification of a pulmonary artery simulating PE) White smoke - high concentration contrast in an unopacified chamber (e.g. contrast passing across a septal defect)

TABLE OF CONTENTS/OUTLINE

1. Contrast kinetics, phsyiology and normal distribution of contrast on chest CT 2. Definition of smoke and factors contributing to its appearance: Proper window/level settings Visual 'illusion' of filling defects Physiologic causes of smoke 3. Dark smoke - distinguishing a real thrombus or filling defect from artifact PE as the prototype of dark smoke Dark smoke in other chambers/vessels 4. White smoke - a clue to cardiac or extracardiac shunts Intra/extracardiac shunts Arteriovenous connections 5. Strategies to minimize smoke

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High-Density Material in the Pleural Space

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Thomas E. Pendergrast, MD, Winston-Salem, NC (*Presenter*) Nothing to Disclose
Brenda L. Holbert, MD, Greensboro, NC (*Abstract Co-Author*) Nothing to Disclose
Reginald F. Munden, MD, DMD, Winston Salem, NC (*Abstract Co-Author*) Nothing to Disclose
J. Michael Holbert, MD, Winston Salem, NC (*Abstract Co-Author*) Author, Reed Elsevier

For information about this presentation, contact:

tpenderg@wakehealth.edu

TEACHING POINTS

By viewing the exhibit the learner should be able to: 1. Recognize common causes and appearances of high-density material in the pleural space, including calcification and its mimics. 2. Differentiate rare causes and appearances of high-density material in the pleural space. 3. Utilize patient presentation and history to help determine cause and significance of high-density material in the pleural space.

TABLE OF CONTENTS/OUTLINE

1. Brief overview of imaging and anatomy/physiology of the pleural space with radiographic and CT correlation 2. Common causes of calcification in the pleural space -example cases 3. Rare causes of calcification in the pleural space -example cases 4. Causes of high-density material that may mimic calcification in/near the pleural space -example cases 5. Summary, including how to utilize patient presentation and history to help determine cause and significance of high-density material in the pleural space

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CH110-ED-X

Breathing Underwater: A Review of Pleural Physiology, Pathophysiology, and Thoracic Imaging Findings

All Day Room: NA Digital Education Exhibit

Participants
Benjamin D. Parnes, BA , Brooklyn, NY (*Presenter*) Nothing to Disclose
Haneen Ali, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Anna Shmukler, MD, Brooklyn, NY (*Abstract Co-Author*) Nothing to Disclose
Benjamin Zalta, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jeffrey M. Levsky, MD, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Linda B. Haramati, MD, MS, Bronx, NY (*Abstract Co-Author*) Spouse, Board Member, Kryon Systems Ltd

For information about this presentation, contact:

benjamin.parnes@downstate.edu

TEACHING POINTS

1) Review the differential diagnosis for pleural effusions, highlighting characteristic imaging features and clinical correlation.2) Discuss the difference between exudative and transudative pleural effusions, including review of Light's criteria.3) Review suitable diagnostic imaging modalities to identify different types of pleural effusions based on their underlying etiology.4) Identify treatment options for different types of pleural effusions.

TABLE OF CONTENTS/OUTLINE

Review normal physiology of the pleura Review underlying pathophysiology for formation of pleural effusionsClinical case presentations utilizing multimodality imaging including:Transudate: -Cardiac disease - left and right heart failure -Nephrotic syndrome -Cirrhosis - hepatic hydrothoraxExudate: -Infection - parapneumonic effusion, empyema necessitans, reactivation tuberculosis -Malignant pleural effusions - primary lung cancer, metastatic disease, lymphoma, mesothelioma -Inflammatory - asbestos exposure, drugs, pulmonary embolism -Immunologic pleural disease - Dressler's syndrome, rheumatoid arthritis, lupus -Chylothorax - lymphangioleiomyomatosis -Hemothorax -Abdominal causes - pancreatitis, Meig's Syndrome -Iatrogenic

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CH111-ED-X

Lung Cancer Screening: An Algorithmic Approach

All Day Room: NA Digital Education Exhibit

Participants
Marie Surovitsky, DO, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
Corinne C. Liu, MD, Mineola, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

cliu@nyuwinthrop.org

TEACHING POINTS

The American College of Radiology Lung CT screening and Reporting Data System (Lung RADS) plays a major role in aiding the radiologist and referring clinicians in the follow up of pulmonary nodules found in low dose screening chest Computed Tomography (CT). The purpose of this educational exhibit is to present an algorithmic approach in the interpretation of low dose screening chest CTs. A step by step approach will be presented for solid, part solid and non solid nodules. Specific case examples will also be provided. Participants will understand the imaging findings for different nodules that correspond to a specific Lung RADS category and its follow up recommendation.

TABLE OF CONTENTS/OUTLINE

An algorithmic approach will be presented, divided into solid, part solid and non solid nodules, based on Lung RADS. Specific cases will be presented to help understand the different Lung RADS categories depending on the size, density and additional imaging characteristics of nodules. List of cases: Solid pulmonary nodules, ranging from Lung RADS 1 to 4, with algorithmic approach in each case Part solid pulmonary nodules, ranging from Lung RADS 1 to 4, with algorithmic approach in each case Non solid pulmonary nodules, ranging from Lung RADS 1 to 4, with algorithmic approach in each case

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Bronchopulmonary Sequestration: Spectrum of Appearance on CT

All Day Room: NA Digital Education Exhibit

Participants
Neda Rastegar, MD, Newark, NJ (*Presenter*) Nothing to Disclose
Pierre D. Maldjian, MD, West Caldwell, NJ (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

neda_ras80@yahoo.com

TEACHING POINTS

Bronchopulmonary sequestration (BPS) is defined as a segment of nonfunctioning lung parenchyma which lacks communication with the tracheobronchial tree that receives blood supply from an aberrant systemic artery. BPS can have a variety of appearances on MDCT and is often encountered as an unexpected abnormality. The goals of this exhibit are to illustrate characteristic findings of BPS as seen on MDCT, discuss features that facilitate prompt recognition, review the classification scheme of BPS and demonstrate the variety of appearances of this disorder.

TABLE OF CONTENTS/OUTLINE

This presentation features a case-based illustration of the spectrum of appearances of BPS on MDCT. The exhibit is organized as follows:A) Definition, embryology and epidemiology of BPSB) Classification scheme of BPS (intralobar vs extralobar)C) Illustration of spectrum of appearances of BPS on CTD) Differential diagnosis of BPSE) Complications of BPSF) Treatment of BPS

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Throw Chest Radiologists a Bone!: Thoracic Diseases with Musculoskeletal Manifestations and Vice Versa

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Alexandre Semionov, MD, PhD, Montreal, QC (*Presenter*) Nothing to Disclose
John P. Kosiuk, MD, Cartierville, QC (*Abstract Co-Author*) Nothing to Disclose
Amr M. Ajlan, MD, Jeddah, Saudi Arabia (*Abstract Co-Author*) Nothing to Disclose
Federico Discepola, MD, Saint-Laurent, QC (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1) Being able to list 25 non-infectious and non-neoplastic pathological entities which may result in thoracic and musculoskeletal (MSK) radiological abnormalities. 2) Being able to integrate non-specific findings of thoracic and/or MSK radiological abnormalities in order to arrive to a specific diagnosis or a short differential diagnostic list of the entities above.

TABLE OF CONTENTS/OUTLINE

Each case will be presented as radiological image(s) of thoracic and MSK abnormalities. The combination of the thoracic and MSK findings should lead to a fairly specific diagnosis. Explanation of the findings and brief review of the pathological entities will be provided. The pathological entities included in the presentation: 1. Sarcoidosis 2. Langheran's cell histiocytosis 3. Erdheim-Chester 4. Holt-Oram Syndrome 5. Pentalogy of Cantrell 6. Klippel-Feil syndrome 7. Cleidocranial dysplasia 8. Poland syndrome 9. Lymphangiomatosis 10. Neurofibromatosis type 1 11. Tuberous sclerosis 12. Marfan syndrome 13. Rheumatoid arthritis 14. Systemic lupus erythematosus 15. Systemic sclerosis 16. Polymyositis/dermatomyositis 17. Relapsing polychondritis 18. Ankylosing spondylitis 19. Amyloidosis 20. Hemochromatosis 21. Hyperparathyroidism 22. Rickets 23. Niemann-Pick disease 24. Sickle cell anemia 25. Extramedullary hematopoesis

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CH114-ED-X

Collateral Pathways from Superior Thoracic Inlet Venous Obstruction (STIVO): Review of Embryology, Anatomy, and Clinical Relevance

All Day Room: NA Digital Education Exhibit

Participants
Andreas A. Meier, MD, New York, NY (*Presenter*) Nothing to Disclose
Hatem Alkadhi, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

In patients with STIVO blood seeks detours which results in the formation of collateral pathways. In a review of CT exams of such patients, we could define 8 distinct pathways (s. table) These pathways play a critical role in radiologic imaging bc pseudopathologic enhancement of bony structures and parenchymal organs may occur

TABLE OF CONTENTS/OUTLINE

Pathophysiology STIVO caused by occlusion of the SVC and/or its tributaries due to tumors, radiotherapy, interventions Reduced/stopped bloodflow via the physiological main route forces blood to develop detours Imaging CT: modality of choice for confirmation & clarifying underlying disease MRI: No radiation exposure makes it the reference standard for patients with congenital vascular anomalies, pregnant women, younger patients US: minor role for intrathoracic veins Review of imaging findings CT exams of patients with STIVO: identification of 8 collateral pathways Description of each pathway: embryolog, anatomy, clinical/radiological implications, pitfalls Summary Venous detours often develop in more than one pathway simultaneously and can cause pseudopathologic enhancement of bony structures/parenchymal organs. It is important to recognize imaging findings associated with venous collateral pathways to make the correct diagnosis.

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CH116-ED-X

Should I Be Concerned About That? Clarifying Common Doubts in Incidental Nodule Management Encountered in General Practice (An Update of the Fleischner Society Guidelines)

All Day Room: NA Digital Education Exhibit

Participants
Juliana M. Bueno, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Luis A. Landeras, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Jonathan H. Chung, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Incidental pulmonary nodules are very common and most cases are managed with aplomb by most radiologists. Specific situations in which radiologists may struggle have been included in the recent update of the Fleischner Society Guidelines for incidental nodule management. A straightforward and clear plan of action in these situations will be presented, useful for both the thoracic imagers and radiologists practicing in other subspecialties. After reviewing this exhibit the learner will be able to: 1. Define the classification of pulmonary nodules and the rationale behind the different management 2. Identify specific situations encountered in general practice that require additional considerations in the management of incidental pulmonary nodules 3. Implement the appropriate steps to follow in these cases in order to optimally complete the characterization and imaging work-up of incidental pulmonary nodules

TABLE OF CONTENTS/OUTLINE

1. Classification of pulmonary nodules: difference between solid and subsolid lesions 2. How to appropriately measure solid and subsolid lesions 3. Case-based review and the appropriate steps to follow in specific situations, according to the new guidelines: • multiple pulmonary nodules • nodules detected on incomplete thoracic CT scans • apical scarring • perifissural lesions • cystic lesions

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CH117-ED-X

Test Your Knowledge: Venous Collateral Pathways in the Chest

All Day Room: NA Digital Education Exhibit

Participants
Komal A. Chughtai, MD, Rochester, NY (*Presenter*) Nothing to Disclose
Thomas Marini, East Syracuse, NY (*Abstract Co-Author*) Nothing to Disclose
Zachary M. Nuffer, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Susan K. Hobbs, MD,PhD, Pittsford, NY (*Abstract Co-Author*) Nothing to Disclose
Katherine A. Kaproth-Joslin, MD, PhD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

thomas_marini@urmc.rochester.edu

TEACHING POINTS

1) Review normal and abnormal venous anatomy in the chest and upper extremities 2) Apply knowledge of collateral pathways to localize venous obstruction

TABLE OF CONTENTS/OUTLINE

1) Review of normal venous anatomy in the chest and upper extremities using original illustrations 2) The majority of the presentation consists of image rich case presentations in quiz format presenting a venous obstruction followed by the question "where does the blood go?" The answer to the quiz question will be outlined on both CT images from the cases and original illustrations highlighting the direction of blood flow and different collateral pathways. a. Axillary vein obstruction b. Subclavian vein obstruction c. Brachiocephalic vein obstruction d. Superior vena cava obstruction i. Above the azygos vein ii. At the level of the azygos vein iii. Below the azygos vein

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Congenital and Acquired Transdiaphragmatic Communication: Types, Imaging, Mimics, Complications and Treatment

All Day Room: NA Digital Education Exhibit

Awards
Cum Laude

Participants
Swar H. Shah, MD, Rochester, NY (*Presenter*) Nothing to Disclose
Apeksha Chaturvedi, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Prabhakar Rajiah, MD, FRCR, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Sudhakar N. Pipavath, MD, Mercer Island, WA (*Abstract Co-Author*) Consultant, Boehringer Ingelheim GmbH; Advisor, Boehringer Ingelheim GmbH; Adjudicator, Gilead Sciences, Inc
Ashu S. Bhalla, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Abhishek Chaturvedi, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1) Normal development and anatomy of the diaphragm. 2) Identify different types diaphragmatic defects. 3) Learn the key findings on the diagnostic tests (radiography, CT with and without contrast, MRI, Cholangiography and Nuclear Medicine Scintigraphy. 4) Develop an algorithmic approach to apply the definitive diagnostic test features and imaging modality. 3) Learn the complications associated with these defects, how to recognize them. 4) Key findings that the treating surgeon is looking for in the radiology report to optimize for surgical repair.

TABLE OF CONTENTS/OUTLINE

I Types of diaphragmatic defects: congenital, acquired. post traumatic II Flowchart depicting an algorithmic approach on how and when to apply which diagnostic modality. A. Radiographs and fluoroscopy B. CT C. MRI D. Nuclear Medicine III Evaluation of the herniated viscera for life threatening complications such as strangulation, or incarceration. IV Treatment options from interventional radiology V Key findings that the treating surgeon is looking for in the radiology report to optimize for surgical repair

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Update of the Fleischner Society Guidelines for Nodule Management: Answers to Frequently Asked Questions - Subsolid Pulmonary Nodules

All Day Room: NA Digital Education Exhibit

Participants
Juliana M. Bueno, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Luis A. Landeras, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Jonathan H. Chung, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

In the 2017 update for the Fleischner Society Guidelines, the recommendations for management of subsolid lesions have been modified. Increased latitude in nodule management may introduce unexpected challenges for radiologists and clinicians in general practice. After reviewing this exhibit the learner will be able to: 1. Recognize imaging characteristics for subsolid pulmonary nodules: pure ground-glass nodules vs part-solid nodules 2. Define the appropriate method for measurement of subsolid lesions 3. Identify specific situations that may represent a challenge in the decision making process when applying the revised criteria for subsolid nodules 3. Implement the new criteria for subsolid nodule management

TABLE OF CONTENTS/OUTLINE

1. New criteria for subsolid nodule management 2. Definition of subsolid lesion 3. Appropriate measurement method 4. Potential practical challenges with the new guidelines: a. Risk factors that really count b. Morphologically suspicious ground glass nodules < 6 mm in low risk patients: follow-up versus no follow-up c. The solid component remains stable but measures >6mm: is that a suspicious feature? d. The overall size of the lesion is stable but the solid component has increased: what is the appropriate step to follow? 5. Answers to these situations for an optimal utilization of the new guidelines

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Puff the Magic Dragon: A Review of Marijuana Use and Associated Thoracic Imaging Findings

All Day Room: NA Digital Education Exhibit

Participants
Benjamin D. Parnes, BA , Brooklyn, NY (*Presenter*) Nothing to Disclose
Narmadan Kumarasamy, MD, MPH, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Anna Shmukler, MD, Brooklyn, NY (*Abstract Co-Author*) Nothing to Disclose
Benjamin Zalta, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jeffrey M. Levsky, MD, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Linda B. Haramati, MD, MS, Bronx, NY (*Abstract Co-Author*) Spouse, Board Member, Kryon Systems Ltd

For information about this presentation, contact:

benjamin.parnes@downstate.edu

TEACHING POINTS

1) Discuss effects of marijuana use on respiratory tract function.2) Identify differences in the methodology of marijuana smoking compared to tobacco smoking, and how this contributes to different pathophysiological findings.3) Discuss thoracic imaging findings in chronic natural marijuana smokers and synthetic marijuana smokers.4) Discuss association between chronic marijuana smoking and the increased risk of respiratory tract cancer and lower respiratory tract infection.5) Discuss association between marijuana smoking in immunocompromised patients and invasive aspergillosis.

TABLE OF CONTENTS/OUTLINE

Review of clinical symptoms found in patients who chronically smoke marijuanaReview of pathophysiological effects of chronic marijuana use on the respiratory systemClinical case presentations utilizing multimodality imaging including: -Emphysema in patients with chronic marijuana use compared to chronic tobacco smokers -Chronic bronchitis and findings related to small airway disease including tree-in-bud pattern and nodular opacities -Organizing pneumonia -Lung cancer -Infection such as invasive aspergillosis

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Diseases with Thoracic and Orbital Involvement: What the Radiologist Should Know

All Day Room: NA Digital Education Exhibit

Participants
Felipe Aluja, MD, Bogota, Colombia (*Presenter*) Nothing to Disclose
Samira E. Saraya, MBChB, PhD, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Vilaas Shetty, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Sanjeev Bhalla, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Fernando R. Gutierrez, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

macario171@gmail.com

TEACHING POINTS

1) To recognize the diseases that share thoracic and orbital involvement divided into autoimmune, vasculitis, connective tissue diseases, multisystemic and congenital. 2) Describe the physiopathology and their clinical presentation, with special emphasis in the thoracic involvement and mentioning the orbital most common involvement. 3) Review the key elements regarding the imaging findings based on a diagnostic algorithm, that the radiologists must look for in order to do an appropriate diagnosis.

TABLE OF CONTENTS/OUTLINE

Introduction The eye and the chest: how are they related Orbital involvement general features Thoracic involvement: characteristics and imaging features Sjögren syndrome (Autoimmune) Systemic lupus erythematous (Autoinmmune) Grave´s Disease (Autoimmune) Myasthenia gravis (Autoimmune) Relapsing polychondritis (Autoimmune) Granulomatosis with polyangiitis (Vasculitis) Polymyositis/dermatomyositis (Connective tissue diseases) Sarcoidosis (Multisystemic) Amyloidosis (Multisystemic) Erdheim Chester disease (Multisystemic) Lymphoma (Multisystemic) Tuberculosis (Multisystemic) Neurofibromatosis (Congenital) Marfan syndrome (Congenital) Diagnostic algorithm Conclusion

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CH122-ED-X

Imaging of Response to Radiation Therapy in the Chest: Impact of Therapeutic Modality on Image Interpretation

All Day Room: NA Digital Education Exhibit

Participants
Dennis H. Kwon, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Alexandra Doms, BA, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Abigail T. Berman, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Charles B. Simone II, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Varsha Jain, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Caitlin Schonewolf, MD, MS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Sharyn I. Katz, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

dennis.kwon@uphs.upenn.edu

TEACHING POINTS

• Brief description of major radiation therapy options with discussion of clinical indications, advantages/disadvantages for treatment of thoracic malignancy. • Review radiologic manifestations of radiation-induced pneumonitis as a function of time over course of therapy. Explain how these changes may differ by radiation modality type. • Describe the potential pitfalls in image interpretation during radiation therapy response assessment for thoracic malignancy, including differentiation between expected therapy-induced changes and recurrence and when to consider pseudo-progression.

TABLE OF CONTENTS/OUTLINE

1. Description of 3 major radiation options with discussion of indications, pros, and cons • Stereotactic body radiation therapy (SBRT) • Intensity-modulated radiation therapy (IMRT) • Proton therapy (PT) 2. Imaging characteristics that define pneumonitis and radiation fibrosis • Consolidation, crazy paving, ground glass halo, nodular-like, scar-like pattern, and mass-like pattern 3. CT manifestations of pneumonitis with time based on radiation modality 4. Expected and atypical appearance post-radiation • Signs of recurrence • Differentiating what is expected versus signs of recurrence and avoiding common pitfalls • Differential diagnosis of post-treatment complications

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CH123-ED-X

The Mediastinal Visceral Space: Central Pathway for the Spread of Mediastinal Disease

All Day Room: NA Digital Education Exhibit

Participants
J. Michael Holbert, MD, Winston Salem, NC (*Presenter*) Author, Reed Elsevier
Michael Oliphant, MD, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

By reviewing this exhibit the learner should: 1. Understand the relationship of branchial pouch and foregut embryology to the mediastinal visceral space. 2. Comprehend the extent of the mediastinal visceral space in the adult. 3. Be able to identify, analyze and predict the pathway of spread of gas, fluid, fat and soft tissue mass through the mediastinal visceral space.

TABLE OF CONTENTS/OUTLINE

1. Brief overview of the embryology of the branchial pouches and foregut. 2. Discussion of the extent of the mediastinal visceral space in the adult. 3. Examples of the pathway of spread of different types of material through the mediastinal visceral space, including: a) gas (peribronchovascular gas, pneumomediastinum) b) fluid (positive contrast material after esophageal perforation, mediastinal pseudocyst) c) fat (lipoma) d) soft tissue mass (mediastinal goiter, granulomatous lymph nodes, metastatic disease) 4. Examples of the influence of the mediastinal visceral space on the pathways of spread through the mediastinum, including: a) between the neck and mediastinum b) between the lungs and mediastinum c) between the abdomen and mediastinum 5. Summary discussing the important role of the mediastinal visceral space as a central pathway for spread of mediastinal disease.

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CH124-ED-X

Alveolar Pulmonary Metastases: Facing the Challenges

All Day Room: NA Digital Education Exhibit

Participants
Marta Vilas, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose
Flavio Zuccarino, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Lara Pijuan, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Enric Ripoll, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Marta Cufi, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Luis A. del Carpio Bellido Vargas, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Angel Gayete Cara, MD, PhD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Antonio Fernando Fernandez Alarza, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mvilas@parcdesalutmar.cat

TEACHING POINTS

To depict the most relevant imaging features in alveolar pulmonary metastases. To present their radio-pathological correlation. To describe benign and malignant pulmonary conditions that are potential diagnostic pitfalls.

TABLE OF CONTENTS/OUTLINE

Alveolar pulmonary metastases represent an uncommon presentation of metastatic lung disease, in which tumor cells grow by lining alveolar walls (i.e. lepidic growth). The most frequent causes for such metastatic pattern are tumors of the gastrointestinal tract. In order to facilitate the diagnosis of this type of metastases, in this poster a series of illustrative cases together with their radio-pathological correlation will be presented. Different examples ranging from pancreatic, colonic and ovarian adenocarcinomas, to renal cancer and melanoma will be exposed. At CT, typical findings include air-space nodules, consolidations, focal or confluent ground-glass opacities and 'halo sign' nodules; all of which are unspecific, thus leading to difficulties in the adequate diagnosis. Potential pitfalls in their differential diagnosis represented by benign (pneumonia, organizing pneumonia, alveolar sarcoidosis, pulmonary infarction) and malignant conditions (lung adenocarcinoma and lymphoma) will also be illustrated.

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CH125-ED-X

Fibrosing Mediastinitis Revisited: Multimodality Imaging and Histopathologic Correlation of Focal and Diffuse Fibrosing Mediastinitis

All Day Room: NA Digital Education Exhibit

Awards
Identified for RadioGraphics

Participants
Sherief Garrana, MD, Kansas City, MO (*Presenter*) Nothing to Disclose
Jennifer R. Buckley, MD, Kansas City, MO (*Abstract Co-Author*) Nothing to Disclose
Santiago Martinez-Jimenez, MD, Kansas City, MO (*Abstract Co-Author*) Author, Reed Elsevier; Author, Oxford University Press
John J. Borsa, MD, Overland Park, KS (*Abstract Co-Author*) Nothing to Disclose
Phillip Munoz, MD, Kansas City, MO (*Abstract Co-Author*) Nothing to Disclose
Melissa L. Rosado De Christenson, MD, Kansas City, MO (*Abstract Co-Author*) Author, Thieme Medical Publishers, Inc Author, Reed Elsevier Author, Oxford University Press

For information about this presentation, contact:

sherief.garrana@gmail.com

TEACHING POINTS

1. Review the epidemiology and pathogenesis of the focal and diffuse forms of fibrosing mediastinitis. 2. Describe characteristic imaging features on multiple modalities, including CT, MR and PET/CT. 3. Illustrate pathology that may mimic or be hidden within fibrosing mediastinitis and provide tips for making an accurate diagnosis on CT and MR. 4. Discuss complications as well as conventional and evolving interventional and non-interventional treatment options. 5. Highlight the importance of different imaging modalities for routine patient follow-up and assessment of treatment response.

TABLE OF CONTENTS/OUTLINE

Fibrosing medastinits is a rare, benign, and sometimes life-threatening process which occurs due to proliferation of fibrotic tissue within the mediastinum. The focal subtype is more common and typically associated with an abnormal immunologic response to Histoplasma capsulatum exposure, while the diffuse form is idiopathic and related to various autoimmune diseases. Recognition of imaging features in conjunction with patients' clinical history can facilitate differentiation of fibrosing mediastinitis from possible mimics. Furthermore, careful assessment of the fibrotic tissues is crucial on initial and follow up imaging to exclude underlying malignancy, and to accurately evaluate disease progression or treatment response.

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CH126-ED-X

Pulmonary Edema: Common and Uncommon Etiologies and Radiographic Manifestations

All Day Room: NA Digital Education Exhibit

Participants
Maria F. Barile, MD, Boston, MA (*Presenter*) Nothing to Disclose
Eric Schmidlin, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Hiroto Hatabu, MD, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation ; Research Grant, AZE, Ltd; Research Grant, Canon Inc; Research Grant, Konica Minolta Group; Consultant, Toshiba Medical Systems Corporation
Andetta R. Hunsaker, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

MBARILE@PARTNERS.ORG

TEACHING POINTS

1. Become familiar with the common and uncommon radiographic manifestations and causes of pulmonary edema 2. Understand the pathophysiology of various etiologies of pulmonary edema.

TABLE OF CONTENTS/OUTLINE

Table of contents/outline: 1. Definition of pulmonary edema a. Schematic of pulmonary interstitium/alveoli b. Factors affecting extravascular fluid movement (Starling equation) 2. Common and uncommon radiographic manifestations of pulmonary edema a. Common radiographic manifestation i.Kerley lines ii.Peribronchial cuffing iii.Vascular redistribution iv.Symmetric groundglass and consolidative opacities v.Crazy paving b.Uncommon radiographic manifestations i.Asymmetric ground glass or consolidation ii.Focal consolidation 3. Common and uncommon etiologies of pulmonary edema a. Common Etiologies i.Heart failure ii.ARDS b. Uncommon etiologies of pulmonary edema i.MV regurgitation ii.PE iii.PVOD iv.Smoke inhalation v.Drugs- "Crack lung", salicylate toxicity,opiods vi.Capillary leak syndrome - from chemotx- gemcitiabine, monoclonal antibiodies, interleukins vii.Re-expansion pulmonary edema viii.Neurogenic pulmonary edema ix.High altitude pulmonary edema

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Multimodality Imaging Of Solitary Fibrous Tumor of the Pleura (SFTP)

All Day Room: NA Digital Education Exhibit

Participants
Gensuke Akaike, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Jitesh Ahuja, MD, MBBS, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Manuela C. Matesan, MD, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1: Review of epidemiology, pathogenesis and clinical manifestations of SFTP.2: Review typical imaging findings on CT and F-18 FDG PET/CT.3: Discussing role of CT and F-18 FDG PET/CT in differentiating benign and malignant SFTP.4: Differential diagnoses and pitfalls.

TABLE OF CONTENTS/OUTLINE

1: Solitary fibrous tumor (SFT) is rare fibroblastic mesenchymal tumor exhibiting CD 34 that can arise from serosal membrane throughout the body. Solitary fibrous tumor of the pleura (SFTP) usually arises from the visceral pleura.2: Most SFTs are benign but up to 20 % of lesion are considered pathologically malignant. However, pathologically benign cases sometimes demonstrate clinically aggressive behavior. 3: We will discuss the behavior of SFTP, imaging findings and the role of each modalities to achieve better clinical management.

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Calcific/Ossific Disorders of the Lungs and Pleura

All Day Room: NA Digital Education Exhibit

Awards
Magna Cum Laude
Identified for RadioGraphics

Participants
Hamza Jawad, MBBS, Saint Louis, MO (*Presenter*) Nothing to Disclose
Sanjeev Bhalla, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

jawadh@wustl.edu

TEACHING POINTS

1. To acknowledge the different causes of diffuse pulmonary and pleural calcifications/ossification.2. Use a systematic approach based on the location of calcifications/ossification to narrow the differential diagnosis. 3. Incorporate ancillary imaging features to correctly identify the cause for calcifications/ossification.

TABLE OF CONTENTS/OUTLINE

1. Review the epidemiology, pathogenesis and imaging feature of disorders that result in multiple pleural or parenchymal calcifications/ossification:a. Pleural: asbestos exposure, chronic empyema/hemothorax, fibrothorax, talc pleurodesis, tuberculosis. b. Pulmonary: metastatic calcifications, dystrophic calcifications, dendriform pulmonary ossification, calcified nodules - healed varicella pneumonia, histoplasmosis, tuberculosis, metastasis, silicosis, sarcoidosis.c. Mixed: pulmonary alveolar microlithiasis, diffuse pulmonary ossification.2. Describe an organized approach to the correct diagnosis based on the location of calcifications/ossification and other ancillary imaging findings.

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The Good the Bad and the Ugly: Recognizing Thoracic Radiotherapy Complications

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Marcelo K. Benveniste, MD, Houston, TX (*Presenter*) Nothing to Disclose
Brett W. Carter, MD, Houston, TX (*Abstract Co-Author*) Editor, Reed Elsevier
Sonia L. Betancourt Cuellar, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Girish S. Shroff, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Ana Paula Benveniste, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Erika G. Odisio, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Edith M. Marom, MD, Ramat Gan, Israel (*Abstract Co-Author*) Speaker, Bristol-Myers Squibb Company

For information about this presentation, contact:

mfbenveniste@mdanderson.org

TEACHING POINTS

1- Radiotherapy plays a central role in the treatment of many thoracic malignancies including lung, esophageal, breast and thymic epithelial neoplasms, mesothelioma, and lymphoma. 2- Newer radiotherapy delivery techniques result in non-traditional patterns of radiation changes to the lungs and surrounding organs, which should not be confused with tumor recurrence, infection or other lung diseases. 3- Radiotherapy complications are divided into early and late complications, occurring years after delivery. Organs affected may be at the center of the radiation field or outside of it and include the heart, great vessels, esophagus, lung, liver and chest wall. 4- Imaging following radiotherapy is helpful in detecting symptomatic and asymptomatic complications including radiation-associated malignancies.

TABLE OF CONTENTS/OUTLINE

1- Newer radiotherapy delivery techniques, their typical patterns of radiation pneumonitis, and time to maturation. 2- Expected changes from radiation affecting the lungs, heart, pleura, pericardium, esophagus and liver. 3- Differentiation of tumor-like patterns of radiation injury from infection and local recurrence. 4- Identifying complications in the symptomatic and asymptomatic patient affecting the lungs, chest wall, heart, vessels and mediastinum.

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Tuberculosis in 4D: Imaging Findings from Head to Toe and Throughout the Time

All Day Room: NA Digital Education Exhibit

Participants
Raissa A. Felippe, MD, rio de janeiro, Brazil (*Presenter*) Nothing to Disclose
Bianca Guedes Ribeiro, MD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Luis Paulo S. Gil, MD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Ana Costa, MD , Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, RIO DE JANEIRO, Brazil (*Abstract Co-Author*) Nothing to Disclose
Gabriella M. Borges, MD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD, Rio De Janeiro, Brazil (*Abstract Co-Author*) Investor, Healfies LLC

For information about this presentation, contact:

raissa.alves.med@gmail.com

TEACHING POINTS

(1) Tuberculosis is an infection caused by Mycobacterium tuberculosis, which is spread through the air in saliva particles. The bacillus generates an inflammatory reaction, primarily neutrophil mediated, until a granulomatous reaction is formed. (2) Patients may remain asymptomatic for the rest of the host's life or progress later to fully developed tuberculosis. (3) The aim of this study is to discuss about tuberculosis in different stages of infection, and describe the most relevant imaging findings in distinct organs and systems, such as lungs, pleura, lymph nodes and bones.

TABLE OF CONTENTS/OUTLINE

Overview:Tuberculosis: Epidemic desease. Pathophysiology: from Gohn's nodule to disseminated tuberculosis. Main characteristics of the mycobacteria. Imaging protocols: MDCT and HRCT of the chest, MRI (chest, spine, abdomen, brain). Imaging Findings : Lungs Pleura Lymph nodes Meninges Bones Kidneys and urinary system Gastrointestinal tract Peritoneum Lower GU tract Tuberculosis in immunodepressed patients. Tuberculosis associated with fungal diseases. Differential diagnosis. Summary and didactical body scheme.

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A Sound Approach to Biopsy: Ultrasound Guided Techniques For Lung and Chest Percutaneous Interventions

All Day Room: NA Digital Education Exhibit

Participants
Robert Villani, MD, Manhasset, NY (*Presenter*) Nothing to Disclose
Ashwin Balasubramaniam, MD, New Hyde Park, NY (*Abstract Co-Author*) Nothing to Disclose
Suraj H. Rambhia, MD, New Hyde Park, NY (*Abstract Co-Author*) Nothing to Disclose
Rakesh D. Shah, MD, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

rvillani@northwell.edu

TEACHING POINTS

1. Learn the necessary ultrasound scanning techniques to evaluate lung and chest normal anatomy and pathology. 2. Patient selection. Who will benefit from Ultrasound guided interventions and why. 2. Learn the technique of ultrasound guided percutaneous procedures of the chest and lungs. This will include: Localization and selection of lesions. Application of local anesthesia. Needle selection and techniques. 3. Become familiar with associated limitations and pitfalls and possible complications.

TABLE OF CONTENTS/OUTLINE

1. Introduction. What is and why should you employ ultrasound guided chest/lung interventions. 2. Patient selection. 3. Anatomy. 4. Ultrasound Technique for Chest and lung evaluation. (probe selection and scanning technique). 5. Needle selection and technique. 6. Limitations, pitfalls, and possible complications. 7. Summary/Review

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Pulmonary Embolism: Much Beyond Deep Venous Thrombosis Embolization

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Participants
Eduardo K. Fonseca, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Rodrigo B. Passos, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Hamilton Shoji, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Mauricio Yamanari, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marcelo B. Funari, MD, Ribeirao Pires, Brazil (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

edukaiser_unf@hotmail.com

TEACHING POINTS

The purpose of this exhibit is: 1. To review pathophysiology of pulmonary embolism and its findings in chest x-ray and CT 2. To discuss the pathophysiology and imaging findings in hemodynamic consequences of a massive embolism 3. To discuss atypical embolisms, their imaging findings and differential diagnosis

TABLE OF CONTENTS/OUTLINE

0- Pathophysiology 1- Pulmonary embolism classic findings 2- Massive embolism (imaging and hemodynamic consequences) 3- Fat embolism (trauma and cosmetic surgery complication) 4- Infectious embolism 5- Mycoplasma pneumoniae pneumonia induced pulmonary embolism 6- Gas embolism 7- Amniotic embolism 8- Vertebroplasty cement embolism 9- Catheter tip embolism 10- Projectile embolism 11- Tumoral embolism

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The Exhibition and Clinical Utility of High Resolution Three Dimensional Surface/Volume Rendering (HR-3D) CT in Various Pleural/ Pulmonary Diseases

All Day Room: NA Digital Education Exhibit

Participants
Nobukata Kazawa, MD, PhD, Nagoya, Japan (*Presenter*) Nothing to Disclose
Yuta Shibamoto, MD, PhD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Masanori Kitaichi, Sakai, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiromi Wada, MD,PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

nobukaz@med.nagoya-cu.ac.jp

TEACHING POINTS

On HR-3D-CT,the visceral pleural involvements by interstitial pneumonia were clearly displayed as relative high density area,and honeycombing lung and emphsematous bullae were also appreciated as pleural bulging. The intra/interlobular septal thickenings were clearly observed on HR-3D-CT with hypersensitivity pneumonitis, congestive heart failure and lymphoproliferative diseases.

TABLE OF CONTENTS/OUTLINE

Sixty-one patients (31 men and 30 women;mean 56.6 years old) with pleural/pulmonary disease were examined by thin slice (0.5-1mm) MDCT, and then the high resolution 3D volume/surface rendering images were constructed. The visceral pleural lesions of the interstitial pneumonia(NSIP,UIP,CVD-IP) were clearly displayed. Bulging pleura in honeycombing lung or bullous emphysema, and the depression of the pleura by the chest wall or parietal pleural lesions were precisely shown on HR-3D-CT. The interlobar fissure and interlobular septal thickenings were more easiy recognized in patients with congestive heart failure or lymphoproliferative disease than 2D-CT. The intra/interlobular septal thickenings were clearly observed in patients with hypersensitivity pneumonitis, congestive heart failure and lymphoproliferative diseases. The sensitivity of subtle pleural lesions on HR-3D-CT were significantly better than the conventional 2D-CT statistically.

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New CT-Based Mediastinal Compartment Classifications and Differential Diagnosis of Mediastinal Tumors

All Day Room: NA Digital Education Exhibit

Awards
Cum Laude

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

For information about this presentation, contact:

nakazot@cc.saga-u.ac.jp

TEACHING POINTS

To understand the traditional and new CT-based mediastinal compartment classifications of the mediastinal compartments. To learn differential diagnosis of mediastinal tumors according to the CT-based mediastinal compartment classification. To review CT and MRI findings and pathological features of mediastinal tumors.

TABLE OF CONTENTS/OUTLINE

Traditional classifications of the mediastinal compartments Felson classification Heitzman classification Zylak classification, etc. New CT-based classifications of the mediastinal compartments Japanese Association for Research on the Thymus (JART) classification International Thymic Malignancy Interest Group (ITMIG) classification Radiological and pathological features and differential diagnosis of mediastinal tumors according to the ITMIG mediatinal compartment classification Prevascular compartment Solid: thymic epithelial tumors, malignant lymphoma, germ cell tumors, thymolipoma, etc. Cystic: thymic syst, cystic teratoma, pericardial cyst, etc. Visceral compartment Solid: malignant lymphoma, neurogenic tumors, etc. Cystic: foregut cyst, etc. Paravertebral compartment Solid: neurogenic tumors, extramedullary hematopoiesis, myelolipoma, etc. Cystic: lateral menigocele, thoracic duct cyst, etc.

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Interventional Radiologic Procedures in Thoracic Infections: What Every Radiologist Should Know

All Day Room: NA Digital Education Exhibit

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Participants
Daniel Vas, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose
Ivan Vollmer, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Mariana N. Benegas Urteaga, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Angel Gayete Cara, MD, PhD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Marcelo Sanchez, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

dvas@clinic.cat

TEACHING POINTS

To review the imaging findings, indication criteria, procedures and techniques of radiological interventions in infective pulmonary, pleural and mediastinal diseases. When, why and how should a general/thoracic radiologist act?

TABLE OF CONTENTS/OUTLINE

LUNG: • Bacterial infections: Indication of percutaneous aspiration • Pyogenic lung abscess Imaging findings Indication of ultrasound/CT guided drainage Technique, management and efficacy • Fungal infections Imaging findings Indication of aspiration and biopsy • Complications PLEURA: • Management of pleural effusion, empyema • Thoracentesis Guidance Volume Intrapleural fibrinolytic agents Complications • Drainage Criteria (collocation, removal) Technique (guidance, tube size, drainage systems) Complications MEDIASTINUM: • Pericardiocentesis - Percutaneous drainage • Mediastinal abscess, fluid collection, pseudocyst Indication and controversies of drainage Techniques

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Interpreting the Reversed Halo Sign: Differential Characteristics and Key Clues

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Participants
Belen Del Rio Carrero, MD, Terrassa, Spain (*Presenter*) Nothing to Disclose
Lola Esteba, MD, Terrassa, Spain (*Abstract Co-Author*) Nothing to Disclose
Marina Torres, Badalona, Spain (*Abstract Co-Author*) Nothing to Disclose
Marta Ferrer, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Inmaculada Romero, MD, Terrassa, Spain (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

belendlrio@gmail.com

TEACHING POINTS

To learn to recognize the reversed halo sign and to know the spectrum of diseases in which it is seen. To become familiar with the key findings that enable the differential diagnosis among conditions in which the reversed halo sign can occur. To assimilate the pieces of clinical data that can be relevant to narrow down the differential diagnosis.

TABLE OF CONTENTS/OUTLINE

Introduction Definition of the reversed halo sign (RHS). What does the RHS translate? Histopatholgy. Differential morphologic characterictics of the sign: 4.1 RHS with thick rim and reticular center: Fungal infections 4.2 RHS with micronodules: Granulomatous diseases Key clues: Review of the disease spectrum in which the RHS can ocur pointing out the relevant clinical data and imaging findings. 5.1 Infectious diseases: invasive fungal infections, tuberculosis, pneumocystis jiroveci pneumonia, secondary pracoccidiodomicosis, hystoplasmosis, cryptococosis and secondary organising pneumonia, 5.2 Tumoral related: radiofrequency ablation lesions, radiation induced lung disease, chemotherapy induced drug toxicity, metastasis. 5.3 Vascular diseases: pulmonary infarct and vasculitides. 5.4 Indolent diseases:sarcoidosis, COP, lymphomatoid granulomatosis, lipoid pneumonia, chronic eosinophilic pneumonia, adenocarcinoma with lepidic patthern.

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Opportunities for Translation of Quantitative Imaging Biomarkers into Clinical Cardiothoracic CT

All Day Room: NA Digital Education Exhibit

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Awards
Cum Laude
Identified for RadioGraphics

Participants
Fernando U. Kay, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Orhan K. Oz, MD, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Suhny Abbara, MD, Dallas, TX (*Abstract Co-Author*) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG
Prachi P. Agarwal, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Prabhakar Rajiah, MD, FRCR, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Eduardo J. Mortani Barbosa, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

fernando.kay@utsouthwestern.edu

TEACHING POINTS

1) To provide a practical understanding of the principles underlying quantitative CT methods with potential clinical use in cardiothoracic imaging; 2) To underscore the leadership role of RSNA's Quantitative Imaging Biomarkers Alliance (QIBA) for improving the value and applicability of quantitative methods into clinical practice.

TABLE OF CONTENTS/OUTLINE

1)Introductiona. What are Quantitative Imaging Biomarkers (QIB)?b. Role of RSNA's Quantitative Imaging Biomarkers Alliance.2) Case study of critical opportunities for QIB in Chest CT:a. Lung nodule volumetryb. Emphysema quantificationc. Dynamic expiratory collapse of the trachead. Pulmonary blood flow (dynamic CT) and Perfused blood volume (dual-energy CT)e. Calcium scoref. Epicardial fatg. Quantitative bone mineral density (QCT)3) Conclusions/Take-home points

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Pulmonary Tuberculosis: A Change of Paradigm

All Day Room: NA Digital Education Exhibit

Participants
Maria Jesus L. Gonzalez, MD, Granada, Spain (*Presenter*) Nothing to Disclose
Beatriz Gutierrez Martinez, MD, Toledo, Spain (*Abstract Co-Author*) Nothing to Disclose
Monica Bernabeu Rodriguez, MD, Toledo, Spain (*Abstract Co-Author*) Nothing to Disclose
Andres Enriquez-Puga, MBChB, MSc, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Rafael Morcillo Carratala, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Carmen Ruiz Sr, Toledo, Spain (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

To analyze the radiological features on chest X-ray (CXR) and computed tomography (CT) of primary and post-primary presentation patterns of pulmonary tuberculosis (TB). To review the thoracic sequelae and complications from pulmonary tuberculosis.

TABLE OF CONTENTS/OUTLINE

Classical knowledge divides pulmonary TB into primary and post-primary according to the time of exposure, but it has been proven that the radiological appearance is more related to the immune stage rather than the time of exposure. We assess the role of imaging in the diagnosis and follow-up of TB disease, in the knowledge that immunocompromised patients tend to present with a primary pattern, whereas immunocompetent patients tend to present with a post-primary pattern. Moreover, we review the sequelae and complications which can be categorized as parenchymal, airway, pleural, mediastinal, chest wall and vascular lesions.

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Optimized Preprocedural Evaluation and Technique for CT-Guided Transthoracic Lung Biopsy: Comprehensive and Up-to-Date Literature Review

All Day Room: NA Digital Education Exhibit

Participants
Rehan S. Quadri, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Sachin S. Saboo, MD, FRCR, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Suhny Abbara, MD, Dallas, TX (*Abstract Co-Author*) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG
Alison Palumbo, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Sanjeeva P. Kalva, MD, Dallas, TX (*Abstract Co-Author*) Consultant, General Electric Company; Royalties, Reed Elsevier; Royalties, Springer Nature; Investor, Althea Healthcare
Patrick D. Sutphin, MD, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

rehan.quadri@gmail.com

TEACHING POINTS

Review the key high risk clinical characteristics for CT guided Trans-Thoracic Needle Biopsy (CT-TTNB) Establish a concise essential checklist of imaging features for lung biopsy targets on pre-procedural CT that alter technique and can increase risk of complications Provide an Up to date optimized technique based on current literature Highlight important post-procedural management steps

TABLE OF CONTENTS/OUTLINE

Overview of CT-guided TTCNB Indications Diagnostic Accuracy Key Anatomy Pre-Procedural Evaluation High risk clinical characteristics Essential findings of biopsy targets on pre-biopsy CT Concise check list for pre-biopsy complication risk assestment Percutaneous Technique FNA vs Core-Needle Biopsy Co-axial techniques Intermitent CT versus CT fluoroscopy Needle positioning, trajectory and lesion sampling Additional equipment including hemostatic valves and closure devices Intra-procedural complications Post-procedural Management Routine monitoring and chest X-rays Post-procedural Complications Specifics on Pneumothorax Biopsy Results and Follow Up

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Histoplasmosis: The Many Flavors of a Forgotten Fungus

All Day Room: NA Digital Education Exhibit

Participants
Michele Perillo, MD, FRCPC, Montreal, QC (*Presenter*) Nothing to Disclose
John P. Kosiuk, MD, Cartierville, QC (*Abstract Co-Author*) Nothing to Disclose
Karl Sayegh, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Jana L. Taylor, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Genevieve Belley, MD, Monteal, QC (*Abstract Co-Author*) Nothing to Disclose
Alexandre Semionov, MD, PhD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Richard Fraser, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

.

TEACHING POINTS

After viewing this exhibit, the learner will : have a baseline understanding of the epidemiological and clinical findings in histoplasmosis be more comfortable in recognizing the various potential thoracic manifestation of histoplasmosis have an appreciation for the overlap in appearance between histoplasmosis and other disease processes, both neoplastic and infectious/inflammatory be exposed to the potential complications of histoplasmosis

TABLE OF CONTENTS/OUTLINE

Clinical and Epidemiological findings in Histoplasmosis Imaging Manifestations of Histoplamosis -Nodular Disease -Masses and mass like lesions -Mediastinal manifestations and fibrosing mediastinitis -Granulomas and varied appearances of calcified abnormalities -Consolidation and consolidative type processes Imaging appearance of histoplasmosis related complications Summary and key teaching points

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CH141-ED-X

Pulmonary Manifestation of the Collagen Vascular Disorder

All Day Room: NA Digital Education Exhibit

Participants
Iclal Ocak, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Diane C. Strollo, MD, Gibsonia, PA (*Abstract Co-Author*) Nothing to Disclose
Kristen Veraldi, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

ocaki@upmc.edu

TEACHING POINTS

Review most common collagen vascular diseases (CVD) associated with lung involvement and depict characteristic thoracic and systemic imaging features, with emphasis on interstitial pneumonias. Intergrate clinical, serologic, imaging and in some cases pathologic features to provide a focused differential diagnosis.

TABLE OF CONTENTS/OUTLINE

The CVDs are a heterogenous group of systemic autoimmune and connective tissue diseases (CTD) with a prediliction for intertitial lung disease (ILD). The most common are rheumatoid arthritis (RA), scleroderma, dermatomyositis/polymyositis (PM/DM), mixed CTD, systemic lupus erythematosis (SLE) and Sjogren syndrome. Common patterns of ILD include usual interstitial pneumonia (UIP), nonspecific interstitial pneumonia (NSIP), organizing pneumonia (OP), lymphoid interstitial pneumonia (LIP), acute interstitial pneumonia (AIP). Constrictive bronchiolitis and necrobiotic lung nodule and lung hemorrhage may occur. Other features include pleural effusion and thickening, serositis, pulmonary hypertention, esophageal involvement. RA typically manifests as UIP, NSIP, or OP. Scleroderma manifests as UIP, NSIP or accentuated bronchiectasis. PM/DM manifests as NSIP, SLE as effusions, Sjogren as LIP, NSIP or UIP. AIP represennts an acute exacerbation, may occur any CVD/ILD, and portends poorer prognosis.

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TNM Staging System for Esophageal Cancer: What is New

All Day Room: NA Digital Education Exhibit

Participants
Sonia L. Betancourt Cuellar, MD, Houston, TX (*Presenter*) Nothing to Disclose
Marcelo K. Benveniste, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
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*) Editor, Reed Elsevier
Jeremy J. Erasmus, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

slbetancourt@mdanderson.org

TEACHING POINTS

To standardize staging and facilitate management the division of the esophagus into upper, middle and lower thirds based on adjacent thoracic anatomic structures is maintained but the esophagogastric junction is redefined: cancers involving the esophagogastric junction with epicenters 2 cm or less into the gastric cardia are staged as adenocarcinomas of the esophagus, while those with more than 2 cm into the cardia are staged as gastric carcinomas. The 8th edition of the AJCC-UICC TNM staging of esophageal carcinoma includes different classifications that depend on the histology of the tumor: there are three different staging groups for both adenocarcinoma and squamous cell carcinoma (clinical- cTNM, pathologic - pTNM, and post neoadjuvant pathologic group -ypTNM). There are important refinements included in the 8th edition of the AJCC-UICC TNM staging for esophageal carcinoma that produce different stage subgroups.

TABLE OF CONTENTS/OUTLINE

Table of content I- Background for the 8th edition of the TNM staging system for esophageal carcinoma II- Esophageal anatomic cancer categories: TNM staging criteria III- Esophageal non-anatomic categories: location, histopathologic cell type, histologic grade IV-Staging groups: clinical- (cTNM), pathologic - (pTNM), and post neoadjuvant pathologic group -(ypTNM) V-Stage-based management

Honored Educators

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Chest Digital Tomosynthesis: A Useful Tool Between X-Ray and CT

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Participants
Nicolas Garcia, MD, Santiago, Chile (*Presenter*) Nothing to Disclose
Juan C. Prieto Rayo SR, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Jose Gutierrez Chacoff, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Veruska de Luccas, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Cristian Varela, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

nicolasgarciaa@gmail.com

TEACHING POINTS

- Recognize the basic technical aspects of chest digital tomosynthesis. - Review the fundamentals of image interpretation. - Identify advantages and limitations of chest digital tomosynthesis. - Acknowledge the potential applications and suggested indications.

TABLE OF CONTENTS/OUTLINE

1. Chest digital tomosynthesis systems: Technical aspects. 2. Fundamental of image interpretation: What to look for? 3. Advantages and limitations: - Diagnostic accuracy - Radiation dose - Costs 4. Potential applications and suggested indications: Case based review. - Pulmonary nodules characterization. - Pulmonary nodules follow up. - Discrimination between parenchymal and chest wall abnormalities. - Mediastinal masses evaluation. - Pulmonary mycobacterial disease. 5. Summary.

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Coincidence? I Think Not! What You Don't Know About Pulmonary Vein Hypoperfusion

All Day Room: NA Digital Education Exhibit

Participants
Ahmad Parvinian, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Chi Wan Koo, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Philip A. Araoz, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

parvinian.ahmad@mayo.edu

TEACHING POINTS

1. To demonstrate the imaging findings of pulmonary vein hypoperfusion 2. To explain the pathophysiology underlying pulmonary venous hypoperfusion in the setting of coexisting thoracic disease 3. To identify common and uncommon conditions associated with this phenomenon, with an emphasis on diagnostic pitfalls

TABLE OF CONTENTS/OUTLINE

1. Overview of Pulmonary Venous Anatomy and Physiology 2. Case-Based Examples of Pulmonary Vein Hypoperfusion Infectious Inflammatory Neoplastic Congenital Vascular Iatrogenic 4. Pitfalls 5. Summary

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Common and Uncommon Manifestations of Cardiothoracic Mucormycosis

All Day Room: NA Digital Education Exhibit

Participants
Matthew Haber, MD, Boston, MA (*Presenter*) Nothing to Disclose
Rachna Madan, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Hiroto Hatabu, MD, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation ; Research Grant, AZE, Ltd; Research Grant, Canon Inc; Research Grant, Konica Minolta Group; Consultant, Toshiba Medical Systems Corporation
Mark M. Hammer, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mmhammer@bwh.harvard.edu

TEACHING POINTS

1. Select patient populations are at high risk for developing pulmonary and cardiac mucormycosis. A high index of suspicion is necessary while interpreting chest CT scans in these patients for early and accurate detection of this potentially fatal life threatening infection. 2. Knowledge of the imaging appearances of pulmonary and cardiac mucormyosis plays a key role in suggesting the presence of this infection and guiding further management

TABLE OF CONTENTS/OUTLINE

1. Patient populations at risk for Mucormycosis 2. Pulmonary nodules and consolidations a. Reverse halo sign b. Groundglass halo c. Cavitation d. Vascular cut-off e. Lobar infarction 3. Cardiac a. Endocarditis i. Vegetation ii. Septic pulmonary emboli 4. Endobronchial lesions 5. Invasion of adjacent structures a. Chest wall b. Mediastinum c. Diaphragm d. Across fissures 6. MR appearance a. 'black hole' post-contrast b. T2 hypointense rim

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Thoracic Hernias: A Radiologic Review

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Participants
Felipe Aluja, MD, Bogota, Colombia (*Presenter*) Nothing to Disclose
Fernando R. Gutierrez, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Sanjeev Bhalla, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

macario171@gmail.com

TEACHING POINTS

• To recognize the different types of thoracic hernias • Describe the imaging findings in the different types of thoracic hernias, their appearance in conventional radiology and computed tomography. • Review the key elements in regard to the imaging diagnosis, focusing on their characteristics, associated findings and some others needed for an adequate diagnosis. • Propose a simple algorithm approach for the thoracic hernias based on imaging findings.

TABLE OF CONTENTS/OUTLINE

Introduction Characteristics and types of thoracic hernias (Congenital, acquired and traumatic/iatrogenic) Imaging characteristics of each type of thoracic hernia: o Diaphragmatic (Bochdaleck, Morgagni, Traumatic, congenital) o Mediastinal (Hiatal hernia, abdominal, cardiac) o Pulmonary (apical lung hernia, intercostal lung hernia) o Chest wall and vertebrae (disc herniation) Algorithm approach Conclusions

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Dynamic Chest Radiography for Follow-Up Assessment of Diaphragm Movement

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FDA Discussions may include off-label uses.

Participants
Rie Tanaka, PhD, Kanazawa, Japan (*Presenter*) Nothing to Disclose
Isao Matsumoto, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Masaya Tamura, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuo Kasahara, MD, PhD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Shuhei Yoshida, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Seiichi Kakegawa, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Shikou Kaneko, Hachioji, Japan (*Abstract Co-Author*) Employee, Konica Minolta Group
Shintaro Muraoka, Hachioji, Japan (*Abstract Co-Author*) Employee, Employee, Konica Minolta Group
Tsutomu Yoneyama, Hachioji, Japan (*Abstract Co-Author*) Employee of Konica Minolta, Inc.
Yukihiro Matsuura, RT, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Junsei Horii, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Shigeru Sanada, PhD, Kanazawa, Japan (*Abstract Co-Author*) Stockholder, Hologic, Inc Research Grant, EIZO Corporation

For information about this presentation, contact:

rie44@mhs.mp.kanazawa-u.ac.jp

TEACHING POINTS

To understand the fundamental observations, imaging procedures, and diagnostic performances of dynamic flat-panel (FPD) based chest radiography for follow-up assessment of diaphragm movement

TABLE OF CONTENTS/OUTLINE

Various types of abnormal motion (non/reduced, time-lagged, and paradoxical motion) Imaging procedure Analysis method Diagnostic approaches Case reports (phrenic nerve paralysis, perioperative lobectomy, atelectasis, COPD, etc.)

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Similar but Not the Same: Differentiating Pulmonary Mucormycosis from Aspergillosis

All Day Room: NA Digital Education Exhibit

Participants
Mi Young Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Dabee Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hyun Jung Koo, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mimowdr@gmail.com

TEACHING POINTS

To illustrate CT imaging features of pulmonary mucormycosis (PM) and invasive pulmonary aspergillosis (IPA).

TABLE OF CONTENTS/OUTLINE

1. Background CT has given us important clues for the clinical suspicion and early treatment of invasive mould pneumonia in immunocompromised patients. 2. Illustration of CT findings for IPA and PM 1) Angioinvasive form - Macronodule (>=1 cm in diameter) - Mass-shaped consolidation - Infarct-shaped consolidation - Halo sign 2) Airway-invasive form - Clusters of centrilobular nodules (<1cm in diameter) - Peribronchial consolidation - Ground-glass opacity - Smooth bronchial wall thickening 3) Necrotizing pneumonia form - Air-crescent sign - Cavitary lesion with consolidation - Internal low attenuation within consolidation - Reverse halo sign (typical RHS, bird's nest sign) 3. Clinical Relevance/Application No available laboratory markers and low culture sensitivity of PM & insufficient sensitivity and specificity of galactomannan assay to diagnosis IPA. The RHS is a more frequent findings of PM than of IPA; conversely, the airway-invasive form is a less common findings of PM than of IPA. These findings may help to diagnosis and initiate appropriate anti-fungal agent in early stage of mucormycosis and aspergillosis in immunocompromised patients.

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Primary Intrathoracic Sarcomas: Epidemiological Particularities and Radio-Pathological Correlations

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Participants
Amandine CROMBE, Bordeaux, France (*Presenter*) Nothing to Disclose
Francois Le Loarer, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Jean-Michel Coindre, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Xavier Buy, MD, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Pierre-Francois Lintingre, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Nicolas Alberti, MD, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Eberhard Stoeckle, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Jean Palussiere, MD, Bordeaux, France (*Abstract Co-Author*) Travel support, Bracco Group
Sophie Cousin, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Maud Toulmonde, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Antoine Italiano, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Michele Kind, MD, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

a.crombe@bordeaux.unicancer.fr

TEACHING POINTS

Primary intrathoracic sarcomas (PITS) are rare malignant tumors arising in lung, pleura, mediastinum, vessels, heart. CT and MRI are the best modalities to characterize PITS. Radiologists must evoke sarcomas facing large well-limited, heterogeneous, vascularized mass with pleural contact and effusion, few lymphadenopathies. However, imaging lacks of specificity. Histology distribution is different from soft tissue sarcomas (STS) of extremities and retroperitoneum. Although precise initial tumor location is difficult to precise on CT, epidemiology of PITS differs depending on their starting place. Based on retrospective research on the pathology and radiology databases of our comprehensive cancer center, and on RRePS database (reference network in sarcoma), our aim is to describe epidemiology, radiopathological particularities of PITS.

TABLE OF CONTENTS/OUTLINE

Epidemiology Per topography: pleura, lung, mediastin, heart, vessels Comparison with non-PITS sarcomas Radio-pathological correlations of main histologies Angiosarcoma Intimal Sarcoma Dedifferentiated liposarcoma (LPS) Myxoid-LPS Synovial sarcoma Solitary fibrous tumor Leiomyosarcoma Epitheloid hemangioendotheioma Unclassified pleomorphic sarcoma SMARCA4-deficient sarcoma Differential diagnoses Tips Radiologist's role Short lists per topography, CT features

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Is the Effectiveness of the Spiral Flow Realizable Also in a Clinical CT Scanning Scene?

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Participants
Hiroshi Moriya, MD, Fukushima, Japan (*Presenter*) Nothing to Disclose
Shun Muramatsu, RT, Fukushima, Japan (*Abstract Co-Author*) Nothing to Disclose
Koji Yuba, Tokyo, Japan (*Abstract Co-Author*) Employee, Nemoto Kyorindo Co, Ltd

TEACHING POINTS

The purpose of this exhibit is: 1. To review a newly developed connecting tube, which generates a spiral flow of saline. 2. To explain the necessity of pulmonary 3D-CTA for video-assisted thoracic surgery. 3. To show the time-density-curve of contrast-medium using this tube in clinical CT scanning. 4. To explain the usefulness and limitation of this tube for pulmonary 3D-CTA.

TABLE OF CONTENTS/OUTLINE

1. The new connecting tube can generate spiral flow. The tube increased the effect of a saline chaser and significantly improved aortic enhancement during hepatic arterial phase (Kidoh M, et al. Eur Radiol 2013; 23: 3213-3218). The tube increased the enhancement of coronary arteries and improved the visibility of distal segments in coronary CTA (Tomizawa N, et al. Int. J. of Radiology 2016 March 3(1): 90-94). 2. It is necessary to separate and image a pulmonary artery and vein for 3D-CTA. Optimal administration of intravenous contrast-medium is essential. 3. The time-density-curves for Split Bolus Tracking protocols. The maximum CT value using the new tube protocol was significantly higher than that using conventional tube protocol. And the contrast-medium was washed away earlier using the new tube protocol. 4. The new connecting tube improved the contrast enhancement of pulmonary artery and vein separately.

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CH153-ED-X

What a Profound Traceal World!

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Participants
Ryo Miyazawa, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose
Yasuyuki Kurihara, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Masaki Matsusako, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

(1) CT and MRI anatomy necessary to understand tracheal diseases. (2) Useful and pathognomonic radiologic geatures of tracheal diseases.

TABLE OF CONTENTS/OUTLINE

I. Anatomy - Normal tracheal anatomy (CT, MRI) - Anatomical variations (tracheal bronchus, paratracheal air cysts) II. Tracheal disorders - Congenital (tracheal-esophageal fistula, complete tracheal rings, tracheal duplication) - Inflammatory (granulomatosis with polyangitis, relapsing polychondritis, asthma, tracheomalacia) - Tumors (adenoid cystic carcinoma, squamous cell carcinoma, hamartoma) III. Miscellaneous - amyloidosis, tracheobronchopathia oteochondroplastica, tracheomegaly

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Pulmonary Lymphatic Pathology: Imaging, Genetics, and Beyond

All Day Room: NA Digital Education Exhibit

Participants
Jason I. Halpern, MD, Providence, RI (*Presenter*) Nothing to Disclose
Thomas K. Egglin, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Terrance T. Healey, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Saurabh Agarwal, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

jason.halpern@lifespan.org

TEACHING POINTS

Understand the microscopic lymphatic structure within the secondary pulmonary lobule Understand the macroscopic lymphatic system of the thorax and basic embryology Use this anatomic basis to understand patterns of congenital and aquired lymphatic pathology Discuss associated genetic syndromes and congenital lymphatic abnormalities Understand the different modalities used in evaluation of the pulmonary lymphatic system

TABLE OF CONTENTS/OUTLINE

Macroscopic embryology and anatomy of pulmonary lymphatic system Microscopic anatomy of the secondary pulmonary lobule with focus on lymphatics Primary pulmonary processes involving the Lymphatic system Lymphangioleiomyomatosis Neoplastic and systemic diseases with lymphatic pulmonary distribution Lymphangitic carcinomatosis Sarcoidosis Kaposi sarcoma Causes of chylous effusions; traumatic, idiopathic, and syndromic Trauma idiopathic Noonan and Turner syndromes Congenital lesions and disorders Lymphangioma Lymphangiohemangioma Pulmonary lymphangiomatosis Lymphangiectasis Genetic Associations Tuberous Sclerosis, Noonan Syndrome, Gorham syndrome, Turner Syndrome Advances in the genetics of the lymphatic system Imaging modalities of the lymphatic system CT Lympography/lymhangiograpy lypmhoscintigraphy MR lymphography

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To Review the Imaging Appearances of Pleural Pathologies on 18FDG PETCT

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Participants
Deepashri Basavalingu, MBBS, Mysore, India (*Presenter*) Nothing to Disclose
Shivakumar Swamy Shivalingappa, DMRD, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose
Indiresh N. Desai, MBBS, DMRD, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose
Sudhakar Sampangi, DMRD, Banglaore, India (*Abstract Co-Author*) Nothing to Disclose
Mahesh Ashok Kumar, MBBS,MD, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose
Avinash A. Kesari, DMRD, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Kumar Kallur, MBBS, MD, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

deepashri.b@gmail.com

TEACHING POINTS

- Pleural involvement- either primary or secondary may be seen in a wide array of pathological processes-traumatic, inflammatory, infectious or neoplastic. - Primary pleural neoplasms are of 11 different histologic types; the commonest being mesothelioma - Metabolic activity of the pleural pathologies can sometimes be useful in differentiating tumors from tumor like conditions.

TABLE OF CONTENTS/OUTLINE

- Differential diagnoses of pleural pathologies- Traumatic, Inflammatory, Neoplastic (ICD 10 classification), Infectious - Traumatic pleural pathologies- Hemothorax, Surgical emphysema and pneumothorax, Non-acute fracture deformity mimicking pleural lesion, bronchopleural fistula - Infectious- Empyema- split pleura sign, Loculated pleural effusion - Inflammatory- Apical pleural fibrosis, Pleural plaques- calcified, non- calcified - Neoplastic: PETCT appearances of lipoma, solitary fibrous tumor of pleura, lymphoma, mesothelioma, pleural metastases- calcified, non- calcified - Tumor like conditions: Rosai Dorfman disease, Desmoid Fibromatosis of chest wall, Tuberculosis of thoracic spine

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Adding Value: What Do Pulmonologists Want from Radiologists and Vice Versa - Imaging Examples and Learning Points from a Joint Clinical Governance Round

All Day Room: NA Digital Education Exhibit

Participants
Amanda C. Jewison, BMBS,FRCR, Brighton, United Kingdom (*Presenter*) Nothing to Disclose
Oliver Duxbury, MBBCh, BSc, Brighton, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Nigel D. Marchbank, MBBS, Brighton, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Prasanna Perera, MBBS, MRCP, Norfolk, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Nigel J. Davies, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Charlie Sayer, MBBS, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Common 'perceptual errors' in chest imaging with examples and learning points 'Cognitive' or 'decision making' errors - why they occur and how to improve performance Pitfalls arising from a lack of relevant clinical information, availability of prior imaging, or misapplication of technology How to optimize viewing conditions, viewing technique and radiographic technique The critical, urgent or unsuspected findings the pulmonologist needs to know about with examples Free-text reporting versus template reporting Enhanced multimedia reporting as a tool

TABLE OF CONTENTS/OUTLINE

Selection of imaging cases taken from a cross-departmental clinical governance round where highlighted errors and discrepancies documented by pulmonologists were discussed with the radiology department Perceptual errors on chest radiographs and strategies for improvement Avoidable errors arising from inaccurate/absent clinical information; failure to review prior imaging and satisfaction of search Missed findings on thoracic CT Cognitive errors, for example, misclassification of airspace, airways and interstitial abnormalities Erroneous advice e.g. lung nodule surveillance for benign perifissural nodules Inaccurate application of nodule volumetry software 'Overdiagnosis' in the older patient (senescent lung)

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Response Assessment in Non-Small Cell Lung Cancer (NSCLC): Beyond RECIST Past, Present and Future

All Day Room: NA Digital Education Exhibit

Awards
Magna Cum Laude

Participants
Amanda C. Jewison, BMBS,FRCR, Brighton, United Kingdom (*Presenter*) Nothing to Disclose
Oliver Duxbury, MBBCh, BSc, Brighton, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Joanna Stokoe, MRCP,FRCR, Brighton, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Nigel D. Marchbank, MBBS, Brighton, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Guy J. Burkill, MD, Sussex, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Alex Weller, Tooting, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ioannis Vlahos, MRCP, FRCR, London, United Kingdom (*Abstract Co-Author*) Research Consultant, Siemens AG; Research Consultant, General Electric Company;
Charlie Sayer, MBBS, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

• Background to response assessment in solid tumors - rationale, applicability and limitations • Describe current improvements over diameter measurement e.g. tumor volumetry • Examples of metabolic response assessment eg PERCIST • Response assessment of molecular therapies eg growth and tumor burden • Response in immunotherapy with examples of 'pseudoprogression' and use of irRECIST • Limitations of RECIST for SABR and microwave ablation assessment • Limitations of bone disease assessment - potential solutions e.g. WB DWI-MR • Novel and future techniques e.g. dynamic perfusion CT/MR; DWI MRI and novel PET tracers eg FLT

TABLE OF CONTENTS/OUTLINE

• History of response assessment in solid tumors • Limitations of diameter measurements and potential solutions • Limitations in addressing tumor biology, vascularization and metabolism with proposed imaging solutions • Limitations of RECIST for targeted molecular therapies, immunotherapies and local therapies • Tumor growth/burden assessment for novel therapies • 'Pseudoprogression' and immune-mediated response assessment tools • Novel imaging biomarkers for predicting and assessing therapeutic response • Tumor vascularization - dynamic contrast enhanced CT/MRI • Tumor biology - DWI MR and FLT PET • Future developments - novel PET tracers, radiolabelled therapeutics, MRI spectroscopy/hypoxia imaging

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When Amyloidosis Involves the Respiratory System

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Participants
Sandra Delgado, MD, Bilbao, Spain (*Presenter*) Nothing to Disclose
Berta Ruiz, MD, Bilbao, Spain (*Abstract Co-Author*) Nothing to Disclose
Marta Sarabia, MD, Bilbao, Spain (*Abstract Co-Author*) 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
Lander Anton Mendez, MD, Bilbao, Spain (*Abstract Co-Author*) Nothing to Disclose
Garazi Elizundia Lopez, MD, Bilbao, Spain (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To review the pathophysiology of amyloidosis disease 2. To explain the utility of CT in the diagnosis 3. To describe the imaging findings of thoracic amyloidosis

TABLE OF CONTENTS/OUTLINE

1. Pathophysiology of amyloidosis disease 2. Thoracic manifestations of amyloidosis disease 1. Wall of blood vessels 2. Airways 3. Myocardial interstitium 4. Pleura 5. Parenchyma 3. Review of imaging findings 4. Sample cases 5. Prognosis and treatment

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CH159-ED-X

Radiologic Overview of Aspiration-Induced Lung Diseases in Adults

All Day Room: NA Digital Education Exhibit

Participants
Eun-Young Kang, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jae Wook Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hwan Seok Yong, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ki Yeol Lee, MD, PhD, Ansan , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yu-Whan Oh, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

keyrad@korea.ac.kr

TEACHING POINTS

Aspiration can cause a broad spectrum of lung diseases. The type of aspiration-induced lung diseases depends on the quantity and nature of the aspirated material, the chronicity, and the host responses. Despite its frequency, definitive diagnosis of aspiration-induced lung diseases is challenging to make. In this exhibit, we will discuss the spectrum of aspiration-induced lung diseases with a focus on diagnostic aspect and radiologic manifestations.

TABLE OF CONTENTS/OUTLINE

We provide of an overview of aspiration-induced lung diseases particularly regarding on disease entities and radiologic features. 1. Definition of aspiration 2. Risk factors of aspiration 3. Pathophysiology and pathology of aspiration-induced lung diseases 4. Diseases with predominantly airway manifestion: Foreign body aspiration Diffuse aspiration bronchiolitis 5. Diseases with predominantly lung parenchymal manifestation: Acute diseases: Aspiration pneumonia, Aspiration pneumonitis, Near drowning Chronic diseases: Exogenous lipoid pneumonia, Interstitial lung disease

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Primary Tracheobronchial Amyloidosis and Its Imaging Features

All Day Room: NA Digital Education Exhibit

Participants
Helena A. Pereira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Katia H. Nishiyama, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Rogerio Z. Pinetti, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Alexandre M. Silva, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Gustavo Pinto, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Roberto Blasbalg, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Elaine Yanata, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Vivian C. Silva, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

helenaacp@gmail.com

TEACHING POINTS

- To review CT common and uncommon imagings findings of primary tracheobronchial amyloidosis, since it is a rare condition and the liteturature limited to case reports. - Main differential diagnosis of tracheobronchial amyloidosis

TABLE OF CONTENTS/OUTLINE

1) purpose - to review the main imaging findings of primary tracheobronchial amyloidosis2) differential diagnosis of primary tracheobronchial amyloidosis3) conclusion: the primary tracheobronchial amyloidosis is a rare disease and the CT plays an importante role at its diagnosis. Radiologists should be aware of its common and uncommon images findings to be helpfull at correct diagnosis.

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Thoracic Involvement of Igg4-Related Disease: Radiologic-Pathologic Correlation

All Day Room: NA Digital Education Exhibit

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Certificate of Merit

Participants
Ryoko Egashira, MD,PhD, Saga, Japan (*Presenter*) Nothing to Disclose
Yuko Waseda, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Takahiko Nakazono, MD, PhD, Saga, Japan (*Abstract Co-Author*) Nothing to Disclose
Ken Yamaguchi, MD, Saga, Japan (*Abstract Co-Author*) Nothing to Disclose
Mikiko Hashisako, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Irie, MD, PhD, Saga, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. To review the concept of IgG4-related disease (IgG4-RD) 2. To learn the anatomical and pathological background of IgG4-RD 3. To demonstrate CT findings of IgG4-RD with pathologic correlation 4. To understand the problems in diagnosing IgG4-RD

TABLE OF CONTENTS/OUTLINE

1. Review the concept of IgG4-RD History Clinical issues Systemic manifestations of IgG4-RD 2. Review the anatomical basis of pulmonary lesion 3. CT findings of pulmonary IgG4-RD with pathologic correlation Classification of CT findings: dense nodule/mass, perilymphatic pattern, ground-glass opacity CT findings of various cases with pathologic correlation 4. Extra-pulmonary thoracic CT findings of IgG4-RD 5. Problems and the role of radiologists in diagnosing IgG4-RD

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Giving Thought to UIP Pattern: Radiologic-Pathologic Correlation in Various Etiologies and the Role of Radiologists in Multidisciplinary Diagnosis

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Ryoko Egashira, MD,PhD, Saga, Japan (*Presenter*) Nothing to Disclose
Ken Yamaguchi, MD, Saga, Japan (*Abstract Co-Author*) Nothing to Disclose
Takahiko Nakazono, MD, PhD, Saga, Japan (*Abstract Co-Author*) Nothing to Disclose
Keita Kai, MD,PhD, Saga, Japan (*Abstract Co-Author*) Nothing to Disclose
Mikiko Hashisako, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Irie, MD, PhD, Saga, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. To review the importance of usual interstitial pneumonia (UIP) pattern in diagnosing interstitial lung disease 2. To learn the anatomical and pathological basis of UIP pattern 3. To demonstrate HRCT findings showing UIP pattern on histology with various clinical background

TABLE OF CONTENTS/OUTLINE

1. Review the importance of UIP pattern in diagnosing interstitial lung disease Review the latest classification of IIPs Clinical issues including antifibrotic drugs Prognosis in various etiologies 2. Review the anatomical background of UIP 3. HRCT findings with pathologic correlation early and advanced phase of IPF-UIP UIP pattern in various etiologies other than IPF: connective tissue diseases, chronic hypersensitivity pneumonitis, interstitial pneumonitis with autoimmune features 4. The role of radiologists in multidisciplinary diagnosis

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An Interactive Radiologic-Pathologic Correlation of WHO 2015 Classification Primary Epithelial Tumors of the Lung

All Day Room: NA Digital Education Exhibit

Participants
Carolina S. Carcano, MD, Miami Beach, FL (*Abstract Co-Author*) Nothing to Disclose
David T. Wymer, MD, Miami, FL (*Presenter*) Nothing to Disclose
Christopher Febres-Aldana, MD, Miami Beach, FL (*Abstract Co-Author*) Nothing to Disclose
John Alexis, MD, Miami Beach, FL (*Abstract Co-Author*) Nothing to Disclose
William F. Burke III, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

-Review the new WHO 2015 classification for lung tumors, specifically primary epithelial tumors. -The radiologic appearance of primary lung tumors are based on underlying histologic findings of the tumor, and suggests a specific diagnosis. -MDCT imaging is a valuable modality for evaluation of pre-operative lung cancer, and better understanding of the radiologic-pathologic correlation for the findings impacts early management and diagnostic workup.

TABLE OF CONTENTS/OUTLINE

-An interactive low power histologic section of normal lung parenchyma directing to primary epithelial tumors of the lung, based on anatomic location such as central/hilar, alveolar, peribronchial, no predilection, etc. -Individual educational sub-sections with histopathologic evidence for the radiologic findings of primary epithelial lung tumors including: adenocarcinoma (lepidic, acinar, papillary, etc.), squamous cell carcinoma, neuroendocrine tumors (small cell, carcinoid, etc.), sarcomatoid carcinoma, salivary gland-type tumors, papilloma, adenoma. -Main radiologic features that direct management of these different types of primary malignancies.

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How to Differentiate Between Benign and Malignant Pleural Effusion with Non-Enhanced Dual-Energy Spectral CT

All Day Room: NA Digital Education Exhibit

Participants
Zhang Xirong, MMed, Xianyang City, China (*Presenter*) Nothing to Disclose
Chuangbo Yang, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Dong Han, MD, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoxia Chen, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Yongjun Jia, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Tian Qian, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Hui Tan, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1) To illustrate the limitations of distinguishing the nature of pleural effusion in conventional CT imaging 2) To illustrate the advantages of monochromatic images in dual-energy Spectral CT, with more imaging parameters in the differential diagnosis of the disease

TABLE OF CONTENTS/OUTLINE

1) Limitations of conventional CT ·Conventional CT uses polychromatic x-ray beams that produces average attenuation across a wide energy spectrum ·Limited and discrete tube voltages (photon energy) (80-140kVp) ·Benign and malignant pleural effusion have similar CT number in 80-140kVp 2) Advantages of Spectral CT imaging ·Spectral CT generates both monochromatic image sets from 40-140keV ·Monochromatic images at 40keV and 140keV increase the CT number differences between benign and malignant pleural effusion for better separation 3) Strategies to maximize the diagnosis between benign and malignant pleural effusion ·Finding the best keV images to maximize the CT number difference between the two effusions, and determine threshold values for separating them ·Combined age and disease history for overall image analysis ·The importance of ROI selection: make sure the data is closer to reality

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Uncommon Pulmonary Manifestations from Extrapulmonary Tumors: CT-Pathologic Correlation

All Day Room: NA Digital Education Exhibit

Awards
Identified for RadioGraphics

Participants
Tomas C. Franquet, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose
Melissa L. Rosado De Christenson, MD, Kansas City, MO (*Abstract Co-Author*) Author, Thieme Medical Publishers, Inc Author, Reed Elsevier Author, Oxford University Press
Edson Marchiori, MD, PhD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Gerald F. Abbott, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Santiago Martinez-Jimenez, MD, Kansas City, MO (*Abstract Co-Author*) Author, Reed Elsevier; Author, Oxford University Press
Laura Lopez, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Phillip Munoz, MD, Kansas City, MO (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

tfranquet@santpau.cat

TEACHING POINTS

• Review the uncommon pulmonary imaging findings from extrapulmonary neoplasms • Correlate imaging findings with underlying histopathology • Provide a structured framework for formulating a differential diagnosis

TABLE OF CONTENTS/OUTLINE

Metastatic disease to the lungs can occur by different mechanisms, and each route is usually associated with characteristic clinical, radiologic, and pathologic features. This exhibit will review and illustrate the high-resolution CT manifestations of uncommon pulmonary involvement by extrapulmonary malignancies, correlating the CT findings with the underlying pathologic abnormalities. Pathogenesis of metastasis include: 1) Direct extension, 2) Vascular invasion: a) Tumor embolism and b) Tumoral thrombotic microangioapthy, 3) Pleural space seeding, metastases and pneumothorax, 4) Airway dissemination: endobronchial masses, 5) Interstitial thickening: Lymphangitic carcinomatosis, 6) Diffuse pulmonary hemorrhage: a) Metastatic angiosarcoma and choriocarcinoma, 7) Vascular neoplasms: Kaposi sarcoma and epithelioid hemangioendothelioma, and 8) Secondary pulmonary lymphoma and leukemia. Recognition of the imaging morphology of these lesions and the underlying histopathologic changes allows the radiologist to present a focused differential diagnosis and help direct appropriate management.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Melissa L. Rosado De Christenson, MD - 2012 Honored EducatorSantiago Martinez-Jimenez, MD - 2014 Honored EducatorSantiago Martinez-Jimenez, MD - 2015 Honored EducatorSantiago Martinez-Jimenez, MD - 2017 Honored EducatorGerald F. Abbott, MD - 2015 Honored Educator

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Ballistic and Penetrating Injuries of the Chest: What Residents Need to Know

All Day Room: NA Digital Education Exhibit

Awards
Identified for RadioGraphics

Participants
Ashwani Gore, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Brent Little, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Nikhil Goyal, MD, Staten Island, NY (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

After reviewing this exhibit, the reader will be able to: 1. Understand the basic mechanisms of ballistic injury 2. Understand common injuries of the chest from ballistic weapons and know the expected vascular, lung, and cardiac complications from penetrating trauma 3. When appilcable, understand what additional studies may be helpful in the acute setting for a more complete evaluation in this type of patient

TABLE OF CONTENTS/OUTLINE

1. Basic Ballistics - bullets, trajectories, methods of injury to body tissues 2. Injuries and their radiological appearances: Chest wall, Lung, Cardiac, Vascular, Airway 3. Summary

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Edge of the Film: How to Manage Incidental Extra-Pulmonary Findings on Thoracic Imaging

All Day Room: NA Digital Education Exhibit

Participants
Oliver Duxbury, MBBCh, BSc, Brighton, United Kingdom (*Presenter*) Nothing to Disclose
Amanda C. Jewison, BMBS,FRCR, Brighton, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ioannis Vlahos, MRCP, FRCR, London, United Kingdom (*Abstract Co-Author*) Research Consultant, Siemens AG; Research Consultant, General Electric Company;
Nigel D. Marchbank, MBBS, Brighton, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Guy Burkill, Brighton, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Charlie Sayer, MBBS, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Common extra pulmonary findings on thoracic CT with examples and key learning points Which of these require further imaging or diagnostic tests and which do not? Specific radiological signs that can help distinguish those that require more work up from 'leave alone lesions' Useful descriptive terminology with specific reference to guidelines where applicable

TABLE OF CONTENTS/OUTLINE

Incidental findings on computed tomography (CT) can lead to a cascade of further investigations which are often not warranted and can be costly both financially and emotionally. A case series from of thoracic scans demonstrating the most common and important incidental extra-pulmonary findings • Cardiac findings • Breast lesions • Thyroid nodules • Adrenal nodules • Hepatobiliary and pancreatic abnormalities • Renal lesions • Bone abnormalities Each category will focus on: • Which findings require further diagnostic work up with reference to specific imaging modalities / protocols and society guidelines where applicable • 'leave alone lesions' • Specific radiological signs that can help discriminate benign from malignant pathology • Guidance for notification of critical, urgent or unsuspected findings to the clinician and patient

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

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The Aftermath of Bronchiectasis: A Radiologist's Guide to Finding Answers

All Day Room: NA Digital Education Exhibit

Participants
Pratik Patel, MD, Gainesville, FL (*Presenter*) Nothing to Disclose
Sagar B. Amin, MD , Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose
Tan-Lucien H. Mohammed, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Review the anatomy and pathophysiology of bronchiectasis. 2. Present HRCT protocols and techniques for optimizing the evaluation for bronchiectasis. 3. Classify the imaging features of bronchiectasis through an algorithmic approach using characteristic distribution patterns and secondary findings. 4. Illustrate a multitude of cases to provide an inclusive differential for bronchiectasis. 5. Review the clinical evaluation and management for various causes of bronchiectasis.

TABLE OF CONTENTS/OUTLINE

Anatomy and pathophysiology of bronchiectasis Guide to evaluating bronchiectasis - Optimizing HRCT protocols and techniques - Algorithm for categorizing bronchiectasis into shorter differentials Cases of bronchiectasis with clinical presentation and management - CF - Sarcoidosis - TB - MAI - ABPA - Primary Ciliary Dyskinesia - GVHD - Bronchiolitis Obliterans - Immunodeficiency (CVID) - Chronic Aspiration - ARDS - Pulmonary Fibrosis (NSIP/UIP) - Alpha-1 antitrypsin deficiency - Tracheobronchomegaly - Endobronchial tumor - Bronchial atresia - Post Radiation Conclusion

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Rare Primary Tumors of the Lung and Pleura: A Radiological Pathological Review of Unusual Entities

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Joanna Moser, MBChB, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose
Brendan Tinwell, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Konstantinos Stefanidis, MD, PhD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sisa Grubnic, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Anouchka Goldman, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
John Du Parcq, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ioannis Vlahos, MRCP, FRCR, London, United Kingdom (*Abstract Co-Author*) Research Consultant, Siemens AG; Research Consultant, General Electric Company;

For information about this presentation, contact:

joanna.b.moser@gmail.com

TEACHING POINTS

The purpose of this educational exhibit is to provide a reference illustrated synopsis of rare tumors encountered in clinical practice. The exhibit is a radiological pathological correlated review of rare benign and malignant tumours. For each entity the typical radiological features, pathological findings, and typical clinical presentation is provided. Where appropriate differentiating features and outcome/clinical management are highlighted.

TABLE OF CONTENTS/OUTLINE

Focal Lung Lesions: - Malignant: Rarer lung carcinoma variants (sarcomatoid tumor, granular cell tumor, mucoepidermoid lung carcinoma), adenoid cystic tumors, myoepithelial carcinoma, pulmonary blastoma, primary melanoma, etc.- Benign: Inflammatory myofibroblastic tumor, intrapulmonary fibrous tumor, clear cell tumor ("sugar tumor"), benign epithelial tumors: papilloma (squamous, glandular, mixed), sclerosing hemangioma/pneumocytoma, Type II pneumocyte papilloma, mucinous cystadenoma, etc.Focal Pleural Lesions: Synovial sarcoma, small cell mesothelioma, etcVascular lesions: LeiomyosarcomaMultifocal lesions: DIPNECH, MMPH

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Pulmonary Lymphatics and Related Pathologies: What Radiologists Should Know

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Participants
Timothy Lu, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Hongju Son, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

lutimoth@einstein.edu

TEACHING POINTS

1) Pulmonary lymphatics keep the lung dry and defend the lungs from airborne particles and microbes. In addition, the lymphatics allow a local influx of liquid to clear and clean inflamed or damaged tissue. 2) The size of the lymphatic system expands manifold in response to an excess fluid load, cancer, or inflammation. Consequently, pulmonary lymphatics play an important role in the adaptive immune response. 3) Knowing the role of lymphatic vessels in the pathogenesis of lung diseases is helpful to understand radiographic findings in order to make accurate diagnosis and to guide proper patient management. 4) The purpose of this presentation is to: - Review pulmonary lymphatic anatomy. - Review the pathogenesis of diseases related to pulmonary lymphatics. - Review clinical and radiographic findings of these pathologies.

TABLE OF CONTENTS/OUTLINE

1) Overview of the pulmonary lymphatics anatomy. 2) Pathogenesis of diseases related to pulmonary lymphatics. 3) Review of common and uncommon lymphatics involving diseases: - Lymphatic spread of neoplasm - Sarcoidosis - Asthma - Congenital diseases/insufficient development of lymphatics - Lymphangioleiomyomatosis - Iatrogenic/post treatment changes 4) Typical clinical and radiographic findings of lymphatics involving lung diseases on variable imaging modalities.

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Thoracic Ultrasonography A to Z: Everything You Need to Know!

All Day Room: NA Digital Education Exhibit

Participants
Guilherme C. Del Guerra, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Eduardo K. Fonseca, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Antonio Rahal Junior, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Paulo Savoia, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Francisco Neto, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marcelo B. Funari, MD, Ribeirao Pires, Brazil (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

guilhermeciconelli@gmail.com

TEACHING POINTS

Learning about many uses of thorax ultrasound. Normal pleural echo, A lines, B lines, False B lines (E and Z lines), Pleural Effusion, Consolidation, Necrotising Pneumonia, Empyema, Pneumothorax, Blue Protocol, FALLS Protocol, CAUSE Protocol. Thoracic ultrasonography has become essential in the radiological medicine.

TABLE OF CONTENTS/OUTLINE

We will be using cases materials from our hospital to illustrate the imaging findings. Title: Thoracic Ultrasonography A to Z: Everything You Need to Know! Thorax was once considered inaccessible site for ultrasonography. However, a better understanding of the physical bases of the artifact lines has shown that ultrasound may be more valuable in the various thoracic conditions. It is imperative that the radiologist knows the details of the accomplishment of the thoracic ultrasonography. The purpose of this exhibit is: to review, discuss and explain: 1-Normal pleural echo 2-A lines 3-B lines 4-False B lines (E and Z lines) 5-Pleural Effusion 6-Consolidation 7-Necrotising Pneumonia 8-Empyema 9-Pneumothorax 10-Blue Protocol, FALLS Protocol, CAUSE Protocol Thoracic ultrasonography has become essential in the different health care settings.

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Sonographic Evaluation of Diaphragmatic Dysfunction

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Participants
Farouk Dako, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Scott A. Simpson, DO, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Chandra Dass, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

fdako123@gmail.com

TEACHING POINTS

1. Diaphragmatic dysfunction is an under-diagnosed cause of dyspnea that can lead to significant functional impairment. 2. Ultrasonography of the diaphragm is a radiation-free portable imaging technique. 3. The utility of ultrasound for functional evaluation of the diaphragm is not well known among radiologists and there is very limited available information in the radiological literature regarding current clinical applications of this technique. 4. Ultrasound demonstrates superior evaluation of diaphragmatic dysfunction compared to fluoroscopy which is the traditionally used modality. 5. The purpose of this review is to provide the essentials for performing this imaging technique, an expected range of normal findings, a guide for image interpretation and the limitations of the technique. 6. Diaphragmatic ultrasonography can be used to optimize mechanical ventilator settings and proper timing for extubation in critically ill patients.

TABLE OF CONTENTS/OUTLINE

Introduction Anatomy Clinical Presentation Sonographic Technique Diaphragm excursion: Diaphragm thickness Normal sonographic findings Diaphragm excursion: Diaphragm thickness Clinical applications Assessment of diaphragm dysfunction: Critical care and ventilator support: Diaphragm pacing (DP)

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The Many Faces of Leukemia in the Thorax

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Girish S. Shroff, MD, Houston, TX (*Presenter*) Nothing to Disclose
Carol C. Wu, MD, Houston, TX (*Abstract Co-Author*) Author, Reed Elsevier
Marcelo K. Benveniste, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Brett W. Carter, MD, Houston, TX (*Abstract Co-Author*) Editor, Reed Elsevier
Chitra Viswanathan, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Mylene T. Truong, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

gshroff@mdanderson.org

TEACHING POINTS

Leukemias are classified as myeloid or lymphoid depending on the abnormal cells produced and as acute or chronic according to cellular maturity. The four major leukemia types are acute myeloid leukemia (AML), chronic myeloid leukemia (CML), acute lymphoblastic leukemia (ALL), and chronic lymphocytic leukemia (CLL). After viewing this exhibit, participants should understand the intrathoracic manifestations of leukemia.

TABLE OF CONTENTS/OUTLINE

Intrathoracic manifestations of leukemias: (1) Lymphadenopathy or mediastinal mass a. Mediastinal lymphadenopathy b. Axillary lymphadenopathy c. Myeloid sarcoma (2) Pulmonary opacities a. Leukemic infiltration b. Leukostasis c. Leukemic cell lysis pneumopathy d. Hyperleukocytic reaction e. Secondary pulmonary alveolar proteinosis (PAP) f. Secondary amyloid with CLL (3) Pleural involvement - pleural effusion, pleural masses or thickening, or a combination (4) Pericardial involvement - similar to pleural involvement, may manifest as effusion, masses/thickening, or a combination Discuss role of CXR, chest CT, and PET/CT in leukemia Differential diagnostic considerations (e.g., lymphoma, metastatic disease, and benign conditions such as sarcoidosis or infection) and differentiating features

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Radiologic Findings of Postoperative Complications after Thoracic Surgery

All Day Room: NA Digital Education Exhibit

Awards
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Participants
Yeo Ryang Kang, MD, Goyang-si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yoon Ki Cha, MD, Goyang-si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jeung Sook Kim, MD, Goyang, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jungeun Lee, MD, Goyang City, Korea, Republic Of (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

sublime256@naver.com

TEACHING POINTS

To recognize normal postoperative changes after thoracic surgery. To identify clinical and radiologic features of early and late complications after thoracic surgery.

TABLE OF CONTENTS/OUTLINE

1. General overview of normal postoperative changes after thoracic surgery. 2. Review the early and late complications following thoracic surgery and the CT appearance of these postoperative complications. A) Early complications Pulmonary edema Lung torsion Atelectasis Bronchopleural fistula Empyema ARDS B) Late complications Anastomotic stricture Recurrence of primary disease Wound infection Complications related to treatment 3. Summary and conclusion

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Unlocking the Mystery of Thymus Gland: Imaging Holds the key to the Chest

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Participants
Raju Sharma, MD, New Delhi, India (*Presenter*) Nothing to Disclose
Naveen Rajamohan, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Devasenathipathy Kandasamy, MBBS, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Ankur Goyal, MBBS, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Shivanand R. Gamanagatti, MBBS, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Rajinder Parshad, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Arun K. Gupta, MBBS, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

raju152@yahoo.com

TEACHING POINTS

• This exhibit will showcase the imaging features of thymic masses • Role of imaging in resolving the hyperplasia versus thymoma conundrum will be highlighted • Discuss recent advances in imaging

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Diagnostic Dilemmas in Chest Imaging

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Awards
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Participants
Elizabeth Duran-Pilarte, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose
Jinel A. Scott, MD, Brooklyn, NY (*Abstract Co-Author*) Nothing to Disclose
Stephen A. Waite, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

elizabeth.duran-pilarte@downstate.edu

TEACHING POINTS

1. Discuss common and uncommon clinically significant diagnostic dilemmas in chest imaging that the general radiologist should be aware of. 2. Present an approach to diagnostic dilemmas to help the radiologist arrive at the accurate diagnosis 3. Discuss common diagnostic pitfalls in chest imaging

TABLE OF CONTENTS/OUTLINE

Chest radiographs and chest CTs are among the most common radiographic examinations performed in the Emergency Department. Because of the inherent complexity, subtlety and non-specificity of chest imaging, diagnostic dilemmas are common and can be distressing for the non chest specialized radiologist, tasked with producing a report containing a specific diagnosis or a reasonable differential diagnosis helpful for clinicians. This exhibit seeks to highlight a few of these clinically significant diagnostic dilemmas with an aim to provide the non chest radiologist with a helpful approach to these difficult cases, possibly preventing unnecessary additional imaging. Cases: 1. Mass vs consolidation 2. Pneumonia vs atelectasis 3. Mediastinal mass vs hematoma 4. Mediastinal nodes vs thymic tissue 5. Tiny dots on chest xray 6. Bronchial atresia vs lung nodules 7. Pulmonary emboli vs flow artifact 8. Ulcerated plaque vs penetrating ulcer 9. Ductus diverticulm vs pseudoaneurysms 10.Talc vs extravasated contrast

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CH180-ED-X

Lung Transplant for the Radiologist: Updates on Pre and Post-Transplant Imaging Features with Clinical and Pathologic Correlation

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Crystal Chang, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Kathleen Ruchalski, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose
Fereidoun G. Abtin, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

crystalchang@mednet.ucla.edu

TEACHING POINTS

To review the current indications and contraindications for lung transplantation To review pulmonary function test and radiologic correlation in lung transplant To discuss the current clinical, imaging, and pathologic findings of post-transplant pulmonary complications, with particular focus on chronic lung allograft dysfunction

TABLE OF CONTENTS/OUTLINE

1. Indications and contraindications for lung transplant with imaging examples 2. Pulmonary function test - what the radiologist should know 3. Surgical techniques for lung transplantation 4. Post-transplant complications: Non-pulmonary parenchymal Pulmonary parenchymal

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CH181-ED-X

Pulmonary Cystic Lesions: Atypical Presentation of Lung Cancer

All Day Room: NA Digital Education Exhibit

Participants
Ema V. Leal, MD, Santiago, Chile (*Presenter*) Nothing to Disclose
Javier A. Cacho I, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Juan Carlos Diaz Patino, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Julia Alegria, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Claudio Silva, MD , Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Guillermo Chong, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Cristobal A. Ramos Sr, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Yumay Pires, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

dra.ema.leal@gmail.com

TEACHING POINTS

1) Describe imaging findings of "nodule within a cyst".2) Explain pathophysiology for the appearance of this peculiar neoplastic lesion.3) Present follow-up findings and progression in time of nodules within cyst walls.4) Explain the association of progressive thickening of the cystic nodule walls and lung cancer.5) Alert the radiological community that not all cystic lesions should be considered benign.

TABLE OF CONTENTS/OUTLINE

1) Definition of "nodule within a cyst" and its association with lung cancer2) Presentation of cases of cysts with progressive thickening of their walls resulting in lung cancer3) Imaging markers suspicious of malignancy in "nodule within a cyst", on CT and PET/CT, mainly progressive thickening of wall (Exophytic, endophytic, circumferential, multiple clustered small cysts), according to Mascalchi classification.4) Recognize the risk factors related to cystic nodules with progressive thickening of the walls (sex, age and smoking).

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CH182-ED-X

Lung Ultrasound Essentials

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

Participants
Alice Wielandner, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Constanze Bardach, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Stefan Boehme, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Frederic Tomboel, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Florian Thuerk, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Eugenijus Kaniusas, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Prerana P. Agarwal, DMRD, MBBS, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Christian J. Herold, MD, Vienna, Austria (*Abstract Co-Author*) Research Grant, Siemens AG Research Grant, Bayer AG Research Grant, Agfa-Gevaert Group Research Grant, Bracco Group Research Grant, Guerbet SA Speakers Bureau, Bayer AG Speakers Bureau, Bracco Group Stockholder, Hologic, Inc
Helmut Prosch, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

This exhibition aims to provide a quick review of (1) the clinical role of lung ultrasound (LUS), (2) the technical background and (3) settings, (4) sonographic lung anatomy, (5) pathologies and (6) case based 'pearls and pitfalls' to equip the novice with the essentials to apply LUS.

TABLE OF CONTENTS/OUTLINE

Table of contents/outline: (1) Clinical role of lung ultrasound (2) Back to the basics. How does it work? Physical explanatory models. (3) Setting on the bedside. Selection of transducer, settings (ferquence, depth, focus,..), standardized anatomical assessment points. (4) Lung anatomy (soft tisuse, muscle/ribs, pleura, lung parenchyma, diaphragm) (5) Most common patterns and pathologies in dysnea (dynamic ultrasound movie clips and CT correlation for better comprehension): (a) A line pattern (b) B line pattern (c) Consolidation pattern (d) Pneumothorax (e) Dynamic ultrasound assessment of respiratory management (with CT correlation) (5) Basic lung assessment algorithm in dyspnea (6) Case based pearls and pitfalls (7) Summary and outlook

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The Quantification of Respiratory Movements Using Dynamic Respiratory CT

All Day Room: NA Digital Education Exhibit

Participants
Hiroshi Moriya, MD, Fukushima, Japan (*Presenter*) Nothing to Disclose
Yukihiro Nagatani, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Tsuneo Yamashiro, MD, Nishihara, Japan (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation
Shun Muramatsu, RT, Fukushima, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Ushio, Otsu, Italy (*Abstract Co-Author*) Nothing to Disclose
Motoharu Hakozaki, Fukushima, Japan (*Abstract Co-Author*) Nothing to Disclose
Kotaro Sakuma, MD, Fukushima, Japan (*Abstract Co-Author*) Nothing to Disclose
Manabu Nakagawa, MD, Miyagigun, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinsuke Tsukagoshi, PhD, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation

TEACHING POINTS

To show the dynamic images of thorax, diaphragm, bronchial tree, mediastinum, and lung parenchyma that were obtained using dynamic respiratory CT and 4D voxel-tracking methods. To show the time curve created from respiratory dynamic images. To explain the relationships between dynamic respiratory CT imaging findings and respiratory function test results. To show the dynamic respiratory CT images of typical cases of respiratory diseases.

TABLE OF CONTENTS/OUTLINE

1. Dynamic images of thorax, diaphragm, bronchial tree, mediastinum, and lung density that were obtained using dynamic respiratory CT and 4D voxel-tracking methods. The motion of the diaphragm was the gold standard against which other anatomical structures were judged. Any structures were well correlated with the movement of the diaphragm. 2. Time curve created from respiratory dynamic images. The time curve was obtained from all structures. 3. Relationships between dynamic respiratory CT imaging findings and respiratory function test results. Flow volume curve of regional parenchyma was obtained from regional lung volume change. 4. Typical cases of respiratory diseases.

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CT Evaluation of Cavitary Lung Lesions

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Participants
Asha Kandathil, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Kiran Batra, MD, Coppell, TX (*Abstract Co-Author*) Nothing to Disclose
Sachin S. Saboo, MD, FRCR, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Prabhakar Rajiah, MD, FRCR, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Michael J. Landay, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Suhny Abbara, MD, Dallas, TX (*Abstract Co-Author*) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG

TEACHING POINTS

Pulmonary cavities, described by the Fleischner society as a "gas-filled space, seen as a lucency or low-attenuation area, within pulmonary consolidation, a mass, or a nodule" could have a benign or malignant etiology Knowledge of clinical presentation and ancillary radiological findings will help narrow the differential considerations Radiological analysis of a cavitary lung lesion should include number, location, wall characteristics, arterially enhancing foci, intracavitary material and pleural communication Wall thickness is not a reliable indicator of benign or malignant etiology Post treatment cavitation may represent a favourable response to novel chemotherapy agents

TABLE OF CONTENTS/OUTLINE

Illustrate benign and malignant etiologies of pulmonary cavities Highlight clinical and radiological clues which will help narrow the differential considerations Illustrate complications such as pneumothorax, pseudoaneurysms and intracavitary mycetoma which will require alternate management

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CH186-ED-X

Acute and Chronic Lung Allograft Dysfunction (ALAD-CLAD): Review of Nomenclature with Emphasis on Cross Sectional Imaging Findings with Histopathological Correlation - A Road Less Travelled

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Ameya J. Baxi, MBBS, DMRD, San Antonio, TX (*Presenter*) Nothing to Disclose
Carlos S. Restrepo, MD, San Antonio, TX (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

baxi@uthscsa.edu

TEACHING POINTS

Define, illustrate & discuss taxanomy & etiopathogenesis of ALAD-CLAD Review literature & characteristic imaging findings of ALAD-CLAD Discuss-illustrate imaging findings and differential diagnosis

TABLE OF CONTENTS/OUTLINE

Lung allograft rejection is a major cause of morbidity & mortality following lung transplantation. Recently a broader definition of ALAD-CLAD is decsribed, which encompasses a more inclusive definition of post-transplant dysfunction & includes bronchiolitis-obliterans syndrome, restrictive allograft syndrome, recurrent primary disease, anastomotic stricture, azithromycin-responsive allograft dysfunction, pleuro-pulmonary fibroelastosis,, & specific causes of acute decline in lung function. Cross sectional imaging has evolved over a peroid of time & now has ability to answer specific clinical questions. In this exhibit, we will review challenges of diagnosing ALAD-CLAD from diagnoss to understand the pathogenesis. Aims/Objectives: Introduction Taxonomy Review of literature & pathogenesis Imaging findings Differential diagnosis Teaching points Conclusion: Recent intoducton of ALAD-CLAd has changed clinical practise in lung transplant recepients. Recognizing characteristic imaging findings of subgroups within ALAD-CLAD may allow etiology specific treatment and csn signifiantly reduce morbidity and mortality.

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The Neglected Adult Thymus: Variants, Pathology and Mimics

All Day Room: NA Digital Education Exhibit

Participants
Francisco Garcia-Morales, MD, Plano, TX (*Presenter*) Nothing to Disclose
Pramod K. Gupta, MD, Plano, TX (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

fgarcianm@yahoo.com

TEACHING POINTS

Be familiar with the normal appearance and variants of the thymus in the adult with CT and MRI Recongize the common thymic lesions in the adult The utility of MRI with chemical shift imaging to characterize thymic hyperplasia Role of CT, MRI and PET-CT to evaluate thymic masses Mimics of thymic pathology

TABLE OF CONTENTS/OUTLINE

Review the normal anatomy of the anterior mediastinum Evaluate the normal appearence of the thymus in the adult population Recognize the anatomical variants of the thymus How to address the not uncommon fingdings of multinodular densities in the thymic region Utility of MRI to differentiate between thymic hyperplasia and other lesions including neoplasia Role of MRI in-and-out of phase and DWI sequences to evaluate thymic lesions Utility of CT, MRI and PET-CT to evalute thymic masses

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CH190-ED-X

Mediastinal Lymphadenopathy: Differential Diagnosis Based on Tomographic Patterns

All Day Room: NA Digital Education Exhibit

Participants
Jucelio P. Moura Filho, BMedSc, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Thais C. Lima, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Bernardo S. Oliveira, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Giovanni G. Cerri, MD,PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Hye J. Lee, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

This study aims to describe and illustrate the main aspects of the lymph node involvement in the mediastinum, by benign and malignant conditions, since the tomographic patterns and location of the lymph nodes involved may provide diagnostic clues to several of these diseases. The purpose of this exhibit is: - To recognize characteristic imaging findings of a normal mediastinal lymph nodes; - To illustrate the main characteristics that should be evaluated in the lymph nodes to narrow the differential diagnosis; - To describe and keep in mind the major differential diagnosis of mediastinal lymphadenopathy.

TABLE OF CONTENTS/OUTLINE

I) Normal mediastinal lymph node II) Most frequent causes of mediastinal lymphadenopathy III) The main characteristics that should be evaluated to narrow the differential diagnosis and some pulmonary findings that can help to stablish the diagnosis along with the lymph nodes changes. Location: - Hilar bilateral and symmetrical - Anterior mediastinum - Hilar and paratracheal, ispislateral to the foci of consolidation - Related to the drainage of the affectec lobe - Superior mediastinum Morfologic aspect: - Circumscribed - Coalescent - Inavise (fat or other mediastinal structures) Density: - Soft tissue density - Hypodense/necrotic - Calcified - Hipervascularized IV) Conclusion

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Taking it to Heart: What the Radiologist Needs to Know About Cardiac Devices Encountered on Chest Imaging

All Day Room: NA Digital Education Exhibit

Participants
Hayden A. Salts, MD , Norfolk, VA (*Presenter*) Nothing to Disclose
Anthony P. Trace, MD,PhD, Richmond, VA (*Abstract Co-Author*) Nothing to Disclose
Sarah C. Shaves, MD, Virginia Beach, VA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Provide a comprehensive overview of cardiac devices encountered on chest imaging. Teach the Radiologist what these devices look like on various modalities. Update the Radiologist on device function, orthotopic placement, and indications. Review MR saftety relevant to each device.

TABLE OF CONTENTS/OUTLINE

Artificial Heart - Function, Indications - Plain film, CT - Device ex-vivo, Orthotopic posititions - Discus Intra Aortic Balloon Pump - Function, Indications - Plain film, CT - Device ex-vivo - Discus Implantable Loop Recorder - Function, Indications - Plain film, CT - Device ex-vivo, Orthotopic positions - Discus Right Ventricular Leadless Pacer - Functions, Indications - Plain film, CT - Device ex-vivo, Orthotopic positions - Discus LifeVest Defibrillator - Function, Indications - Plain film, CT - Device ex-vivo, Orthotopic posisions - Discus Atrial Septal Closure Device - Function, Indications - Plain film, CT - Device ex-vivo - Discus Descending Thoracic Aortic Conduit - Function, Indications - Plain film, CT - Device ex-vivo, Orthotopic positions - Discus MitraClip - Function, Indications - Plain film, CT - Device ex-vivo, Orothotopic positions - Discus MR Safety References

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Sonographic Evaluation of the Diaphragm: Morphology and Kinetics in Pathological Processes

All Day Room: NA Digital Education Exhibit

Participants
Nicolau F. Guerreiro, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Felipe L. Costa, MD , Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Daniela F. Vieira Vendramini, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Thais C. Lima, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Roberto B. Taveira, MD, SAO PAULO, Brazil (*Abstract Co-Author*) Nothing to Disclose
Jose De Arimateia B. Araujo Filho, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Fabio O. Lima, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Antonio S. Marcelino, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Giovanni G. Cerri, MD,PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Flavia A. Foronda, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

guerreironfc@gmail.com

TEACHING POINTS

Throughout this presentation, reader will be able to see how ultrasonography can be used for the diagnosis of diaphragmatic pathologies, and also appreciate: Ultrasonography technique to properly access diaphragm. - Patient positioning - Adequate probe - Acoustic windows Evaluation of diaphragm morphology. Analysis of diaphragm function using B and M modes. How to acquire and interpret the diaphragm thickening fraction (DTF) Presentations of the main diaphragm dysfunctions.

TABLE OF CONTENTS/OUTLINE

Short videos, drawings and ultrasonography images in normal and pathological diaphragm processes will be illustrated: Demonstration of diaphragm ultrasound technique. Examples of how to properly expose the diaphragm. Ultrasonography in B and M modes to access morphology and function. Question based clinical examples of: - Diaphragmatic paralysis - Diaphragmatic atrophy - Diaphragmatic weakness - Diaphragm ultrasound use in predicting weaning success from mechanical ventilation

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CH193-ED-X

Non-Neoplastic Radiological Findings in Smokers

All Day Room: NA Digital Education Exhibit

Participants
Yasmeen Tandon, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Ruchi Yadav, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

tandony@ccf.org

TEACHING POINTS

When provided with the history that the patient is a smoker, most radiologists rightly become much more diligent in their search for nodules or masses given the higher prevalence of lung cancer in these patients. However, there are multiple additional non neoplastic findings that are commonly seen in smokers. The purpose of this educational exhibit is to review the most common non-neoplastic radiological manifestations of smoking, to describe the distinguishing characteristics of each of these entities, discuss the common differential diagnosis, and to briefly review the pathophysiology of several of these entities.

TABLE OF CONTENTS/OUTLINE

1. Airway Findings: -Saber sheath trachea - Bronchial wall thickening with secretions/chronic bronchitis 2. Lung Findings: -Emphysema -Respiratory bronchiolitis and Respiratory bronchitis interstitial lung disease (RB-ILD) - Desquamative intersitial pneumonia (DIP) - Smoking-related interstitial fibrosis (SRIF). - Pulmonary langerhans cell histiocytosis (PLCH) -Acute eosinophilic pneumonia - Combined pulmonary fibrosis and emphysema (CPFE) - Usual interstitial pneumonia (UIP) - Non-specific interstitial pneumonia (NSIP) 3. Other: -Osteoporosis -Compression fractures -Coronary artery disease.

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CH195-ED-X

Multimodality Evaluation of Central Venous Obstruction in the Chest: The Usual and Unusual Suspects of Collateralization

All Day Room: NA Digital Education Exhibit

Participants
Lisa Walker, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Amit Gupta, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Michael D. Enzerra, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Henry Chen, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Robert C. Gilkeson, MD, Cleveland, OH (*Abstract Co-Author*) Research Consultant, Riverain Technologies, LLC Research support, Koninklijke Philips NV Research support, Siemens AG Research support, General Electric Company

For information about this presentation, contact:

Lisa.walker2@uhhospitals.org

TEACHING POINTS

1) To discuss the usual pathways of collateral formation in central venous obstruction. 2) To describe the unusual pathways of collateral formation in central venous obstruction. 3) "The role of multimodality imaging" in the improved imaging of unusual alternative collateral channels in central venous obstruction.

TABLE OF CONTENTS/OUTLINE

1) Introduction Clinical presentation Demographics Causes of central venous obstruction (malignant causes vs non-malignant causes) Prognosis 2) Normal venous drainage in the chest 3) Pathophysiology of collateral vessel formation 4) Usual collateral pathways in central venous obstruction Azygos and hemiazygos pathway Internal mammary pathway Lateral thoracic pathway 5) Uncommon collaterals pathways in central venous obstruction Cavoportal pathway/vein of sappey collateralization Systemic to pulmonary collateralization resulting in left to right shunt (collaterals to left atrium, left and right pulmonary veins) Vertebral pathway with pseudopathological intraosseous enhancement 6) The role of multimodality imaging including novel techniques such as dual-energy CT, retrospective PET/CT fusion and MRI.

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CH198-ED-X

Thoracic Manifestations of Common Inheritable Immunodeficiency Disorders (CIID): Complete Radiological Spectrum

All Day Room: NA Digital Education Exhibit

Participants
Ameya J. Baxi, MBBS, DMRD, San Antonio, TX (*Presenter*) Nothing to Disclose
Daniel Ocazionez, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Santiago Martinez-Jimenez, MD, Kansas City, MO (*Abstract Co-Author*) Author, Reed Elsevier; Author, Oxford University Press
Daniel Vargas, MD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
Carlos S. Restrepo, MD, San Antonio, TX (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

baxi@uthscsa.edu

TEACHING POINTS

Discuss common inheritable immunodeficiency disorders affecting thorax Discuss characteristic multimodality imaging findings and imaging based differential diagnosis

TABLE OF CONTENTS/OUTLINE

Immunodeficiency disorders (primary or secondary) impair immune system's ability to defend body resulting in severe, long lasting & recurrent bacterial, viral or fungal infections or cancers. Primary disorders are rare, hereditary & manifest during infancy/childhood. Secondary disorders are more common, develop later in life & are caused by certain drugs or HIV. Any system of body can be involved, respiratory infections are first to start (recurring sinusitis, pneumonias, bronchiectasis, lung abscess, tree-in bud nodules, etc). In this exhibit, we discuss characteristic multimodality imaging findings and differential diagnosis of CIID affecting thorax. Increased awareness of such entities will contribute to optimized patient care. Aims/Objectives • Introduction & classification of CIID • Humoral immunodeficiencies o Common Variable Immunodeficiency o X-linked agammaglobulinemia o Ig A deficiency • Cellular & combined immunodeficiency disorders o DiGeorge Syndrome o Severe combined immunodeficiency o Wiskott-Aldrich syndrome o Ataxia Telangiectasia o Hyper IgE syndrome • Imaging findings in CIID • Differential diagnosis • Conclusion

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CH199-ED-X

Test Your Knowledge: Benign Lesions of the Adult Esophagus

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Thomas Marini, East Syracuse, NY (*Presenter*) Nothing to Disclose
Zachary M. Nuffer, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Katherine A. Kaproth-Joslin, MD, PhD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Susan K. Hobbs, MD,PhD, Pittsford, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

thomas_marini@urmc.rochester.edu

TEACHING POINTS

1) Review normal esophageal anatomy 2) Review benign causes of esophageal dilatation/stricture 3) Review benign causes of esophageal wall thickening including esophagitis, varices, and hematoma 4) Review the varied types of esophageal fistula 5) Review the spectrum of pathology seen in esophageal rupture

TABLE OF CONTENTS/OUTLINE

Image rich cased-based quiz questions designed to highlight key imaging findings and clinical features of benign esophageal pathology found in the adult. Questions will also be geared toward drawing important distinctions between similar pathology and forming broad differentials. They may involve illustrative case based vignettes or ask about a key imaging finding demonstrated in a radiograph. Proposed topics include: a. Esophageal dilation i. Scleroderma ii. Achalasia b. Stricture i. Foreign body impaction c. Wall thickening i. Neoplasms ii. Esophagitis iii. Esophageal Varices iv. Esophageal Hematoma d. Wall thinning i. Zenker diverticula ii. Killian-Jamieson diverticula iii. Pulsion diverticula iv. Epiphrenic diverticula e. Fistulas i. Tracheoesophageal fistula ii. Aortoesophageal fistula iii. Pericardioesophageal/atrioesophageal fistula f. Rupture i. Mallory-Weiss tear ii. Boerhaave syndrome iii. Iatrogenic perforation g. Congenital i. Duplication Cyst

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CH200-ED-X

Imaging of the Pleura: The Good, the Bad, and the Ugly

All Day Room: NA Digital Education Exhibit

Participants
Ericka M. Leon, MD, DF, Mexico (*Presenter*) Nothing to Disclose
Mariana Licano, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Gisela Munoz, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Maria Augusta Serrano Cueva, MD, Distrito Federal, Mexico (*Abstract Co-Author*) Nothing to Disclose
Ignacio Munoz-Lopez, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

erickasnap@hotmail.com

TEACHING POINTS

To recognize the normal pleural anatomy. Review the classification and the multimodal radiological findings of pleural effusions: exploit your tools! Key signs in pneumothorax " can't miss this " features.Learn to recognize malignant effusions and the role of the radiologist in the treatment and follow-up.

TABLE OF CONTENTS/OUTLINE

Cased based discussion of:The normal pleural complexCharacterization of pleural effusions: Rx, US and CT findings in uncomplicated, loculated and malignant etiologies Main radiographic signs in pneumothoraxDiagnostic keys in pleural neoplasms: Lipoma, Pleural Fibroma, Malignant mesotheliomaPET/ CT role in the treatment and follow up of pleural neoplasms

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CH201-ED-X

Lessons from Thoracic Oncologic Multidisciplinary Conference: What the Radiologist Needs to Know

All Day Room: NA Digital Education Exhibit

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Certificate of Merit

Participants
Girish S. Shroff, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Chitra Viswanathan, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Mylene T. Truong, MD, Houston, TX (*Presenter*) Nothing to Disclose
Brett W. Carter, MD, Houston, TX (*Abstract Co-Author*) Editor, Reed Elsevier
Bradley S. Sabloff, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Caroline Chiles, MD, Winston-Salem, NC (*Abstract Co-Author*) Advisory Board, ImBio, LLC
Jeremy J. Erasmus, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Reginald F. Munden, MD, DMD, Winston Salem, NC (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mtruong@mdanderson.org

TEACHING POINTS

in thoracic oncology, the multidisciplinary approach to patient care uses best practices to assist in screening, diagnostic evaluation, and treatment. The multidisciplinary team, comprised of physicians from radiology, medical, surgical, and radiation oncology, pathology, pulmonology, and cancer prevention, is integral in the decision making process of patient management. This exhibit reviews the lessons learned from the cases presented at Thoracic Oncologic Multidisciplinary Conference.

TABLE OF CONTENTS/OUTLINE

1. Lung cancer screening, initial -multiple nodules (part-solid, non-solid, solid nodules). Interpretation, nodule risk assessment, selection of nodules for intervention, pathology 2. Lung cancer screening, management and follow-up -non-solid nodule that grows. Interpretation of CT- Lung-RADS, nodule risk assessment, differential diagnosis: AAH, AIS, MIA 3. Stage 1A lung cancer - interpretation of CT and PET/CT; clinical approach. Need nodal sampling? Mediastinoscopy vs EBUS? Lobectomy vs segmentectomy? Radiofrequency ablation vs focussed beam radiation? 4. EGFR/ALK/PDL1 mutation tumor - Discussion with pathologist regarding how much tissue needed and what type of biopsy preferred. Measuring response to immune checkpoint inhibitors. RECIST vs irRC? 5. Synchronous lung primaries -How to identify? How to manage?

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CH202-ED-X

CT Imaging Features of Axillary Disease: Knowing the Nooks and Crannies

All Day Room: NA Digital Education Exhibit

Participants
Joan Albert Prat-Matifoll, MD , Barcelona, Spain (*Presenter*) Nothing to Disclose
Jorge Andreu, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Marta Gonzalo Carballes, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Esther Pallisa, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Ana L. Sanchez Martinez, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Oscar Persiva Morenza, MPH, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Diego Varona Porres, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Manuel Escobar Sr, MD, PhD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

joanalbertpratrx@gmail.com

TEACHING POINTS

- To review the basic anatomy of the axilla - To illustrate the most common as well as the most uncommon axillary pathologies. - To provide a plain short list of CT findings to face these pathologies while reporting chest CTs.

TABLE OF CONTENTS/OUTLINE

A. Basic Anatomy B. Pathology 1.Skin and subcutaneous tissues: Seborrheic keratosis, sebaceous cyst/inclusion cyst, melanoma and skin metastases 2.Adipocytic Tumors: Lipoma, Liposarcoma 3.Lymph Node-Related Diseases: Benign Reactive Lymph Node Hyperplasia, Silicone Adenopathy, Sarcoidosis, Histiocytic Necrotizing Lymphadenitis Infectious: Tuberculous Lymphadenitis, Toxoplasmosis, Granulomatous Neoplastic: Castleman Disease, Metastatic and Lymphoma 4.Accessory Breast-Related Diseases: Fibroadenoma, PASH 5,Fibrous and Fibrohistiocytic Tumors: Fibromatosis, Desmoid Tumor, Pleomorphic Sarcoma, or MFH 6.Peripheral Nerve Sheath Tumors 7.Vascular Tumors: Hemangioma, Lymphangioma, Pseudoaneurysms, Hemangiopericytoma 8.Postsurgical Lesions: Skin thickening, lymphoedema, post-operative fluid collections, fat necrosis, abscess, haematoma 9.Infectious diseases: Necrotizing fascitis 10.Other Axillary Lesions: Epidermal Inclusion Cyst, Synovial Sarcoma

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CH203-ED-X

Pulmonary Vascular Tumors and Proliferations: CT- Pathologic Correlation

All Day Room: NA Digital Education Exhibit

Participants
Sitang Nirattisaikul, MD, Hat Yai, Thailand (*Abstract Co-Author*) Nothing to Disclose
Tomas C. Franquet, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose
Melissa L. Rosado De Christenson, MD, Kansas City, MO (*Abstract Co-Author*) Author, Thieme Medical Publishers, Inc Author, Reed Elsevier Author, Oxford University Press
Santiago Martinez-Jimenez, MD, Kansas City, MO (*Abstract Co-Author*) Author, Reed Elsevier; Author, Oxford University Press
Phillip Munoz, MD, Kansas City, MO (*Abstract Co-Author*) Nothing to Disclose
Ana M. Gimenez, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

sitrang_n@hotmail.com

TEACHING POINTS

• Review the spectrum of pulmonary primary and secondary vascular tumors & proliferations • Correlate imaging findings with underlying histopathology • Provide a structured framework for formulating a differential diagnosis

TABLE OF CONTENTS/OUTLINE

Vascular tumors and proliferations represent uncommon pulmonary diseases and occur in a variety of clinical settings. This exhibit will review and illustrate the CT manifestations of various pulmonary vascular tumors and proliferations, correlating the CT findings with the underlying pathologic abnormalities. Classification of Pulmonary Vascular Tumors and Proliferations Primary tumors of the pulmonary vasculature 1) Pulmonary artery sarcoma, 2) Pulmonary epithelioid hemangioendothelioma, 3) Primary choriocarcinoma of the pulmonary artery and 4) Sclerosing pneumocytoma. Secondary tumors of the pulmonary vasculature 1) Pulmonary tumor embolism, 2) Pulmonary thrombotic tumoral microangiopathy (PTTM), 3) Intravascular lymphomatosis and 4) Direct growth and extension of tumor into pulmonary vasculature Pulmonary vascular proliferations 1) Pulmonary A-V fistula, 2) Pulmonary capillary hemangiomatosis, 3) Lymphagiomatosis and 4) Congenital pulmonary lymphangiectasia

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CH204-ED-X

Correlation among Lung Perfusion Blood Volume (Lung PBV), Lung Perfusion SPECT, and Pulmonary Angiography Images in Patients with Chronic Thromboembolic Pulmonary Hypertension (CTEPH) Before and After Balloon Pulmonary Angioplasty (BPA)

All Day Room: NA Digital Education Exhibit

Participants
Hirofumi Koike, Sasebo, Japan (*Presenter*) Nothing to Disclose
Eijyun Sueyoshi, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Ichiro Sakamoto, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Masataka Uetani, MD, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoo Nakata, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Kouji Maemura, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1.Purpose or Aim of the exhibit the purpose of this exhibit is: 1. To present lung perfusion blood volume (lung PBV), lung perfusion SPECT, and pulmonary angiography images in patients with chronic thromboembolic pulmonary hypertension (CTEPH) before and after balloon pulmonary angioplasty (BPA) 2. To understand mechanism of lung PBV imaging 3. To present the lung PBV, lung perfusion SPECT, and pulmonary angiography images findings in patients with CTEPH before and after BPA 4.To know the differences and clinical feasibility of correlation with lung PBV, lung perfusion SPECT, and pulmonary angiography image findings in patients with CTEPH before and after BPA 2.Conclusion with major teaching points The major teaching points of this exhibit are 1.Knowledge of lung PBV, lung perfusion SPECT, and angiography images in patients with CTEPH before and after BPA 2.Knowledge of clinical feasibility of correlation of lung PBV, lung perfusion SPECT, and pulmonary angiography image findings in patients with CTEPH before and after BPA

TABLE OF CONTENTS/OUTLINE

1. Mechanism of lung PBV imaging 2.Illustrative cases -Review of lung PBV, lung perfusion SPECT, and pulmonary angiography image in patients with CTEPH before and after BPA 3.Discussion 4.Summary

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CH205-ED-X

Which Scan Mode We Should Use with 320 Detector Row CT for Pulmonary Imaging

All Day Room: NA Digital Education Exhibit

Participants
Marie-Pierre Debray, MD, Paris, France (*Presenter*) Speaker, Boehringer Ingelheim GmbH; Speaker, F. Hoffmann-La Roche Ltd
Karim Haioun, Puteaux, France (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation
Antoine Khalil, MD, Paris, France (*Abstract Co-Author*) Spouse, Employee, sanofi-aventis Group; Research Consultant, C. R. Bard, Inc; Research Consultant, GEMS; Research Consultant, Cook Group Incorporated; Research Consultant, Mectronic plc

For information about this presentation, contact:

marie-pierre.debray@aphp.fr

TEACHING POINTS

To explain new acquisition modes available in 320 detector row CT scanners and illustrate their potential applications in chest diseases To propose specific acquisition protocols adapted to each clinical situation

TABLE OF CONTENTS/OUTLINE

320 detector row CT scanners can image a wide anatomic area in one gantry rotation. Combined with registration and dose reduction tools, they provide 4D dynamic acquisitions with acceptable radiation dose, to study the movement of structures, perfusion of pathologic lesions or to characterize vascular abnormalities. The 4D scan mode is suitable for diaphragmatic motion analysis, tracheomalacia assessment, tumor and lung perfusion, evaluation of vascular malformations. Ultra short acquisitions, using either volume or helical mode, are useful for agitated patients and allow low contrast media volume angioscanographic studies. Two techniques are available to create iodine maps of the lungs: single energy, with subtraction, or dual energy, with 2 successive volumes in less than 1 sec. Perfusion using dual input algorithm can be calculated for up to 16 cm. This education exhibit will illustrate the range of available acquisition modes for various thoracic diseases (pulmonary embolism, interstitial lung diseases, vascular malformations, airway diseases, diaphragmatic palsy, lung cancer and nodule characterization).

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CH206-ED-X

Mountains Beyond Mountains: Lessons and Limitations from Non-Contrast CT Imaging of Advanced Chest Pathology in an Underserved, Rural International Community

All Day Room: NA Digital Education Exhibit

Participants
Lyndon Luk, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Michael Chervonski, MD, Long Island City, NY (*Abstract Co-Author*) Nothing to Disclose
Mary D. Maher, MD, New York, NY (*Presenter*) Nothing to Disclose
Ernst Garcon, MD, Brooklyn, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

lyndon.luk@gmail.com

TEACHING POINTS

1. To demonstrate importance and diagnostic value of a donated CT scanner in an underserved, rural international community and review pertinent findings of non-contrast CT imaging in patients with advanced chest pathology. 2. To evaluate limited availability and accessibility of non-contrast CT imaging in an underserved, rural international community and highlight the need to provide CT interpretation skills to this country's radiology trainees. 3. To review our role and challenges in providing imaging services and education to an underserved, rural international community.

TABLE OF CONTENTS/OUTLINE

1. Background Limitations of radiology resources in an underserved, rural international community (no IV contrast, biomedical engineering support and no MRI) Limitations of radiology training (no active radiology residents with CT interpretation skills) Very limited public access to non-contrast CT services available in this rural community 2. Review pertinent imaging findings in patients with advanced chest pathologies and artifacts on non-contrast CT imaging 3. Discuss value of non-contrast CT and utilization in patient management in this underserved, rural community. 4. Review of our Radiology department's role and challenges in providing imaging services and education to international communities in need.

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CH207-ED-X

When Vasculitis Manifests in the Thorax: Spectrum of Imaging Findings

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Kana Suga, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose
Jay Starkey, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Kurihara, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Fukuda Toshinori, MD, Chuo, Japan (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

gyakusugi@gmail.com

TEACHING POINTS

1. There are many subtypes of vasculitis that involve pulmonary and mediastinal structures. 2. Each subtype of vasculitis often has characteristic imaging features.

TABLE OF CONTENTS/OUTLINE

We explain new Chapel Hill classification of vasculitis (2012) with demonstrative cases as follows: Classification - Chapel Hill Consensus Conference 2012 Cases of each vasculitis involving thoracic structures Large vessel vasculitis (LVV) - Takayasu arteritis Medium vessel vasculitis (MVV) - Kawasaki disease (KD) Small vessel vasculitis (SVV) - Antineutrophil cytoplasmic antibody associated vasculitis -- Microscopic polyangiitis (MPA) -- Granulomatosis with polyangiitis (GPA) -- Eosinophilic granulomatosis with polyangiitis (EGPA) - Immune complex SVV -- AntiGBM vasculitis (Goodpasture syndrome) -- IgA vasculitis (Henoch-Schonlein) Variable vessel vasculitis (VVV) - Behcet's disease

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CH208-ED-X

Chest Perfusion Imaging (CPI): From Technical Principles to Clinical Applications

All Day Room: NA Digital Education Exhibit

Participants
Jordi Broncano, MD, Cordoba, Spain (*Presenter*) Nothing to Disclose
Teodoro Martin, MD, Jaen, Spain (*Abstract Co-Author*) Nothing to Disclose
Roberto Garcia Figueiras, MD, PhD, Santiago de Compostela, Spain (*Abstract Co-Author*) Nothing to Disclose
Sandra Baleato Gonzalez, MD, PhD, Santiago, Spain (*Abstract Co-Author*) Nothing to Disclose
Fernando Caro Mateo, Cadiz, Spain (*Abstract Co-Author*) Nothing to Disclose
Antonio Luna, MD, Jaen, Spain (*Abstract Co-Author*) Consultant, Bracco Group; Speaker, General Electric Company; Speaker, Toshiba Medical Systems Corporation

For information about this presentation, contact:

j.broncano.c@htime.org

TEACHING POINTS

1. To review the physical basis, technical adjustmnents and quantifications methods of computed tomography (CT) and magnetic resonance (MR) based chest perfusion. 2. To explore the current clinical applications and potential pitfalls of perfusion imaging in the thorax. 3. Elaborate a practical diagnostic algorithm for the application of CT and MR based perfusion in chest diseases.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Vascularization of normal and abnormal tissues 3. Physical basis of chest perfusion imaging 3.1. CT based perfusion 3.2 MR based perfusion 3.3. Artifacts in chest perfusion imaging and how to avoid them 3.4. Contrast media in chest perfusion imaging 4. Clinical applications 4.1. Characterization of lung lesions 4.2. CPI in lung cancer staging 4.3. Mediastinal neoplasms 4.4. Evaluation of pleural tumoral and non - tumoral conditions 4.5. Characterization of chest wall masses 4.6. CPI in treatment monitoring and detection of recurrence 5. Pitfalls in CPI 6. Diagnostic algorithm of chest lesion based on CPI 7. Conclusion

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CH209-ED-X

Lung Cancer Classification Made Simple: Tips, Tricks and Current Updates

All Day Room: NA Digital Education Exhibit

Participants
Pedro Panizza, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Ana I. Oliveira, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Tassia R. Yamanari, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Thais C. Lima, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Renata F. Pereira, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Valter R. Dos Santos Junior, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Guilherme H. Bachion, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Chang k. Chi, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marcio V. Sawamura, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Natally Horvat, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Publio C. Viana, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Giovanni G. Cerri, MD,PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Ricardo V. Auad, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Hye J. Lee, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

pedropanizza@gmail.com

TEACHING POINTS

Review the clinical, radiological and pathologic characteristics of the lung cancer. Demonstrate with an intuitive and schematic way how to perform the accurate classification and staging of the lung cancer. Expound how the radiologist may guide the requesting physician with the therapeutic options according to with the disease stage.

TABLE OF CONTENTS/OUTLINE

Review the clinical and epidemiologic data of the lung cance, as well as the.imaging findings according to the 3 components analisis: T for extent of the primary tumor, N for involvement of lymph nodes and M for distant metastases. Demonstrate that T component is subdivided by primary tumor size, as well as other descriptors of invasion into adjacent structures. The N component is determined by the location of involved lymph nodes. The M component is subdivided into intrathoracic dissemination, a single extrathoracic metastasis and multiple metastases. Explain that the stage classification nomenclature is used simply as a tool for communication among clinical trials and clinical guidelines, which is what one has to look to for treatment recommendations. Discuss the changes from the 7th classification of lung cancer to the 8th.

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CH210-ED-X

Primary Thoracic Sarcomas: A Pictorial Essay

All Day Room: NA Digital Education Exhibit

Participants
Ricardo F. Zagatti, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Luisa J. Sauer, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Brunna Oliveira, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Hye J. Lee, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Ellen C. Nascimento, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marcio V. Sawamura, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Mark Wanderley, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Vivian C. Silva, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Ricardo Guerrini, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Reader will be able to accomplish the following by viewing this exhibit:? Recognize imaging findings of primary sarcomatoid neoplasms of the chest, as well as their relevant clinical features.? Remind that primary thoracic sarcomas are rare, but should be kept in mind as differential diagnosis of lesions that affect the mediastinum, lung and pleura.

TABLE OF CONTENTS/OUTLINE

• Discuss radiological features of sarcomatoid neoplasm of the chest in a didactic approach:I - Sarcomatoid neoplasms of the chest wall including: chondrosarcoma, desmoid sarcomaII - Sarcomatoid neoplasms of pleura including: malignant solitary fibrous tumor, mesotheliomaIII - Sarcomatoid neoplasms of lung including: pleomorphic sarcoma, pulmonary sarcomatoid carcinoma, pulmonary synovial sarcoma, Kaposi sarcoma, primary pulmonary chondrosarcomaIV - Sarcomatoid neoplasm of mediastinum including:EsophagealVascularCardiac / pericardial• Illustrate with imaging features of computed tomography (CT) and/or magnetic resonance (MR) of all cases and radiologic-pathologic correlation of the most didactic ones.• A brief summary of relevant clinical features of each of the diseases presented is also comprised.

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CH211-ED-X

Isolated Aortitis: Concept and Imaging Diagnosis

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Participants
Ichiro Sakamoto, Nagasaki, Japan (*Presenter*) Nothing to Disclose
Hironori Onizuka, MD, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Eijun Sueyoshi, MD, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Masataka Uetani, MD, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

To learn new concept of isolated aortitis To learn Chapel Hill Consensus Conference 2012 To learn relationship between isolated aortitis and other aortitis such as Takayasu arteritis and giant cell arteritis To learn imaging and clinical manifestations of isolated aortitis and other aortitis

TABLE OF CONTENTS/OUTLINE

1. Concept of isolated aortitis 2. Explanation of relationship between isolated aortitis and other aortitis 3. Imaging and clinical findings of isolated aortitis and other aortitis 4. Discussion 5. Directions and summary

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CH212-ED-X

Primary Chest Wall Tumors Radiologic-Pathologic Correlation

All Day Room: NA Digital Education Exhibit

Participants
Natalia Y. Zuniga, MD, Cali, Colombia (*Presenter*) Nothing to Disclose
Martin E. Renjifo, MD, Bogota, Colombia (*Abstract Co-Author*) Nothing to Disclose
Sara Y. Rodriguez, MD, Cali, Colombia (*Abstract Co-Author*) Nothing to Disclose
Mauricio Velasquez, MD, MD, Bogota, Colombia (*Abstract Co-Author*) Nothing to Disclose
Luz F. Sua, MD, Cali, Colombia (*Abstract Co-Author*) Nothing to Disclose
Bladimir Perez, Cali, Colombia (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

natyzu07@gmail.com

TEACHING POINTS

Diagnostic imaging cannot distinguish benign from malignant lesions, however it can be suggestive of tumor type and differentiating benign from malignant tumors. CT is useful for detecting findigns of extracompartmental extension like calcified tumor matrix, cortical destruction, and involvement of pleural, lung, mediastinal, and nodal. MRI is useful for characterizing the lesion giving precise delineation of tissue planes including bone and vasculature. Malignant osseous tumors of the chest wall account for approximately 55% of all chest wall masses. The most common primary malignancies include sarcomas, such as chondrosarcoma, osteosarcoma, and the Ewing sarcoma family of tumors. Benign osseous tumors of the chest wall are less frequently than malignant neoplasms. Most of these lesions are osseous or cartilaginous in etiology and include fibrous dysplasia, osteochondroma, aneurysmal bone cysts and giant cell tumor. Malignant and benign soft tissue neoplasms of the chest wall represent a heterogeneous group of lesions that may be divided into the following groups based on the tissue of origin: adipocytic, vascular, peripheral nerve sheath, fibroblastic, myofibroblastic, fibrohistiocytic, and cutaneous.

TABLE OF CONTENTS/OUTLINE

Classification of chest wall tumors - Imaging Evaluation - Osseous and soft tissue chest wall tumors -Conclusions

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CH213-ED-X

What the Radiologist Needs to Know About Pulmonary Thromboembolism with Dual-Energy CT

All Day Room: NA Digital Education Exhibit

Participants
Xavier S. Herdoiza, MD, Quito, Ecuador (*Abstract Co-Author*) Nothing to Disclose
Pablo A. Cuaspud, MD, Quito, Ecuador (*Presenter*) Nothing to Disclose
Natali A. Flores, MD, Quito, Ecuador (*Abstract Co-Author*) Nothing to Disclose
Maria V. Espinoza, MD, Quito, Ecuador (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

xavsebsem@hotmail.com

TEACHING POINTS

To recognize artifacts in Dual Energy CT of the lung and a true perfusion defect. To discuss different perfusion patterns seen in acute and chronic pulmonary thromboembolism. To explain the utility of Dual Energy CT and measuring iodine related attenuation (IRA) values in acute pulmonary clot and the IRA change ratio in chronic pulmonary thromboembolism. To use Dual Energy CT as a complementary tool to known CT features in pulmonary thromboembolism.

TABLE OF CONTENTS/OUTLINE

- Introduction - Objectives - Pulmonary thromboembolism Protocol of Dual Energy CT - Common artifacts in Dual Energy CT of the lung. - Review of imaging findings and patterns • CT features of pulmonary thromboembolism. • Dual energy CT of the lung in acute pulmonary thromboembolism • Dual energy CT of the lung in chronic pulmonary thromboembolism - Iodine related attenuation values in acute and chronic pulmonary thromboembolism. - Sample cases - Conclusions

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CH214-ED-X

Chest X-Ray in Intensive Care Unit Patients: What to Know About Thoracic Devices

All Day Room: NA Digital Education Exhibit

Participants
Elisa Baratella, MD, Trieste, Italy (*Presenter*) Nothing to Disclose
Manuel Belgrano, Trieste, Italy (*Abstract Co-Author*) Nothing to Disclose
Federica Arban, MD, Trieste, Italy (*Abstract Co-Author*) Nothing to Disclose
Irene Campo, Trieste, Italy (*Abstract Co-Author*) Nothing to Disclose
Vincenzo Cioffi, MD, Trieste, Italy (*Abstract Co-Author*) Nothing to Disclose
Maria A. Cova, MD, Trieste, Italy (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

To describe the most common thoracic devices used in clinical practice, in the Department of Intensive Care Unit. To describe their normal appearence and placement. To illustrate the complications related to their displacement or malposition.

TABLE OF CONTENTS/OUTLINE

Intensive care unit patients present several devices, commonly used in clinical practice (naso-gastric tube, endotracheal tube, central venous catheter, Swan-Ganz catheter ...) Daily or routine chest radiographs are performed to monitor those patient; chest x-ray has an important role in the diagnosis of malposition and possible complications related to the placement of devices. The Radiologists must be familiar with the correct placement of each device, the most frequent malposition and the possible complications related to their malposition (pneumothorax, hematoma, ...) on chest x-ray. In some selected cases CT has to be performed to better define specific complications.

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CH215-ED-X

Unraveling the Mysteries of the Chest Wall: Complete Imaging Review of Chest Wall Masses

All Day Room: NA Digital Education Exhibit

Participants
Anurima Patra, MD, Mumbai, India (*Presenter*) Nothing to Disclose
Amit Janu, MBBS, MD, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

anurima_p@rediffmail.com

TEACHING POINTS

1. To learn the radiologic anatomy of chest wall. 2. To learn the various imaging modalities (radiograph, CT, MRI and PET) and their utility in diagnosing common and uncommon chest wall lesions. 3. To simplify the classification of chest wall masses based on age distribution, location and tissue of origin. 4. Pictorial review of common and uncommon chest wall masses and their salient differentiating points.

TABLE OF CONTENTS/OUTLINE

1. Introduction: Radiological anatomy of chest wall. 2.Classification of chest wall masses based on age distribution, nature and tissue of origin, such as neural, vascular, pleural, osseous and adipose tissue etc. 3. Pictorial illustration of common and uncommon chest wall masses on Radiograph, CT, PET scan and MRI including the tell tale signs. 4. How to differentiate between these masses and their implications on management.

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CH216-ED-X

Thoracic Involvement in Collagen Vascular Disorders: A Pictorial Essay

All Day Room: NA Digital Education Exhibit

Participants
Bernardo S. Oliveira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Tassia R. Yamanari, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Thais C. Lima, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Jucelio P. Moura Filho, BMedSc, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marcio V. Sawamura, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Chang k. Chi, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Giovanni G. Cerri, MD,PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

salgado.bernardo@gmail.com

TEACHING POINTS

To review and illustrate general patterns of chest involvement in collagen vascular disorders. To review and illustrate imaging hallmarks related to specific diseases, from the commonest features to the rare variations. To manage a rational diagnostic approach based on imaging findings and clinical correlation. To recognize superimposed or mimicker conditions such as infection, drug toxicity and occupational exposure.

TABLE OF CONTENTS/OUTLINE

A variety of collagen vascular disorders such as systemic lupus erythematosus, rheumatoid arthritis, systemic sclerosis, dermatopolymyositis and Sjogren syndrome frequently affect thoracic structures, which is an important cause of mortality in this group. Imaging patterns of lung parenchyma involvement, as well as mediastinal findings, may have great diagnostic value, especially when clinical setting is challenging due to concomitant conditions such as infection, drug toxicity or occupational exposure. Besides, some findings such as honeycombing and pulmonary trunk enlargement work as biomarkers for worse prognosis.

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CH217-ED-X

Dual Energy CT in Evaluation of Pulmonary Embolism: Opportunities, Challenges, Pitfalls and Solutions

All Day Room: NA Digital Education Exhibit

Participants
Yuki Tanabe, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Prabhakar Rajiah, MD, FRCR, Dallas, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

radprabhakar@gmail.com

TEACHING POINTS

1. To review the current role of dual energy CT in the evaluation of pulmonary embolism. 2. To understand the challenges and pitfalls associated with dual energy CT in PE 3. To discuss the solutions for these challenges and pitfalls. 4. To evaluate a workflow that is optimal for the evaluation of pulmonary embolism.

TABLE OF CONTENTS/OUTLINE

1. DECT Principles 2. Technologies of dual energy CT 3. Types of images- Iodine maps, VNC,VMI, effective Z 4. Applications of dual energy CT in pulmonary embolism - Perfusion maps- Diagnosis of small Pes; Higher sensitivity; prognosis; Chronic PE perfusion patterns - Low virtual monoenergetic images- Improving contrast in suboptimal studies - High virtual monoenergetic images- Decreasing artifacts - Virtual non contrast- Eliminates need for true non contrast - Virtual non contrast and iodine maps- Characterization of other lung abnormalities 5. Challenges and pitfalls with solutions - Perfusion defects- False positive- Emphysema, pulmonary abnormalities (Ground glass opacities, atelectasis, tumors, etc)- Correlate with lung windows (Wedge- PE; Circumscribed- Lung; Patchy- Lung) - Perfusion defects false negative- Small embolus, non-occlusive embolus; suboptimal windowing 8. Artifacts in perfusion imaging- Beam hardening, air soft tissue interact, motion of heart and diaphragm, FOV

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CH218-ED-X

Update on Thoracic Applications of Multienergetic CT

All Day Room: NA Digital Education Exhibit

Participants
Kevin R. Kalisz, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Negin Rassouli, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Hamid Chalian, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Luis A. Landeras, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Robert C. Gilkeson, MD, Cleveland, OH (*Abstract Co-Author*) Research Consultant, Riverain Technologies, LLC Research support, Koninklijke Philips NV Research support, Siemens AG Research support, General Electric Company
Prabhakar Rajiah, MD, FRCR, Dallas, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

radprabhakar@gmail.com

TEACHING POINTS

1. To review the different implementations of multienergetic CT technology 2. To discuss updates on the utility of multienergetic CT in thoracic imaging 3. To highlight the thoracic applications of multienergetic CT utilizing several case examples. 4. To demonstrate the pitfalls of multienergetic CT.

TABLE OF CONTENTS/OUTLINE

• Physics of multienergetic CT • Different technologies of multienergetic CT- Dual source, rapid kV switching, dual layer, dual spin, split beam, photon counting • Comparison of different technologies, advantages, limitations • Multienergetic workflow and images- Iodine, Virtual non contrast, effective atomic number, virtual monoenergetic • Cardiothoracic applications of multienergetic CT with clinical case examples - Pulmonary embolism- Acute - Pulmonary embolism- Chronic - Pulmonary hypertension - Low contrast pulmonary vascular studies - Lung lesion characterization- Benign vs malignant - Lymph nodal characterization- Benign vs malignant - Tumor Response using perfusion mapping - Artifact reduction- Metallic, beam hardening

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Chest Abnormalities in Gastrointestinal Disorders: Imaging Review of a Complex Synergy

All Day Room: NA Digital Education Exhibit

Participants
Verghese George, MBBS, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Lakshmi Ananthakrishnan, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Vasantha Vasan, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Jewel N. Appleton, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Prabhakar Rajiah, MD, FRCR, Dallas, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

radprabhakar@gmail.com

TEACHING POINTS

1. To review the entities that affect the chest as well as the gastrointestinal system 2. To understand the role of imaging in the evaluation of these entities 3. To illustrate the abnormalities that involve both the chest and GIT

TABLE OF CONTENTS/OUTLINE

Introduction Review of entities that involve the chest and gastrointestinal system. Review of imaging modalities- Illustration of the entities that involve the chest and gastrointestinal system - Crohn disease- Overlapping syndromes (sarcoidosis, Wegener, amyloidosis), drug reactions, infections, thromboembolism - Ulcerative colitis- Airway inflammation, bronchiectasis, infiltrative lung disease, necrotic nodules, serositis - Scleroderma- ILD - Hiatal hernia/GERD- Aspiration, Barrett's, strictures, maliganancy - Liver disease- Portopulmonary hypertension, hepatic hydrothorax, hepatopulmonary syndrome - Ig4 related sclerosing disease - Fibrosing mediastinitis - Pancreatitis- Effusions, pseudocysts, ARDS, Fat embolism - Whipple disease - Celiac disease- Lane Hamilton syndrome with pulmonary hemosiderosis - Familial adenomatosis polyposis- Desmoid - Diaphragmatic hernias- Pulmonary hypoplasia - Splenic injury- Intrathoracic splenosis - Chagas disease- Cardiomyopathy, aneurysms, thrombosis - Pneumoretroperitoneum tracking into mediastinum

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Cardiothoracic Abnormalities in Genitourinary Disorders: A Multimodality Review

All Day Room: NA Digital Education Exhibit

Participants
Verghese George, MBBS, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jewel N. Appleton, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Vasantha Vasan, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Lakshmi Ananthakrishnan, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Abhishek Chaturvedi, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Prabhakar Rajiah, MD, FRCR, Dallas, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

radprabhakar@gmail.com

TEACHING POINTS

Cardiothoracic abnormalities may be seen as a consequence of genitourinary disease or through generalized systemic involvement of both the organs. 1. To review the entities that affect the chest as well as the genitourinary system 2. To understand the role of imaging in the evaluation of these entities 3. To illustrate the abnormalities that involve both the chest and genitourinary system

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Review of entities that involve the chest and genitourinary system. 3. Review of imaging modalities- Radiograph, CT, MRI, echocardiography, Angiography, nuclear medicine 4. Illustration of the entities that involve the chest and genitourinary system - Lymphangioleiomyomatsis - Birt Hogg Dube syndrome (Folliculin gene syndrome) - Erdheim Chester disease - Vasculitis/glomerulonephritis (Goodpasture syndrome, ANCA associated vasculitis, SLE, PAN, Henoch Schonlein purpura, Behcet's, mixed cryoglobulinemia) - Post-partum cardiomyopathy - Benign metastasizing leiomyoma - Endometriosis - Meig's syndrome - Renal calcifications - Renal cancer extending through IVC into right atrium - Intrathoracic kidney - Autosomal dominant polycystic kidney - Renal osteodystrophy changes in bones

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What's in a Name: Thoracic Imaging Findings in Erdheim-Chester Disease

All Day Room: NA Digital Education Exhibit

Participants
Mojdeh Mirmomen, Bethesda, MD (*Presenter*) Nothing to Disclose
Arlene Sirajuddin, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Anna K. Paschall, BS, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Faraz Farhadi, Bethesda, VA (*Abstract Co-Author*) Nothing to Disclose
Moozhan Nikpanah, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Juvianee Estrada-Veras, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
William A. Gahl, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Rolf Symons, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Ashkan A. Malayeri, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mojdeh.mirmomen@nih.gov

TEACHING POINTS

• To discuss genomics of Erdheim-Chester disease (ECD) and association of BRAF mutation with different imaging and clinical findings. • To review the thoracic imaging findings of ECD: o Computed tomography o Magnetic resonance findings • To understand the clinical relevance of imaging findings in regards to morbidity and outcome.

TABLE OF CONTENTS/OUTLINE

• History and incidence: cohort demographics, prevalence • Genetic and molecular basis: Mutation in proto-oncogene BRAF V600E, association with clinical manifestations • Pathology Findings: lipid-laden histiocytic accumulation in various organs, unique immunohistochemical features • Clinical presentations: spectrum of thoracic symptoms • Radiological Findings: MRI and CT finding in patients with ECD through several imaging examples. • Prognosis and outcome: multi-systemic involvement, mortality rate

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Avoiding a Pain in the Neck: A Review of Lower Neck Anatomy and Pathology Encountered on Thoracic CT

All Day Room: NA Digital Education Exhibit

Participants
Nishant D. Parekh, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Rishi Agrawal, MD, Chicago, IL (*Abstract Co-Author*) Speakers Bureau, Boehringer Ingelheim GmbH
Hatice Savas, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Eric M. Hart, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Computed tomography (CT) of the thorax results in imaging varying portions of the lower neck in most patients. Yet, for most Thoracic radiologists this can be a blind spot. The lower neck contains complex anatomy and potential pathology packed into a relatively small cross-sectional area. Knowledge of the anatomy and common pathologies in the lower neck is critical to practicing Thoracic radiologists. After viewing this exhibit, the learner will be able to: (1) Identify the major anatomy of the lower neck (2) Recognize anatomic variants and post-surgical appearances in the lower neck (3) Recognize common pathologies in the lower neck (4) Ensure appropriate management of incidental findings to avoid missed lesions or unnecessary diagnostic evaluation

TABLE OF CONTENTS/OUTLINE

I. Cross-sectional anatomy of the neck a. Normal anatomy b. Accessory muscles c. Asymmetric muscle atrophy d. Neck dissection types II. Pathology a. Thyroglossal duct cyst - typical, infected and containing thyroid carcinoma b. Sternocleidomastoid muscle - abscess, fibromatosis and hematoma c. Laryngeal neoplasm - squamous cell carcinoma, papilloma; and a mimic (laryngoplasty) d. Supraclavicular lymphadenopathy e. Internal jugular vein thrombus and Lemierre syndrome f. Retropharyngeal abscess

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SSA05

Chest (Thoracic Malignancy/Lung)

Sunday, Nov. 26 10:45AM - 12:15PM Room: S404CD

CH OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
John P. Lichtenberger III, MD, Bethesda, MD (*Moderator*) Author, Reed Elsevier
Beth Zigmund, MD, Haddonfield, NJ (*Moderator*) Consultant, BioVentrix, Inc

Sub-Events

SSA05-01 Radiologists vs Deep Learning System (3D Convolutional Neural Network): Radiological Prediction of Pathological Invasiveness in Lung Adenocarcinoma

Sunday, Nov. 26 10:45AM - 10:55AM Room: S404CD

Participants
Masahiro Yanagawa, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose
Hirohiko Niioka, PhD, Toyonaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Akinori Hata, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Noriko Kikuchi, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Osamu Honda, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshiyuki Watanabe, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Hironori Ohigashi, Toyonaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Seiichi Tagawa, PhD, Toyonaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Jun Miyake, PhD, Toyonaka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare results of radiological prediction of pathological invasiveness(PI) in lung adenocarcinoma among three radiologists and deep learning system.

METHOD AND MATERIALS

This study included 90 patients (M:F=50:40) with 24 cases of adenocarcinoma in situ(AIS, PI=0mm), 20 cases of minimally invasive adenocarcinoma(MIA, PI<=5mm), and 46 cases of invasive adenocarcinoma(IVA, PI>5mm). CT images with 0.625-mm thickness were evaluated. Three radiologists (R1, R2, R3; 7, 8, 25 years of experience) diagnosed each nodule by predicting PI from CT findings: irregular margin, air bronchiologram with disruption and/or irregular dilatation, pleural indentation, and solid component in part-solid nodule(size<=5mm or >5mm). In ground-glass nodule(GGN), a nodule density(dense or inhomogeneous) was evaluated. 3D Convolutional Neural Network (3D-CNN) was used as the deep learning system (DL, Tensorflow ver.0.12.1). Input data size from 3D CT images is 30x30x30 pixels(1601mm^3). The 3D-CNN structure is constructed with 2 successive pairs of convolution and max-pooling layers, and 2 fully-connected layers. The output layer is composed of 3 nodes to recognize the 3 conditions (0=AIS,1=MIA,2=IVA) or 2 nodes for the 2 conditions (0=AIS,1=MIA/IVA). Repeated measures ANOVA and multivariate ROC analysis were used statistically.

RESULTS

90 nodules were 24 AISs(16GGNs, 8part-solids), 20 MIAs(3GGNs, 12part-solids, 5solids), and 46 IVAs(5GGNs, 20part-solids, 21solids). There were no significant differences in accuracy rates with or without PI among DL, R1, R2, and R3: 73.3%, 80%, 74%, and 83.3%. There were no significant differences in pathological diagnostic accuracy rates among DL, R1, R2, and R3: 51.1%, 61.1%, 53.3%, and 64.4%. Area under curves (AUC) of DL, R1, R2, R3 were 0.712(95% confidence intervals[CI], 0.61 to 0.80), 0.665(95%CI, 0.56 to 0.76), 0.574(95%CI, 0.47 to 0.68), and 0.714(95%CI, 0.61 to 0.80). AUCs of DL and R3 were significantly higher than R2 (p=0.039 and 0.026, respectively).

CONCLUSION

Despite small training data, DL showed accuracy rate almost equal to radiologists. AUC of DL was almost the same as the radiologist with much experience, which was significantly higher than the radiologist with small experience.

CLINICAL RELEVANCE/APPLICATION

Deep learning system can predict the PI in lung adenocarcinoma from CT images, resulting in being equal to radiologist with much experience.

SSA05-02 Preoperative Assessment of Parietal Pleural Invasion/Adhesion of Subpleural Lung Cancer: Advantage of Software-Assisted Analysis Using 4-Dimensional Dynamic-Ventilation CT

Sunday, Nov. 26 10:55AM - 11:05AM Room: S404CD

Participants
Tsuneo Yamashiro, MD, Nishihara, Japan (*Presenter*) Research Grant, Toshiba Medical Systems Corporation
Maho Tsubakimoto, MD, Nishihara, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Moriya, MD, Fukushima-City, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukihiro Nagatani, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Nanae Tsuchiya, Okinawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Sadayuki Murayama, MD, PhD, Nishihara-Cho, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation

For information about this presentation, contact:

clatsune@yahoo.co.jp

PURPOSE

Using 4-dimensional (4D) dynamic-ventilatory scanning provided by a 320-row computed tomography (CT) scanner, we aimed to assess parietal pleural invasion and adhesion of peripheral (subpleural) lung cancer.

METHOD AND MATERIALS

Eighteen patients with subpleural lung cancer underwent both dynamic-ventilation CT during free breathing and conventional (static) chest CT as a preoperative assessment. Subsequently, the absence of parietal pleural invasion or adhesion was surgically confirmed in 13 patients, while the presence of parietal pleural invasion or adhesion was surgically confirmed in five patients. Two chest radiologists, who were blinded to patient status, cooperatively evaluated the presence of pleural invasion/adhesion on the chest CT by two different methods: (i) observing conventional (static) high-resolution CT images, reconstructed in the axial, coronal, and sagittal directions; and (ii) observing 4D dynamic-ventilation CT images combined with a colored map created by research software that suggested the absence/presence of pleural invasion/adhesion based on the difference in the movements between the lung surface and chest wall. The parameters of diagnostic accuracy were assessed including a receiver operating characteristic analysis.

RESULTS

For the assessment of pleural invasion/adhesion, observing the software-assisted 4D dynamic-ventilation CT images achieved perfect diagnostic accuracy (sensitivity, 100%; specificity, 100%; area under the curve [AUC], 1.000), in comparison with observing the conventional chest CT (sensitivity, 60%; specificity, 77%; AUC, 0.846).

CONCLUSION

Software-assisted 4D dynamic-ventilation CT can be utilized as a novel imaging approach for accurate preoperative analysis of pleural invasion/adhesion of peripheral lung cancer.

CLINICAL RELEVANCE/APPLICATION

This is the first study to show the clinical utility of software-aided, 4D dynamic-ventilation CT images for the preoperative diagnosis of parietal pleural invasion/adhesion of subpleural lung cancer.

SSA05-03 Reduction of TNM Misstaging in Routine FDG-PET/CT Reports of NSCLC Patients Using Computer-Aided Standardized Label Segmentation

Sunday, Nov. 26 11:05AM - 11:15AM Room: S404CD

Participants
Alexander Sauter, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Gregor Sommer, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Kevin Mader, DPhil,MSc, Zuerich, Switzerland (*Abstract Co-Author*) Employee, 4Quant Ltd; Shareholder, 4Quant Ltd
Joshy Cyriac, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Thomas Weikert, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Bram Stieltjes, MD,PhD, Basel, Switzerland (*Presenter*) Nothing to Disclose

PURPOSE

FDG-PET/CT is the diagnostic standard procedure for staging of NSCLC patients. To date, most hospitals create free-style reports that do not necessarily contain all staging-relevant information. This may lead to misstaging and subsequently erroneous treatment planning. Therefore, we extracted the TNM staging formula from previous free-style PET/CT reports (RIS Stage) and compared these with a segmentation-based approach.

METHOD AND MATERIALS

First, the reports from 145 patients who underwent FDG-PET/CT for primary staging of NSCLC at the University Hospital Basel were extracted from the RIS and TNM (7th edition) stage was determined according to the text information by an experienced radiology and nuclear medicine physician. Next, the corresponding PET and CT image datasets were downloaded from the PACS and transferred to a 3D-slicer-based prototype software that allows for a manual segmentation of tumors, lymph nodes and metastasis using a full set of labels including location information and morphological TNM features.

RESULTS

In a substantial number of patients, not enough information was provided by the report to extract a distinct TNM stage: T: 18.6% (27/145); N: 10.3% (15/145); M: 2.1% (3/145). TNM information could be extracted in all patients with the segmentation-based approach. Furthermore, in 29 cases, there was a considerable discrepancy between the report and annotation: upstaging due the annotations: T: n = 11, N: n = 6, M: n = 4; downstaging due the annotations: T: n = 3; N: n = 4; M: n = 1.

CONCLUSION

We could demonstrate that the proper TNM stage could not be derived from unstructured PET/CT reports in a roughly 30% of the cases . This commonly affects the T-stage because of missing diameter measurements, but also N and M stage. Our approach with tumor labels allows for a clear definition of cancerous lesions in a standardized and reproducible manner.

CLINICAL RELEVANCE/APPLICATION

Labels generated using the proposed approach can be directly translated into clinical decision making such as tumor boards and are less prone to interpretation.

SSA05-04 Computer-Aided Volumetry of the Three-Dimensional Solid Component Size in Part-solid Lung Cancer: Correlation with Prognosis

Sunday, Nov. 26 11:15AM - 11:25AM Room: S404CD

Participants
Shinichiro Kamiya, Nagoya, Japan (*Presenter*) Nothing to Disclose
Shingo Iwano, MD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyasu Umakoshi, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Rintaro Ito, Nagoya, Aichi, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinji Naganawa, MD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

According to the TNM classification of the eighth edition of the UICC, the T factor of a ground-glass nodule is regulated by the size of the solid component within the tumor. The purpose of this study was to investigate the correlation between the postoperative prognosis of patients with part-solid lung cancer and the solid component size acquired using computer-aided three-dimensional (3D) volumetry software on thin-section multi-detector computed tomography (MDCT) images.

METHOD AND MATERIALS

We retrospectively reviewed preoperative MDCT data, surgical records, pathological reports, and postoperative follow-up data of patients with primary lung cancer with ground-glass opacity at our institution from 2013 to 2016, and a total of 92 patients (47 men and 45 women; mean age 66 years) were selected for evaluation. All MDCT data of 0.5-mm thickness were transferred to a 3D workstation, and a chest radiologist measured the maximum solid component size on an axial image (2D-SS) and the 3D maximal solid component size on a multiplanar reconstructed image (3D-SS) within the part-solid nodules. Furthermore, the 3D solid volume (3D-SV) within the nodules was measured using semi-automatic volumetry software. Correlations with postoperative recurrence and disease-free survival (DFS) were compared by receiver operating characteristic (ROC) analysis and a Cox proportional hazards model to assess the predictive values of 2D-SS, 3D-SS, and 3D-SV for prognosis.

RESULTS

For the prediction of postoperative recurrence, the area under the ROC curve was 0.781 for 2D-SS, 0.748 for 3D-SS, and 0.823 for 3D-SV (all $p<0.001$). The optimal cutoff value for 3D-SV for predicting tumor recurrence was 590 mm3, with a sensitivity of 0.923 and specificity of 0.747. According to the multivariate Cox proportional hazards model, the only significant predictive factor for DFS was a 3D-SV > 590 mm3 (hazard ratio 6.03, $p<0.001$).

CONCLUSION

The measurement of 3D-SV using computer-aided 3D volumetry software predicted the postoperative prognosis of patients with part-solid lung cancer more accurately than did 2D-SS or 3D-SS.

CLINICAL RELEVANCE/APPLICATION

3D computer-aided volumetry of primary lung cancer will lead to more accurate prognostic predictions compared with tumor diameter measurement on 2D images, especially for part-solid lung cancer.

SSA05-05 Prediction of the Invasive Component of Lung Adenocarcinoma with Software Segmentation of the Solid Component in Subsolid Nodules: Value of the Vessel Removal Algorithm

Sunday, Nov. 26 11:25AM - 11:35AM Room: S404CD

Participants
Lorenzo Garzelli, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Su Yeon Ahn, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kum Ju Chae, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chang Min Park, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Helen Hong, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Samsung Electronics Co, Ltd; Research Grant, DRTECH Co, Ltd

For information about this presentation, contact:

lorenzo.garzelli@aphp.fr

PURPOSE

The relationship between the invasive component of lung adenocarcinomas and the solid component of subsolid nodules on CT has been well established. This study aimed to evaluate the value of a vessel removal algorithm in segmentation of subsolid nodules by comparing the measurements of the solid component on CT with the measurement of the invasive component on pathology in lung adenocarcinomas manifesting as subsolid nodules.

METHOD AND MATERIALS

Among 283 cases of surgically resected lung adenocarcinomas, 73 cases which manifested as subsolid nodules on thin-section CT and had the invasive component of <= 10 mm on pathology were selected for analyses. For each nodule, semi-automated segmentation was performed by 2 radiologists and 3D longest, axial longest and effective diameters of solid component were

measured before and after using a vessel removal tool. These measurements were compared with the invasive component diameter on pathology using the paired t-test and Pearson's correlation test.

RESULTS

After removing cases with insufficient segmentation, 68 subsolid nodules were included for statistical analysis. The mean maximal diameter of the invasive component on pathology was 4.6 mm (range, 0 - 10 mm). The correlation between software and pathology measurements was significant ($p<0.01$) and the correlation after vessel removal ($r= 0.49$ to 0.54) was better than before vessel removal ($r=0.27$ to 0.41). The mean measurement difference between solid component on CT and invasive tumor on pathology ranged from 0.73 mm to 2.44 mm before vessel removal and from -1.05 mm to 0.10 mm after vessel removal. The smallest mean measurement difference was obtained with 3D longest diameter of solid component after vessel removal in both readers (-0.26 mm to 0.10 mm), with no significant difference from pathology ($p=0.53$-0.83).

CONCLUSION

By adding a vessel removal algorithm in software segmentation of subsolid nodules, the prediction of invasive component in lung adenocarcinomas can be improved.

CLINICAL RELEVANCE/APPLICATION

Removing pulmonary vessels in segmenting subsolid nodules on CT may lead to a better prediction of the invasive component on pathology and therefore to a better management of such nodules.

SSA05-06 Clinical Application of Quantitative Dual-Energy CT Iodine Maps and CT Morphologic Features in Distinguishing Small Cell Lung Cancer from Non-Small Cell Lung Cancer

Sunday, Nov. 26 11:35AM - 11:45AM Room: S404CD

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

For information about this presentation, contact:

xxllpositive@163.com

PURPOSE

To evaluate prospectively the clinical usefulness of quantitative dual-energy CT (DECT) iodine enhancement metrics combined with morphological CT features in distinguishing small cell lung cancer (SCLC) from non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS

106 consecutive untreated patients (76 men, 30 women; mean age, 61.1 years ± 9.5) were enrolled and underwent DECT before biopsy. A total of 28 conventional CT descriptors were assessed. DECT metrics including Iodine density, iodine ratio and normalized iodine uptake were measured. Multiple logistic regression analyses were applied to identify independent factors of lung cancer subtypes. Two areas under the receiver operating characteristic curve (ROC) were compared.

RESULTS

Histology revealed adenocarcinoma in 44, squamous cell carcinoma (SCC) in 36 and small cell lung cancer (SCLC) in 26 patients. SCLCs were found more frequently in larger ($P=0.014$) and centrally located ($P=0.012$) tumors, tumors with homogeneous enhancement ($P=0.044$), lymphadenopathy ($P=0.038$), confluent mediastinal lymphadenopathy ($P<0.001$), encasement of mediastinal structures($P=0.004$), vascular involvement ($P=0.005$), lung atelectasis and/or obstructive pneumonia ($P=0.019$) and lower iodine density, iodine ratio and normalized iodine uptake (all $Ps<0.01$).NSCLCs were more likely to be with spiculation ($P=0.005$), vascular convergence ($P=0.011$), thickened adjacent bronchovascular bundles ($P=0.017$), and pleural retraction ($P=0.005$).The significantly independent prognostic factors of SCLC were larger tumor size, central location, confluent mediastinal lymphadenopathy, homogeneous enhancement, lower iodine ratio and normalized iodine uptake, and without coarse spiculation when adjusting for pleural retraction and lung atelectasis and/or obstructive pneumonia. ROC curve analysis indicated that use of CT features combined with DECT metrics (area under the ROC curve, AUC =0.981) was significantly superior to use of CT features alone (AUC = 0.908) ($P=0.007$).

CONCLUSION

Quantitative iodine-enhanced metrics generated from DECT in combination with CT features can be used to distinguish SCLC from NSCLC better than use of CT features alone.

CLINICAL RELEVANCE/APPLICATION

DECT can provide both quantitative iodine-enhanced metrics and CT features for discrimination of SCLC from NSCLC and is recommended for clinical use to help initial planning of lung cancer management.

SSA05-07 Comparison of the FDG-PET Avidity of Benign and Malignant Pure Ground Glass Opacities (GGOs): Is Higher FDG-PET Uptake More Typical of Benign GGOs?

Sunday, Nov. 26 11:45AM - 11:55AM Room: S404CD

Participants
Shaunagh McDermott, FFR(RCSI), Boston, MA (*Presenter*) Nothing to Disclose

Aoife Kilcoyne, MBBCh, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Yingbing Wang, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
James A. Scott, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Elkan F. Halpern, PhD, Boston, MA (*Abstract Co-Author*) Research Consultant, Hologic, Inc Research Consultant, Real Imaging Ltd Research Consultant, Gamma Medica, Inc Research Consultant, K2M Group Holdings, Inc
Jeanne B. Ackman, MD, Boston, MA (*Abstract Co-Author*) Spouse, Stockholder, Everest Digital Medicine; Spouse, Consultant, Everest Digital Medicine; Spouse, Stockholder, Cynvenio Biosystems, Inc; Scientific Advisory Board, Cynvenio Biosystems, Inc; Consultant, PAREXEL International Corporation

PURPOSE

To determine whether 2-[fluorine-18] fluoro-2-deoxy-d-glucose (FDG) PETuptake is higher in benign or malignant GGOs.

METHOD AND MATERIALS

1013 of 2544 total diagnostic PET-CT scans performed in 2011 were randomly selected and retrospectively reviewed to assess for pure GGOs with a mean diameter > 1 cm. 59 GGOs were identified by image review in 40 patients (21F, 19M, mean age 62 yrs, range 22-85 yrs), with a mean of 1.5 GGO per patient, range 1-5. Two observers, blinded to PET findings and final diagnosis, independently reviewed the CT images with respect to location, size, and attenuation (mean Hounsfield units) of GGOs. A third observer, blinded to final diagnosis, analyzed the PET images. A region-of-interest (ROI), inclusive of the entire GGO, was used to measure the maximum standardized uptake value (SUVmax). Final diagnosis of malignancy was made based on pathology, if available, or upon increased size and attenuation; final diagnosis of benignity was made if the GGO resolved, was new compared to a scan performed within the last 3 months, or was stable for at least 60 months; otherwise the GGO was considered indeterminate. The benign and malignant GGOs were compared using a 2-tailed Student's t test.

RESULTS

3 of 59 GGOs were excluded due to less reliable SUV measurements (proximity to adjacent FDG-avid structures). Of the remaining 56 GGOs, 15 GGOs were indeterminate, resulting in a cohort of 41 pure GGOs, 31 benign and 10 malignant. Benign GGOs were significantly larger than malignant ones (average mean diameter 26 mm versus 14 mm, respectively) (p=0.04). The SUVmax was higher in the benign group (mean 2.2; median 1.3; range 0.4-8.8) than the malignant group (mean 0.8; median 0.8; range 0.5-1.4) (p=0.05). With an SUVmax threshold to ensure 100% sensitivity for detection of malignancy, the specificity for the detection of malignancy was 39%. There was no significant difference in mean attenuation (p=0.4).

CONCLUSION

Benign pure GGOs had higher FDG-PET uptake than malignant GGOs. At an SUVmax threshold ensuring 100% sensitivity for malignancy, 39% of benign GGOs could avoid misinterpretation as malignant lesions.

CLINICAL RELEVANCE/APPLICATION

This study shows that higher FDG PET-uptake is much more typical of benign, than malignant, pure GGOs. Awareness of this finding should improve PET-CT interpretation of GGOs and resultant clinical management.

SSA05-08 Histologic Subtypes Are Not Associated with the Presence of Sarcopenia in Lung Cancer

Sunday, Nov. 26 11:55AM - 12:05PM Room: S404CD

Participants
Eun Young Kim, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chang Rae Kim, MD, Incheon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hee Young Lee, MD, Incheon , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yoon Kyung Kim, MD, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jeong Ho Kim, MD, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

oneshot0229@gmail.com

PURPOSE

Sarcopenia is prevalent and a known adverse prognostic effector in lung cancer (LCA). However, the relationship between sarcopenia and histology remains uncertain in LCA.

METHOD AND MATERIALS

Consecutive patients with newly diagnosed LCA (n=778) between June 2012 and February 2015 were retrospectively reviewed to identify factors associated with sarcopenia. Sarcopenia was defined as CT-determined L3 muscle index (muscle area at L3/height2) of < 55 cm2/m2 for men and < 39 cm2/m2 for women.

RESULTS

Mean patient age was 67.7 ± 10.8 years, and most (73.1%) were male. The most prevalent histology was adenocarcinoma (44.0%) and 71.6% of patients had stage III or IV disease. The overall prevalence of sarcopenia was 48.2% (60.3% in men, and 15.3% in women). Univariable analysis showed sarcopenia was significantly associated with male gender, age (>= 65 years), smoking status, lower BMI (< 23 kg/m2), advanced stage (III and IV), and high comorbidity score (Charlson index >= 3). Furthermore, the prevalence of sarcopenia was higher in squamous cell carcinoma (54.9%) and small cell LCA (56.4%) than in adenocarcinoma (39.8%). Multivariable analyses showed sarcopenia was independently associated with a male gender (odds ratio [OR], 11.13), elderly (OR, 2.02) and low BMI (OR, 6.28), stage IV (OR, 1.98), and high comorbidity (OR, 1.93). However, no significant association was found between histologic subtypes and sarcopenia.

CONCLUSION

In a single center lung cancer cohort, sarcopenia was found to be significantly associated with old age, male gender, an advanced stage, comorbidities, and low BMI in LCA. However, histology subtype was not an independent factor for the presence of sarcopenia.

CLINICAL RELEVANCE/APPLICATION

Understanding of associated factors of sarcopenia might provide better understanding of the mechanism responsible for cancer cachexia in lung cancer.

SSA05-09 Imaging Features Associated with Spread through Air Spaces (STAS) in Patients with Lung Adenocarcinoma

Sunday, Nov. 26 12:05PM - 12:15PM Room: S404CD

Awards
Student Travel Stipend Award

Participants
Seon Kyoung Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Tae Jung Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

seonkyung.kim@samsung.com

PURPOSE

Spread through air spaces (STAS) is a recently recognized pattern of tumor invasion and has been reported to be a predictor of recurrence and survival in lung adenocarcinomas (ADCs). However, there has been no detailed investigation on imaging-based identification of STAS in lung ADC. We aimed to explore the imaging features for predicting STAS in surgically resected lung ADCs.

METHOD AND MATERIALS

Presence of STAS was evaluated in 1,295 surgically resected ADCs from April 2015 to December 2016. STAS-positive and STAS-negative patients were matched 1:2 using patient variables (e.g.: age, sex and smoking status). CT morphologic features (solidity, location, margin, shape, cavity, calcification, central low-attenuation, ill-defined opacity around the tumor, air-bronchogram, satellite lesion, pleural retraction, and percentage of solid portion), and FDG uptake on PET were analyzed by using multivariate logistic regression and receiver operating characteristics (ROC) curve.

RESULTS

STAS was found in 127 (9.7%) of 1295 patients. Ninety-six STAS-positive patients and 188 STAS-negative patients after matching were included in the analyses. STAS was found more frequently in solid tumors (75 of 96, 78.1%) than part-solid (21 of 96, 21.9%) or ground-glass nodules (0 of 96, 0%) (P<0.001). STAS was also found to be associated with central low-attenuation, ill-defined opacity around the tumor, percentage of solid portion and FDG uptake (P<0.001, respectively). Percentage of solid portion was unique independent predictor for the presence of STAS (OR 1.061, 95% C.I. 1.039-1.085) and cut-off value of 90.8% showed good discriminatory power with a sensitivity of 89.6% and a specificity of 61.2%.

CONCLUSION

Percentage of solid portion on CT appears to be a promising imaging biomarker for predicting STAS in lung ADCs, potentially allowing proper management.

CLINICAL RELEVANCE/APPLICATION

CT imaging features of lung ADC can be used to identify the presence of STAS and may help clinicians make better decisions about the exact extent of surgical resection or radiation therapy.

SSA24

Vascular Interventional (IO-Lung Cancer)

Sunday, Nov. 26 10:45AM - 12:15PM Room: E350

CH CT IR VA

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Thomas-Evangelos G. Vrachliotis, MD, PhD, Athens, Greece (*Moderator*) Nothing to Disclose
Hyun S. Kim, MD, New Haven, CT (*Moderator*) Nothing to Disclose

Sub-Events

SSA24-01 Towards Transpulmonary Chemoembolization with Degradable Starch Microspheres: Systematic Analysis of Local and Systemic Effects in a Porcine Model

Sunday, Nov. 26 10:45AM - 10:55AM Room: E350

Participants
Alexandra Barabasch, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Saskia von Stillfried, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Anton Sander, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Maximilian F. Schulze-Hagen, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Federico Pedersoli, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Markus Zimmermann, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Bruners, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Isfort, MD, Aachen, Germany (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

isfort@ukaachen.de

PURPOSE

To systematically investigate local and systemic effects of transpulmonary chemoembolization (TPCE) with degradable-starch-microspheres (DSM) and doxorubicin. Long-term goal is to establish DSM-TPCE as treatment option for pulmonary malignancies.

METHOD AND MATERIALS

9 pigs underwent TPCE via a catheter placed in either the right or left lower-lobe-pulmonary-artery (LLPA) and bland embolization (TPE) of the contralateral LLPA . Pulmonary-arterial pressure, heart-rate and oxygenation were recorded immediately before and at 1, 3, 5 and 10 minutes after treatment. To investigate possible non-target embolization, animals underwent cerebral MRI. Animals were sacrificed after a contrast-enhanced chest CT for pathologic examination 12 hours (3), 24 hours (3) and 72 hours (3) after treatment.

RESULTS

Mean injected DSM-dose until stasis was similar in TPCE and TPE (4.2±1.4 vs. 4.5±1.5mL). Pulmonary-arterial pressure increased significantly 3 minutes after treatment (TPE: 17±5 vs. 27±7mmHg; TPCE: 22±6 vs. 36±8mmHg). No systemic cardiovascular effects, i.e. no change of heart-rate or oxygenation pre- vs. post TPCE or TPE were observed. No evidence of structural lung damage or permanent perfusion obstruction was observed on contrast-enhanced CT. No non-target embolization was found on cerebral MRI. Pathologic assessment revealed nonspecific local inflammation of the lung parenchyma, with increasing degree from 12 to 72h after treatment.

CONCLUSION

In this large-animal modal, TPCE and TPE appear feasible and safe. Only a clinical asymptomatic, mild increase in pulmonary-arterial pressure was observed. Non-target embolization to the brain did not occur. TPCE, as well as TPE did not cause significant damage to the normal lung-parenchyma.

CLINICAL RELEVANCE/APPLICATION

Transpulmonary chemoembolization is a treatment option for non-resectable pulmonary malignancies. It is minimally invasive and allows delivery of high chemotherapy doses to the tumor. The results of this preclinical study justify the conductance of TPCE for treatment in patients with malignant lung tumors to deliver higher doses of the chemotherapeutic agent to the tumor and meanwhile reduce side effects.

SSA24-02 To Evaluate the Clinical Utility of an Electromagnetic Navigation System for Performing Liver Biopsies with Real Time PET-CT and US Fusion

Sunday, Nov. 26 10:55AM - 11:05AM Room: E350

Participants

Stylianos Drisis, MD, Brussels, Belgium (*Presenter*) Nothing to Disclose
Maxime Deforche, ARRT, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose
Marc P. Lemort, MD, Louvain La Neuve, Belgium (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

stylianos.drisis@bordet.be

PURPOSE

To evaluate the clinical utility of an electromagnetic navigation system for performing liver biopsies with real time PET-CT and US fusion.

METHOD AND MATERIALS

Fusion of PET-CT and US was performed during biopsies for 32 patients with liver metastasis. Twenty-four showed heterogeneous lesions (mixed SUV values with probably necrotic areas) and 8 showed homogenous lesions (smooth and homogeneous distribution of SUV values). Clinical impact of fusion was evaluated according to the following criteria: i) re-planification of target after fusion ii) localization- visualization of the lesion. iii) Success of the biopsy.

RESULTS

For the group of heterogeneous lesions, fusion has changed the target of the radiologist in all 24 cases aiming intra-tumoral regions of high FDG uptake. For the homogeneous lesions group, in 6 cases the fusion helped to better visualize the lesion either because of low US contrast (2 cases) either because of localization in the liver dome (4 cases). All biopsies were successful with sufficient material for sequencing.

CONCLUSION

Real time fusion of PET-CT and US has facilitated the biopsy for all 23 heterogeneous lesions and for 6 out of 8 homogeneous lesions.

CLINICAL RELEVANCE/APPLICATION

Using functional information during liver biopsies can facilitate the interventional radiologist by targeting only the FDG active therefore highly cellularised regions of the tumor. Moreover it increases radiologists' confidence with better visualization and localization of the lesion especially in difficult liver regions such as the dome. In the future functional imaging will be more involved in the planification of percutaneous biopsies.

SSA24-03 Ablation Therapy of Non-Colorectal Cancer Lung Metastases: Retrospective Analysis of Tumor Response post Laser-Induced Interstitial Thermotherapy (LITT) Radiofrequency Ablation (RFA) and Microwave Ablation (MWA)

Sunday, Nov. 26 11:05AM - 11:15AM Room: E350

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
Mohammed A. Alsubhi, BMBS, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Tatjana Gruber-Rouh, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Benjamin Kaltenbach, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Iris Burck, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Bita Panahi, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Marc Harth, MD, Frankfurt am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

nour410@hotmail.com

PURPOSE

To retrospectively compare the local tumor response and survival rates in patients with non-colorectal cancer lung metastases post ablation therapy using laser-induced thermotherapy-(LITT), radiofrequency ablation-(RFA) and microwave ablation-(MWA).

METHOD AND MATERIALS

Retrospective analysis of 175 CT-guided ablation sessions performed on 109 patients (43 males and 66 females, mean age: 56.6years). 17 patients with 22 lesions underwent LITT treatment (tumor size: 1.2-4.8cm), 29 patients with 49 lesions underwent RFA (tumor size: 0.8-4.5 cm) and 63 patients with 104 lesions underwent MWA treatment (tumor size: 0.6-5 cm). CT-scans were performed 24-hours post therapy and on follow-up at 3, 6, 12, 18 and 24 months.

RESULTS

The overall-survival rates at 1-,2-,3- and 4-year were 93.8%,56.3%,50.0% and 31.3% for patients treated with LITT,81.5%,50.0%,45.5% and 24.2% for patients treated with RFA and 97.6%, 79.9%,62.3% and 45.4% for patients treated with MWA respectively. The mean survival-time was 34.14 months for MWA, 34.79 months for RFA and 35.32 months for LITT. In paired comparison a significant difference could be detected between MWA versus RFA (p=0.032). The progression-free survival showed a median of 23.49 ± 0.62 months for MWA,19.88 months ±2.17 months for LITT and 16.66 ± 0.66 months for RFA(p=0.048). The lowest recurrence rate was detected in lesions ablated with MWA (7.7%; 8 of 104 lesions) followed by RFA (20.4%; 10 of 49 lesions) and LITT (27.3%;6 of 22 lesions) p- value of 0.012. Pneumothorax was detected in 22.16% of MWA ablations, 22.73% of LITT ablations and 14.23% of RFA ablations.

CONCLUSION

LITT, RFA and MWA may provide an effective therapeutic option for non-colorectal cancer lung metastases with an advantage for MWA regarding local tumor control and progression-free survival rate.

CLINICAL RELEVANCE/APPLICATION

LITT, RFA and MWA have a therapeutic potential regarding local tumor control and progression-free survival rate patients with non-colorectal cancer lung metastases .

SSA24-04 Image Guided Tumor Biopsies in a Prospective Molecular Triage Study (MOSCATO 01): What Are the Risks?

Sunday, Nov. 26 11:15AM - 11:25AM Room: E350

Participants
Lambros C. Tselikas, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Clara Prud'Homme, MD , Paris, France (*Presenter*) Nothing to Disclose
Frederic Deschamps, Villejuif, France (*Abstract Co-Author*) Research Consultant, Medtronics plc
Adrien Allorant, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Antoine Hollebecque, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Stefan Michels, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Christophe Massard, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Samy Ammari, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Charles Ferte, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Maud Ngo Camus, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Philippe Vielh, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Ludovic Lacroix, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Eric Solary, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Jean Charles Soria, MD, PhD, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Thierry J. De Baere, MD, Villejuif, France (*Abstract Co-Author*) Consultant, Terumo Corporation; Speaker, Medtronic plc; Consultant, General Electric Company; Consultant, Guerbet SA

For information about this presentation, contact:

lambros.tselikas@gustaveroussy.fr

PURPOSE

To describe complications of percutaneous image-guided biopsies for genomic analysis in cancer patients, their management and to determine pre-procedural risk factors.

METHOD AND MATERIALS

Data from biopsies performed at a single center in the prospective MOSCATO-01 clinical trial were recorded between November 2011 and March 2016.Data included patient demographics, previous therapies, and biology reports.Tumor and procedure characteristics were evaluated.Complications, their management, and tumor cellularity were recorded.Univariate and multivariate analysis was performed to determine predictive factors for complications.

RESULTS

Seven-hundred and forty biopsies were performed on 689 patients, with a mean of 4 samples per biopsy. Biopsies were performed on tumors in the liver (n:=:297), lung (n:=:184), lymph nodes (n:= 121), bone (n:=:14), or another site (n:=:122) under CT (31%) or US guidance (69%). Seventy patients (10%) experienced a complication including 67% grade 1, 23% grade 2, 10% grade 3, 0% grade 4 and the mortality rate was 0%. Most common complications were pneumothorax (61%), hemorrhage (24%) and pain (7%) and none was life-threatening. Among 10 hemorrhagic complications, 3 required trans-arterial embolization. Tumor location (lung), renal function (creatinine as a continuous variable), lesion size (as a continuous variable), depth (distance to pleura for lung biopsies, as a continuous variable) and prone position, were found as predictive factors for complication in univariate analysis.By multivariate analysis:only tumor location (lung vs other) OR=1.26 [1.18-1.34], and depth for lung biopsies OR=1.26 [1.18-1.34], were significant risk factors in our population.Biopsies where contributive for genomic analysis in 88% of cases.

CONCLUSION

Percutaneous image-guided core-needle biopsies are feasible and safe in cancer patients for molecular screening. The different risk factors identified did not increase mortality or preclude the successful acquisition of useful tissue for genomic analysis.

CLINICAL RELEVANCE/APPLICATION

umor biopsies are key for genomic analysis to drive targeted therapies matching specific molecular alterations. Percutaneous image-guided biopsies are feasible and safe.

SSA24-05 Feasibility Study of CT-Guided Needle Insertion Using Stereotaxic Unit for Lung Biopsy

Sunday, Nov. 26 11:25AM - 11:35AM Room: E350

Participants
Sang Young Oh, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Joon Beom Seo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyung Jin Won, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Coreline Soft, Inc
Hongho Kim, Yongin-si, Korea, Republic Of (*Abstract Co-Author*) Employee, Hyundai Heavy Industries, Co, Ltd
Hee Jun Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jooae Choe, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Younghoon Cho, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

ojangsa@gmail.com

PURPOSE

Purpose of this study is to evaluate accuracy and feasibility of CT-guided, robot-assisted needle placement of lung lesion

Purpose of this study is to evaluate accuracy and feasibility of CT-guided, robot-assisted needle placement of lung lesion

METHOD AND MATERIALS

The robot system including 5-axis robot arm, a mobile platform with motor controllers, dedicated workstation for planning of needle path, and the navigation system (Polaris Spectra®; NDI, Canada) was developed. It provides useful functions including such as needle path planning, respiration monitoring, laser guidance, automatic needle positioning and guiding. To evaluate the feasibility and accuracy of the system in needle placement, patient with lung lesions requiring biopsy were included. Under CT guidance. CT scan was performed to localize the target lesion and the CT data was transferred to the system. The spatial relation between patient and the robot system was registered with navigation system. After planning the needle path on workstation, the spatial information was translated to the robotic system. The robot system automatically angulates the needle to the target and depth of insertion is determined. Total of 21 needle insertion trials were performed. Using the CT images after the insertion, distance between the target and actual needle tip and angle between preplanned route and actual needle pathway were measured.

RESULTS

The distances between the target and the needle tip for robot assisted was 8.13±5.2mm. Angular deviation was 4.49±2.86°. Procedure was 17m45s±4m36. Since additional CT scanning was performed. Small amount of pneumothorax occurred in three patients, but no additional procedures were needed. Small amount of hemoptysis occurred in one patient.

CONCLUSION

Developed robot system provides comparable accuracy of CT guided needle placement for lung lesion to conventional procedure.

CLINICAL RELEVANCE/APPLICATION

Compared with conventional biopsy procedures, it is expected to use tools that make it easier to perform biopsy by lowering barriers to entry by non-experts.

SSA24-06 Meteorological Conditions and Incidence of Pneumothorax and Chest Tube Placement after Percutaneous CT-Guided Lung Biopsy

Sunday, Nov. 26 11:35AM - 11:45AM Room: E350

Participants
Divya Sridhar, MD, New York, NY (*Presenter*) Nothing to Disclose
Bedros Taslakian, MD, New York , NY (*Abstract Co-Author*) Nothing to Disclose
Varshaa Koneru, Telangana, India (*Abstract Co-Author*) Nothing to Disclose
James S. Babb, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

Bedros.Taslakian@nyumc.org

PURPOSE

Previous studies suggest that changes in atmospheric pressure may correlate with the incidence of idiopathic spontaneous pneumothorax. The aim of our study was to retrospectively evaluate the meteorological variables that may influence rates of pneumothorax and chest tube placement after percutaneous CT-guided lung biopsy, in particular the atmospheric pressure (P) and temperature (T).

METHOD AND MATERIALS

We analyzed 338 percutaneous CT-guided lung biopsies performed with 20-gauge coaxial cutting needles between December 2011 and May 2014. For each day within the period analyzed, the mean P (mP), as well as mean (mT), maximal, and minimal temperatures, were recorde. To evaluate the influences of pressure changes, differences in mP were calculated from one day before and one day after the procedure. We also recorded the humidity and presence or absence of special weather conditions (thunderstorms, snow, and rainfall). Unequal variance t test was used to measure the degree of association. P-value <0.05 was considered significant.

RESULTS

The overall incidence of pneumothorax was 34.0% (115/338), with 26.1% (30/115) requiring chest tube placement (8.9% of all procedures). The average mP and mT were 29.9 ± 0.2 inches of mercury (inHg) and 58.2 ± 17.01°F, respectively, during the study period. The mP did not correlate significantly with post-biopsy pneumothorax (p= .277) or chest tube placement (p=.767). There was also no correlation between the mT and post-biopsy pneumothorax (p=.619) or chest tube placement (p=.987). Pressure changes, humidity, and special weather conditions did not significantly influence the occurrence of pneumothorax or chest tube placement. No threshold in the mP was found to determine the probability of pneumothorax occurrence or chest tube placement rate.

CONCLUSION

Although meteorological factors may impact incidence of spontaneous pneumothorax, no correlation was found in our study between these factors and incidences of post-biopsy pneumothorax and chest tube placement. Further studies could confirm these findings with a larger study population, as well as investigate the impact of more rapid and profound pressure changes, such as in the setting of air travel, on these complications.

CLINICAL RELEVANCE/APPLICATION

Routine weather fluctuations do not impact the incidence of post-biopsy pneumothorax, despite correlations with spontaneous pneumothorax, and should not impact procedure planning.

SSA24-07 Percutaneous Cryoablation of Metastatic Lung Tumors: High Efficacy with Low Morbidity

Sunday, Nov. 26 11:45AM - 11:55AM Room: E350

Participants

Hussein D. Aoun, MD, Dearborn, MI (*Abstract Co-Author*) Reviewer, Galil Medical Ltd
Peter J. Littrup, MD, Providence, RI (*Abstract Co-Author*) Founder, CryoMedix, LLC ; Research Grant, Galil Medical Ltd; Research Grant, Endo International plc ; Consultant, Delphinus Medical Technologies, Inc
Salah Abdelhadi, MD, Detroit, MI (*Presenter*) Nothing to Disclose
Mark J. Krycia, BS, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Barbara A. Adam, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Matthew Prus, BS, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

aounh@karmanos.org

PURPOSE

To assess technical feasibility, efficacy and complication rates of CT guided cryoablation of metastatic lung tumors in multiple locations.

METHOD AND MATERIALS

CT fluoroscopic-guided percutaneous cryoablation was performed in 185 procedures on 252 metastatic lung tumors in 104 patients. Tumor and ablation volumes, location, abutting vessels >3mm, recurrences, and PFT's were reviewed for all patients. Complications were graded by the National Institutes of Health, Common Terminology of Complications and Adverse Events 4.0 (CTCAE).

RESULTS

All procedures were performed with conscious sedation. Mean FEV1 and DLCO2 were 86.6% (32-144%) and 76.9% (29-110%), respectively. Overall tumor and ablation mean size was 2.0 cm (0.5 - 12.3 cm) and 4.1 cm (2.1-12.8), respectively. Total major complication rates were only 3.7% (7/185), and were not statistically significant between tumors <=3 cm (2.8% N=4/147) vs >3cm (7.9% N=3/38) (p>0.1). No statistical significance was noted for major complications with central tumors or major vessel proximity (p>0.1). A pneumothorax occurred in 88 procedures (47.6%) of which 43 (23.2%) were self-limited resolving without intervention and 42 (22.7%) requiring immediate suction or short term chest tube (< 24hrs). Only 3 (1.6%) procedures required prolonged chest tube (>grade 3). Recurrence rates of 5.2% (13/252) were greater in tumors >3cm (12.2% N=5/41) vs tumors <3cm (3.8% N=8/211) (p<0.05). Although recurrence rates increased for central tumors near major vessels 7.0% (7/100) compared with peripheral tumors 3.9% (6/152) this was not statistically significant (p> 0.1).

CONCLUSION

CT guided percutaneous cryoablation of lung metastasis provides a low morbidity alternative with one of the highest efficacy rates noted in literature, regardless of tumor size. Tumor size and location does not significantly affect complication rates.

CLINICAL RELEVANCE/APPLICATION

Appropriately delivered thoracic metastasis cryoablation is affected by tumor size yet still produces very low recurrence and complication rates.

SSA24-08 Lung Metastases: Role of Transpulmonary Chemoembolization (TPCE) in a Palliative or Neoadjuvant Intention

Sunday, Nov. 26 11:55AM - 12:05PM Room: E350

Participants
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Presenter*) Nothing to Disclose
Ahmed i. Ahmed, MBCHB, Assiut, Egypt (*Abstract Co-Author*) Nothing to Disclose
Mostafa A. El-Sharkaway, Assiut, Egypt (*Abstract Co-Author*) Nothing to Disclose
Afaf A. Hassan, Assiut, Egypt (*Abstract Co-Author*) Nothing to Disclose
Hossam M. Kamel, Assiut, Egypt (*Abstract Co-Author*) Nothing to Disclose
Duaa B. Thabet, Assiut, Egypt (*Abstract Co-Author*) Nothing to Disclose
Nour-Eldin A. Nour-Eldin, MD,PhD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Nagy N. Naguib, MD, MSc, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

T.Vogl@em.uni-frankfurt.de

PURPOSE

To evaluate tumor response, local tumor control and survival after the treatment of secondary lung metastases using transpulmonary chemoembolization (TPCE) in palliative and neoadjuvant intention.

METHOD AND MATERIALS

Between 08/04 and 11/16 142 patients (mean 56.6±13.5 years; 73 females, 69 males) with unresectable lung metastases underwent repetitive TPCE (mean: 5.7±2.8 sessions). Primary tumors were colorectal carcinoma (n=58), breast cancer (n=27), sarcoma (n=13), renal cell carcinoma (n=8) and others (n=36). Bilateral lung involvement occurred in 79.6% of patients (median number of lung nodules: 10). 50 patients who underwent subsequent ablation either for all lesions (complete) or some lesions (incomplete) were included. Preinterventional MRI and postinterventional CT was performed after each session. Response was assessed according to the RECIST criteria. Local tumor progression and overall survival were analyzed using Kaplan-meier and Cox hazard regression.

RESULTS

After evaluation of tumor response partial response (PR) was achieved in 11.3% (n=16), stable disease (SD) in 66.2% (n=94) and progessive disease (PD) in 22.5% (n=32). Mean survival time and time to progression were 24.3 months and 7.5 months respectively from the date of first intervention. The longest mean survival time was recorded in breast cancer patients with 28.4 months followed by colorectal cancer with 25 months. In the pallilative group mean survival was 19.4 months vs 30.4 months in the neoadjuvant group with subsequent ablation.

CONCLUSION

TPCE has the potential to improve local tumor control and to prolong survival with a neoadjuvant potential when ablation therapies are combined.

CLINICAL RELEVANCE/APPLICATION

Combined TPCE and ablation therapies can improve local tumor control and survival vs. TPCE alone.

SSA24-09 Visible Beads for Pulmonary Artery Embolization (PAE) - Proof of Principle

Sunday, Nov. 26 12:05PM - 12:15PM Room: E350

Participants
Christof M. Sommer, MD, Heidelberg, Germany (*Presenter*) Research Grant, AngioDynamics, Inc; Research Grant, Terumo Corporation; Research Grant, PharmaCept GmbH; Technical support, BTG International Ltd; Technical support, Boston Scientific Corporation; Technical support, Siemens AG; Technical support, Medtronic plc;
Alexander Harms, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Thuy D. Do, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Theresa L. Gockner, MD, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Christopher L. Schlett, MD, MPH, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Dominik Vollherbst, MD, Heidelberg, Germany (*Abstract Co-Author*) Grant, AngioDynamics, Inc
Philippe L. Pereira, MD, Heilbronn, Germany (*Abstract Co-Author*) Research Consultant, Terumo Corporation; Speaker, AngioDynamics, Inc; Speaker, Terumo Corporation; Advisory Board, Siemens AG; Advisory Board, Terumo Corporation; Board, Bayer AG; Advisory Board, Medtronic plc; Support, Bracco Group; Support, PharmaCept GmbH; Support, Terumo Corporation; Support, Siemens AG; Support, Novartis AG; Support, Cook Group Incorporated; Research Grant, Biocompatibles International plc; Research Grant, Siemens AG; Research Grant, Terumo Corporation; Research Grant, BTG International Ltd
Manfred Jugold, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Arne Warth, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Goetz M. Richter, MD, PhD, Heidelberg, Germany (*Abstract Co-Author*) Research Grant, CeloNova BioSciences, Inc; Research Grant, Boston Scientific Corporation; Research Grant, Siemens AG; Research Grant, Medtronic plc
Hans-Ulrich Kauczor, MD, Heidelberg, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Bayer AG; Speakers Bureau, Boehringer Ingelheim GmbH; Speakers Bureau, Siemens AG; Speakers Bureau, Koninklijke Philips NV; Speakers Bureau, Bracco Group; Speakers Bureau, AstraZeneca PLC;
Paul G. Flechsig, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

christof.sommerqmed.uni-heidelberg.de

PURPOSE

To analyze the degree of x-ray visibility of different types of microspheres for pulmonary artery embolization (PAE).

METHOD AND MATERIALS

Three different types of microspheres were analyzed: narrow-size calibrated 250µm-Embozene™, narrow-size calibrated 250µm-VISIBLE, and broad-size calibrated 100-300µm-DCBead™. Initially, in-vitro imaging applying MicroCT and human-scale CT was performed. Subsequently, 6 pigs underwent PAE of peripheral lung segments using the different types of microspheres. Thereby, the embolization endpoint was defined as delivery of a pure microsphere volume of 0.5 ml in each embolization position. After PAE, in-vivo human-scale DynaCT and CT followed, and subsequently sacrifice, lung harvest and preparation of paraffin blocks of the embolized lung segments. Representative paraffin blocks underwent ex-vivo imaging applying MicroCT. The study endpoint included the degree of x-ray visibility.

RESULTS

In-vitro imaging applying MicroCT and human-scale CT identified the lowest x-ray visibility for 250µm-Embozene™, the highest x-ray visibility for 250µm-VISIBLE, and a lack of x-ray visibility for 100-300µm-DCBead™. Ex-vivo imaging applying MicroCT identified the lowest x-ray visibility for 250µm-Embozene™, the highest x-ray visibility for 250µm-VISIBLE, and a lack of x-ray visibility for 100-300µm-DCBead™. Angiography after PAE documented occlusion of sub-segmental arteries for all types of microspheres. In-vivo imaging applying human-scale DynaCT and CT identified the highest x-ray visibility for 250µm-VISIBLE, and a lack of x-ray visibility for 250µm-Embozene and 100-300µm-DCBead™.

CONCLUSION

In this study, PAE with 250µm-Embozene™, 250µm-VISIBLE, and 100-300µm-DCBead™ results in a different degree of x-ray visibility of the microspheres.

CLINICAL RELEVANCE/APPLICATION

Potential clinical advantages of PAE applying 250µm-VISIBLE include better treatment control due to the high degree of x-ray visibility of the microspheres, and - when compared with 100-300µm-DCBead™ - controlled occlusion of arteries with a size closely corresponding to the nominal microsphere size (bronchiolus-associated arteries).

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CHS-SUA

Chest Sunday Poster Discussions

Sunday, Nov. 26 12:30PM - 1:00PM Room: CH Community, Learning Center

CH

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Tami J. Bang, MD, Aurora, CO (*Moderator*) Nothing to Disclose

Sub-Events

CH224-SD-SUA1 A New Parameter in the Morphological Evaluation of COPD: The Bulla Index

Station #1

Participants
Cristina Utrilla, MD, Madrid, Spain (*Presenter*) Nothing to Disclose
Alicia Linares Beltran, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Francisco Garcia-Rio, MD, PhD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Inmaculada Pinilla Fernandez, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Raul Galera, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Isabel Torres Sanchez, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

cristinautrilla@hotmail.com

PURPOSE

To compare the bulla index (BI) between COPD patients and healthy subjects. To assess the accuracy of this parameter to discriminate COPD phenotypes and the severity. To analyze the relationship between the BI and the lung function parameters.

METHOD AND MATERIALS

58 patients with moderate-severe COPD and 25 healthy subjects were included. Clinical and functional evaluation and MDCT scan with quantitative data post processing were performed; assessment of attenuation, including mean lung density [MLD], low attenuation volumes [LAV] and the BI.

RESULTS

BI was higher in COPD patientes than in control subjects (2.88±1.91 vs 0.45±0.91,p<0.001). Class1 bullae (2-8mm3) discriminates better COPD from control subjects than conventional measures of lung density. COPD patients with severe airflow limitation showed a higher BI than patients with moderate limitation (3.6±1.6 vs 2.5±2.0; p=0.034) whereas Class4 bullae (>120 mm3) were lower in risk GOLD groups A-B than in C-D groups (1.3±1.9vs 4.1±4.0 vs 16.4 ± 22.4%; p=0.035). BI was also higher in non-exacerbator COPD patients with emphysema than with chronic bronchitis (3.5±1.7 vs 1.5 ±1.7;p=0.005). BI shows a direct relationship with the BODE index (r =0.418;p=0.003) and the score of the St George Respiratory Questionnaire (r =0.338; p=0.018) and it is correlated with most of the lung function parameters: FEV1(r =-0.429; p=0.002), FEV1/FVC (r =-0.573;p<0.001), FRC(r=0.621;p<0.001), DLCO(r =-0.477; p =0.001), DLCO/VA (r=-0.509;p<0.001) and PaO2 (r =-0.433;p=0.011).

CONCLUSION

Bulla Index has a different behavior in COPD patients, depending on severity and phenotype, reaching a better discriminative capacity than other parameters, keeping a remarkable correlation with quality of life and lung function parameters.

CLINICAL RELEVANCE/APPLICATION

The Bulla Index measured by cuantitaive volumetric MDCT is a usuful parameter in the evaluation of COPD patients.

CH225-SD-SUA2 Time-Dependent Analysis of Incidence, Risk Factors and Clinical Significance of Pneumothorax after Percutaneous Lung Biopsy

Station #2

Participants
Woo Hyeon Lim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chang Min Park, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Soon Ho Yoon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun-Ju Lim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eui Jin Hwang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong Hyuk Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Samsung Electronics Co, Ltd; Research Grant, DRTECH Co, Ltd
Eun Kyoung Hong, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

smtwh89@gmail.com

PURPOSE

To evaluate the time-dependent incidence, risk factors, and clinical significance of percutaneous lung biopsy (PLB)-related pneumothorax in 3251 patients.

METHOD AND MATERIALS

From January 2012 to November 2015, 3251 patients underwent 3354 Cone-beam CT-guided PLBs for lung lesions. Cox proportional-hazards, logistic and linear regression analyses were performed to identify time-dependent risk factors of PLB-related pneumothorax, risk factors of drainage catheter insertion and those of prolonged catheter placement, respectively.

RESULTS

Pneumothorax occurred in 915 out of 3354 PLBs (27.3%), with 25.1% (230 of 915) occurring during follow-ups. Older age (Hazard ratio [HR]=1.009; P=.0024), emphysema (HR=1.624; P<.0001), smaller target (HR=0.922; P<.0001), deeper location (HR=1.175; P<.0001), multiple pleural passages (HR=1.576; P<.0001), and longer puncture time (HR=1.036; P<.0001) were significant risk factors for the earlier occurrence of PLB-related pneumothorax, while presence of hemoptysis (HR=0.503; P=.0001) showed a protective effect against the earlier development of pneumothorax. Seventy-five cases (8.2% of pneumothorax) underwent chest drainage catheter placement. Mean duration of catheter placement of these cases was 3.2±2.0 days. Emphysema (Odds ratio [OR]=2.400; P=.0019) and longer puncture time (OR=1.053; P=.0146) were assessed to be significant risk factors for catheter insertion, and older age (Parameter estimate=1.0139; P=.0124) was a predictive factor for prolonged catheter placement.

CONCLUSION

PLB-related pneumothorax occurred in 27.3% of all PLBs, among which 25.1% developed during follow-ups, and 8.2% of PLB-related pneumothorax required drainage catheter placement. Smaller target size, emphysema, deeply-located lesions were significant risk factors of PLB-related pneumothorax. Emphysema and older age were related with drainage catheter insertion and prolonged catheter placement, respectively.

CLINICAL RELEVANCE/APPLICATION

With the information regarding occurrence timing of PLB-related pneumothorax, clinicians would be able to provide tailored management to patients.

CH226-SD-SUA3 Differential Diagnosis Efficacy of Thymic Solid Tumors with Intravoxel Incoherent Motion Diffusion-Weighted MR Imaging

Station #3

Participants
Shi-Jun Duan, Xian, China (*Presenter*) Nothing to Disclose
Yu-Chuan Hu, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Wen Wang, xian, China (*Abstract Co-Author*) Nothing to Disclose
Guang-Bin Cui, MD, Xian, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

283507727@qq.com

PURPOSE

To retrospectively evaluate the differential diagnosis performance of intravoxel incoherent motion diffusion-weighted imaging (IVIM-DWI) for thymoma, thymic carcinoma and thymic lymphoma.

METHOD AND MATERIALS

Seventy-one subjects (49 men, 22 women; age range, 5-72 years) including thymoma (n=27), thymic carcinoma (n=16) and thymic lymphoma group (n=28) confirmed by pathological analysis underwent thoracic MRI on a 3.0-T MRI system, including conventional sequence and 9 b-value (b-value: 0 - 1,000 s/mm2) DWI. Multi-b-value apparent diffusion coefficient (ADCmb) were calculated by mono-exponential model.Pure diffusion coefficient (D), pseudo-diffusion coefficient (D*) and perfusion fraction (f) were calculated with bi-exponential model. Mean ADCmb, D, D*, and f values were compared for the differences among thymoma, thymic carcinoma and thymic lymphoma groups by one-way ANOVA, and further post hoc multiple comparisons were performed with Bonferroni test or Dunett's T3 test. Receiver operating characteristic curve (ROC) analyses were performed to determine the efficacy and optimum thresholds for differentiating the defined groups by various parameters.

RESULTS

The mean D and D* value in thymoma were significant higher than the value from thymic carcinoma and lymphoma (D, 0.90, 0.62 and 0.49 ×10-3 mm2 /s; D*, 9.50, 5.56 and 3.62×10-3 mm2 /s, and 10.47, 4.76 and 4.01 × 10-3 mm2 /s, respectively, all P < 0.001),while there were no significant difference between the thymic carcinoma and lymphoma (P > 0.05/3). The mean ADCmb value in thymic lymphoma were significantly lower than thymoma and thymic carcinoma (ADCmb, 0.71, 1.32 and 0.99 ×10-3 mm2 /s, respectively, P<0.001), but no significant difference between the thymoma and thymic carcinoma (P > 0.05/3). As for the f value, no significant difference were found among groups (P > 0.05). The AUC and cutoff value, respectively, for differentiating thymoma from thymic lymphoma: ADCmb, 0.946 and 0.872 ×10-3 mm2/s; D, 0.861 and 0.721×10-3 mm2/s; D*, 0.878 and 4.80 × 10-3 mm2/s; for differentiating thymic carcinoma from lymphoma for ADCmb, D and D* were as follows: ADCmb, 0.786 and 0.932×10-3 mm2/s; D, 0.670 and 0.679 ×10-3 mm2/s; D*, 0.721 and 4.2 ×10-3 mm2/s.

CONCLUSION

We suggest that IVIM-DWI measurements could be used to differentiate thymic solid tumors preoperatively.

CLINICAL RELEVANCE/APPLICATION

IVIM parameters could potentially be used in clinical practice regarding differential diagnosis of thymic tumors.

CH227-SD-SUA4 Integrated Prognostic Evaluation of Clinicopathologic and Radiologic Factors in Lung Squamous Cell Carcinoma

Station #4

Participants
Kyowon Gu, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ho Yun Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Insuk Sohn, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hong Kwan Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yong Soo Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jhingook Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Mog Shim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jaeil Zo, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

kyowon.gu@gmail.com

PURPOSE

To explore the radiologic and clinicopathologic factors affecting the prognosis of the patients with squamous cell carcinoma (SqCC) of the lung.

METHOD AND MATERIALS

We reviewed pathologic specimens and imaging characteristics of primary tumors from 396 consecutive patients who underwent surgical resection for lung SqCC. Tumor location, enhancement, necrosis, obstructive pneumonia and underlying lung disease were evaluated on preoperative CT scans. Clinicopathologic and histopathologic factors including the ratio of metastatic lymph nodes were also assessed. The relationships between those variables and survival (overall survival [OS] and disease-free survival [DFS]) were analyzed using univariate and multivariate cox regression analysis.

RESULTS

The median follow-up period was 56.2 months. There were 24 patients (6.1%) with local recurrence and 130 patients (32.8%) with metastasis after surgical resection. The location of the tumor was central in 256 patients (64.7%) and peripheral in 140 patients (35.3%). On univariate analysis, the presence of underlying pulmonary fibrosis or emphysema and tumor necrosis on CT as well as older age, poor differentiation of the tumor, operation type, adjuvant radiation, higher LN ratio, higher pN and pM categories were correlated with poorer overal survivial with statistical significances, whereas OS rates were not different in terms of tumor location. As for DFS, DFS rates were significantly different according to all factors above other than tumor necrosis, age, and LN ratio. On multivariate analysis dealing with all variables less than 0.1 in P value, differentiation (hazard ratio [HR]=2.49), pN (HR=1.50), adjuvant radiation (HR=1.56), age (HR=1.06), FEV1/FVC(%) (HR=1.02) as well as combined obstructive pnuemonia (HR=0.727) and heterogenous tumor enhancement (HR=1.011) on CT were independent predictors of OS. On the other hand, only pM category (HR=11.05) and adjuvant radiation (HR=0.24) were remained as independent predictors for DFS.

CONCLUSION

Imaging characteristics such as tumor necrosis, heterogenous enhancement as well as coexisting underlying lung disease would be potential parameters for prognostic stratification of patients with lung SqCC, allowing for the triage of patients who necessitate further adjuvant therapy.

CLINICAL RELEVANCE/APPLICATION

Preoperative CT scan would be potential prognostic biomarkers in the lung squamous cell carcinoma patients.

CH101-ED-SUA5 Non-Neoplastic Diffuse Soft Tissue Chest Wall Diseases

Station #5

Participants
Zachary S. Kelm, MD, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Matthew A. Frick, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Darin B. White, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Christian W. Cox, MD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

kelm.zachary@mayo.edu

TEACHING POINTS

The purpose of this exhibit is:1. To review the differential of diffuse non-neoplastic soft tissue diseases of the chest wall2. To discuss a general approach to narrowing the differential3. To explain the utility of MR or contrast-enhanced imaging in evaluating these disorders

TABLE OF CONTENTS/OUTLINE

General review of non-neoplastic soft tissue diseases of the chest wallReview disease characteristics and image findings with case examples- Proteus syndrome- Lipodystrophy- Dermatomyositis- Infection/Tuberculosis- Elastofibroma dorsi- Scapulothoracic bursitis- Cobb syndrome- Muscular amyloidosis- Subcutaneous amyloidosis- Fibrodysplasia ossificans progressiveDiscussion of approach to narrow the differential

CH188-ED-SUA6 Lung Cancer Operative Planning: What the Surgeon Wants to Know

Station #6

Awards
Cum Laude

Participants

Konstantinos Stefanidis, MD, PhD, London, United Kingdom (*Presenter*) Nothing to Disclose
Joanna Moser, MBChB, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sarah L. Sheard, MBBS, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Anouchka Goldman, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sisa Grubnic, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ioannis Vlahos, MRCP, FRCR, London, United Kingdom (*Abstract Co-Author*) Research Consultant, Siemens AG; Research Consultant, General Electric Company;
Carol Tan, MBBS, Tooting, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

kstefanidis@nhs.net

TEACHING POINTS

The surgical approach to lung cancer management is more nuanced than simply operable or non-operable. Surgical decisions may relate to the approach, extent of resection, the need for bronchovascular reconstruction, the use of prosthetic materials to attempt chest wall or diaphragmatic repair and the rationale for treatment of previously "unresectable" T4 or metastatic disease.The purpose of this educational exhibit is:1.To understand the implications of the radiological findings in the pre-operative staging, planning and surgical decision.2.To show the anatomical landmarks which should be reviewed in pre-surgical planning.

TABLE OF CONTENTS/OUTLINE

1. VATS v thoracotomy (impact of location of disease, N1/2 nodal stations, single/multistation, prior pleurodesis, etc)2. Pneumonectomy versus bilobectomy, lobectomy or sub-lobectomy - impact of main/accessory fissures, vascular variants (e.g. accessory lingular artery, PAPVR)3. Anatomy considerations for sleeve lobectomy (e.g. nodal status, bronchial arteries) 4. Pulmonary emphysema and fibrosis evaluation for borderline lung function surgery (CAD volumetry)5. Chest wall and diaphragmatic invasion en bloc resection and graft planning by CT6. Operative management options for T4 central disease, including differentiation of pericardial/myocardial involvement (cardiac gated MRI)

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CHS-SUB

Chest Sunday Poster Discussions

Sunday, Nov. 26 1:00PM - 1:30PM Room: CH Community, Learning Center

CH

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Tami J. Bang, MD, Aurora, CO (*Moderator*) Nothing to Disclose

Sub-Events

CH228-SD-SUB1 Quantitative Radiomics Model in Predicting Malignancy of Small Solid Nodules Detected by Low-Dose CT Screening for Lung Cancer

Station #1

Participants
Xueguo Liu, MD, Zhuhai, China (*Abstract Co-Author*) Nothing to Disclose
Liting Mao, Zhuhai, China (*Presenter*) Nothing to Disclose
Mingzhu Liang, Zhuhai, China (*Abstract Co-Author*) Nothing to Disclose
Xin Li, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Huan Chen, Zhuhai, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

liuxueg@mail.sysu.edu.cn

PURPOSE

The aim of this study is to assess the usefulness of quantitative radiomics model extracted from baseline low-dose CT screening in predicting malignancy of small solid pulmonary nodules.

METHOD AND MATERIALS

This retrospective study included 194 cases (age 51.8±10.0, 45 to 79 years; male 140,female 54) of solid lung nodules (diameter 6-15mm, 6.9±2.4mm; benign 6.1±1.5mm,malignant 9.0±2.9mm) detected in baseline low-dose CT screening for lung cancer. Pathologic confirmation was obtained in 55 lung cancers and 4 benign nodules, the remaining139 nodules stable in long term follow-up(2-10 years,3.7±1.2years) were considered as benign. The non-contrasted CT images reconstructed with lung kernel at slice thickness of 1mm were processed to extract 329 quantitative radiomics features using Analysis-Kinetic software. A predicting model was established with the training set of 112 benign and 44 malignant nodules and was tested with the validation set of 27 benign and 11 malignant nodules through the analysis of R square. The performance of radiomics based model in predicting lung cancer was compared with that of Canada Lung Imaging Reporting and Data System (CLI-RADS).

RESULTS

44 non-redundant features were extracted from the training data set according to the selecting criteria of the Pearson correlation coefficient more than 0.9 among features, including shape based features (4 variables) and statistical features that including first-order histogram features (8 variables) and high-order texture features (32 variables). And the high-order texture features account for 73%.These specific features were regarded as independent variables to build a logistic regression function, namely prediction model. The model was applied to validation data, its accuracy attained 84.2% (AUC=0.895), which was higher than that of CLI-RADS (76.3%). The sensitivity and specificity of the model were 90.9% and 81.5% respectively. Its false positive rate was 3.7%.

CONCLUSION

Radiomics model extracted from baseline of low-dose CT screening for lung cancer can be used in predicting malignancy of small solid pulmonary nodules.

CLINICAL RELEVANCE/APPLICATION

Radiomics features model can be used to predict malignancy of 6-15mm small solid nodules detected by low-dose CT screening for lung cancer.It could be used in upgrading differentiatial accuracy of computer aided diagnosis(CAD).

CH229-SD-SUB2 Radio-guided Occult Lesion Localization of Nonpalpable Lung Lesions: Technique Implementation and First Results

Station #2

Participants
Maria del Mar Cordon Holzknecht, MBBS, Tarragona, Spain (*Presenter*) Nothing to Disclose
Daniel Rodriguez Martinez, Sabadell, Spain (*Abstract Co-Author*) Nothing to Disclose
Pau Rodriguez Taboada, Tarragona, Spain (*Abstract Co-Author*) Nothing to Disclose
David Carrera, MD, Tarragona, Spain (*Abstract Co-Author*) Nothing to Disclose
Monica Danus Lainez, Reus, Spain (*Abstract Co-Author*) Nothing to Disclose
Enric Baeta Capellera, Reus, Spain (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mcordonholzknecht@gmail.com

PURPOSE

To describe the technique and evaluate the effectiveness of the implementation of SPECT/CT radiotracer marker system for the intraoperative localization of nonpalpable small lung nodules in two institutions, which are the reference hospitals of a total population of 595.836 inhabitants.

METHOD AND MATERIALS

From January 2013 to January 2017 we analyzed 27 patients who underwent radiotracer-CT marking of nonpalpable pulmonary nodules suspicious of malignancy, subsequent to their approval by the thoracic oncology committee. Patients accepted for this procedure where those with resectable nonpalpable nodular lung lesions. 31 nodules in 27 patients where included (15 men, 12 women; age range, 17-84 years; mean age, 62.3 years). We measured the size of the targeted nodule and performed the injection 0.2 mL of the radiotracer 99mTc-MAA, guided by CT with a 22G needle. Complications derived from radiotracer marking were registered. Afterwards SPECT-CT images of the chest were obtained to confirm the correct location of the radiotracer and radio-guided surgery was performed with a gamma-detecting probe the same day. We analyzed the accuracy of CT- radiotracer marking and radio-guided surgery detection, complications of marking, disease-free resection margins and histological results of nodules.

RESULTS

In the 27 patients, the average nodule size was 8.12 mm (range 3-20 mm). All nodules were accessible for radiotracer CT-guided marking, complications occured in 8 (29.6 %) of 27 patients. Correct SPECT-CT location of prior marked nodules ocurred in 28 of 31 nodules. In 30 of 31 nodules (96.7 %), thoracoscopic resection of the targeted nodule was successful. Malignancy was reported in 25 nodules (15 metastases and 10 primary) and benignity in 5. There were disease-free resection margins in 29 of the 31 nodules. 25 patients underwent atypical segmentectomy and lobectomy in 2.

CONCLUSION

Radiotracer CT-guided lung-marker system is an effective and secure method for intraoperative localization of pulmonary nodules and enables more conservative surgical resections.

CLINICAL RELEVANCE/APPLICATION

Small pulmonary nodules are difficult to locate intraoperatively because they are usually not visible and not palpable. Radiotracer CT-marking offers an accurate localization of these nodules, enabling the surgeon to detect them easier during surgery and to be confident in practicing minimally invasive resections.

CH230-SD-SUB3 Correlation between Lung Attenuation Parameters in COPD Patients and Their Left Ventricle Systolic and Diastolic Function

Station #3

Participants
Cristina Utrilla, MD, Madrid, Spain (*Presenter*) Nothing to Disclose
Alicia Linares Beltran, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Marta Martinez-Schmickrath, MD, Aviles, Spain (*Abstract Co-Author*) Nothing to Disclose
Francisco Garcia-Rio, MD, PhD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Raquel Casitas, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Isabel Torres Sanchez, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

cristinautrilla@hotmail.com

PURPOSE

Analyze the relationship between lung attenuation in COPD patients and their left ventricle systolic and diastolic function. Identify the predominant topographic determinants of this relationship.

METHOD AND MATERIALS

58 patients with moderate-very severe COPD, clinically stable without previous cardiovascular disease. An echocardiography, M-mode with Doppler pulse was performed to evaluate the systolic (Ejection fraction[EF]), and diastolic function (transmitral filling flux, E/A relation). Paired inspiratory/expiratory MDCT scan with quantitative post processing data was performed, with assessment of attenuation (mean lung density [MLD], low attenuation volumes [LAV], subranges and percentiles).

RESULTS

There was a significant relation between the EF and the MLD values in inspiration(r=0,565;p=0,009), LAV(r=-0,689;p=0,001), subrange1 (r=-0,719;p<0,001) and P15 (r=0,689; p=0,001), and with LAV (r=-0,487;p=0,030), subrange1 (r=-0,497;p=0,026) and P15 (r=0,456; p=0,026) in expiration. The only independent EF value was the P15 in inspiration (r2=0,258; p=0,031). Regarding to the topographic distribution, the EF was independently related to the P15 of the lower third of the left lung (r2=0,298;p=0,019). While the diastolic dysfunction, the E/A relation was significant correlated to MLD inspiration values(r=0,429;p=0,003), LAV (r=-0,351;p=0,018),subrange1(r=-0,374; p=0,011) and P15(r=0,350;p=0,022), being the sole independent determinant value the inspiration MLD (r2=0,184;p=0,003) and, regarding topographic distribution, the medium third of the right lung MLD, in inspiration, value (r2=0,241;p=0,001).

CONCLUSION

There is a direct proportional relation between lung attenuation in COPD patients, and their systolic and diastolic function. P15 value is associated with the systolic function and MLD is better related to the diastolic function. We identify a different topographic contribution to the left ventricle function.

CLINICAL RELEVANCE/APPLICATION

There is correlation beteween lung attenuation parameters and the left ventricular function. Using MDCT information, cardiac

There is correlation between lung attenuation parameters and the left ventricular function. Using MDCT information, cardiac events could be predicted.

CH231-SD-SUB4 Comparison of the FDG-PET Avidity of Benign and Malignant Pure Ground Glass Opacities (GGOs): Is Higher FDG-PET Uptake More Typical of Benign GGOs?

Station #4

Participants
Shaunagh McDermott, FFR(RCSI), Boston, MA (*Presenter*) Nothing to Disclose
Aoife Kilcoyne, MBBCh, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Yingbing Wang, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
James A. Scott, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Elkan F. Halpern, PhD, Boston, MA (*Abstract Co-Author*) Research Consultant, Hologic, Inc Research Consultant, Real Imaging Ltd Research Consultant, Gamma Medica, Inc Research Consultant, K2M Group Holdings, Inc
Jeanne B. Ackman, MD, Boston, MA (*Abstract Co-Author*) Spouse, Stockholder, Everest Digital Medicine; Spouse, Consultant, Everest Digital Medicine; Spouse, Stockholder, Cynvenio Biosystems, Inc; Scientific Advisory Board, Cynvenio Biosystems, Inc; Consultant, PAREXEL International Corporation

PURPOSE

To determine whether 2-[fluorine-18] fluoro-2-deoxy-d-glucose (FDG) PETuptake is higher in benign or malignant GGOs.

METHOD AND MATERIALS

1013 of 2544 total diagnostic PET-CT scans performed in 2011 were randomly selected and retrospectively reviewed to assess for pure GGOs with a mean diameter > 1 cm. 59 GGOs were identified by image review in 40 patients (21F, 19M, mean age 62 yrs, range 22-85 yrs), with a mean of 1.5 GGO per patient, range 1-5. Two observers, blinded to PET findings and final diagnosis, independently reviewed the CT images with respect to location, size, and attenuation (mean Hounsfield units) of GGOs. A third observer, blinded to final diagnosis, analyzed the PET images. A region-of-interest (ROI), inclusive of the entire GGO, was used to measure the maximum standardized uptake value (SUVmax). Final diagnosis of malignancy was made based on pathology, if available, or upon increased size and attenuation; final diagnosis of benignity was made if the GGO resolved, was new compared to a scan performed within the last 3 months, or was stable for at least 60 months; otherwise the GGO was considered indeterminate. The benign and malignant GGOs were compared using a 2-tailed Student's t test.

RESULTS

3 of 59 GGOs were excluded due to less reliable SUV measurements (proximity to adjacent FDG-avid structures). Of the remaining 56 GGOs, 15 GGOs were indeterminate, resulting in a cohort of 41 pure GGOs, 31 benign and 10 malignant. Benign GGOs were significantly larger than malignant ones (average mean diameter 26 mm versus 14 mm, respectively) (p=0.04). The SUVmax was higher in the benign group (mean 2.2; median 1.3; range 0.4-8.8) than the malignant group (mean 0.8; median 0.8; range 0.5-1.4) (p=0.05). With an SUVmax threshold to ensure 100% sensitivity for detection of malignancy, the specificity for the detection of malignancy was 39%. There was no significant difference in mean attenuation (p=0.4).

CONCLUSION

Benign pure GGOs had higher FDG-PET uptake than malignant GGOs. At an SUVmax threshold ensuring 100% sensitivity for malignancy, 39% of benign GGOs could avoid misinterpretation as malignant lesions.

CLINICAL RELEVANCE/APPLICATION

This study shows that higher FDG PET-uptake is much more typical of benign, than malignant, pure GGOs. Awareness of this finding should improve PET-CT interpretation of GGOs and resultant clinical management.

CH108-ED-SUB5 ABCs of EGFR, ALK, and ROS1: The Modern Science of Radiogenomics

Station #5

Awards
Certificate of Merit

Participants
Adina Haramati, MD, Manhasset, NY (*Presenter*) Nothing to Disclose
Stuart L. Cohen, MD, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose
Cheryl Mensah, MD, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose
Nagashree Seetharamu, MD, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose
Andrew J. Plodkowski, MD, Syracuse, NY (*Abstract Co-Author*) Nothing to Disclose
Amar B. Shah, MD, Queens, NY (*Abstract Co-Author*) Nothing to Disclose
Rakesh D. Shah, MD, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Summarize the basic cell biology of genetic markers 2. Discuss the role of imaging in the diagnosis and prognosis of NSCLC 3. Understand imaging findings associated with individual genetic aberrations in lung cancer 4. Explain the impact of Radiogenomics in the treatment and prognosis of NSCLC

TABLE OF CONTENTS/OUTLINE

-Review clinically relevant cell biology and oncogenic drivers needed to understand the role of genetic markers and its application to NSCLC -Explain the role of diagnostic imaging in the diagnosis and prognosis of NSCLC through literature review -Review imaging findings associated with individual genetic aberrations in lung cancer -Use multidisciplinary lung cancer cases from our health system to illustrate the synergy of imaging and genetic markers in the diagnosis, treatment, and prognostication of NSCLC

CH194-ED-SUB6 Practical Dual-Energy CT Workflows for Problem-Solving in Chest Imaging

Station #6

Awards
Certificate of Merit

Participants
Fernando U. Kay, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Asha Kandathil, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Suhny Abbara, MD, Dallas, TX (*Abstract Co-Author*) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG
Prabhakar Rajiah, MD, FRCR, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

fernando.kay@utsouthwestern.edu

TEACHING POINTS

1) To introduce a portfolio of common cases encountered in chest imaging where dual-energy CT (DECT) can play a decisive role, and 2) to provide useful DECT tools and simple step-by-step blueprints for approaching such cases.

TABLE OF CONTENTS/OUTLINE

1) Introductiona. Brief review of DECT tools (including material decomposition and virtual monoenergetic imaging)2) Case-based illustration of problem-solving algorithms:a. Perfused blood volume maps in pulmonary embolism studies b. Use of small contrast volume with low keV imaging/Use of low keV imaging to tackle suboptimal opacification of the pulmonary arteriesc. Use of high keV imaging for metallic artifactsd. Use of VNC and iodine maps to characterize lung nodulese. Use of virtual non-contrast (VNC) to assess calcificationsf. Use of VNC for assessing surgical material versus hematomag. Use of VNC and iodine maps to characterize mediastinal lymph nodesh. High keV imaging for reducing beam-hardening artifactsi. Iodine maps to quantify tumor perfusion and assess treatment response3) Conclusion and take-home points

VSIO11

Interventional Oncology Series: Lung, Kidney and Bone

Sunday, Nov. 26 1:30PM - 6:00PM Room: S405AB

CH GU IR MK

AMA PRA Category 1 Credits ™: 4.00
ARRT Category A+ Credits: 4.75

FDA Discussions may include off-label uses.

Participants
Christos S. Georgiades, MD, PhD, Baltimore, MD (*Moderator*) Consultant, Boston Scientific Corporation; Consultant, Galil Medical Ltd
Sean M. Tutton, MD, Milwaukee, WI (*Moderator*) Medical Director, Benvenue Medical, Inc; Consultant, Benvenue Medical, Inc; Researcher, Siemens AG; Consultant, BTG International Ltd

LEARNING OBJECTIVES

1) To show attendees the possible complications related to percutaneous ablation for Lung, Kidney and Bone tumors. 2) To present pre-ablation maneuvers that mitigate those risks. 3) To describe treatments/interventions that minimize the impact of those complications, once they occur.

Sub-Events

VSIO11-01 Keynote and Series Opening: Interventional Oncology - Where We Stand and Where We Go

Sunday, Nov. 26 1:30PM - 2:00PM Room: S405AB

Participants
Stephen B. Solomon, MD, New York, NY (*Presenter*) Research Grant, General Electric Company

LEARNING OBJECTIVES

View Learning Objectives under main course title

VSIO11-02 Evidence-Based Lung Cancer Ablation

Sunday, Nov. 26 2:00PM - 2:20PM Room: S405AB

Participants
Terrance T. Healey, MD, Providence, RI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View Learning Objectives under main course title

VSIO11-03 Complications of Lung Cancer Ablation: Prevention & Treatment

Sunday, Nov. 26 2:20PM - 2:35PM Room: S405AB

Participants
Samdeep Mouli, MD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View Learning Objectives under main course title

VSIO11-04 Histological Subtype as a Predictor of Localized Recurrence after Thermal Ablation of Lung Adenocarcinoma

Sunday, Nov. 26 2:35PM - 2:45PM Room: S405AB

Awards
Student Travel Stipend Award

Participants
Seth Stein, MD, New York, NY (*Presenter*) Nothing to Disclose
Song Gao, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Waleed M. Shady, MBBCh, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Elena N. Petre, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jeremy C. Durack, MD, New York, NY (*Abstract Co-Author*) Scientific Advisory Board, Adient Medical Inc; Investor, Adient Medical Inc;
Carole A. Ridge, MD, Dublin 7, Ireland (*Abstract Co-Author*) Nothing to Disclose
Prasad Adusumilli, New York City, NY (*Abstract Co-Author*) Nothing to Disclose
Stephen B. Solomon, MD, New York, NY (*Abstract Co-Author*) Research Grant, General Electric Company
Etay Ziv, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether histologic subtyping from biopsies can predict local recurrence after thermal ablation for lung adenocarcinoma.

METHOD AND MATERIALS

Patients treated with percutaneous thermal ablation for lung adenocarcinoma that had pre-ablation needle biopsy with analysis of histological components were identified. Age, gender, smoking status, treatment indication (primary stage 1 tumor versus salvage), histologic subtype, ground glass radiographic appearance, tumor size, ablation modality, and ablation margin were evaluated in relation to time to local recurrence (TTLR). Cumulative incidence of recurrence (CIR) was calculated using competing risks analysis and compared across groups using Fine and Grey method with clustering. Multivariate analysis was conducted with stepwise regression.

RESULTS

There were 45 patients with 49 lesions diagnosed as adenocarcinoma on pre-ablation biopsy and with histologic subtype analysis. Of these, 22% (11) had micropapillary components, 14% (7) had solid components, and 37% (18) had high grade components (defined as presence of micropapillary, solid, mucinous, and/or cribiform components). In the univariate analysis, solid (subdistribution hazard ratio [SHR]=4.63, p=0.005, 95% confidence interval [CI]=1.59-13.5), micropapillary (SHR=4.42, p=0.0051, CI=1.56-12.5), and high grade (SHR=14.5, p=0.00051, CI=3.21-65.5) were significantly correlated with shorter TTLR. On multivariate analysis, high grade (SHR 14.5., 95% CI: 3.22-65.3, p=0.0005) was the only independent predictor TTLR. The 1, 2, and 3-year CIR in patients with high grade tumors was 29%, 45%, and 62% compared to 0%, 8% and 8% in patients with non-high grade tumors.

CONCLUSION

High grade histological components identified in pre-ablation biopsy are associated with shorter TTLR thermal ablation of lung adenocarcinoma.

CLINICAL RELEVANCE/APPLICATION

This study supports the utility of biopsy for histologic subtype as a prognostic indicator of faster local recurrence prior to lung ablation.

VSIO11-05 Evidence Base for Kidney Cancer Ablation

Sunday, Nov. 26 2:45PM - 3:05PM Room: S405AB

Participants
David J. Breen, MD, Southampton, United Kingdom (*Presenter*) Proctor, BTG International Ltd; Proctor, Galil Medical Ltd; Proctor, Johnson&Johnson; Proctor, NeuWave Medical, Inc

For information about this presentation, contact:

david.breen@uhs.nhs.uk

LEARNING OBJECTIVES

1. To appreciate the unique tumour biology and behavior of T1 a and b renal cancer and how this imfluences the outcome data.2. To understand the relative merits and limitations of traditional, standard of care renal surgery and how partial, laparoscopic and robotic partial nephrectomy impinge influence the debate.3. To gain insight into the relative merits and limitations of renal radio-frequency and cryoablation.4. To appreciate the current standing of the evidence for image-guided ablation of both T1a and T1b renal tumours.5. To understand how traditional cancer outcome metrics can be problematic in T1 renal cancer and how costs and complications also play a central role in the evidence for smaller renal cancer ablation.

LEARNING OBJECTIVES

1) To appreciate the natural history and epidemiology of T1 renal cell carcinoma(RCC) and how this impinges on the currently available oncological outcome data for image-guided ablation of RCC. 2) Clarify frailties of the currently available outcome data on RCC ablation. 3) To outline the currently available evidence base for renal tumour ablation, including the relative merits of radiofrequency versus cryoablation. 4) To understand how the evidence base might be forthcoming and underpinned by analysis of relative complications and cost-effectiveness incurred by surgical resection.

VSIO11-06 Complications of Kidney Cancer Ablation: Prevention & Treatment

Sunday, Nov. 26 3:05PM - 3:20PM Room: S405AB

Participants
Kelvin K. Hong, MD, Baltimore, MD (*Presenter*) Scientific Advisory Board, Boston Scientific Corporation; Scientific Advisory Board, BTG International Ltd; Research support, Merit Medical Systems, Inc;

LEARNING OBJECTIVES

The participant will be exposed to common complications related to percutaneous renal ablation, and the participant will be introduced to strategies to recognize and mitigate/correct them.

LEARNING OBJECTIVES

View Learning Objectives under main course title

VSIO11-07 3D Quantitative Imaging Biomarkers as Predictors for Systemic Disease Progression in Patients with Renal Cell Carcinoma Undergoing Ablation

Sunday, Nov. 26 3:20PM - 3:30PM Room: S405AB

Participants

Bruno R. Tegel, Berlin, Germany (*Presenter*) Nothing to Disclose
Todd Schlachter, MD, Farmington, CT (*Abstract Co-Author*) Nothing to Disclose
Steffen Huber, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Jeffrey S. Pollak, MD, Woodbridge, CT (*Abstract Co-Author*) Nothing to Disclose
Ming De Lin, PhD, Cambridge, MA (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jean-Francois H. Geschwind, MD, Westport, CT (*Abstract Co-Author*) Consultant, Koninklijke Philips NV; Consultant, Terumo Corporation; Consultant, Bayer AG; Consultant, Boston Scientific Corporation; Consultant, BTG International Ltd; Consultant, Bristol-Myers Squibb Company; Consultant, Johnson & Johnson; Consultant, Guerbet SA; Consultant, Merck & Co, Inc; Research Grant, Boston Scientific Corporation; Research Grant, BTG International Ltd; Research Grant, Guerbet SA; Research Grant, Koninklijke Philips NV; Research Grant, PreScience Labs, LLC; Founder and CEO, PreScience Labs, LLC
Julius Chapiro, MD, New Haven, CT (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV

PURPOSE

To investigate the role of 3-dimensional quantitative imaging biomarkers such as tumor volume and enhancing tumor volume as predictors of extra-renal metastatic progression and progression free survival in patients with renal cell carcinoma (RCC) undergoing image-guided tumor ablation and to compare the prognostic value with TNM stage, R.E.N.A.L. score and tumor diameter.

METHOD AND MATERIALS

A HIPAA-compliant retrospective analysis with approval of the Institutional Review Board and waiver of informed consent was performed. A total of 37 patients with RCC that were treated with ablation (radiofrequency- or cryoablation) at our institution between 2007 and 2015. TNM stage, R.E.N.A.L. score, tumor diameter, tumor volume and enhancing tumor volume were measured on dynamic, contrast-enhanced CT or MRI imaging at baseline and correlated with occurrence of extrarenal metastases and progression free survival (PFS) after ablation.

RESULTS

Time to extra-renal metastases: While no significant difference was observed with stratification of the cohort according to TNM stage, R.E.N.A.L. score and tumor diameter, the stratification according to tumor volume and enhancing tumor volume of >= 5 cm3 versus < 5 cm3 resulted in a statistically significant stratification ($p = 0.022$ and $p = 0.016$, respectively) with an Odds ratio of 6.69 (95% CI, 0.33-134.4) and 8.48 (95% CI, 0.42-170.1). PFS: None of the conventional measures achieved significant separation of the survival curves. Only when stratified by enhancing tumor volume, did the survival differ significantly ($p = 0.039$) in both groups with an Odds Ratio of 2.25 (95% CI, 0.54-9.35) for patients with an enhancing tumor volume >= 5 cm3 versus < 5cm3. Median PFS was 49.3 months (95% CI, 28.9-69.7) in the group with high enhancing tumor volume versus 68.2 months (95% CI, 53.8-82.7) in patient with lower enhancing tumor volume.

CONCLUSION

Quantification of enhancing tumor volume on baseline imaging demonstrated superiority over all other assessment techniques and can be used as a prognostic imaging biomarker for the development of extra-renal metastases and as an early surrogate for expected PFS in patients with RCC.

CLINICAL RELEVANCE/APPLICATION

The enhancing tumor volume is a readily available imaging biomarker with a strong predictive value for therapeutic outcomes and may lead to a more precise, personalized patient surveillance post ablation.

VSIO11-08 Bone Ablation: Technique & Outcomes

Sunday, Nov. 26 3:45PM - 4:05PM Room: S405AB

Participants
Anil N. Kurup, MD, Rochester, MN (*Presenter*) Research Grant, Galil Medical Ltd Royalties, UpToDate, Inc

LEARNING OBJECTIVES

View Learning Objectives under main course title

VSIO11-09 Cementoplasty for Malignant Bone Lesions

Sunday, Nov. 26 4:05PM - 4:20PM Room: S405AB

Participants
Alexios Kelekis, MD, PhD, Athens, Greece (*Presenter*) Speaker, Toshiba Medical Systems Corporation

For information about this presentation, contact:

akelekis@med.uoa.gr

LEARNING OBJECTIVES

1) To understand the complex anatomy related to treating by cementoplasty. 2) To distinguish the different types of malignant lesions and decide appropriate treatment. 3) To show technical approaches for the spine and peripheral skeleton. 4) To manage treatment and have appropriate strategy according to the malignant lesion at hand. 5) To learn how to manage complications.

ABSTRACT

Nearly 60% of oncologic patients will develop osseous metastasis with bone pain. A significant number of patients have intractable pain, unresponsive to medical treatment that will need complementary therapy. External beam radiation is part of the initial approach, but not always effective in providing complete or durable pain relief. It is also associated with neural damage and osteonecrosis of the irradiated area. In order to provide a more long term and sustainable treatment, percutaneous approaches have been developing, both for primary and metastatic disease. The have advantages and disadvantages, compared to open surgery, including but not limited to short hospitalization, immediate return to medical treatment and quick healing process. Disadvantages mainly rely on restrictions about the size and type of lesions to be treated, as well as the debulking capabilities of percutaneous approaches. A multitude of metastatic lesions can be treated such as renal, lung, melanoma, breast and prostate,

myeloma and lymphoma. Percutaneous cementoplasy is a term referring to the injection of substrates inside bone; usually polymers which pass from a liquid, injectable state, to a solid state. During the liquid phase the injection is being performed. The injectates have the advantage to stabilize the lytic lesion and at the same time provide a loco regional effect. Additionally they can be combined with other materials (metal or plastic) for structural support, as well as other treatments such as ablation or embolization, to enhance the loco-regional tumor effect. Nowadays, cementoplasty can be performed in most osseous sites, including spine, pelvis and long bones, using a variation of techniques and approaches. Imaging guidance is also very important. Correct alignment and image projection defines the approach and the delivery. Assessing imaging, recognizing vital structures, as well as technical and imaging skills in order to access the lesion, is part of the knowledge needed. Finally, the treatment goal should be related to the patient lesion type and survival probability. One should define whether treatment is associated with purely palliative or loco-regional tumor control. The choice will orientate the treatment strategy.

VSIO11-10 Imaging Optimization by Twin-Beam Dual Energy Computed Tomography to Improve Visualization of Therapeutic Ice Ball Margins During Cryoablation of Musculoskeletal Malignancies

Sunday, Nov. 26 4:20PM - 4:30PM Room: S405AB

Participants
Steven Yevich, MD, MPH, Houston, TX (*Presenter*) Nothing to Disclose
Gouthami Chintalapani, Hoffman Estates, IL (*Abstract Co-Author*) Nothing to Disclose
Rahul A. Sheth, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Steven Y. Huang, MD, Houston, TX (*Abstract Co-Author*) Scientific Advisory Board, Adient Medical Inc
Sharjeel Sabir, MD, Houston, TX (*Abstract Co-Author*) Travel support, Merit Medical Systems, Inc; Travel support, Boston Scientific Corporation; Travel support, NeuWave Medical, Inc
Alda L. Tam, MD, Houston, TX (*Abstract Co-Author*) Medical Monitor, Galil Medical Ltd; Research Grant, AngioDynamics, Inc;

PURPOSE

To evaluate the applicability of twin-beam dual energy computed tomography (DECT) for improved assessment of therapeutic ice ball ablation margins during cryoablation of musculoskeletal malignancies.

METHOD AND MATERIALS

Twin beam DECT was acquired for 5 initial patients in a new ongoing initiative during cryoablation of musculoskeletal malignancies as a radiation dose neutral alternative to standard CT acquisition. All ablated masses were located in close proximity to bone (within 1 cm) or originated within bone, with or without extra-osseous soft tissue extension. The original 120kV X-ray beam was pre-filtered into two X-ray spectra using gold (Au) and tin (Sn) filters. Specific post processing was applied to generate a spectrum of monochromatic images ranging from 40KeV to 190KeV. These images were manipulated to identify the appropriate kV that best characterized the margins of the therapeutic ice ball in order to assist the interventional radiologist in clinical assessment of lesional coverage.

RESULTS

Ability to quickly manipulate the post-processed monochromatic images along the 40-190 KeV spectrum allowed improved visualization of ice ball margins for musculoskeletal malignancies. The interface between ice ball and soft tissue was best depicted on the lower end of the energy spectrum of approximately 60-70KeV. In the immediate proximity to metallic needle artifacts or dense bony structure, a high energy spectrum of approximately 90-120KeV improved the ice ball margin visualization.

CONCLUSION

Early evaluation in this ongoing trial suggests a clinic advantage to dual energy CT with monochromatic spectral analysis to improve identification of the cryoablation ice ball margins and overcome substantial visibility challenges caused by relative density variability in musculoskeletal tissues and metallic needle artifacts.

CLINICAL RELEVANCE/APPLICATION

Substantial challenges are present when performing cryoablation musculoskeletal malignancy as ice ball margins prove difficult to visualize due to the high variability in relative density of the muscle, fat, and bone. In addition, metallic needle artifact from cryoablation probes also leads to ice ball margin obscuration. Twin beam dual energy CT may provide a real clinical advantage as a dose neutral post-processing application to assist the interventionalist in therapeutic decision making during cryoablation.

VSIO11-11 Advantages of RFA vs MW vs CRYO: Physics Based Approach

Sunday, Nov. 26 4:30PM - 4:45PM Room: S405AB

Participants
Matthew R. Callstrom, MD, PhD, Rochester, MN (*Presenter*) Research Grant, EDDA Technology, Inc; Research Grant, Galil Medical Ltd; Consultant, Medtronic plc; Consultant, Endocare, Inc; Consultant, Johnson and Johnson; Consultant, Thermedical, Inc;

For information about this presentation, contact:

callstrom.matthew@mayo.edu

LEARNING OBJECTIVES

After attending this lecture, the attendee should be able to describe the characteristics of different ablation systems.After attending this lecture, the attendee should be able to describe how different ablation systems can be applied to the treatment of tumors. After attending this lecture, the attendee should be able to describe unique advantages of different ablation systems for specific interventional oncology applications.

LEARNING OBJECTIVES

View Learning Objectives under main course title

VSIO11-12 Tumor Boards: Techniques and Challenging Cases in Lung, Kidney and Bone

Sunday, Nov. 26 5:00PM - 6:00PM Room: S405AB

Participants
Debra A. Gervais, MD, Boston, MA (*Presenter*) Nothing to Disclose
Terrance T. Healey, MD, Providence, RI (*Presenter*) Nothing to Disclose
Samdeep Mouli, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Muneeb Ahmed, MD, Wellesley, MA (*Presenter*) Research Grant, General Electric Company; Stockholder, Agile Devices, Inc; Scientific Advisory Board, Agile Devices, Inc
David J. Breen, MD, Southampton, United Kingdom (*Presenter*) Proctor, BTG International Ltd; Proctor, Galil Medical Ltd; Proctor, Johnson&Johnson; Proctor, NeuWave Medical, Inc
Kelvin K. Hong, MD, Baltimore, MD (*Presenter*) Scientific Advisory Board, Boston Scientific Corporation; Scientific Advisory Board, BTG International Ltd; Research support, Merit Medical Systems, Inc;
Christos S. Georgiades, MD, PhD, Baltimore, MD (*Presenter*) Consultant, Boston Scientific Corporation; Consultant, Galil Medical Ltd
Anil N. Kurup, MD, Rochester, MN (*Presenter*) Research Grant, Galil Medical Ltd Royalties, UpToDate, Inc
Alexios Kelekis, MD, PhD, Athens, Greece (*Presenter*) Speaker, Toshiba Medical Systems Corporation
Matthew R. Callstrom, MD, PhD, Rochester, MN (*Presenter*) Research Grant, EDDA Technology, Inc; Research Grant, Galil Medical Ltd; Consultant, Medtronic plc; Consultant, Endocare, Inc; Consultant, Johnson and Johnson; Consultant, Thermedical, Inc;
Sean M. Tutton, MD, Milwaukee, WI (*Presenter*) Medical Director, Benvenue Medical, Inc; Consultant, Benvenue Medical, Inc; Researcher, Siemens AG; Consultant, BTG International Ltd

LEARNING OBJECTIVES

1. To recognize some of the rare complications associated with percutaneous ablation 2. To learn mitigate maneuvers that minimize the risks of such complications 3. To learn how to address these complications should they occur

LEARNING OBJECTIVES

View Learning Objectives under main course title

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/ Debra A. Gervais, MD - 2012 Honored Educator

RC101

Interstitial Lung Disease: Update 2017

Sunday, Nov. 26 2:00PM - 3:30PM Room: S406A

CH CT

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

For information about this presentation, contact:

jerasmus@mdanderson.org

Sub-Events

RC101A Pulmonary Fibrosis

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

LEARNING OBJECTIVES

Understand how to distinguish between common fibrosing interstitial pneumonias, usual interstitial pneumonia, nonspecific interstitial pneumonia, and chronic hypersensitivity pneumonitis. Know the guidelines for diagnosis of idiopathic pulmonary fibrosis, as recently updated by the Fleischner Society.

RC101B Hypersensitivity Pneumonitis

Participants
Santiago E. Rossi, MD, Capital Federal, Argentina (*Presenter*) Advisory Board, Koninklijke Philips NV; Advisory Board, Boehringer Ingelheim GmbH; Speaker, Boehringer Ingelheim GmbH; Royalties, Springer Science+Business Media Deutschland GmbH

For information about this presentation, contact:

santirossi@cdrossi.com

LEARNING OBJECTIVES

1) Review the most common imaging findings of hypersensitivity pneumonitis (HP) (case based). 2) Describe clinical manifestations of HP. 3) Identify the newly proposed classification of HP.

Active Handout:Santiago E. Rossi

http://abstract.rsna.org/uploads/2017/17000307/Active RC101B.pdf

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/ Santiago E. Rossi, MD - 2015 Honored Educator

RC101C Smoking-Related Interstitial Lung Diseases

Participants
Carolina A. Souza, MD, Ottawa, ON (*Presenter*) Consultant, Pfizer Inc; Consultant, Boehringer Ingelheim GmbH ; Consultant, F. Hoffmann-La Roche Ltd; Speaker, Pfizer Inc; Speaker, Boehringer Ingelheim GmbH; Speaker, F. Hoffmann-La Roche Ltd

For information about this presentation, contact:

csouza@toh.on.ca

LEARNING OBJECTIVES

1) Describe the spectrum of smoking-related interstitial lung diseases and their clinical manifestations. 2) Recognize the high-resolution CT appearances of smoking-related lung diseases. 3) Identify the most common imaging differential diagnoses of smoking-related interstitial lung diseases.

Active Handout:Carolina A. Souza

http://abstract.rsna.org/uploads/2017/17000308/Active RC101C.pdf

RC101D Sarcoidosis

Participants
Lacey Washington, MD, Durham, NC (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

lacey.washington@duke.edu

LEARNING OBJECTIVES

1) Review the classic clinical and imaging manifestations and common complications of thoracic sarcoidosis. 2) Review less well known clinical features and imaging findings.

PS12

Sunday Afternoon Plenary Session

Sunday, Nov. 26 4:00PM - 5:45PM Room: Arie Crown Theater

CH GI MK NR PD

AMA PRA Category 1 Credits ™: 1.75
ARRT Category A+ Credit: 1.75

Participants
Richard L. Ehman, MD, Rochester, MN (*Presenter*) CEO, Resoundant, Inc; Stockholder, Resoundant, Inc;

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/ Richard L. Ehman, MD - 2016 Honored Educator

Sub-Events

PS12A Report of the RSNA Research and Education Foundation

Participants
N. Reed Dunnick, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Abstract

Since 1984, your RSNA Research & Education (R&E) Foundation has supported more than 1,200 investigators. An R&E Grant can inspire a career in research and help develop the leaders of tomorrow's radiology. The mission of the RSNA R&E Foundation is to improve patient care by supporting research and education in radiology and related scientific disciplines by funding grants and awards to individuals and institutions that will advance radiologic research, education and practice. Generous donations from individuals, private practice groups and corporations ensure that work continues year after year. Foundation grant recipients innovate solutions and methodologies to solve challenges facing radiology today, from discovering new MRI techniques for breast cancer imaging to using data integration to gain insights into the developing brain. In 2017, the R&E Foundation awarded more than $4 million for the second consecutive year, funding researchers at 50 institutions. At a 30 percent funding rate, the Foundation primes the pump of radiology research by supporting early-career investigators. Grant recipients report earning an additional $40 for every dollar awarded by the Foundation. The R&E Foundation launched its Campaign in 2014 to raise $17.5 million dollars and ensure a continuity of funding for these critical projects. Invest in the Foundation today to demonstrate your commitment to the future of your specialty. The Inspire-Innovate-Invest Campaign ends this year, and we need your help to reach our goal. As we all strive to "Explore. Invent. Transform." during this annual meeting, please take time to visit the R&E Foundation Booth, located in Lakeside Center East, Level 3. There you can discover the 2017 grant recipients and their innovative projects and learn how you can support the Foundation through our Campaign.

PS12B Image Interpretation Session

Participants
Desiree E. Morgan, MD, Birmingham, AL (*Presenter*) Research Grant, General Electric Company
John Eng, MD, Cockeysville, MD (*Presenter*) Nothing to Disclose
James C. Anderson, MD, Portland, OR (*Presenter*) Nothing to Disclose
Marta E. Heilbrun, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose
Eva Llopis, MD, Valencia, Spain (*Presenter*) Nothing to Disclose
Angelisa M. Paladin, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify key abnormal findings on radiologic studies that are critical to making a specific diagnosis. 2) Construct a logical list of differential diagnoses based on the radiologic findings, focusing on the most probable differential diagnoses. 3) Determine which, if any, additional radiologic studies or procedures are needed in order to make a specific final diagnosis. 4) Choose the most likely diagnosis based on the clinical and the radiologic information.

Honored Educators

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SPSH20

Hot Topic Session: Machine Learning and Artificial Intelligence in Lung Imaging

Monday, Nov. 27 7:15AM - 8:15AM Room: E451A

BQ CH CT IN

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Bram Van Ginneken, PhD, Nijmegen, Netherlands (*Moderator*) Stockholder, Thirona BV Co-founder, Thirona BV Research Grant, MeVis Medical Solutions AG Research Grant, Delft Imaging Systems Research Grant, Toshiba Corporation

For information about this presentation, contact:

bram.vanginneken@radboudumc.nl

Sub-Events

SPSH20A Deep Learning for CT Lung Cancer Screening

Participants
Bram Van Ginneken, PhD, Nijmegen, Netherlands (*Presenter*) Stockholder, Thirona BV Co-founder, Thirona BV Research Grant, MeVis Medical Solutions AG Research Grant, Delft Imaging Systems Research Grant, Toshiba Corporation

LEARNING OBJECTIVES

1) Understand the benefits, risks and opportunities of integrating artificial intelligence into CT lung cancer screening. 2) Become aware of the state-of-the art in this field, following the spectacular results of the Data Science Bowl 2017 organized by Kaggle where fully automated systems for diagnosing lung cancer from baseline screening CT scans were presented that outperform radiologists.

SPSH20B Using Artificial Intelligence to Develop Noninvasive Biomarkers in Lung Cancer

Participants
Hugo Aerts, PhD, Boston, MA (*Presenter*) Stockholder, Sphera Inc

For information about this presentation, contact:

Hugo_Aerts@dfci.harvard.edu

LEARNING OBJECTIVES

1) Learn about the motivation and methodology of A.I. technologies in Radiology. 2) Learn about scientific studies investigating the role of radiologic AI with other -omics data for precision medicine. 3) Learn about open-source informatics developments.

SPSH20C CT Quantitation of ILD: The End of the Beginning

Participants
Joseph Jacob, MBBS, MRCP, Rochester, MN (*Presenter*) Consultant, Boehringer Ingelheim GmbH

For information about this presentation, contact:

joseph.jacob@nhs.net

LEARNING OBJECTIVES

1) Understand why computer analysis of CT imaging has relevance in interstitial lung diseases. 2) Understand the limitations of visual CT scoring. 3) Understand the various quantitative analytic techniques/tools. 4) Become aware of the latest results achieved by quantitative tools in predicting outcome across the various interstitial lung diseases.

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RC201

Imaging of Thoracic Neoplasms: Update 2017

Monday, Nov. 27 8:30AM - 10:00AM Room: E353C

CH CT MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Edith M. Marom, MD, Ramat Gan, Israel (*Moderator*) Speaker, Bristol-Myers Squibb Company

For information about this presentation, contact:

edith.marom@gmail.com

jerasmus@mdanderson.org

LEARNING OBJECTIVES

1) Utilize MR for imaging lung cancer. 2) Evaluate tumor response. 3) Image thymoma. 4) Stage lung cancer with the 8th edition TNM staging.

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events

RC201A Advances in MR Imaging of Lung Cancer

Participants
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Toshiba Medical Systems Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Fuji Pharma Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;

For information about this presentation, contact:

yosirad@kobe-u.ac.jp

LEARNING OBJECTIVES

1) Understand the appropriate MR sequence lung cancer for answering each clinical question. 2) Identify the clinical relevance of MR imaging as compared with other modalities in not only lung cancer, but also pulmonary nodule patients. 3) Recognize the potential of 3T MR system for new MR imaging of lung cancer.

ABSTRACT

Since the clinical application of MR imaging in thoracic diseases, numerous basic and clinical researchers reported technical advances in sequencing, scanners and coils, image acquisition and reconstruction techniques, contrast media utilization, and development of post-processing tools. Among these, MR imaging was considered a major new research and diagnostic tool for various pulmonary diseases, especially lung cancer. As a result, state-of-the art thoracic MR imaging now has the potential to be used as a substitute for traditional imaging techniques and/or play a complimentary role in patient management. In this lecture, I will 1) present the appropriate MR sequence of lung cancer for answering each clinical question, 2) identify the clinical relevance of MR imaging as compared with other modalities in not only lung cancer, but also pulmonary nodule patients, and 3) discuss the potential of 3T MR system for new MR imaging in lung cancer.

RC201B Evaluating Tumor Response

Participants
Tina D. Tailor, MD, Durham, NC (*Presenter*) Research support, General Electric Company

For information about this presentation, contact:

tina.tailor@duke.edu

LEARNING OBJECTIVES

1) Discuss the role of CT for tumor response assessment. 2) Discuss limitations for traditional CT response criteria, including WHO and RECIST. 3) Discuss therapy response in the setting of novel lung cancer therapies, including immunotherapy.

RC201C Imaging of Thymoma

Participants
Edith M. Marom, MD, Ramat Gan, Israel (*Presenter*) Speaker, Bristol-Myers Squibb Company

For information about this presentation, contact:

edith.marom@gmail.com

LEARNING OBJECTIVES

1) Identify an incidental thymoma. 2) Apply the most appropriate imaging modality for the evaluation of thymoma. 3) Assign the newly proposed TNM stage to a newly diagnosed thymoma.

URL

http://pubs.rsna.org/doi/figure/10.1148/rg.2017160096

Honored Educators

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RC201D Lung Cancer Staging

Participants
Travis S. Henry, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

travis.henry@ucsf.edu

LEARNING OBJECTIVES

1) List the changes to the 8th TNM system for lung cancer staging. 2) Interpret CT for lung cancer staging by providing relevant T, N, and M information to the referring clinician. 3) recognize pertinent positive and negative imaging findings that alter management of lung cancer patient.

Honored Educators

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RC222

Imaging for Personalized Medicine: Thorax

Monday, Nov. 27 8:30AM - 10:00AM Room: S103AB

CH PH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

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

Sub-Events

RC222A Anatomical Imaging for Personalized Medicine in the Thorax

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

For information about this presentation, contact:

gdhugo@vcu.edu

LEARNING OBJECTIVES

1) Understand how respiration impacts radiotherapy imaging and delivery and how to implement strategies to mitigate these issues on a patient-specific basis. 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.

RC222B Functional Imaging for Targeting and Adaptation in the Thorax

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

For information about this presentation, contact:

marthamm@med.umich.edu

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.

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SSC03

Chest (Lung Nodule)

Monday, Nov. 27 10:30AM - 12:00PM Room: S504CD

CH CT OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Carole A. Ridge, MD, Dublin 7, Ireland (*Moderator*) Nothing to Disclose
Jo-Anne O. Shepard, MD, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

SSC03-01 Automatic Detection of Malignant Pulmonary Nodules on Chest Radiographs Using a Deep Convolutional Neural Network: Detection Performance and Comparison with Human Experts

Monday, Nov. 27 10:30AM - 10:40AM Room: S504CD

Awards
Student Travel Stipend Award

Participants
Ju G. Nam, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Chang Min Park, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Samsung Electronics Co, Ltd; Research Grant, DRTECH Co, Ltd
Sunggyun Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, Lunit Inc
Jong Hyuk Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eui Jin Hwang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyungjin Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Su Suk Oh, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Geonhwan Ju, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, Lunit Inc
Jaehong Aum, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, Lunit Inc

For information about this presentation, contact:

dyuing89@gmail.com

PURPOSE

To evaluate the performance of a deep learning-based automatic detection (DLAD) algorithm in detecting malignant pulmonary nodules on chest radiographs (CPAs) and its comparison with human experts.

METHOD AND MATERIALS

A DLAD algorithm was developed using a 25-layer deep convolutional network in a novel semi-supervised manner with 41,792 cases. For this observer performance test, 181 CPAs not used in the development of DLAD were included: 119 CPAs with 147 pathologically- or clinically-confirmed malignant lung nodules (mean size, 2.50 cm±1.60) and 62 normal CPAs. Reference for the nodules was established via CT taken within a week. Nineteen readers including 3 non-radiology physicians, 6 radiology residents, 5 board-certified radiologists, and 5 thoracic radiologists independently reviewed each CPA to detect lung nodules on a five-point confidence scale without DLAD (test 1). After test 1, each reader was allowed to change their decision by reviewing the results of test 1 and that of DLAD (test 2). The detection performances of DLAD, human experts (test 1), and human experts using DLAD (test 2) were evaluated and compared using jackknife free-response receiver operating characteristic (JAFROC) figure of merits (FOMs) on a per-nodule basis.

RESULTS

DLAD alone exhibited a FOM of 0.857, which was significantly higher than that of 16 of 19 readers (all *P*s <0.05). The mean FOM of the 19 readers using DLAD were significantly higher than that without DLAD (0.825 vs. 0.713, *P*=0.002). All readers showed improved detection performances for malignant pulmonary nodules using DLAD (mean FOM increase of 0.044 [range, 0.007-0.193]) with significant differences in 15 readers (*P*<0.05). On subgroup analysis, FOMs of the four reader groups (non-radiology physicians, radiology residents, board-certified radiologists, and thoracic radiologists) were 0.678, 0.784, 0.808, and 0.820, respectively, and their detection performances significantly improved with DLAD (0.814, 0.817, 0.827, 0.841; all *P*s <0.005).

CONCLUSION

DLAD showed better performance than most experts in detecting malignant pulmonary nodules on CPAs and enhanced the performance of human experts when used in conjunction.

CLINICAL RELEVANCE/APPLICATION

The excellent performance of DLAD demonstrates its great potential in changing our daily clinical practice; DLAD may provide

preliminary interpretation in pulmonary nodule detection on chest radiographs.

SSC03-02 Assessment of CT Texture Analysis as a Tool for Lung Nodule Follow-Up

Monday, Nov. 27 10:40AM - 10:50AM Room: S504CD

Participants
Sarim Ather, MBChB, PhD, Oxford, United Kingdom (*Presenter*) Nothing to Disclose
Lyndsey C. Pickup, MEng, DPhil, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Optellum Ltd.; Former employee, Mirada Medical Ltd.
Aambika Talwar, MA, MBBCHIR, Oxford, United Kingdom (*Abstract Co-Author*) Research funded, Mirada Medical Ltd
Julien M. Willaime, PhD, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Mirada Medical Ltd
Heiko Peschl, 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

For information about this presentation, contact:

sarim.ather@ouh.nhs.uk

PURPOSE

Lung nodule volumetry is currently the preferred method of following up small indeterminate lung nodules. This study assesses how CT texture analysis (CTTA) performs compared to volumetry in differentiating benign and malignant nodules.

METHOD AND MATERIALS

Data was collected for 143 patients with lung nodules (4-15mm) on an initial CT scan, with a follow-up CT 29 to 2747 days later. All scans had a slice thickness below 1.5mm. Nodules were delineated in 3D using a thresholded region with manual edits and the contour was propagated to a latter scan using deformable image registration. Definitive nodule diagnoses were established through histology, 2-year stability or malignant growth. Initially, the set was biased with respect to size (large nodules more likely to be cancer), so a subset of 113 patients (58 benign, 55 malignant) was selected such that size at presentation was uninformative (AUC 0.50-0.51). From each CT, a suite of classical texture features (Harlick, Gabor etc.) at various sizes/scales was extracted from isotropically-resampled volumes containing the contoured nodule. A derived feature vector was then created based on texture-feature changes between the first and second timepoints for each nodule, and volume doubling time (VDT) was calculated.

RESULTS

Area under the ROC curve (AUC) analysis showed that the VDT alone as an indicator of malignancy only performed at AUC=0.70 (95% CI=0.69-0.71). In contrast, the best difference-of-texture feature achieved AUC=0.81 (95% CI=0.80-0.82), with changes in size-linked texture features appearing more reliable than either absolute size at the second timepoint (AUC=0.75, 95% CI=0.74-0.76), or VTD. The mean of the top ten texture AUCs was above 0.76. This shows that quantitative texture measures extracted more information from the CT than size or VDT, and that this information is beneficial in malignancy prediction.

CONCLUSION

Our results indicate that changes in quantified texture around lung nodules and their surrounding microenvironment may be a more accurate tool for stratifying malignant lung nodules than VDT alone.

CLINICAL RELEVANCE/APPLICATION

Quantitative texture measures may be a useful adjunct in the follow-up of indeterminate lung nodules.

SSC03-03 Deep Learning-based Automatic Detection Algorithm for the Detection of Malignant Pulmonary Nodules on Chest Radiographs

Monday, Nov. 27 10:50AM - 11:00AM Room: S504CD

Participants
Sunggyun Park, Seoul, Korea, Republic Of (*Presenter*) Employee, Lunit Inc
Chang Min Park, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Geonhwan Ju, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, Lunit Inc
Minjae Kang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, Lunit Inc
Jaehong Aum, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, Lunit Inc
Sangheum Hwang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, Lunit Inc
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Samsung Electronics Co, Ltd; Research Grant, DRTECH Co, Ltd
Jong Hyuk Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eui Jin Hwang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyungjin Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ju G. Nam, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Su Suk Oh, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

sgpark@lunit.io

PURPOSE

We developed a deep learning-based automatic detection (DLAD) algorithm for the detection of malignant pulmonary nodules on chest radiographs, and evaluated its diagnostic performance and nodule detection performance using large-scale chest radiograph (CR) data.

METHOD AND MATERIALS

A total of 44,087 CRs comprised of 9,269 abnormal and 34,818 normal CRs were collected. Abnormal CRs were pathologically or

clinically diagnosed as having malignant pulmonary nodules in 3,892 individuals (M:F=2,244:1,648; mean age, 63.6 years). Normal CRs were from 30,784 individuals (M:F=16,886:13,798; mean age, 51.3 years). We randomly split the datasets into a training set (33,467 normal and 8,625 abnormal CRs), a validation set (675 normal and 322 abnormal CRs) and a test set (675 normal and 322 abnormal CRs). There were no overlaps among these three datasets. We designed a deep convolutional network with 25 layers and 8 residual connections, and trained this network using a novel semi-supervised learning approach that partially utilized the location of the lesions, i.e., 6 thoracic radiologists manually marked the location of the abnormal lesions (3,213 CRs) in the abnormal CRs of the training set. The same radiologists also tagged the locations of all abnormal CRs in the validation and test sets to evaluate the localization performance of the DLAD algorithm. We then quantitatively verified the performances of DLAD by analyzing receiver-operating characteristics (ROC) curves for classification performance and localization average precision (AP) for detection performance.

RESULTS

In the validation dataset, DLAD showed an area under the ROC curve (AUC) of 0.9793, with an accuracy, sensitivity, and specificity of 93.83%, 85.54% and 98%, respectively. DLAD achieved 0.9257 for localization AP. In the test dataset, the AUC of DLAD was 0.9777 (accuracy, 93.53%; sensitivity, 86.2%; specificity, 96.15%). Localization AP was 0.862.

CONCLUSION

The DLAD algorithm demonstrated high diagnostic performance in differentiating malignant nodules from normal CR findings. DLAD also showed promising results in automatically detecting the location of nodules.

CLINICAL RELEVANCE/APPLICATION

As a second reader, DLAD has great potential to improve radiologists' detection performance and efficacy of malignant pulmonary nodules on chest radiographs.

SSC03-04 Computer-Aided Detection of Pulmonary Nodules on Chest Radiographs Using Deep Learning

Monday, Nov. 27 11:00AM - 11:10AM Room: S504CD

Awards
Student Travel Stipend Award

Participants
Samuel J. Withey, MBBS , London, United Kingdom (*Presenter*) Nothing to Disclose
Emanuele Pesce, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Robert Bakewell, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Petros-Pavlos Ypsilantis, MA, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Vicky J. Goh, MBBCh, London, United Kingdom (*Abstract Co-Author*) Research Grant, Siemens AG Speaker, Siemens AG
Giovanni Montana, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

giovanni.montana@kcl.ac.uk

PURPOSE

The chest x-ray is the most commonly performed radiology study, yet interpretation can be challenging. Deep learning systems for computer-aided detection (CAD) hold great potential but have been limited by the need for large numbers of radiologist-annotated radiographs. Other authors have described some success with report classification or manual annotation based CAD systems.We aimed to develop a novel nodule-detection CAD system, combining manually annotated images with 750,000 reported radiographs.

METHOD AND MATERIALS

We investigated image- and nodule-based metrics to compare our CAD system to alternatives. An ethics committee waiver of consent was granted.With natural language processing we analyzed free-text reports to generate labels, indicating which of our 750,000 radiographs contain a nodule or other abnormality. For 1,237 images, we provided radiologist-annotated boxes around 1,861 nodules. We proposed a CAD system using convolutional neural networks trained using hybrid loss on class labels and nodule annotations. The system can predict if there is a nodule and its location.For image-based classification, a test set of 7,850 images, 1,864 containing nodules, was used to assess the CAD system in predicting presence of a nodule. For nodule-based classification a test set of 575 previously unseen radiographs containing 787 nodules was used to investigate co-localization whilst penalizing false positives. For both, we applied other leading methodologies to our test dataset for comparison.

RESULTS

Image-based classification yielded an Accuracy of 0.76 and F1 of 0.67 (cf. 0.64 & 0.55 for annotation-based, and 0.72 & 0.62 for report-based CAD systems, respectively).Nodule-based metrics showed Recall 0.65, Precision 0.15, with 43% overlap between manual and CAD bounding boxes (cf. 0.37, 0.28, 30% for annotation-based, and 0.34, 0.10, 17% for report-based CAD systems).

CONCLUSION

Our study demonstrates improved nodule detection and localization from combining manual annotations with 'big data' from 750,000 films.With further work, CAD may act as a 'second reader' for chest radiographs, increasing sensitivity in nodule detection without compromising specificity.

CLINICAL RELEVANCE/APPLICATION

Computer-aided detection systems learning from 'big data' can help detect nodules on chest radiographs with potential to act as a cost-effective 'second reader' across healthcare systems worldwide.

SSC03-05 QIBA Challenge: Establishing Conformance of Segmentation Algorithms for Quantitative CT Volumetry

Monday, Nov. 27 11:10AM - 11:20AM Room: S504CD

Participants

Marthony Robins, BSc, Durham, NC (*Presenter*) Nothing to Disclose
Jayashree Kalpathy-Cramer, MS, PhD, Charlestown, MA (*Abstract Co-Author*) Consultant, Infotech Software Solution
Nancy A. Obuchowski, PhD, Cleveland, OH (*Abstract Co-Author*) Research Consultant, Siemens AG Research Consultant, QT Ultrasound Labs Research Consultant, Elucid Bioimaging Inc
Andrew J. Buckler, MS, Wenham, MA (*Abstract Co-Author*) Stockholder, vascuVis Inc; President, vascuVis Inc; CEO, vascuVis Inc; Stockholder, Elucid Bioimaging Inc; President, Elucid Bioimaging Inc; CTO, Elucid Bioimaging Inc;
Justin B. Solomon, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Maria Athelogou, PhD, Oak Brook, IL (*Abstract Co-Author*) Principal Scientist, Definiens AG
Aria Pezeshk, PhD, Silver Spring, MD (*Abstract Co-Author*) Nothing to Disclose
Berkman Sahiner, PhD, Silver Spring, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas Petrick, PhD, Silver Spring, MD (*Abstract Co-Author*) Nothing to Disclose
Rudresh R. Jarecha, MD,DMRD, Ahamedabad, India (*Abstract Co-Author*) Nothing to Disclose
Ehsan Samei, PhD, Durham, NC (*Abstract Co-Author*) Research Grant, General Electric Company; ; Research Grant, Siemens AG; ; Advisory Board, medInt Holdings, LLC

For information about this presentation, contact:

marthony.robins@duke.edu

PURPOSE

To conduct a public Challenge through Quantitative Imaging Biomarker Alliance (QIBA) to assess the conformance of segmentation algorithms for CT volumetry and to establish interchangeability between real and simulated lesions.

METHOD AND MATERIALS

Simulated lung lesion models (based on pathologically confirmed malignant tumors) were virtually inserted into (a) 3 phantom datasets using validated projection and image-domain insertion programs, and (b) 30 clinical chest CT cases containing real lesions "hybrid datasets". The study was designed as a public Challenge to academic researchers and commercial software developers to apply their volume estimation algorithms on simulated and corresponding real lung lesions. Equivalence between real and simulated lesions was analyzed in terms of bias and repeatability coefficient (RC) (phantom only), and algorithm reproducibility (variance between measurements by different algorithms on the same lesion). Comparisons were made relative to insertion method, participant, and lesions (shape, size, location).

RESULTS

8 and 16 groups (industry/academic) participated in the phantom and hybrid sections of the Challenge, respectively. Either fully or semi-automated segmentation algorithms were used. Percent bias and repeatability coefficient based on the defined QIBA compliance criteria showed that 3 of 8 groups were fully compliant with the profile, and one close non-compliance. For compliant groups, %bias (95% confidence intervals) was -0.43% (±5.6%) for real and -0.34 to -2.2% (±5.8%) for simulated lesions; while RC was 13% for real and 2 to 13% for simulated lesions.

CONCLUSION

Hybrid datasets can overcome phantom lack of realism and patient lack of ground truth limitations. Our results indicate that simulated and real lesions are generally comparable but exhibit differences for certain algorithms. This shows simulated lesions inserted into clinical cases can be used in the assessment of quantitative volumetry methods.

CLINICAL RELEVANCE/APPLICATION

Hybrid datasets help us better assess the performance of lesion segmentation algorithms for QIBA Profile conformance. This enables translation of precision medicine in the context of quantitative CT.

SSC03-06 Pulmonary Hamartomas: Safely Increasing the Rate of CT Diagnosis

Monday, Nov. 27 11:20AM - 11:30AM Room: S504CD

Participants
Michal Eifer, MD, Ramat Gan, Israel (*Presenter*) Nothing to Disclose
Orna Komisar, MD, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Efrat Ofek, MD, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Arnaldo Mayer, PhD, Ramat Gan, Israel (*Abstract Co-Author*) Co-founder, RadLogics Inc; Officer, RadLogics Inc
Eli Konen, MD, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Edith M. Marom, MD, Ramat Gan, Israel (*Abstract Co-Author*) Speaker, Bristol-Myers Squibb Company

For information about this presentation, contact:

edith.marom@gmail.com

PURPOSE

For decades, the CT diagnosis of pulmonary hamartoma (PH) has been based on the presence of popcorn calcifications or fat (-40 to -120 HU) limited to a smooth <2.5cm pulmonary nodule. These rigid criteria were selected to avoid classifying necrotic neoplasms as benign. A minority of the PH fulfill these criteria which results in unnecessary surgical resections. The aim of our study was to assess the spectrum of HU distribution in PH and whether the adoption of a wider threshold for fat content can safely be implemented for non invasively diagnosing PH without misinterpreting malignant lesions as benign.

METHOD AND MATERIALS

We retrospectively assessed the CT scans of consecutive histologically confirmed: PH (histPH), pulmonary metastases and primary lung cancers as well as PH diagnosed by CT (CTPH). Their size, volume, average, minimum and maximal HU were assessed using an ROI of at least 8 pixels, placed in the lowest attenuation region of the nodule.

RESULTS

There were 52 histPH, 41 metastases, 49 primary lung cancers, and 34 CTPH. PH average size and volume were 14.5mm and 2270.2mm 3 and that of malignancies 26.5mm and 22,031mm 3. Popcorn calcifications were seen in 2 (4%) histPH, 11 (32%) CTPH

and non of the malignant lesions. The average HU for histPH, CTPH, metastases, and primary lung cancers were: 3.99, -10.97, 25.53, 38.61 respectively. Of the malignant lesions, only 4 had an average of <0 HU and comprised of metastses of sarcoma (n=1), colon (n=1), mature cystic teratoma (n=1) and ovary (n=1). Minimum pixel HU value of <0 were seen in 28 (31.1%) of malignant nodules with the lowest minimal pixel value of -42 as compared to 44 (84.6%) of the histPH and 33 (97%) of the CTPH with a minimal pixel value of -168 HU. By raising the average HU threshold value for diagnosing PH from -40 to -20, the sensitivity for diagnosing PH rises from 9.3% to 18.6% while the positive predictive value and the specificity remain 100%.

CONCLUSION

By increasing the threshold for identification of fat in PH to -20 unnecessary surgical intervention may be prevented without misdiagnosing cancer as benign.

CLINICAL RELEVANCE/APPLICATION

By increasing the threshold for fat identification, a greater number of PH will be safely identified and unnecessary surgery avoided.

SSC03-07 Computer-Aided Detection (CAD) Of Pulmonary Nodules on Computed Tomography (CT) With AIDR3D in Vivo-Result: Comparison between Ultra-Low-Dose CT (ULDCT) Equivalent Dose to Chest X-Ray and Low-Dose CT (LDCT)

Monday, Nov. 27 11:30AM - 11:40AM Room: S504CD

Participants
Yukihiro Nagatani, MD, Otsu, Japan (*Presenter*) Nothing to Disclose
Hiroshi Moriya, MD, Fukushima-City, Japan (*Abstract Co-Author*) Nothing to Disclose
Shigetaka Sato, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroaki Nakagawa, Otsu, 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 Medical Systems Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Fuji Pharma 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, Nishihara-Cho, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation
Kiyoshi Murata, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

yatsushi@belle.shiga-med.ac.jp

PURPOSE

To determine the beneficial effect of computer-aided detection (CAD) for pulmonary solid and sub-solid nodules in ultra-low-dose CT with AIDR 3D (ULDCT) and low dose CT with AIDR 3D (LDCT).

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, 68 subjects underwent chest CT (64-row helical mode) using identical 320-row scanners with different tube currents: 240,120 and 20 mA (2.51, 1.26 and 0.21mSv, respectively). Standard of reference (SOR) was established based on consensus reading of CT images at 240mA by two radiologists. CAD was performed in ULDCT (20mA) and LDCT (120mA) with lung reconstruction kernels. Another 2 observers independently assessed lung nodule presence on both methods. In total and 4 subgroups classified according to the combination of nodular size (<5, >5mm) and characters (solid, sub-solid), nodule detection rate (NDR) for both CAD and 2 observers with CAD was compared between both methods with Fisher's exact probability test, and NDR without CAD and that with were compared with McNemar test for each observer. Scan-based false positive ratio by CAD (FPR) was compared with paired t-test between both methods.

RESULTS

For SOR, 123 solid and 100 sub-solid nodules were identified (mean diameter 6.0 ±4.1 mm, range 2-29 mm). NDR by CAD on ULDCT (28%) was similar to that on LDCT (30%) in total as well as the 4 subgroups ($p>0.05$). CAD led to a significant increase of NDR for 2 observers on both modalities for smaller solid nodules (<5mm) ($p<0.001$) and observer 1 on LDCT for larger solid nodules (>5mm) ($p=0.031$). For larger nodules, NDR for 2 observers with CAD on ULDCT (92% for solid, 77% for sub-solid) was comparable to that on LDCT (95% for solid, 86% for sub-solid) ($p>0.05$). FPR on LDCT (2.5±4.1) was similar to that on ULDCT (2.4±2.2).

CONCLUSION

ULDCT showed comparable NDR for larger nodules to LDCT regardless of CAD application. In contrast, adding CAD in ULDCT improved NDR by observers for smaller solid nodules, although similarity in NDR to LDCT was not achieved.

CLINICAL RELEVANCE/APPLICATION

ULDCT could be useful for larger lung nodule detection irrespective of nodular characters and provide improved detection sensitivity of radiologists by CAD for smaller lung solid nodules

SSC03-08 Lung Nodule Volumetry: Variability at Multiphase Cardiac CT

Monday, Nov. 27 11:40AM - 11:50AM Room: S504CD

Participants
Diana Penha, MD, Lisbon, Portugal (*Presenter*) Nothing to Disclose
Klaus L. Irion, MD, PhD, Liverpool, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Colin Monaghan, Liverpool, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Bruno Hochhegger, MD, PhD, Porto Alegre, Brazil (*Abstract Co-Author*) Nothing to Disclose
Erique M. Guedes Pinto, MD, Lincoln, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Wilson Neto, Porto Alegre, Brazil (*Abstract Co-Author*) Nothing to Disclose

Sukumaran R. Binukrishnan, MRCP, FRCR, Manchester, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Arthur S. Souza JR, MD, PhD, Sao Jose Do Rio Preto, Brazil (*Abstract Co-Author*) Nothing to Disclose
Edson Marchiori, MD, PhD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

dianapenha@gmail.com

PURPOSE

The purpose of the study was to determine the intra-scan variability of volumetric measurements of solid pulmonary nodules.

METHOD AND MATERIALS

In this retrospective study, 827 consecutive patients that underwent cardiac multi-phase CT scan were evaluated. All the CT exams were performed on a 256-row CT scanner (SIEMENS Somaton Definition Flash) using 0.6mm slice thickness and soft kernel. The image reconstructions were done using 10 phases in 10% of each RR interval. The images were evaluated in the axial plane to identify the lung nodule and after the semi-automatic tool for lung lesions / volumetry was applied. The volume of the nodule was determined two times according with two different phases of the scan for each patient.

RESULTS

For statistical analysis 66 pulmonary nodules with medium volume of 8mm were included. The mean nodule volumetric difference was 513mm3 or 21.6%. Confidence interval of difference observed on measurements taken on different cardiac phases: Percentile 5. 15mm3 or 0.00%; Percentile 50. 62mm3 or 14%, and Percentile 95. 1696mm2 or 58%. The volume measurements showed significant variability for any one given nodule during a single multi-phase scan ($p<0.05$). There was no correlation between the volume measurement of the nodule and the difference between the volume measurements.

CONCLUSION

There is significant cardiac phase variability in lung nodule volume measurement.

CLINICAL RELEVANCE/APPLICATION

Lung nodule measurements are important in identifying potential early malignant transformation and relies on identifying a significant increase in size (25%) and change in character between serial scans.In recent years many limiting factors to the measurements' accuracy have been identified, such as nodule size, location, morphology, inspiratory effort and others such as the technical parameters of the scan.Our purpose is to determine the importance of the hemodynamic factors in the lung nodule volumetry, measuring the variation and reliability of semiautomated lung nodule volumetric measurements during the same CT acquisition and in different cardiac phases.

SSC03-09 Pulmonary Nodules in Melanoma Patients: How Long Do We Need to Follow Them to Determine if They Are Benign or Metastatic?

Monday, Nov. 27 11:50AM - 12:00PM Room: S504CD

Participants
Magdy M. Soliman, MBBCh, FRCR, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Teresa Petrella, MD,FRCPC, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Frances Wright, MD, MEd, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Nicole Look Hong, MD,MSc, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Laura Jimenez-Juan, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Anastasia Oikonomou, MD, PhD, Toronto, ON (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

anastasia.oikonomou@sunnybrook.ca

PURPOSE

This study aims to determine what timeline should be utilized to follow pulmonary nodules in melanoma patients to confirm metastatic or benign origin and to delineate features that favor metastatic versus benign etiology.

METHOD AND MATERIALS

588 patients had surgery for primary melanoma between 2012-15 in our tertiary care centre. Out of these, 148 patients had baseline chest CT and at least one followup (FU) CT and were included in the study. Patients with definitely benign nodules, metastases and other non-melanoma malignancies were excluded. Nodules were volumetrically measured on FU CTs and a cut-off of 15% difference in volume was considered as significant change. Distance from pleura, peripheral versus central and perifissural location, irregularity, solid versus groundglass density were evaluated. Nodules were considered metastases if they increased in size between two FU CTs or if increase was accompanied by multiple new lung nodules or extrapulmonary metastases.

RESULTS

On baseline CT, 70 patients (A) had at least one indeterminate pulmonary nodule (IPN) and 78 (B) had none. In group A all patients had 243 IPN (0.0236 cm3) and only 1 nodule increased 405% in volume in 5 months and was proven metastatic. Out of 243 IPN, 215 were peripheral, 40 perifissural, 218 solid, 25 groundglass, 4 had irregular margins. 18 nodules increased 50% in volume in the first 3-month CT and either resolved or decreased in another 3 months. During FU, overall, 28 patients developed 33 new nodules (0.0814 cm3) out of whom 24 (86%) were metastases. In 4 patients, nodules resolved or decreased in 5.5 months and were presumed benign. All metastases (33) were solid and 4 were perifissural. Median volume increase between 2 CTs (median 3 months) was 260% ($p <0.001$). All but one metastases had smooth margins.

CONCLUSION

IPN on baseline CT are most likely benign and monitoring up to 6 months can confirm it. Newly developed nodules have a high possibility of being metastatic and FU in 3 months can confirm it if needed. Volume increase is significantly lower in benign than metastatic nodules. Perifissural location of new nodules does not exclude metastatic origin, however groundglass and irregular

margin most likely does.

CLINICAL RELEVANCE/APPLICATION

IPN on baseline CT require monitoring up to 6 months to confirm benign origin. Newly developed nodules have a high risk of being metastatic and follow up in 3 months will confirm increase in size.

SSC10

Nuclear Medicine (Pulmonary and Cardiovascular Imaging)

Monday, Nov. 27 10:30AM - 12:00PM Room: S505AB

CH CT NM VA

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Andrew C. Homb, MD, Rochester, MN (*Moderator*) Nothing to Disclose
Yonglin Pu, MD, PhD, Chicago, IL (*Moderator*) Nothing to Disclose

Sub-Events

SSC10-01 Improved Pulmonary Nodule Detection Using a Next Generation 18F-FDG PET Imaging System

Monday, Nov. 27 10:30AM - 10:40AM Room: S505AB

Participants
Sonya Y. Park, MD, Stanford, CA (*Presenter*) Nothing to Disclose
Lucia Baratto, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Negin Hatami, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Guido A. Davidzon, MD, MS, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Shyam Srinivas, MD, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Viswam S. Nair, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Andrei Iagaru, MD, Stanford, CA (*Abstract Co-Author*) Research Grant, General Electric Company

PURPOSE

One diagnostic indication for FDG PET is to determine whether a pulmonary nodule is benign or malignant based on the uptake of the nodule. However, FDG PET is limited by a relatively low spatial resolution (5 mm) that can lead to underestimation of tracer uptake and detectability in small lesions. The objective of this study was to evaluate the detection rate for pulmonary nodules using a next generation digital PET/CT system using Silicon Photomuliplier (SiPM) technology for increased contrast recovery and lower background variability in patients with known malignancies.

METHOD AND MATERIALS

76 consecutively enrolled patients who were referred for cancer staging by 18F-FDG PET/CT underwent scans on the standard of care (SoC) and new digital system (Discovery Meaningful Insights) from September-December 2016. Images from the SoC PET/CT were reconstructed using time-of-flight (ToF) and ordered subset expectation maximization (OSEM) protocols. Images from digital PET/CT were reconstructed using ToF and a Bayesian penalized likelihood algorithm. Two experienced, nuclear medicine trained readers reviewed both scans for each patient in random order, blinded to clinical information and recorded the location and standardized uptake value (SUV) measurement for each nodule. Differences in acquisition protocols were measured based on the distribution of the analyzed data and difference in detection rates assessed by McNemar's test.

RESULTS

Excluding one patient who had innumerable metastatic nodules on both scans, the number of lesions detected on the digital and standard of care PET/CT were 35 and 20, respectively. Of the 57 patients with negative standard of care scans, 7 (12%) demonstrated FDG-avid pulmonary nodules on the digital PET/CT. More lesions were detected on digital PET/CT in four patients who had nodules identified by both methods. Detection rates remained the same for 65/76 patients (86%), including 51 who were negative on both scans. Digital PET/CT nodules had a higher SUVmax compared to the standard of care (2.0; IQR 0.9-6.0 versus 1.3; 0.6-3.9, $p < 0.001$).

CONCLUSION

Digital PET/CT system detects more FDG avid pulmonary nodules. FDG PET for diagnosing pulmonary nodules and staging metastatic disease to the lungs will require re-evaluation with this new, more sensitive platform.

CLINICAL RELEVANCE/APPLICATION

The new digital PET/CT system can provide higher resolution, and is recommended for the detection of pulmonary nodules.

SSC10-02 Estimating Lung Carbon Monoxide Diffusion Rates with Positron Emission Tomography

Monday, Nov. 27 10:40AM - 10:50AM Room: S505AB

Participants
Delphine L. Chen, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Murali Chakinala, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Colleen McEvoy, MD, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Jeffrey J. Atkinson, MD, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Amy Evans, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose

Amber Salter, PhD, MPH, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Frank Brooks, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

chend@wustl.edu

PURPOSE

Regional assessments of gas exchange could be highly useful for assessing the efficacy vascular-targeted treatment responses in pulmonary arterial hypertension. We performed a pilot study in healthy volunteers to determine whether carbon monoxide (CO) transfer in the lungs could be estimated with 15O-CO positron emission tomography (PET).

METHOD AND MATERIALS

Healthy volunteers were imaged twice in a Siemens Biograph 40 PET/CT scanner. After fully emptying their lungs, volunteers sharply inhaled 20-40 mCi of 15O-CO to maximal inspiration, held their breath for a minimum of 10 seconds, then exhaled during a 7-min dynamic scan acquisition starting at ~30 sec prior to inhalation. End-expiration CT scans were obtained for attenuation correction. From first principles, it is straightforward to show that the logarithmic time-derivative of the alveolar CO concentration is proportional to the pulmonary function testing (PFT) lab-estimated CO transfer rate, KCO, during breath hold. We estimated the maximum total rate of CO transfer from the whole-lung image region as the logarithmic derivative at the inflection point after the peak (image-region clearance rate, IRCR). We input the IRCR with the peak and steady-state CO concentrations as predictors controlling for inter-patient inhalation differences into a multiple linear regression model with the PFT values as the response. Intraclass correlation coefficients (ICC) and Bland-Altman analysis characterized correlation and reproducibility.

RESULTS

Nine healthy volunteers completed the study procedures. One volunteer with a very high KCO (43% above reference values) was excluded so as not to overly influence the regression model. The IRCR was highly correlated with the KCO by Bland-Altman analysis. ICCs were 0.99 and 0.92 for Scan 1 and Scan 2 IRCR values, respectively, vs KCO. The reproducibility of the IRCR was also high (ICC = 0.92).

CONCLUSION

This pilot study demonstrates a high correlation between PET-measured IRCR and PFT-measured KCO, suggesting that 15O-CO PET imaging may be useful for measuring regional differences in CO diffusion.

CLINICAL RELEVANCE/APPLICATION

Estimating regional CO diffusion would be a highly useful biomarker of treatment efficacy for pulmonary vascular-targeted therapies for pumonary arterial hypertension.

SSC10-03 82-Rb PET/CT in Malignant Tumors: First Systemic Analysis

Monday, Nov. 27 10:50AM - 11:00AM Room: S505AB

Participants
Clayton W. Commander, MD,PhD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Hemant Desai, BS,BA, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Marijana Ivanovic, PhD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Amir H. Khandani, MD, Chapel Hill, NC (*Presenter*) Consultant, Progenics Pharmaceuticals, Inc; Consultant, WorldCare International, Inc; Consultant, F. Hoffmann-La Roche Ltd;

PURPOSE

To quantitatively and qualitatively document 82-Rb (Rb) uptake in malignant tumors.

METHOD AND MATERIALS

18 malignant tumors in 18 patients incidentally captured on Rb cardiac PET/CT were included. Ratios of SUVmax (SUV) of each lesion (SUVL) to SUV of the mediastinal blood pool (SUVMBP), lung (SUVLU) and subcutaneous fat (SUVSCF) were calculated (qualitative assessment). Paired t-test and correlation analysis was used to assess the agreement between ratios of SUVL and SUVMBP, SUVLU, SUVSCF on rest and stress images. Lesions (L) were also qualitatively assessed for their uptake (UT) using scores 1 (SCF UTMBP UT). All assessments were conducted on rest and stress images.

RESULTS

Histology: 16 lung cancer (13 NSCLC; 2 small cell; 1 well diff carcinoid), 1 ductal breast cancer and 1 follicular lymphoma. Size range: From 1.0 to 5.0 cm. Mean + SD and median: 2.6 + 1.0 and 2.7, respectively. Quantitative assessment: SUVL/SUVMBP, SUVL/SUVLU and SUVL/SUVSCF ranged from 0.5 to 3.0, 0.5 to 6.2 and 1.5 to 20.3, respectively, on rest images and 0.3 to 3.7, 0.3 to 6.9 and 1.4 to 20.6, respectively, on stress images. Mean + SD and median for SUVL/SUVMBP, SUVL/SUVLU and SUVL/SUVSCF were 1.4 + 0.7 and 1.3, 2.9 + 1.5 and 2.7 and 11.4 + 5.5 and 11.1, respectively, on rest images, and 1.5 + 0.8 and 1.5, 2.7 + 1.6 and 2.5 and 10.6 + 5.5 and 10.4, respectively, on stress images. There was no statistically significant difference between rest and stress values for SUVL/SUVMBP, SUVL/SUVLU and SUVL/SUVSCF. Correlation analysis between rest and stress values for SUVL/SUVMBP, SUVL/SUVLU and SUVL/SUVSCF showed very strong correlation with correlation coefficients of 0.82, 0.89 and 0.91, respectively. Qualitative assessment: There were 10 lesions with score 3, 6 lesions with score 2 and 2 lesions with score 1.

CONCLUSION

Malignant lesions can be readily depicted and their uptake quantified on Rb PET/CT. Specifically, using the ratio of SUVmax of lesions to SUVmax of subcutaneous fat, there is a high target-to-background ratio of Rb signal.

CLINICAL RELEVANCE/APPLICATION

Quantitative Rb PET/CT has the potential to be used as a clinical imaging tool to quantify tumor perfusion.

SSC10-04 Correlation of V/Q Scans and Pulmonary Artery Pressures to Determine Pulmonary Endarterectomy

Outcomes

Monday, Nov. 27 11:00AM - 11:10AM Room: S505AB

Participants
Cinthia Cruz, MD, Boston, MA (*Presenter*) Nothing to Disclose
David Z. Chow, MD, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
James A. Scott, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine if there is a correlation between the counts found on perfusion images pre and postoperatively relative to the pulmonary artery pressure changes in patients who underwent endarterectomy for chronic pulmonary embolism.

METHOD AND MATERIALS

IRB approved and HIPAA compliant single center retrospective study of all patients who underwent pre and post endarterectomy VQ scans for chronic pulmonary embolism in the period of 2008-2015. Studies were acquired at outside institutions were excluded. Pulmonary artery pressures prior and posterior to surgery available in the EMR were further analyzed. ROIs were manually selected in posterior views only using the Polygon tool from the Siemens MI applications. Each lung was divided in two for a total of 4 segments. Mirror tool was used to reproduce the contour selection in the contralateral side increasing repeatibility. Measurements for each segment included: size, total counts and pixels. Operative notes were used to select segments in which surgery was successful. Pearson and Spearman's Rho correlation tests were applied.

RESULTS

102 cases had pre and postoperative VQ scans, only 73 had concurrent PA measurements. Surgeons correctly predicted the outcome in 50/73(68%) of cases relative to pre and post segmental total-count difference. 121 segments in 50 subjects underwent successful surgery and were further analyzed. All preoperative PA pressures (average 77.2) demonstrated a decrease (average 28.3) or positive outcome.PA pressures decreased on average 38% after surgery. Moderate positive correlation was found between PA pressure drop and the increase in total-counts in those segments where clot was removed, R=0.501 p=0.003. The segment with the highest percentage of improvement with surgery was the right lower lung 16% followed by right upper 14.4%, left upper 13% and left lower 10.5% of total counts.

CONCLUSION

Pulmonary segmental VQ scan total counts have a moderately positive proportional correlation with the degree of PA pressure change seen on pre and post endarterectomies.

CLINICAL RELEVANCE/APPLICATION

VQ perfusion quatitations may be used to determine the surgical outcome of endarterectomy for chronic pulmonary embolism and are a good representation of the proportion of pulmonary pressure drop after surgery. Serial VQ scans can reliably be used in the surveillance of post endarterectomy patients as a screening tool for monitoring disease improvement or recurrence.

SSC10-05 Relationship of Carotid Artery F-18 NaF Uptake and Cerebral Ischemia: Comparison with F-18 FDG

Monday, Nov. 27 11:10AM - 11:20AM Room: S505AB

Participants
Takashi Norikane, Kita-gun, Japan (*Presenter*) Nothing to Disclose
Yuka Yamamoto, MD, PhD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukito Maeda, Kita-gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Nishiyama, MD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Atherosclerosis is characterized by the formation and progression of plaque which is a dynamic and complex process involving various pathophysiologic steps including inflammation and calcification. F-18 FDG (FDG) is the most widely validated PET tracer for the evaluation of atherosclerotic inflammation. F-18 sodium fluoride (NaF) provides potential discrimination between active unstable microcalcification and established dormant calcification. The purpose of this study was to evaluate the relationship between NaF uptake in carotid artery and cerebral ischemic changes on MRI in comparison with FDG.

METHOD AND MATERIALS

A total of 24 patients with carotid artery stenosis of 50% or greater determined by using ultrasonography were examined with NaF PET/CT, FDG PET/CT and brain MRI. In one patient, only unilateral carotid artery was used because of indwelling stent. PET emission scanning of the neck region with a 15-min acquisition of one bed position was performed at 60 min after each radiotracer injection. NaF and FDG uptake in carotid arteries were quantified using maximum standardized uptake value (SUVmax). MRI findings were characterized as mild ischemic changes (grade 1), moderate ischemic changes (grade 2), and severe ischemic changes (grade 3) in bilateral cerebral hemispheres.

RESULTS

Twenty-three hemispheres were considered grade 1; 17, grade 2; and 7, grade 3 on MRI. The mean (±S.D.) NaF SUVmax in grade 3 (3.32±0.93) was significantly higher than that in grade 1 (2.02±0.59) and grade 2 (2.22±0.54). There was no significant association between FDG SUVmax and MRI grade.

CONCLUSION

These preliminary results suggest that NaF uptake in carotid artery seems to be useful for the assessment of cerebral ischemic changes.

CLINICAL RELEVANCE/APPLICATION

NaF uptake in carotid artery may be useful for the assessment of cerebral ischemic changes.

SSC10-06 Added Value of Myocardial Perfusion SPECT/CT Studies: Detection of Incidental Pulmonary Artery Dilatation

Monday, Nov. 27 11:20AM - 11:30AM Room: S505AB

Participants
Charles Marcus, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Matthew J. Kruse, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Mehrbod Javadi, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Lilja B. Solnes, MD, MBA, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Steven P. Rowe, MD, PhD , Parkville, MD (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

cmarcus7@jhmi.edu

PURPOSE

To evaluate the incidence of undiagnosed pulmonary artery dilatation using gated CT images in patients with normal myocardial perfusion.

METHOD AND MATERIALS

This was a retrospective review of 200 consecutive patients who underwent a myocardial perfusion SPECT/CT study with a normal myocardial perfusion. The gated CT images were reviewed using a validated mean main pulmonary artery diameter (mPAD) measurement method that has previously been correlated with pulmonary artery pressure measured by right heart catheterization. The indication for the test and patient characteristics were collected. Previously reported mPAD cut-offs (>29.5mm and >31.5mm) were used to stratify patients. The frequency distribution was tabulated for the discrete variables and chi-square test was used for statistical comparison. Continuous variables were compared by non-parametric Mann-Whitney U test and correlations were dony by spearman-rank correlation.

RESULTS

Of the 200 patients, 100 were men and 100 were women. The mean age was 58.7 years. The most common indication was dyspnea (58.9%) followed by pre-operative work-up (22.3%) and chest pain (13.9%). The mean mPAD measurement was 26.3mm. There was a significant correlation between BMI and mPAD (ρ 0.28; $p<0.001$). In our cohort of patients, 23% (46/200) had a mPAD >29.5mm and 13.5% (30/200) patients had a mPAD of >31.5mm suggesting a high prevelance of incidental pulmonary arterial dilatation. Among patients undergoing a myocardial perfusion study for pre-operative work-up, 35.6% patients had a mPAD >29.5mm and 26.7% had a mPAD >31.5mm. There was a higher prevelance of congestive heart failure (62.5% vs 19.6%; $p<0.001$) and hypertension (78.3% vs 21.7%; $p<0.02$) in patients with mPAD >29.5mm. Similarly, there was a high prevelance of congestive heart failure ($p<0.001$), hyperlipidemia ($p<0.04$) and hypertension ($p<0.04$) in patients with mPAD >31.5mm

CONCLUSION

Incidental pulmonary artery dilatation can be detected in as many as 23% of patients with normal myocardial perfusion using the gated CT images and can be an invaluable tool in the early detection of dilated pulmoary arteries in patients with a low index of clinical suspicion

CLINICAL RELEVANCE/APPLICATION

Gated CT images of myocardial perfusion studies can detect incidental pulmonary arterial dilatation and can be evaluated at no extra-cost or procedure to the patient and should be evaluated in all myocardial perfusion studies.

SSC10-07 Quantitative Assessment of Cardiac FDG Uptake During a Long-term Follow-up of Steroid Therapy in Patients with Cardiac Sarcoidosis

Monday, Nov. 27 11:30AM - 11:40AM Room: S505AB

Participants
Masao Miyagawa, MD, PhD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Rami Tashiro, Ehime, Japan (*Abstract Co-Author*) Nothing to Disclose
Emiri Watanabe, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Ryo Ogawa, MD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Naoto Kawaguchi, MD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Masashi Nakamura, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Teruhito Kido, MD, PhD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Akira Kurata, PhD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Teruhito Mochizuki, MD, Toon, Japan (*Presenter*) Nothing to Disclose

PURPOSE

Several studies have confirmed that FDG PET has a high diagnostic accuracy in detecting active myocardial inflammation caused by cardiac sarcoidosis (CS). The aim is to estimate the long-term prognostic value of it during corticosteroid therapy.

METHOD AND MATERIALS

Fifty-two consecutive patients (pts) with CS (23 men and 29 women; 54 ± 10 y) were enrolled in the study. A final diagnosis of CS was made based on the guidelines which were recently revised by the Japanese Circulation Society in 2016. After establishing the diagnosis, all pts received corticosteroid therapy, which was initiated with 30 mg/day of predonisone, followed by gradual tapering over a period of 6-12 months to a maintenance dose of 5-10 mg/day. They underwent FDG PET/CT having a low carbohydrate diet with < 12-h overnight fasting and an injection of heparin. On the PET/CT fusion images, a standard uptake value (SUV) was obtained in the heart and ascending aorta to generate a target-to-background ratio (TBR).

RESULTS

Twenty-five pts had 2 serial PET scans, 10 had 3 serial scans, and 11 had more than 3 scans, resulting there were 151 PET scans.

The time interval between two serial scans was 9.8 ± 8.9 months (2 to 54 months). In 20 pts who were followed at baseline and within 6 months after the initiation of steroid therapy, TBRs significantly decreased from 4.95 ± 2.71 to 2.74 ± 1.30 (P < 0.0001). During the long-term follow-up (5.3 ± 1.9 years), there were 31 pts (59.6%) with adverse cardiac events (2 cardiac deaths; 14 arrhythmias which needed emergency treatment with implantable devices; and 15 hospital admissions due to severe heart failure, while 21 pts remained stable or were improved clinically. In 7 pts, inflammatory exacerbation appeared with an increase in TBR. Eventually, there were smaller percent reduction in TBR among the pts with adverse events than those without (19.9 ± 41.5 vs. 51.9 ± 18.2, P = 0.04).

CONCLUSION

Cardiac events of serious consequences appeared in the majority of patients with cardiac sarcoidosis (CS) during the long-term follow-up of corticosteroid therapy. FDG PET could detect cardiac inflammatory process, hence it would be a predictive biomarker for prognosis of CS.

CLINICAL RELEVANCE/APPLICATION

Adverse cardiac events appeared in the majority of patients with cardiac sarcoidosis (CS) during the long-term follow-up of steroid therapy. FDG PET could detect inflammatory process, hence it would be a predictive biomarker of prognosis of CS.

SSC10-08 Detection and Monitoring of Cardiac and Extra-Cardiac Thoracic Sarcoidosis Using F-18 FLT PET/CT: Comparison with F-18 FDG PET/CT

Monday, Nov. 27 11:40AM - 11:50AM Room: S505AB

Participants
Takashi Norikane, Kita-gun, Japan (*Presenter*) Nothing to Disclose
Yuka Yamamoto, MD, PhD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukito Maeda, Kita-gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Takahisa Noma, Kita-gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroaki Dobashi, MD, Kita-gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Nishiyama, MD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

F-18 FDG (FDG) PET has been proposed to play a role in the diagnosis and therapeutic monitoring of sarcoidosis. However, assessing inflammatory lesions in cardiac sarcoidosis using FDG can be challenging because of normal myocardium uptake. The purpose of this study was to compare the uptake of 3'-deoxy-3'-18F-fluorothymidine (FLT) and FDG in the evaluation of detection and monitoring of cardiac and extra-cardiac thoracic sarcoidosis.

METHOD AND MATERIALS

FLT and FDG PET/CT studies were performed in 20 patients with newly diagnosed sarcoidosis. A follow-up PET/CT scan was also performed after immunosuppressive therapy in 5 patients. The patients had fasted for at least 18 h before FDG PET/CT, but were given no special dietary instructions before FLT PET/CT. Uptake of FLT and FDG was examined visually and semiquantitatively using maximal standardized uptake value (SUVmax).

RESULTS

Two patients had cardiac sarcoidosis, 7 had extra-cardiac thoracic sarcoidosis, and 11 had both cardiac and extra-cardiac thoracic sarcoidosis. Before therapy, 4/20 FDG scans for cardiac region were visually rated as inconclusive because FDG pattern was diffuse, whereas no FLT scans were rated as inconclusive. The sensitivity of FDG PET/CT for detection of cardiac lesions was 85% and the specificity, 100%. The corresponding values for FLT PET/CT were 92% and 100%, respectively. The mean FDG SUVmax of cardiac lesions was significantly higher than that of FLT SUVmax (P<0.005). Before therapy, both FDG and FLT PET/CT detected all 24 extra-cardiac lesions. The mean FDG SUVmax of extra-cardiac lesions was significantly higher than that of FLT SUVmax (P<0.001). After therapy, 3/5 FDG scans for cardiac region were visually rated as inconclusive, whereas no FLT scans were rated as inconclusive. The mean FDG SUVmax and FLT SUVmax of both cardiac and extra-cardiac lesions after therapy were lower than those of before therapy.

CONCLUSION

These findings suggest that FLT PET/CT could detect and monitor cardiac and extra-cardiac thoracic sarcoidosis as well as FDG PET/CT.

CLINICAL RELEVANCE/APPLICATION

FLT PET/CT could detect and monitor cardiac and extra-cardiac thoracic sarcoidosis as well as FDG PET/CT.

SSC10-09 Z-Score for Cardiac Transthyretin Amyloidosis (ATTR)

Monday, Nov. 27 11:50AM - 12:00PM Room: S505AB

Participants
Diego Cecchin, MD, Padova, Italy (*Presenter*) Research Grant, The Piramal Group
Sara Gusella, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesca Girardi, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessia Basso, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Spimpolo, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Davide Poggiali, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Filippo Crimi, MD, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Valentina Bodanza, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Pietro Zucchetta, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Salvalaggio, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Chiara Briani, MD, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Franco Bui, MD, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

diego.cecchin@unipd.it

PURPOSE

Definitive diagnosis of cardiac involvement in Transthyretin amyloidosis (ATTR) requires myocardial biopsy, that is invasive, expensive and it may be complicated by adverse events. Although scintigraphy, using bisphosphonates, has been proposed as an accurate method for the detection of myocardial TTR amyloid load, a consensus on scan interpretation is lacking. Purpose of the present study is to overtake the qualitative analysis using a semi-quantitative approach to easily and objectively classify the degree of myocardial amyloid load in ATTR patients.

METHOD AND MATERIALS

N.6939 99mTc-MDP bone scans, consecutively performed at our Institution, for oncological or rheumatologic conditions (2012-2016), were retrospectively reviewed, using qualitative inspection, to identify those displaying any cardiac uptake. A visual score (Perugini et. al1) and a heart-to-soft tissue (mid-thigh) semi-quantitative uptake ratio have been assigned to the selected scans. A group of 65 healthy controls (HC) (i.e. no cardiac uptake / visual score 0) have been used for comparison and Z-score creation.

RESULTS

N. 56/6939 (0.8%) patients (41M/15F) aged 79±7.35 years showed significant cardiac uptake of 99mTc-MDP on visual inspection. N.39 (70%) were assigned a visual score 1, N.14 (25%) a score 2 and 3 (5%) a score 3. The mean proposed semi-quantitative ratio was 3.8±1.5 for visual score 1, 8.6±3.1 for visual score 2 and 15.9±3.3 for visual score 3. The HC group patients (visual score 0) showed a ratio of 2.75 ± 0.7. Mean calculated Z-Score using HC group as reference was 1.54 for visual score 1, 7.94 for visual score 2 and 17.07 for score 3.

CONCLUSION

The proposed heart-to-mid-thigh semi-quantitative ratio proved to be an easy method to quantify the cardiac uptake of 99mTc-MDP. Z-score showed a good correlation with the score proposed by Perugini et. al and it could offer a more quantitative approach than visual analysis. Further investigations, including genetic analysis, will be needed to help identify amyloid subtypes namely wild-type ATTR (ATTRwt) or genetic ATTR, the latter susceptible of therapeutic options.

CLINICAL RELEVANCE/APPLICATION

Transthyretin-cardiac amyloidosis is rare and underdiagnosed. Early detection is increasingly important in light of the emerging therapies. 99mTc-bisphosphonate tracers have proved highly sensitive for a noninvasive diagnosis

RSNA 2017 Explore. Invent. Transform.
103rd Scientific Assembly and Annual Meeting
November 26 to December 1
McCormick Place, Chicago
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CHS-MOA

Chest Monday Poster Discussions

Monday, Nov. 27 12:15PM - 12:45PM Room: CH Community, Learning Center

CH

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

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

Sub-Events

CH232-SD-MOA1 MR Imaging Characteristics of Thymic Epithelial Tumors: Correlation with WHO Histological Classification and New TNM

Station #1

Participants
Asako Kuhara, Kurume, Japan (*Presenter*) Nothing to Disclose
Kiminori Fujimoto, MD, PhD, Kurume, Japan (*Abstract Co-Author*) Nothing to Disclose
Akiko Sumi, MD, Kurume, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsushi Kawaguchi, Kurume, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomohiro Ebata, Kurume, Japan (*Abstract Co-Author*) Nothing to Disclose
Shuji Nagata, MD, Kurume, Japan (*Abstract Co-Author*) Nothing to Disclose
Naoko Ikehara, MD, Kurume, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshi Abe, MD, Kurume, Japan (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

kuhara_asako@med.kurume-u.ac.jp

PURPOSE

To clarify preoperative magnetic resonance (MR) imaging characteristics of thymic epithelial tumors (TETs) correlated with the World Health Organization (WHO) histological classification updated in 2015 and the TNM staging system proposed by IASLC/ITMIG, and with patients clinical outcome.

METHOD AND MATERIALS

A total of 107 patients with a TET underwent MR imaging before surgery were retrospectively reviewed. Histological subtype of the TET was determined according to the WHO classification. MR imaging features were categorized into 11 findings and into 2 dynamic contrast-enhanced patterns independently by two radiologists. We assessed whether these MR findings which correlated with histological subtypes, TNM staging, and patient outcome.

RESULTS

There were 86 thymomas and 21 thymic carcinomas (83 stage I tumors and 24 stage II-IV tumors). There was statistically significant relationship between WHO histological classification and tumor invasiveness (chi-square, $P < .001$). A univariate logistic regression model showed that invasive tumors (i.e., stage II to IV) were more likely to have one or more MR findings of presence of irregular tumor contour, intra-tumoral hypo-signal intensity on T2-weighted image, irregular boundary with the lung, and/or adjacent chest wall change (all, $P < .05$). A multivariable analysis revealed that the findings of irregular tumor contour, irregular boundary with the lung, and/or adjacent chest wall change were significantly associated with invasive tumor, and these imaging factors correlated with disease specific survivals (all, $P < .05$).With dynamic contrast-enhanced pattern, type B3 thymomas and thymic carcinomas were more likely to have a gradually signal increase pattern, but other subtypes showed a rapidly signal increase with early peak pattern ($P < .05$).

CONCLUSION

MR imaging characteristics of TETs correlated with the 2015 WHO histological subtypes and new TNM staging, and might be helpful in the prediction of prognosis.

CLINICAL RELEVANCE/APPLICATION

MR imaging characteristics of TETs correlated with the 2015 WHO histological subtypes and new TNM staging, and might be helpful in the prediction of prognosis.

CH233-SD-MOA2 Association between Lung Attenuation Parameters, Exacerbations and Lung Function Tests in Cystic Fibrosis Adult Patients

Station #2

Participants
Cristina Utrilla, MD, Madrid, Spain (*Presenter*) Nothing to Disclose
Alicia Linares Beltran, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Macarena Lerin, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

Carlos J. Carpio Segura, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Concepcion Prados Sanchez, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Isabel Torres Sanchez, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

cristinautrilla@hotmail.com

PURPOSE

To assess the relationship between attenuation parameters measured by volumetric lung computed tomography (MDCT) and lung function, in subjects with cystic fibrosis (CF).

METHOD AND MATERIALS

55 patients (32 men) with CF, 32.3 ± 12.4 years, 22.2 ± 2.9 kg / m2, FEV1 2,182.2 ± 1010 ml, were selected. Paired inspiratory/expiratory MDCT scans, in absence of exacerbation, with postprocessing of the quantitative data for evaluation of total lung volume (TLV), high attenuation (HAV) and low attenuation areas (LAV), percentage of emphysema (E%) and bulla index (BI) were performed. Demographic and microbiological data ere collected. Lung function measured as dynamic lung volumes and dyspnea grade (mMRC) were also measured.

RESULTS

HAV (high attenuation volume) on inspiration correlates with exacerbations (r = 0.449, p = 0.004), severe exacerbations (r = 0.734, p <0.001) and dyspnea (r = 0.564, p <0.001). Expiratory HAV correlates with exacerbations (r = 0.389, p = 0.014), severe exacerbations (r=0.645, p <0.001) and dyspnea (r = 0.393, p = 0.013). LAV (low attenuation volume) on expiration (r = 0.533, p <0.001), E% (r = 0.458, p = 0.004) and BI (bulla index) (r = 0.442, p = 0.004) correlated with dyspnea level. FEV1 showed inverse correlation with inspiratory mean lung density (r = -0.325, p = 0.41), with inspiratory HAV (r = -0.556, p <0.001), expiratory HAV (r = -0.396; p = 0.013), expiratory LAV (r = -0.409, p = 0.010), E% (r = -0.460, p = 0.004) and BI (r = -0.397, p = 0.011). Patients with FEV1 <50% pred showed correlation with inspiratory HAV, expiratory LAV, E% and BI (p <0.005). All significant variables were introduced into a logistic regression model, which retained as independent predictor of greater limitation inspiratory HAV and BI.

CONCLUSION

Exacerbations in patients with CF, as well as respiratory function impairment correlate with changes in lung attenuation parameters measured by volumetric MDCT.

CLINICAL RELEVANCE/APPLICATION

There is an association between lung attenuation parameters measured by MDCT, exacerbations and lung function tests results in adult patients with cystic fibrosis. MDCT information could help in the management of CF patients.

CH234-SD-MOA3 MR Imaging of Airway Mucus Contrasts as a Tool to Diagnose Allergic Bronchopulmonary Aspergillosis in Cystic Fibrosis

Station #3

Participants
John Refait, Bordeaux, France (*Presenter*) Nothing to Disclose
Gael Dournes, MD, PhD, Pessac, France (*Abstract Co-Author*) Nothing to Disclose
Michael Fayon, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Patrick Berger, MD, PhD, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Julie Macey, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Michel Montaudon, MD, Pessac, France (*Abstract Co-Author*) Nothing to Disclose
Francois H. Laurent, MD, Pessac, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of the study was to assess the diagnostic accuracy of mucus contrast characterization using MRI to discriminate allergic broncho-pulmonary aspergillosis (ABPA) in cystic fibrosis (CF).

METHOD AND MATERIALS

The study was approved by the local Ethic Committee and all patients or their parents gave written informed consent. 110 consecutive CF patients were screened between January 2014 and July 2015. All patients underwent a non-contrast enhanced MR protocol including routine T1-weighted and T2-weighted sequences. Presence of mucus with both high T1 and low T2 signal intensities, the so-called IMIS(Inverted Mucoid Impaction Signal) sign was qualitatively and quantitatively assessed by 2 physicians blinded for any other data. The Gold Standard to diagnose ABPA was the criteria by the Cystic Fibrosis Foundation Consensus Conference. ABPA status was followed-up during 1 year. Reproducibility was assessed using kappa test, correlation using Spearman coefficient and diagnostic accuracy by calculating IMIS sensitivity and specificity.

RESULTS

108 CF patients were included (mean age=20±11; range=minimum 6 to maximum 53-year-old), 18 with and 90 without ABPA. At the lobar level, inter and intra-reader reproducibility was very good (kappa>0.90). IMIS had a 94% [73, 99] sensitivity and 100% specificity [96, 100] to diagnose ABPA. A complete resolution of IMIS was observed in ABPA patients after 3-months of specific treatment that was significantly correlated with decrease in total IgE level (rho=0.47; p=0.04).

CONCLUSION

IMIS sign was both specific and sensitive to diagnose ABPA in CF. Allergic fungal inflammation appear to induce characteristic modifications of mucus contrasts which are assessable by using a non-invasive, contrast-free and radiation-free method.

CLINICAL RELEVANCE/APPLICATION

Advances in knowledge - Using non-contrast enhanced MRI, IMIS was 100% [96; 100] specific and 94% [73; 99] sensitive to diagnose ABPA in CF. Implications for patient care - Lung MRI is specific and sensitive to diagnose ABPA in CF and thus, may be a tool to assist clinicians in discriminating those patients who may benefit from an ABPA treatment amongst polymicrobial

inflammations. Summary statement: Since ABPA diagnosis requires a combination of criteria including imaging, this study suggests that IMIS is a valuable alternative to HAM for CF patient care, without concern onr radiationdose cumulation during lifelong management.

CH235-SD-MOA4 Diagnostic Performance of Computer-Aided Detection (CAD) Systems for Lung Cancer Screening CT using Synthesized Pulmonary Nodules

Station #4

Participants
Ziwei M. Zhang, MD, PhD, Durham, NC (*Presenter*) Research Consultant, 12 Sigma Technologies; Stock options, 12 Sigma Technologies
Marthony Robins, BSc, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Kingshuk Choudhury, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Michael Peterson, BS, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Christopher D. Calixte, BS, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Justin B. Solomon, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Ehsan Samei, PhD, Durham, NC (*Abstract Co-Author*) Research Grant, General Electric Company; ; Research Grant, Siemens AG; ; Advisory Board, medInt Holdings, LLC
Jared D. Christensen, MD, Durham, NC (*Abstract Co-Author*) Advisory Board, Riverain Technologies, LLC

For information about this presentation, contact:

zzhang003@gmail.com

PURPOSE

To evaluate lung nodule detection performance of three lung CAD systems as stand-alone reader devices with synthesized hybrid lung cancer screening CT data.

METHOD AND MATERIALS

This IRB-approved study assessed CAD performance for lung nodule detection and characterization utilizing a 3D hybrid data set of 100 clinical low-dose screening chest CT exams with a total of 360 computer-generated pulmonary nodules ranging in size, composition, number, and location (Table 1). Three CAD systems were independently tested with manufacturer default parameters: Syngo.Via (vVB 10B, Siemens Healthcare), Aquarius iNtuition viewer (v4.4.11, TeraRecon, Foster City, CA), and Sigma Discover-Lung (v1.0, 12 Sigma Technologies, San Diego, CA). Testing output included nodule detection, size and composition. Detection accuracy, sensitivity, false positive, and true negative rates for each CAD system were calculated. Multivariate analysis was performed to evaluate the effect of nodule size and composition.

RESULTS

Nodule detection sensitivities varied by CAD system (Table 2): Sigma Discover-Lung (75.0%*), Syngo.Via (53.1%), and iNtuition (27.5%). False positive rates for Sigma Discover-Lung and Syngo.Via were similar (0.30 and 0.34, respectively) while the FP rate for iNtuition was significantly higher (1.41*). True negative (TN) rates: Sigma Discover-Lung (85%), Syngo.Via (75%) and iNtuition (20%). Multivariate analysis demonstrated CAD performance significantly improved with increasing nodule size (OR=1.35/mm*) and decreased with subsolid composition. Sigma Discover-Lung performed significantly better than other systems for ground-glass nodule detection (76.7%*) vs Syngo.Via (12.5%) and iNutition (5.0%). *p<0.0001

CONCLUSION

CAD systems utilized as a stand-alone reader for lung cancer screening CT vary in performance based upon nodule size and composition. Sigma Discover-Lung, a deep-learning CAD, demonstrated best overall detection sensitivity for all nodule composition and sizes, but especially for ground-glass and small nodules.

CLINICAL RELEVANCE/APPLICATION

Deep-learning CAD systems may improve accuracy and sensitivity of lung nodule detection for CT lung cancer screening with particular advantages for subsolid and small nodules.

CH115-ED-MOA6 Update of the Fleischner Society Guidelines for Incidental Nodule Management: Answers to Frequently Asked Questions - Solid Pulmonary Nodules

Station #6

Awards
Identified for RadioGraphics

Participants
Juliana M. Bueno, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Luis A. Landeras, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Jonathan H. Chung, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

julianabueno.m@gmail.com

TEACHING POINTS

The Fleischner Society recently updated the criteria for follow-up of incidental solid pulmonary nodules, expanding the flexibility of ordering clinicians in the decision making process and individualizing management of specific lesions. This increased latitude in patient management may introduce new challenges for radiologists After reviewing this exhibit, the learner will be able to: 1. Recognize the most recent modifications to the Fleischner guidelines for incidental solid pulmonary nodules 2. Identify specific situations encountered that may represent a challenge in the decision making process when applying the revised guidelines 3. Apply the new guidelines for solid nodule management with a better understanding of the recent modifications

TABLE OF CONTENTS/OUTLINE

1. New guidelines for pulmonary nodule management: past versus new modifications 2. Potential practical challenges when applying

new guidelines Clinical risk factors that are most significant Appropriate nodule measurement Morphologically suspicious nodules < 6 mm in low risk patients Solid nodules < 6mm in high risk patients: when to consider the "optional" follow-up? Multiple solid nodules > 6mm: can 3-month stability be a false source of reassurance? 3. Answers to these situations for optimal utilization of new management guidelines

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Jonathan H. Chung, MD - 2013 Honored Educator

CH004-EB-MOA Imaging Signs of Chronic Pulmonary Thromboembolism: The Story So Far

Hardcopy Backboard

Participants
Supriya Gupta, MD, Augusta, GA (*Abstract Co-Author*) Nothing to Disclose
Hanzhou Li, Augusta, GA (*Abstract Co-Author*) Nothing to Disclose
Jayanth H. Keshavamurthy, MBBS, Augusta, GA (*Abstract Co-Author*) Nothing to Disclose
Ashwin P. Rao, MD, Augusta, GA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

riya10.in@gmail.com

TEACHING POINTS

Purpose of this exhibit is to: 1. Review the definition, risk factors, significance, and natural history of chronic pulmonary thromboembolism 2. Describe the imaging plethora associated with chronic pulmonary thromboembolism including cardiac, vascular, and pulmonary findings 3. Review the clinical spectrum, stages and corresponding imaging features on CT 4. Briefly discuss the implications of underdiagnosis of chronic pulmonary thromboembolism and the importance of its education in radiology residency

TABLE OF CONTENTS/OUTLINE

1. Introduction of Chronic Pulmonary Thromboembolism 2. Imaging Review of Chronic Pulmonary Thromboembolism a. Cardiac findings b. Vascular findings c. Pulmonary findings d. Mediastinal changes 3. Case-based review of interesting cases of Chronic Pulmonary Thromboembolism 4. Implications of underdiagnosis of chronic pulmonary thromboembolism and importance of its education in radiology residency

CHS-MOB

Chest Monday Poster Discussions

Monday, Nov. 27 12:45PM - 1:15PM Room: CH Community, Learning Center

CH

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Carol C. Wu, MD, Houston, TX (*Moderator*) Author, Reed Elsevier

Sub-Events

CH238-SD-MOB2 SOS Lung Cancer Screening Program: Comparison of Digital Tomosynthesis and CT with an Updated Evaluation of the Last Results

Station #2

Participants
Gianluca Firullo, MD, Cuneo, Italy (*Presenter*) Nothing to Disclose
Maurizo Grosso, MD, Cuneo, Italy (*Abstract Co-Author*) Nothing to Disclose
Stephane Chauvie, PhD, Cuneo, Italy (*Abstract Co-Author*) Stockholder, Dixit srl
Luigi Ferro, Cuneo, Italy (*Abstract Co-Author*) Nothing to Disclose
Ilaria Baralis, Cuneo, Italy (*Abstract Co-Author*) Nothing to Disclose
Donatella Ghirardo, Cuneo, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Priotto, MD, Cuneo, Italy (*Abstract Co-Author*) Nothing to Disclose
Gabriele Gallarato, Cuneo, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of our study was to analyze and compare effective dose and accuracy of Digital Tomosynthesis (DTS) and chest CT in the detection of small lung nodules through a risk population included in a screening program called SOS, for early detection of lung cancer.

METHOD AND MATERIALS

This is a single arm observational study. All the 1843 enrolled patients were considered as high lung cancer risk population and satisfied some inclusion criteria: current or former smoker with more than 20 pack/years, 45-75 years old, negative anamnesis for cancer in the past 5 years and no previous chest CT scan. Patients underwent two DTS, one at baseline and the second after a year. If the baseline DTS showed a nodule with a diameter larger than 5 mm or multiple non-calcified nodules a CT with and without cobntrast medium was performed. Two radiologists reported DTS classifying and describing appearence and dimension of nodules.

RESULTS

132 patients were found positive with the detection of 208 nodules by the DTS and 179 by the CT. 11 patients were positive at the baseline DTS while negative at the CT. DTS were compared to the CT, considered as gold standard, coming out that true findings rate (TFR) was 72% and false findings rate (FFR) was 24%. Instead, negative findings rate (NFR) was 4% and consisted in nodule showed only by CT and not by DTS. Considering as relevant cut-off a nodule dimension of 5 mm (evaluated with CT), TFR increased reaching 96%, while FFR and NFR decreased and were both 2%. ROC (receiver operator characteristics) curves, representing the detection rate of the two methodics, showed an Area Under Curve of 89% for CT (AUC 0,890; 95% C.L. 0,835-0,945) and 80% for DTS (AUC 0,803; 95% C.L. 0,719-0,887). Therefore CT has a slight benefit in lung tumor detection than DTS. The calculation of mean effective dose was 0,09+/-0,04 mSv for DTS and 4,90+/-1,20 mSv for CT.

CONCLUSION

DTS could be a valid alternative to CT for the detection of lung cancer nodules, with good and comparable results in the evaluation of nodules larger than 5 mm. Furthermore DTS allows a lower radiation exposure than CT, resulting as an admittable option for screening program in high risk population for lung cancer.

CLINICAL RELEVANCE/APPLICATION

DTS can play a efficient role in lung cancer screening program because of its lower dose, cost and examination time.

CH239-SD-MOB3 Evaluation of Ultra-Low Dose 4-D Dynamic Ventilation Volume CT Using an Interval Acquisition in Obstructive Pulmonary Diseases

Station #3

Participants
Yinghao Xu, Beijing, China (*Presenter*) Nothing to Disclose
Hongliang Sun, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jing Wen, MD, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Hua Zhang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

xuyinghao@toshiba-medical.com.cn

xuyinghao@toshiba-medical.com.cn

PURPOSE

To investigate the feasibility of reducing radiation dose for dynamic airway evaluation with ventilation volume CT.

METHOD AND MATERIALS

32 subjects highly suspected to have chronic obstructive pulmonary disease (COPD) or other obstructive diseases were enrolled in this study. All subjects were randomly divided into 2 groups and underwent dynamic ventilation volume CT. Group A with 16 subjects was examined using a continuous acquisition protocol: 100kVp, 50mA, 0.35s gantry rotation, and 160mm z-axis coverage for the thoracic trachea to the proximal bronchi; group B with other 16 subjects adopted an interval acquisition (0.35s between intervals) protocol and lowered the tube current to 20mA as to maximally reduce the radiation dose. Images were scanned during a forceful exhalation and reconstructed using AIDR3D in 0.5mm thickness. In the axial section of upper, middle, lower, and mediastinum of lung, ten rounded ROIs were placed by two experienced radiologists on bilateral lung parenchyma (Cp) and an additional ROI was placed on the aorta(Ca). For each ROI, the CT value and the value of noise SD (N) on the reconstructed image were measured, and the CNR=(Cp -Ca)/N was calculated for quantitative evaluation of the image quality. Qualitative image quality was rated on mentioned positions of lung by two radiologists for graininess, lung parenchyma, artifacts, and the overall image quality with a 5-point scale. DLP for both groups were recorded and converted to effective dose (k=0.014) for comparison.

RESULTS

For quantitative image assessment, the CNR of -19.5 of group A was mildly higher than that of -22.9 of group B ($P<0.001$), and for qualitative image evaluation, group A obtained a slightly higher scale than that of group B ($P<0.001$). Both group images were sufficient for rendering clinical diagnosis possible. The mean effective dose of 0.95mSv in group B was nearly 60% less than that of 2.4mSv in group A.

CONCLUSION

Using an interval acquisition protocol and lowering the tube current for dynamic ventilation volume CT can significantly reduce the radiation dose and maintain a comparable good image quality for diagnosis.

CLINICAL RELEVANCE/APPLICATION

A submillisievert low dose dynamic ventilation volume CT can be achieved using an interval acquisition protocol with reduced tube current, and the image quality can meet the requirement for diagnosis in COPD.

CH241-SD-MOB5 Reconstructed Field of View Affects CT-based Pulmonary Airway Wall Metrics and Must be Accounted for in Assessments of Male-Female Differences

Station #5

Participants
Amin Motahari, PhD, Iowa City, IA (*Presenter*) Nothing to Disclose
Eric A. Hoffman, PhD, Iowa City, IA (*Abstract Co-Author*) Founder, VIDA Diagnostics, Inc; Shareholder, VIDA Diagnostics, Inc; CT Advisory Board, Siemens AG;
Wenda Tu, Iowa City, IA (*Abstract Co-Author*) Nothing to Disclose
Jered Sieren, Coralville, IA (*Abstract Co-Author*) Director, Vida Diagnostics, Inc
David W. Kaczka, MD,PhD, Iowa City, IA (*Abstract Co-Author*) CEO, Oscillavent, Inc; Stockholder, Oscillavent, Inc; Medical Advisory Board, Monitor Mask Inc; Stockholder, Monitor Mask Inc
Alejandro Comellas, MD, Iowa City, IA (*Abstract Co-Author*) Nothing to Disclose
Graham Barr, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Meilan K. Han, Ann Arbor, MI (*Abstract Co-Author*) Consultant, Boehringer Ingelheim GmbH; Consultant, GlaxoSmithKline plc; Consultant, Novartis AG; Consultant, AstraZeneca PLC; Consultant, Sunovion; Royalties, UpToDate, Inc
Kung-Sik Chan, Iowa City, IA (*Abstract Co-Author*) Nothing to Disclose
Juerg Tschirren, MS, Coralville, IA (*Abstract Co-Author*) Shareholder, VIDA Diagnostics, Inc
John D. Newell JR, MD, Iowa City, IA (*Abstract Co-Author*) Research Consultant, Siemens AG; Research Grant, Siemens AG; Consultant, VIDA Diagnostics, Inc; Stock options, VIDA Diagnostics, Inc; Consultant, GlaxoSmithKline plc
Jeffrey Curtis, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Christopher B. Cooper, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

eric-hoffman@uiowa.edu

PURPOSE

It is well-established that gender has a significant effect on airway wall thickness. Males tend to have thicker airway walls than their female counterpart. However, in analyzing the role of reconstructed computed tomographic (CT) display field of view (DFOV) on airway wall thickness within the NIH sponsored subpopulations and intermediate outcome measures in COPD study (SPIROMICS) we have identified that this gender effect is confounded with the thickening of airway wall metrics with increased DFOV.

METHOD AND MATERIALS

2818 baseline full inspiratory CT data sets were evaluated within SPIROMICS (smokers and nonsmokers with a full range of COPD status, 40-80 years, 46% Females). Airway wall thickness is selected as the response variable. A generalized Additive Model(GAM) is adopted for the analysis which, compared to the commonly used multi-variate regression, is more robust and flexible in modeling nonlinear relationships between the response variable and its predictors. Two models with DFOV and without DFOV are implemented to see the confounding effect on gender differences. Moreover, Age, Race, BMI, Weight, Height, Scan site, and GOLD status are also considered as confounders in the model.

RESULTS

A total of 22 spatially matched airway segments are analyzed across all subjects. The table depicts the percentage decrease of airway wall thickness for females using males as the baseline before and after adjustment for DFOV. Gender effect is reduced for all segments after adjusting for DFOV, even though the effect varies across different airways, on average adjustment for DFOV reduces the effect of gender by 49.8%. In the case of tracheal wall thickness, the adjusted R2 is increased from 62% to 76% which implies that adding DFOV as a confounder leads to a better model fit.

CONCLUSION

Although females have thinner airway walls, the effect is halved when the measurement are corrected for DFOV.

CLINICAL RELEVANCE/APPLICATION

DFOV of CT reconstructions must be taken into account when assessing population differences in airway wall thickness and when assigning clinical meaning to measures of airway wall thickness.

CH150-ED-MOB6 Post-treatment Complications in Esophageal Cancer: Common and Unexpected CT Imaging Findings

Station #6

Participants
Joan Albert Prat-Matifoll, MD , Barcelona, Spain (*Presenter*) Nothing to Disclose
Richard Mast, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Carmen Parra-Farinas, MD , Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Sandra Castro-Boix, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Laura B. Cabanzo Campos, MD, PhD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Xavier Guri Azogue, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Esteban Ramirez, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
David Armario, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Xavier Merino-Casabiel, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

joanalbertpratrx@gmail.com

TEACHING POINTS

-To review tomographic characteristics of esophageal tumors and esophageal surgeries -To provide a plain short list of CT findings to describe the most common and the most unexpected complications after surgeries/treatments of esophageal tumors

TABLE OF CONTENTS/OUTLINE

A. Main types of tumor and surgery: Ivor Lewis procedure, McKeown procedure, left thoracoabdominal approach, transhiatal esophagectomy, and different forms of bypass surgery B. Complications: CTs performed in the emergency department from april 2013 to may 2017 were reviewed, yielding 50 esophageal emergencies, of which we selected the top 20 most unexpected esophageal emergencies -Tumoral complications and invasion of neighbouring structures: 1.Hemorrhage (Case Nº1) 2.Invasion of neighbouring structures (Nº2) 3.Injury to the tracheobronchial tree (Nº3) -Complications after chemotherapy/radiotherapy: 1.Osteoradionecrosis (Nº4) 2.Tracheomalacia (Nº5) 3.Radiation neumonitis(Nº6) 4.Cavitation (Nº7) -Complications after surgery: 1.Anastomotic leak and mediastinitis (Nº8) 2.Prosthetic complications (Nº9,10,11) 3.Conduit ischaemia(Nº12) 4.Lung complications (Nº13,14) 5.Cardiovascular complications (Nº15) 6.Recurrent laryngeal nerve injury(Nº16) 7.Thoracic duct lesions (Nº17) 8.Tumor recurrence (Nº18) 9.Postsurgical herniations (Nº19) -Other complications(Nº20)

CH221-ED-MOB7 Fibrotic Interstitial Lung Disease: Stepwise Method of Interpretation

Station #7

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Arun C. Nachiappan, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
John T. Debardeleben, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Sharyn I. Katz, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Eduardo J. Mortani Barbosa, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

arun.nachiappan@uphs.upenn.edu

TEACHING POINTS

1. Radiologists and trainees can follow a simple stepwise approach to accurately interpret diffuse lung disease on high resolution computed tomography, which can otherwise be very confusing. 2. Patient history is the first step, such as age, smoking history, connective tissue disease and smoking history. 3. Identifying the predominant type of HRCT pattern is the next step, and these include reticular, nodular, groundglass opacity, consolidation, and honeycombing. 4. One can differentiate between interstitial lung diseases further, to a large degree, based on distribution of extent of findings and relative symmetry of findings between left and right lungs, which are the third and fourth steps. 5. NSIP and UIP are more lower lobe predominant, while sarcoidosis and chronic hypersensitivity pneumonitis (CHP) have substantial upper lobe involvement, whereas CHP and NSIP can have peribronchovascular predominance of findings. UIP, NSIP and sarcoidosis are more symmetric than CHP.

TABLE OF CONTENTS/OUTLINE

• HRCT Stepwise Method • Step 1: Patient History • Step 2: Type of HRCT pattern • Step 3: Distribution of extent of findings • Step 4: Relative symmetry of findings • Search Pattern • Associated Findings • Cases: Challenging cases of Diffuse Lung Disease made easy to interpret • Multidisciplinary conference: Examples of case discussions • Summary

RSNA 2017 Explore. Invent. Transform.
103rd Scientific Assembly and Annual Meeting
November 26 to December 1
McCormick Place, Chicago
Explore Invent Transform

MSCT21

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

Monday, Nov. 27 1:30PM - 3:00PM Room: S100AB

CH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

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

For information about this presentation, contact:

dlitmano@bidmc.harvard.edu

Sub-Events

MSCT21A Thoracic Manifestations of Pediatric Systemic Disorders

Participants
Edward Y. Lee, MD, MPH, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Edward.Lee@childrens.harvard.edu

LEARNING OBJECTIVES

1) Discuss clinical presentation of children with thoracic manifestations of systemic disorders. 2) Learn current imaging techniques for evaluating children with systemic disorders. 3) Review characteristic thoracic imaging findings of children with systemic disorders.

ABSTRACT

This will be an interactive session with case presentations of thoracic manifestations of pediatric systemic disorders. The cases will be presented as unkowns with audience response. Examples of important pediaric systemic disorders which have thoracic manifestations will be included.

MSCT21B Diffuse Lung Disorders

Participants
Diane C. Strollo, MD, Gibsonia, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Provide an overview of diffuse lung disorders in adults, to include idiopathic, rheumatologic, smoking and inhalational, eosinophilic and miscellaneous etiologies. 2) Recognize pertinent findings on chest radiography. 3) Review thin section lung anatomy on CT and the characteristic imaging features of common and unique diffuse lung diseases. 4) Incorporate relevant clinical data to help focus the differential diagnosis. 5) Suggest when to consider biopsy or other interventions in confounding cases.

ABSTRACT

This will be an interactive session with case presentations of diffuse lung diseases in adults. Cases will be presented as unknowns with audience response. Examples of common and characteristic diffuse lung diseases will be included.

MSCT21C Infectious Disorders

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

LEARNING OBJECTIVES

1) Discuss the findings of infection in immunocompetent hosts and use those to arrive at a diagnosis or focused differential. 2) Discuss the findings of infection in immunocompromised hosts and use those to arrive at a diagnosis or focused differential. 3) Describe various presentations of atypical mycobacterial disease in the lungs.

ABSTRACT

This will be an interactive session with case presentation of thoracic infections. Cases will be presented as unknowns with audience response. Examples of common and uncommon thoracic infections will be included.

MSCT21D Non-vascular Mediastinal Disorders

Participants
Theresa C. McLoud, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

mcloud.theresa@mgh.harvard.edu

LEARNING OBJECTIVES

1) Understand the important anatomical components of the mediastinum. 2) Identify and localize mediastinal abnormalities on standard radiography and CT. 3) Develop and prioritize differential diagnoses of non vascular mediastinal masses and other lesions. 4) Learn the accepted management guidelines. 5) Understand the role of MRI in the diagnosis of mediastinal masses and other abnormalities.

ABSTRACT

This will be an interactive session with case presentations of mediastinal lesions. The cases will be presented as unkowns with audience response. Examples of common and unusual non vascular lesions will be included.

MSMC23

Cardiac CT Mentored Case Review: Part III (In Conjunction with the North American Society for Cardiovascular Imaging) (An Interactive Session)

Monday, Nov. 27 1:30PM - 3:00PM Room: S406A

CA CH CT

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants

Jill E. Jacobs, MD, New York, NY (*Director*) Nothing to Disclose
Elliot K. Fishman, MD, Baltimore, MD (*Moderator*) Institutional Grant support, Siemens AG; Institutional Grant support, General Electric Company; Co-founder, HipGraphics Inc;
U. Joseph Schoepf, MD, Charleston, SC (*Moderator*) Research Grant, Astellas Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; Consultant, Guerbet SA; ; ;

For information about this presentation, contact:

efishman@jhmi.edu

schoepf@musc.edu

LEARNING OBJECTIVES

1) Identify cardiac and coronary artery anatomy. 2) Recognize cardiac disease processes, including coronary atherosclerosis, as diagnosed on CT. 3) Understand methods of cardiac CT and coronary CT angiography post-processing. 4) Understand the role of coronary artery calcium scoring. 5) understand the role of Cardiac CTA in coronary artery pathologies including aneurysms, fistulae and other anomalies.

Sub-Events

MSMC23A Pulmonary Veins and Pericardial Disease

Participants
Harold I. Litt, MD, PhD, Philadelphia, PA (*Presenter*) Research Grant, Siemens AG ; Research Grant, Heartflow, LLC; ;

LEARNING OBJECTIVES

1) Describe normal versus anomalous pulmonary venous anatomy. 2) Understand the imaging findings of complications of ablation for atrial fibrillation. 3) Describe abnormalities of the pulmonary veins identifiable on routine CT. 4) Identify the most common pericardial abnormalities evaluated with CT.

MSMC23B Coronary Atherosclerosis III

Participants
Elliot K. Fishman, MD, Baltimore, MD (*Presenter*) Institutional Grant support, Siemens AG; Institutional Grant support, General Electric Company; Co-founder, HipGraphics Inc;

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

The goal of this session is to learn how to interpret pathology involving the coronary arteries beyond the detection of coronary artery stenosis. Focus on exam acquisition protocols, study interpretation protocols, and minimizing radiation dose are addressed. Specific topics addressed will also include coronary artery aneurysm, myocardial bridging, anomalous coronary arteries as well as vasculitis. Potential pitfalls will be addressed and pearls for study optimization will also be discussed.

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/ Elliot K. Fishman, MD - 2012 Honored EducatorElliot K. Fishman, MD - 2014 Honored EducatorElliot K. Fishman, MD - 2016 Honored Educator

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SSE05

Chest (Emphysema and Airways)

Monday, Nov. 27 3:00PM - 4:00PM Room: S404CD

BQ CH CT

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Patricia J. Mergo, MD, Jacksonville, FL (*Moderator*) Nothing to Disclose
David A. Lynch, MBBCh, Denver, CO (*Moderator*) Research support, Siemens AG; Research Consultant, PAREXEL International Corporation; Research Consultant, Boehringer Ingelheim GmbH; Research Consultant, F. Hoffmann-La Roche Ltd; Research Consultant, Veracyte, Inc;

Sub-Events

SSE05-01 A Thin Walled Small Lumen CT-Based Airway Phenotype Identified within the SPIROMICS Cohort

Monday, Nov. 27 3:00PM - 3:10PM Room: S404CD

Participants
Amin Motahari, PhD, Iowa City, IA (*Presenter*) Nothing to Disclose
Eric A. Hoffman, PhD, Iowa City, IA (*Abstract Co-Author*) Founder, VIDA Diagnostics, Inc; Shareholder, VIDA Diagnostics, Inc; CT Advisory Board, Siemens AG;
Juerg Tschirren, MS, Coralville, IA (*Abstract Co-Author*) Shareholder, VIDA Diagnostics, Inc
Graham Barr, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
David W. Kaczka, MD,PhD, Iowa City, IA (*Abstract Co-Author*) CEO, Oscillavent, Inc; Stockholder, Oscillavent, Inc; Medical Advisory Board, Monitor Mask Inc; Stockholder, Monitor Mask Inc
Jered Sieren, Coralville, IA (*Abstract Co-Author*) Director, Vida Diagnostics, Inc
Alejandro Comellas, MD, Iowa City, IA (*Abstract Co-Author*) Nothing to Disclose
Meilan K. Han, Ann Arbor, MI (*Abstract Co-Author*) Consultant, Boehringer Ingelheim GmbH; Consultant, GlaxoSmithKline plc; Consultant, Novartis AG; Consultant, AstraZeneca PLC; Consultant, Sunovion; Royalties, UpToDate, Inc
John D. Newell JR, MD, Iowa City, IA (*Abstract Co-Author*) Research Consultant, Siemens AG; Research Grant, Siemens AG; Consultant, VIDA Diagnostics, Inc; Stock options, VIDA Diagnostics, Inc; Consultant, GlaxoSmithKline plc
Christopher B. Cooper, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Curtis, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

eric-hoffman@uiowa.edu

PURPOSE

We have sought to understand the role of reconstructed computed tomographic (CT) field of view (DFOV) on airway wall thickness within the NIH sponsored subpopulations and intermediate outcome measures in COPD study (SPIROMICS). In doing so, we have identified a subphenotype with thin walled small lumen (TWSL) central airways. We explored the clinical and demographic differences between the TWSL and non-TWSL groups.

METHOD AND MATERIALS

2937 baseline full inspiratory (TLC) and expiratory (RV) CT data sets were evaluated within the full SPIROMICS cohort of smokers with and without COPD and non-smokers. A scatter plot of wall thickness vs. DFOV was plotted for the trachea and right mainstem bronchus (RMB). Two distinct clusters were identified at each location. A linear discriminator algorithm was used to calculate the line separating two clusters. 426 TWSL vs. non-TWSL clinical and demographic comparisons were made via t-tests using conservative Bonferroni correction to keep significance level at $p < .05$. The same method was used to compare CT density-histogram-based measurements.

RESULTS

The line separating TWSL vs. non-TWSL is: WT (mm) = 6.24e-03 DFOV (mm) + 7.77e-02. Subjects below the line at the trachea or the RMB are termed: TWSL. 118 (4%) of subjects were TWSL at the trachea. An additional 932 ((118+932)/2937=35%) were TWSL at RMB. Amongst the 426 clinical and demographic comparisons between RMB-TWSL vs non-TWSL, 103 were significant. The lumen area between TLC and RV was more stable in the TWSL group. The TWSL group is female dominant (P=1.66E-15), six minute walk distance is less (P=4.43E-12) BMI is greater. (P=1.52E-41). Other differentiators include: History of asthma, FEV1, BODE Index, and MRC-defined shortness of breath, all of which are greater in TWSL. The TWSL group had significantly more dense lung regions (>-650HU) and less CT-defined emphysema (<-950Hu) compared with the non-TWSL group.

CONCLUSION

TWSL subjects within the smoking population differentiate from non-TWSL both demographically as well as clinically. The TWSL group have significant airway pathology-associated symptoms coupled with less emphysema and a greater portion of dense lung.

CLINICAL RELEVANCE/APPLICATION

A thin walled and small lumen (TWSL) airway phenotype has been identified which, in a smoking population, is distinct in terms of

demographics, clinical pathophysiology and CT-density characteristics.

SSE05-02 Predictors of Treatment Response in COPD Patients at 1-Year Follow-Up: Value of Advanced CT Quantification

Monday, Nov. 27 3:10PM - 3:20PM Room: S404CD

Awards
Student Travel Stipend Award

Participants
Hyo Jung Park, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sang Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyung-Hyun Do, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae-Woo Song, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Coreline Soft, Inc
Joon Beom Seo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

happyeahj@gmail.com

PURPOSE

To investigate predictive factors of treatment response in COPD patients at 1-year follow-up using advanced quantitative CT analyses.

METHOD AND MATERIALS

This retrospective study was approved by the institutional review board with waiver of informed consent. 258 patients (240 men and 18 women; mean age, 66.0 years ± 8.0) were selected from Korean Obstructive Lung Disease (KOLD) cohort, who underwent baseline chest CT, initial and 1-year follow-up pulmonary function test (PFT) during treatment. Patients received combined inhalation of long-acting beta-agonist and corticosteroid. From volumetric CT data, emphysema index, airway trapping index (ATI), and small airway parameter (AWT-Pi10) using both full-width-half-maximum (FWHM) and integral-based half-band (IBHB) methods were obtained. ATI measurements were acquired by using thresholds of -856HU on expiratory CT (ATI_-856) and by using co-registration (ATI_emphysema, ATI_hyperinflated, ATI_normal, respectively). The clinically meaningful treatment response was defined as an absolute increase of at least 0.225L on follow-up PFT. Multiple logistic regression analysis was performed to identify predictive factors of treatment response

RESULTS

Treatment responders were 41 patients (15.9%). The mean increase in FEV1 was 0.38 ± 0.17 L. Univariate analysis showed that age, initial 6-minite walk distance (6MWD), initial DLCO, emphysema index, ATI_emphysema and Pi10_IBHB were significantly different between patients with and without treatment response (P= 0.008. 0.001, 0.002, 0.004, 0.001 and <0.001, respectively). Multivariate analysis revealed that 6MWD and Pi10_IBHB were independent variables predictive of FEV1 increase (P= 0.001 and <0.001, respectively). The adjusted odds ratio was 1.008 (95% CI, 1.003-1.012) and 5.439 (95% CI, 2.069-14.301) respectively. Receiving operating characteristic curve showed that area under the curve of these two variables was 0.715.

CONCLUSION

Accurate measurement of Pi10 by IBHB methods may help predict treatment outcome of COPD at 1-year follow-up.

CLINICAL RELEVANCE/APPLICATION

Application of advanced CT quantification with acute measure of small airway dimension has been shown to accurately evaluate treatment outcome of COPD; thus, it can be considered to be used in routine clinical practice.

SSE05-03 Inspiratory/Expiratory Xenon-Enhanced Area-Detector CT (ADCT): Utility for Regional Ventilation, Pulmonary Functional Loss and Clinical Stage Evaluations of in Smokers

Monday, Nov. 27 3:20PM - 3:30PM Room: S404CD

Participants
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Toshiba Medical Systems Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Fuji Pharma Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
Yasuko Fujisawa, MS, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation
Yuji Kishida, MD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinichiro Seki, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation
Naoki Sugihara, MEng, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation
Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation
Wakiko Tani, RT, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Erina Suehiro, RT, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshinori Sekitani, MS, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Negi, RT, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Hisashi Tachizaki, Tustin, CA (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation

For information about this presentation, contact:

yosirad@kobe-u.ac.jp

PURPOSE

To evaluate the utility of xenon (Xe) ventilation assessment on inspiratory/expiratory Xe-enhanced area-detector CT (ADCT) for regional ventilation, pulmonary functional loss and clinical stage evaluations in smokers.

METHOD AND MATERIALS

Forty consecutive smokers prospectively underwent inspiratory/expiratory xenon-enhanced ADCT examinations as well as pulmonary function tests. Then, all smokers were classified by GOLD classification based pulmonary function test results. Each CT data was transferred to our proprietary software to generate Xe wash-in (WI), wash-in/wash-out (=WI/WO) ratio and ventilation (=[WI-WO]/WI) ratio maps between inspiratory/expiratory CT scans by pixel-by-pixel analyses. According to the previous study, each pixel within the lung was divided into three lesion groups as follows: normal lung, functional small airway disease (fSAD) and emphysema. To determine regional ventilation differences, each Xe ventilation index was compared three groups by Tukey's HSD test. To evaluate the capability for pulmonary function loss assessment, step-wise regression analyses were performed among all Xe ventilation indexes and pulmonary function test results such as %FEV1 and FEV1/FVC%. Finally, discrimination analysis was performed to determine the concordance capability for GOLD stage classification was also determined.

RESULTS

WI and ventilation ratio had significant difference among three lesion groups ($p<0.05$) and WI/WO ratio of emphysema had significant difference with that of others ($p<0.05$). %FEV1 ($r2=0.71$, $p<0.05$) and FEV1/FVC% ($r2=0.71$, $p<0.05$) were significantly affected by ventilation ratio as 1st step and WI as 2nd step. With all Xe ventilation indexes, the concordance capability for GOLD classification was determined as 87.5 (35/40) %.

CONCLUSION

Xenon ventilation assessment on inspiratory/expiratory xenon-enhanced ADCT was useful for regional ventilation, pulmonary functional loss and clinical stage evaluations in smokers.

CLINICAL RELEVANCE/APPLICATION

Xenon ventilation assessment on inspiratory/expiratory xenon-enhanced ADCT was useful for regional ventilation, pulmonary functional loss and clinical stage evaluations in smokers.

SSE05-04 Visual Emphysema Pattern Using the Fleischner Society Classification System Is Independently Associated with Mortality in Cigarette Smokers

Monday, Nov. 27 3:30PM - 3:40PM Room: S404CD

Participants
David A. Lynch, MBBCh, Denver, CO (*Presenter*) Research support, Siemens AG; Research Consultant, PAREXEL International Corporation; Research Consultant, Boehringer Ingelheim GmbH; Research Consultant, F. Hoffmann-La Roche Ltd; Research Consultant, Veracyte, Inc;
Camille Moore, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
Carla G. Wilson, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
Dipti V. Nevrekar, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Theodore B. Jennermann, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Stephen Humphries, Denver, CO (*Abstract Co-Author*) Research Consultant, PAREXEL International Corporation; Research Consultant, Veracyte, Inc
John H. Austin, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Philippe A. Grenier, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Hans-Ulrich Kauczor, MD, Heidelberg, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Bayer AG; Speakers Bureau, Boehringer Ingelheim GmbH; Speakers Bureau, Siemens AG; Speakers Bureau, Koninklijke Philips NV; Speakers Bureau, Bracco Group; Speakers Bureau, AstraZeneca PLC;
Meilan K. Han, Ann Arbor, MI (*Abstract Co-Author*) Consultant, Boehringer Ingelheim GmbH; Consultant, GlaxoSmithKline plc; Consultant, Novartis AG; Consultant, AstraZeneca PLC; Consultant, Sunovion; Royalties, UpToDate, Inc
Elizabeth A. Regan, MD,PhD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
Barry J. Make, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
Russell Bowler, MD, PhD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
Terri H. Beaty, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas C. Everett, PhD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
John Hokanson, MPH, PhD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Curtis, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Edwin K. Silverman, MD, PhD, Boston, MA (*Abstract Co-Author*) Grant, GlaxoSmithKline plc; Travel support, GlaxoSmithKline plc ; Speaker, Novartis AG;
James D. Crapo, MD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Visual categorization of pattern of emphysema on CT has been shown to correlate with symptomatic impairment. However, the relationship between pattern of emphysema and mortality has not previously been evaluated.

METHOD AND MATERIALS

Of the first 4000 subjects consecutively enrolled in the COPDGene study, 3171 had availability of both visual CT scores and survival information. Trained research analysts performed visual classification of parenchymal emphysema, paraseptal emphysema, and airway wall thickening, on baseline volumetric CT scans of these subjects using the Fleischner Society classification system. Each scan was independently evaluated by two analysts; discordances between analysts were adjudicated by a thoracic radiologist. Severity of emphysema was evaluated quantitatively using % low attenuation < -950 HU (LAA-950). Median duration of follow-up was 6.9 years (range 30 days to 8.5 years). Regression analysis of the relationship between imaging patterns and survival was based on the Cox proportional hazards model, with adjustment for age, race, gender, height, weight, pack-years of cigarette smoking, current smoking status, educational level, and LAA-950, and (in a second model) FEV1.

RESULTS

Observer agreement for presence and pattern of parenchymal emphysema was good to excellent. There were 519 deaths in the group. Compared with subjects who did not have visible emphysema, mortality was significantly greater in those with all grades of CLE (except for trace), with adjusted hazard ratios of 1.8 for mild centrilobular emphysema, 2.5 for moderate centrilobular emphysema, 4.8 for confluent emphysema, and 3.8 for advanced destructive emphysema. This increased mortality persisted after further adjustment for LAA-950 and FEV1, except for those with advanced destructive emphysema.

CONCLUSION

The presence and pattern of parenchymal emphysema according to the Fleischner Society grading system is associated with significantly increased mortality risk, independent of the quantitative severity of disease measured by LAA-950.

CLINICAL RELEVANCE/APPLICATION

Visual evaluation of emphysema pattern is an important novel marker of mortality risk.

SSE05-05 Reconstructed Field of View Affects CT-based Pulmonary Airway Wall Metrics and Must be Accounted for in Assessments of Male-Female Differences

Monday, Nov. 27 3:40PM - 3:50PM Room: S404CD

Participants
Amin Motahari, PhD, Iowa City, IA (*Presenter*) Nothing to Disclose
Eric A. Hoffman, PhD, Iowa City, IA (*Abstract Co-Author*) Founder, VIDA Diagnostics, Inc; Shareholder, VIDA Diagnostics, Inc; CT Advisory Board, Siemens AG;
Wenda Tu, Iowa City, IA (*Abstract Co-Author*) Nothing to Disclose
Jered Sieren, Coralville, IA (*Abstract Co-Author*) Director, Vida Diagnostics, Inc
David W. Kaczka, MD,PhD, Iowa City, IA (*Abstract Co-Author*) CEO, Oscillavent, Inc; Stockholder, Oscillavent, Inc; Medical Advisory Board, Monitor Mask Inc; Stockholder, Monitor Mask Inc
Alejandro Comellas, MD, Iowa City, IA (*Abstract Co-Author*) Nothing to Disclose
Graham Barr, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Meilan K. Han, Ann Arbor, MI (*Abstract Co-Author*) Consultant, Boehringer Ingelheim GmbH; Consultant, GlaxoSmithKline plc; Consultant, Novartis AG; Consultant, AstraZeneca PLC; Consultant, Sunovion; Royalties, UpToDate, Inc
Kung-Sik Chan, Iowa City, IA (*Abstract Co-Author*) Nothing to Disclose
Juerg Tschirren, MS, Coralville, IA (*Abstract Co-Author*) Shareholder, VIDA Diagnostics, Inc
John D. Newell JR, MD, Iowa City, IA (*Abstract Co-Author*) Research Consultant, Siemens AG; Research Grant, Siemens AG; Consultant, VIDA Diagnostics, Inc; Stock options, VIDA Diagnostics, Inc; Consultant, GlaxoSmithKline plc
Jeffrey Curtis, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Christopher B. Cooper, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

eric-hoffman@uiowa.edu

PURPOSE

It is well-established that gender has a significant effect on airway wall thickness. Males tend to have thicker airway walls than their female counterpart. However, in analyzing the role of reconstructed computed tomographic (CT) display field of view (DFOV) on airway wall thickness within the NIH sponsored subpopulations and intermediate outcome measures in COPD study (SPIROMICS) we have identified that this gender effect is confounded with the thickening of airway wall metrics with increased DFOV.

METHOD AND MATERIALS

2818 baseline full inspiratory CT data sets were evaluated within SPIROMICS (smokers and nonsmokers with a full range of COPD status, 40-80 years, 46% Females). Airway wall thickness is selected as the response variable. A generalized Additive Model(GAM) is adopted for the analysis which, compared to the commonly used multi-variate regression, is more robust and flexible in modeling nonlinear relationships between the response variable and its predictors. Two models with DFOV and without DFOV are implemented to see the confounding effect on gender differences. Moreover, Age, Race, BMI, Weight, Height, Scan site, and GOLD status are also considered as confounders in the model.

RESULTS

A total of 22 spatially matched airway segments are analyzed across all subjects. The table depicts the percentage decrease of airway wall thickness for females using males as the baseline before and after adjustment for DFOV. Gender effect is reduced for all segments after adjusting for DFOV, even though the effect varies across different airways, on average adjustment for DFOV reduces the effect of gender by 49.8%. In the case of tracheal wall thickness, the adjusted R2 is increased from 62% to 76% which implies that adding DFOV as a confounder leads to a better model fit.

CONCLUSION

Although females have thinner airway walls, the effect is halved when the measurement are corrected for DFOV.

CLINICAL RELEVANCE/APPLICATION

DFOV of CT reconstructions must be taken into account when assessing population differences in airway wall thickness and when assigning clinical meaning to measures of airway wall thickness.

SSE05-06 Distribution and Change of Parametric Response Map in Patients with Chronic Obstructive Pulmonary Disease: Cross-Sectional and Longitudinal Aspects

Monday, Nov. 27 3:50PM - 4:00PM Room: S404CD

Participants
Cherry Kim, MD, Ansan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Min Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jooae Choe, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyung-Hyun Do, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae-Woo Song, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Coreline Soft, Inc
Joon Beom Seo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

sangmin.lee.md@gmail.com

sanghlim.lee.md@gmail.com

PURPOSE

To evaluate distribution and change of emphysema and regional air trapping by parametric response mapping (PRM) in chronic obstructive pulmonary disease (COPD) patients according to cross-sectional and longitudinal aspects .

METHOD AND MATERIALS

Inspiration and expiration CT scans from 224 subjects (mean age, 65.3 years; M : F = 214 : 10) in COPD cohorts were acquired at baseline and 3 years from the baseline. PRM was performed in all CT scans and classified lung parenchyma as normal (PRMNormal), emphysematous (PRMEmph), and functional small airway disease (PRMfSAD) using the co-registration method of inspiration and expiration CTs and two thresholds (-950 HU and -856 HU). Calculation of the center of distribution that is the median value for both axes and principal eigenvector of the data determined by the principal component analysis were obtained in each patient. After obtaining the center of distribution on CT at baseline and 3years, we indicated disease progression as a vector from the centroid at baseline to the centroid at 3 years per patient.

RESULTS

The distribution of GOLD stages at baseline were stage I in 31 patients, stage II in 121 patients, stage III in 63 patients, and stage IV in 9 patients. At 3 years follow-up, there were stage I in 36 patients, stage II in 116 patients, stage III in 52 patients, and stage IV in 7 patients. On based on pulmonary function tests, 147 patients (65.6%) showed stable GOLD stage while there were aggravation in 26 patients (11.6%) and improvement 38 patients (17.0%), respectively. Principal eigenvectors at baseline and 3 years from the baseline showed the tendency that fSAD was a transitional phase from normal parenchyma to emphysema. The vectors from the centroid at baseline to the centroid at 3 years per patient also demonstrated that functional small airway disease precedes emphysema.

CONCLUSION

PRM of chest CT in COPD patients appears to be a valuable tool in understanding disease progression and evaluating disease status.

CLINICAL RELEVANCE/APPLICATION

Cross-sectional and longitudinal analyses of COPD patients with parametric response map may provide supporting evidences that functional small airway disease precedes emphysema.

SSE06

Emergency Radiology (Chest and Forensic Radiology)

Monday, Nov. 27 3:00PM - 4:00PM Room: N228

CH CT ER

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Zachary S. Delproposto, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose
Savvas Nicolaou, MD, Vancouver, BC (*Moderator*) Institutional research agreement, Siemens AG

Sub-Events

SSE06-01 Clinical Postmortem Computed Tomography Can Demonstrate the Cause of Death or Guide the Autopsy

Monday, Nov. 27 3:00PM - 3:10PM Room: N228

Participants
Lianne Sonnemans, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Mathias Prokop, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG; Speakers Bureau, Bracco Group; Speakers Bureau, Toshiba Medical Systems Corporation; Research Grant, Toshiba Medical Systems Corporation;
Willemijn M. Klein, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

Lianne.Sonnemans@radboudumc.nl

PURPOSE

To investigate the potential of postmortem CT (pmCT) to improve the clinical diagnosis of cause of death.

METHOD AND MATERIALS

86 cadavers underwent whole-body pmCT before conventional autopsy. Radiologists and pathologists were blinded to each other's results and compiled their own reports. Differences in the number of correctly identified clinical diagnoses, prior and post pmCT, as to the cause of death, type of pathology and anatomical system involved, were investigated by McNemar tests, with autopsy as the reference standard.

RESULTS

Using pmCT, the number of correctly identified causes of death, type of pathology and anatomical system involved increased from 53% to 64% (p=0.05), from 65% to 83% (p=0.001) and from 65% to 84% (p=0.001) respectively. The subgroup of cardiovascular causes of death showed almost the lowest sensitivity (54%) for cause of death after pmCT, but the most significant increase in sensitivity for anatomical system, from 62% to 82% (p=0.02) using pmCT.

CONCLUSION

Postmortem CT significantly improves clincial diagnosis as to the cause of death. If the exact cause of death is uncertain after pmCT, radiologists can indicate a particular region of interest, directing pathologists, which in turn may be able to reduce the invasiveness of a conventional autopsy.

CLINICAL RELEVANCE/APPLICATION

Due to decreasing autopsy rates, determination of cause of death relies heavily on clinical assessment. Postmortem CT significantly improves clinical diagnosis as to the cause of death. Used as a pre-autopsy screening, it may be able to reduce the invasiveness, or eliminate entirely, a conventional autopsy.

SSE06-02 Role of CT in the Personal Identification of Cadavers in Mass Disaster: Our Experience in Shipwrecked Migrants

Monday, Nov. 27 3:10PM - 3:20PM Room: N228

Awards
Student Travel Stipend Award

Participants
Federica Vernuccio, MD, Palermo, Italy (*Presenter*) Nothing to Disclose
Ambra Di Piazza, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Salvatore Serraino, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Laura Scopelliti, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Elena Murmura, MD, Sciacca, Italy (*Abstract Co-Author*) Nothing to Disclose

Dario Picone, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Cristina Cattaneo, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Massimo Midiri, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonina Argo, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Sergio Salerno, PhD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Giuseppe Lo Re, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Lagalla, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

federicavernuccio@gmail.com

PURPOSE

To show the enormous contribution of CT in personal identification of migrants in the deadliest Mediterranean shipwreck occurred in April 2015, when a boat with about 700 migrants hoping to reach Sicily drowned off Libyan waters.

METHOD AND MATERIALS

In July 2016, 149 body bags of cadavers of the about 700 migrants were scanned through an 8-channels mobile CT placed next to the tents where coroners, antropologists and police forces were performing forensic studies. One of the main efforts of the team was the personal identification of the migrants; the radiological tools for personal identification have been studied and assessed mixing the different figures' expertise.

RESULTS

The radiological CT tools that proved to be useful for personal identification were:- age estimation: evaluation of bone growth plates (clavicle, scapula, humerus, radium, ulna, pelvic bones, femur, tibia and fibula) and of dental growth (mainly the third molar)- sex determination: evaluation of residual genitalia and of pelvic bones (morphology and angles)- stature estimation through the measurement of long limb bones lenght as the distance between the highest point of the caput femoris and the lowest point of the medial condyle were measured-pre-existing pathological conditions (i.e. fractures, bone diseases)- dental profile assessment-personal belongings (i.e. wallet, razors)Thus, a radiological template to be used in this kind of mass disaster has been created.

CONCLUSION

CT provides an important contribution in personal identification of cadavers in mass disaster and the knowledge of its strenghts and limits in this field is mandatory when approaching to it.

CLINICAL RELEVANCE/APPLICATION

Presentation of the strenghts and limits of CT for personal identification in mass disaster showing its usefulness as added tool to anthropological and autoptic assessment for age estimation and sex determination.

SSE06-03 Thoraco-Abdominal Injuries of Manual and Load-Distributing Band Cardiopulmonary Resuscitation on Postmortem Computed Tomography

Monday, Nov. 27 3:20PM - 3:30PM Room: N228

Participants
Lianne Sonnemans, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Alireza Bayat, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mathias Prokop, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG; Speakers Bureau, Bracco Group; Speakers Bureau, Toshiba Medical Systems Corporation; Research Grant, Toshiba Medical Systems Corporation;
Willemijn M. Klein, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

Lianne.Sonnemans@radboudumc.nl

PURPOSE

To compare thoraco-abdominal post-resuscitation injuries between manual and load-distributing band (LDB) cardiopulmonary resuscitation (CPR) on postmortem Computed Tomography (CT).

METHOD AND MATERIALS

Patients with a thorax-abdomen postmortem CT, performed between July 2012 and December 2016, were classified into three groups: 1) deaths with LDB CPR, 2) deaths with manual CPR and 3) death without CPR. Patients with recent trauma, incomplete thorax-abdomen scanning procedures or below eighteen years of age were excluded. The scans were retrospectively reviewed for anterolateral and posterior rib fractures, sternal and vertebral fractures, pneumothorax, pleural fluid, hemothorax, epigastric effusion, abdominal free air and peri-organic abdominal fluid or hemorrhages. Chi-square and Mann-Whitney U tests were used to test for significant differences between the LDB and manual CPR group, and between the resuscitated and the non-resuscitated group.

RESULTS

The LDB group (n=38) showed more often (63% vs. 21%, p=0.001) a posterior rib fracture than the manual CPR group (n=29). Compared to the non-resuscitated group (n=58), the resuscitated group showed more often an anterolateral (88% vs. 9%, p<0.001) and posterior (45% vs. 0%, p<0.001) rib fracture, more anterolateral fractured ribs per patient (4 vs. 10, p=0.003), more often a sternal fracture (52% vs. 2%, p<0.001), epigastric effusion (42% vs. 7%, p<0.001) and less pelural fluid (14mm vs. 34mm, p=0.002), if present.

CONCLUSION

In unsuccessful resuscitations, the use of LDB CPR resulted in more posterior rib fractures than manual CPR. CPR in general, either manual or LDB, led to more rib and sternal fractures and more epigastric effusion.

CLINICAL RELEVANCE/APPLICATION

CPR leads to more fractures and organ injury than no CPR. Even more posterior rib fractures are observed when LDB CPR is used instead of manual CPR. Post-CPR injuries are comparable to high-energy trauma. This is important knowledge for caretakers of survivors, leading to more specific treatment and an argument to perform a CT scan in survivors.

SSE06-04 CCTA in Patients with Positive Troponin and Low Clinical Suspicion for ACS: A Useful Diagnostic Option to Exclude Obstructive CAD

Monday, Nov. 27 3:30PM - 3:40PM Room: N228

Awards
Student Travel Stipend Award

Participants
James P. Nugent, BSC, Vancouver, BC (*Presenter*) Nothing to Disclose
Jun Wang, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Luck J. Louis, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Tim O'Connell, MD, Meng, Vancouver, BC (*Abstract Co-Author*) President, Resolve Radiologic Ltd; CEO, Emtelligent Software Ltd; Speaker, Siemens AG
Graham Wong, MD, MPH, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Jacqueline Saw, MD, FRCPC, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Faisal Khosa, FFR(RCSI), FRCPC, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Patrick D. McLaughlin, FFR(RCSI), Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

jamespnugent@outlook.com

PURPOSE

Traditional algorithms in the management of ACS dictate that patients with a positive troponin should be admitted to hospital and undergo invasive coronary angiography (ICA). A recognized proportion of these patients will have no evidence of coronary artery disease (CAD) on ICA. In this study we report the CCTA findings in a carefully selected subgroup of patients with positive troponin who have low clinical suspicion for ACS.

METHOD AND MATERIALS

IRB approved retrospective analysis of 491 consecutive patients referred for CCTA between 04/04/2015 to 04/02/2017. All scans were performed on a dual source CT scanner in the emergency department of a level I trauma centre. Charts were reviewed for first positive troponin (TnI > 0.045 µg/L, Siemens Dimension Vista Flex® CTNI; Newark, USA) within 24 h prior imaging. 108 patients met inclusion criteria; 14 were excluded due to technical factors or substantial motion artifact. Statistical analysis was performed using Student's t-test with Prism 6 for Mac OS X version 6.0c (La Jolla, USA).

RESULTS

94 patients (55 men, 39 women) with a mean TnI of 2.22 ± 2.82 µg/L underwent CCTA an average of 4.8 ± 3.4 hours after a positive Tn test. Mean age was 54.2 14.6 yrs. CCTA demonstrated complete absence of CAD in 41 patients (44%; 22 M, 19 F). CAD with less than 25% stenosis was observed in 25 patients (27%; 10 M, 15 F). CAD with 25-50% stenosis was observed in 9 patients (10%; 8 M, 1 F). CAD with greater than 50% stenosis was observed in 19 patients (20%; 15 M, 4 F). Patients with greater than 50% stenosis were significantly older than patients with no CAD (47.6 vs. 59.1 yrs, p = 0.0073).

CONCLUSION

CCTA can be successfully used to exclude CAD in a carefully selected subgroup of patients with positive troponin with low clinical suspicion for ACS. In our study 44% of these low risk patients had no CAD and a further 27% of patients had CAD with less than 25% stenosis.

CLINICAL RELEVANCE/APPLICATION

Current management guidelines direct patients with positive troponin toward invasive catheter angiography. CCTA is a non-invasive alternative to image coronary arteries when the clinical picture suggests ACS is unlikely.

SSE06-05 Prognostic Value of CT Pulmonary Angiography (CTPA) Parameters in Acute Pulmonary Embolism (APE)

Monday, Nov. 27 3:40PM - 3:50PM Room: N228

Participants
Chiara Moroni, MD, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Maurizio Bartolucci, MD, florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Simone Vanni, MD, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Peiman Nazerian, MD, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Marco Bartolini, MD, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Vittorio Miele, MD, Florence, Italy (*Presenter*) Nothing to Disclose

PURPOSE

To correlate CTPA parameters with prognostic stratification of patients with APE

METHOD AND MATERIALS

We retrospectively evaluated 140 outpatients with symptomatic APE diagnosed with CTPA. Death or clinical deterioration at 30 days were the primary endpoint. CTPA were evaluated by two blinded readers for: quantitative obstruction of pulmonary arteries (using Qanadli score), right ventricle diameter/left ventricle diameter ratio (RVD/LVD) and diameters of pulmonary trunk, superior

cava vein, azygos vein and coronary sinus. We applied a multiple logistic regression analysis of CTPA parameters, (using the following measures: >9 mm for coronaric sinus, >10 mm for azigos vein, > 1,1 for RVD/LVD) to evaluate the association with right ventricle disfunction (RVD), measured by echocardiogram, and primary outcome.

RESULTS

20/140 patients (14,3%) experienced death or clinical deterioration. We didn't analyze superior cava vein diameter due to high interobserver variability. Multiple logistic regression analysis demonstrated a significative correlation between RVD/LVD >1,1 (OR 6,1 CI 95%2.1-18.5) and RVD. No association, however, was found between RVD and azygos vein and coronaric sinus diameters. Coronaric sinus diameter >9 mm (O 11,6 CI95% 2,5-52,7) significantly correlates with primary outcome.

CONCLUSION

In APE, RVD/LVD is as good as echocardiogram in predicting RVD. Coronaric sinus diameter correlates with risk of short-term adverse events.

CLINICAL RELEVANCE/APPLICATION

CT angiography parameters is as good as ecocardiogram in predictong right ventricle deterioration anche strongly correlates with short time adverse events.

SSE06-06 Recent Trends in Use of Coronary CT Angiography and Radionuclide Myocardial Perfusion Imaging in Emergency Department Patients with Chest Pain

Monday, Nov. 27 3:50PM - 4:00PM Room: N228

Participants
David C. Levin, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Laurence Parker, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Ethan J. Halpern, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Vijay M. Rao, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

david.levin@jefferson.edu

PURPOSE

Recent studies by Litt, Hoffmann, Goldstein, and others have shown that in patients presenting to Emergency Departments (EDs) with chest pain, using coronary CT angiography (CCTA) as the initial imaging test leads to shorter ED length of stay, shorter time to diagnosis, higher frequency of discharge from the ED, and lower costs, compared with standard therapy which commonly involves use of radionuclide myocardial perfusion imaging (MPI). There is no difference in outcomes. Our goal was to compare recent trends in use of these 2 imaging modalities in ED patients.

METHOD AND MATERIALS

We analyzed the nationwide Medicare Physician/Supplier Procedure Summary Master Files for 2006-2015. The CPT codes for CCTA and MPI were selected and procedure volumes were tabulated. Medicare's place-of-service codes were used to identify those exams done in EDs. Medicare's specialty codes were also used to determine the number of these exams done by radiologists and cardiologists.

RESULTS

In 2006, a total of 22,342 MPIs were done in Medicare ED patients. Except for a dip in 2010, volume remained relatively stable over the ensuing years and was virtually identical in 2015 (22,338) to its 2006 level. By comparison, in 2006 a total of 126 CCTAs were performed in Medicare ED patients. This number increased steadily in subsequent years and reached 1919 by 2015 (+1423%). The 2015 ratio of use of MPIs to CCTAs in EDs was 11.6 to 1. In 2015, radiologists interpreted 78% of ED MPIs and 83% of ED CCTAs. Cardiologists interpreted 21% of ED MPIs and 16% of ED CCTAs.

CONCLUSION

Volumes of MPIs done in ED patients with chest pain have remained relatively stable in recent years. CCTA volume has increased rapidly, but is still far below that of MPI. This is of concern in view of previous studies showing that CCTA is a more effective and efficient procedure in these ED patients. Radiologists appear to have a stronger presence than cardiologists in ED imaging of patients with suspected coronary artery disease.

CLINICAL RELEVANCE/APPLICATION

CCTA use is increasing rapidly in ED patients with chest pain, but it is still used much less frequently than MPI.

MSCT22

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

Monday, Nov. 27 3:30PM - 5:00PM Room: S100AB

CH VA

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

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

Sub-Events

MSCT22A Vascular Mediastinal Disorders

Participants
Patrick M. Colletti, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize common vascular mediastinal abnormalities, including aneurysm, dissection, and thrombosis. 2) Adjust timing to avoid biopsy or similar interventions in vascular lesions in the future.

ABSTRACT

The largest structures in the mediastinum are vascular, including the aorta, IVC, and pulmonary arteries and veins. Potential abnormalities include dilated, obstructed,and annomalous or collateral vessels. Thus, anuerysms, thrombosis, and occlusions and collateral vssels are occasionally noted. It is most important to identify vascular abnormalities in order to avoid inappropriate biopsies.

Active Handout:Patrick M. Colletti

http://abstract.rsna.org/uploads/2017/17000466/Active MSCT22A.pdf

MSCT22B Neoplastic Disorders

Participants
Jeremy J. Erasmus, MD, Houston, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jerasmus@mdanderson.org

LEARNING OBJECTIVES

1) Better understand thoracic neoplastic disorders including lung cancer, esophageal cancer and malignant mesothelioma. 2) Be able to discuss the common and uncommon manifestations of intrathoracic malignancies. 3) Be able to advise colleagues on the use of CT, PET/CT and MR imaging in the evaluation and TNM staging of patients with intrathoracic malignancies. 4) Be conversant with the common dilemmas and pitfalls in staging.

ABSTRACT

Neoplastic disease in the thorax including primary malignancies (non-small cell lung cancer, esophageal cancer, malignant pleural mesothelioma) and metastasis are commonly encountered in clinical practice and can have a wide range of imaging manifestations. CT is almost typically used to diagnose, stage and assess treatment response in patients with intrathoracic malignancies. FDG-PET and MR imaging compliment conventional CT assessment and improve the accuracy of staging. This talk will review cases that elucidate the appropriate use of imaging in patients with intrathoracic malignancies as well as pitfalls in assessment and staging issues and dilemmas encountered in clinical practice.

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/ Jeremy J. Erasmus, MD - 2015 Honored Educator

MSCT22C Large Airway Disorders

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

For information about this presentation, contact:

ellakaz@umich.edu

LEARNING OBJECTIVES

1) To better understand the spectrum of abnormalities that involve the large airways. 2) To learn advanced imaging techniques used to evaluate the large airways. 3) To learn the radiologic manifestations of the most common large airway lesions.

ABSTRACT

Diseases of the central tracheobronchial tree are uncommon, challenging to detect radiographically and occur in a structure that is generally less well interrogated when interpreting chest radiographic images. Advanced imaging techniques on modern multidetector CT scanners with multiplanar and 3D renderings, dynamic and multiphasic examinations (inspiratory/expiratory) and virtual endoscopy, have advanced our ability to both detect and characterize large airway abnormalities. The 'large' airways are defined as the trachea through segmental bronchi, the larger structures residing within the mediastinum may be referred to as 'intramediastinal,' and the smaller structures are located within the lungs, referred to as 'intraparenchymal'. Congenital abnormalities are uncommon and often incidentally detected, including a tracheal bronchus and the rare accessory cardiac bronchus, bronchial atresia and rare congenital tracheal stenosis. Among aquired abnormalities, post intubation stenosis, tracheomegaly and the saber trachea are the most common centrally, and foreign body aspiration is the most common within the larger intraparenchymal airways. Less common acquired disease include primary malignancy and metastases, chronic inflammatory and granulomatous diseases such as tracheobronchomalacia, amyloidoisis, polychondritis, granulomamatosis with polyangitis and sarcoidosis and infection, such as tuberculosis. Once abnormalities are identified, careful demonstration and measurement of the extent of abnormality is important when considering surgical and / or endobronchial interventional therapeutic approaches.

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

MSCT22D MRI of the Mediastinum, Pleura, and Lungs

Participants
Jeanne B. Ackman, MD, Boston, MA (*Presenter*) Spouse, Stockholder, Everest Digital Medicine; Spouse, Consultant, Everest Digital Medicine; Spouse, Stockholder, Cynvenio Biosystems, Inc; Scientific Advisory Board, Cynvenio Biosystems, Inc; Consultant, PAREXEL International Corporation

LEARNING OBJECTIVES

1) Become more aware of thoracic MR's value as a problem solver in the thorax. 2) Understand how MR assists with tissue diagnosis. 3) Learn how MR can add diagnostic specificity beyond that of CT, assisting clinical management, guiding the thoracic surgeon, and preventing unnecessary diagnostic intervention/surgery.

ABSTRACT

This case review will highlight the value of MRI as a problem-solving tool in the thorax. It will demonstrate how MR's tissue diagnostic capability can yield diagnostic specificity beyond that of CT. When used appropriately and performed well, MR can increase diagnostic certainty, guide the thoracic surgeon with regard to clinical management and surgical approach, and prevent unnecessary diagnostic intervention and follow-up for mediastinal, pleural, and lung masses.

RSNA 2017 Explore. Invent. Transform.
103rd Scientific Assembly and Annual Meeting
November 26 to December 1
McCormick Place, Chicago
Explore Invent Transform

SPDL21

Chest and Abdomen (Case-based Competition)

Monday, Nov. 27 4:30PM - 6:00PM Room: E451B

CH GI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Paul J. Chang, MD, Chicago, IL (*Presenter*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Advisory Board, Bayer AG; Advisory Board, Aidoc Ltd; Advisory Board, McCoy
Neety Panu, MD, FRCPC, Thunder Bay, ON (*Presenter*) Nothing to Disclose
Ashley Altman, MD, Chicago, IL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

pchang@radiology.bsd.uchicago.edu

ashley.altman@uchospitals.edu

LEARNING OBJECTIVES

1) Be introduced to a series of radiology case studies via an interactive team game approach designed to encourage 'active' consumption of educational content. 2) 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) Receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance. *This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.*

ABSTRACT

The extremely popular audience participation educational experience, Diagnosis Live!, is an expert-moderated session featuring a series of interactive case studies that will challenge radiologists' diagnostic skills and knowledge. The session features a lively, fast-paced game format: participants will be automatically assigned to teams who will then use their personal mobile devices to test their knowledge in a fast-paced session that will be both educational and entertaining. After the session, attendees 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.

RSNA 2017 Explore. Invent. Transform.
103rd Scientific Assembly and Annual Meeting
November 26 to December 1
McCormick Place, Chicago
Explore Invent Transform

SPDL30

Keeping Radiology Weird: Spot Diagnoses from the Pacific Northwest (Case-based Competition)

Tuesday, Nov. 28 7:15AM - 8:15AM Room: E451B

CA CH MK NR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Fergus V. Coakley, MD, Portland, OR (*Moderator*) Founder, OmnEcoil Instruments, Inc; Shareholder, OmnEcoil Instruments, Inc
Bryan R. Foster, MD, Portland, OR (*Presenter*) Nothing to Disclose
Cristina Fuss, MD, Portland, OR (*Presenter*) Nothing to Disclose
David R. Pettersson, MD, Portland, OR (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

fussc@ohsu.edu

petterss@ohsu.edu

coakleyf@ohsu.edu

fosterbr@ohsu.edu

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.*

CS34

Chronic Thromboembolic Pulmonary Hypertension (CTEPH): The Under-Recognized Disease that all Radiologists Should Know About: Presented by Bayer

Tuesday, Nov. 28 8:30AM - 10:00AM Room: S105D

PARTICIPANTS

Chair: Carole Dennie, MD, Ottawa, Canada; Albert Hsiao, MD, San Diego, CA; Bernhard Meyer, MD, Hannover, Germany; Deepa Gopalan, MD

CME

The Course does not offer CME credit

Sub-Events

CS34A **What Is CTEPH, Why Does It Matter, and Who is at Risk?**

PARTICIPANTS

Carole Dennie, MD, Ottawa, Canada

CS34B **CTEPH: How You Can Help to Make This Crucial Diagnosis**

PARTICIPANTS

Albert Hsiao, MD, San Diego, CA

CS34C **Role of Imaging in Guiding Treatment Approaches for CTEPH**

PARTICIPANTS

Bernhard Meyer, MD, Hannover Germany

CS34D **What are the Future Imaging Modalities for CTEPH Diagnosis?**

PARTICIPANTS

Deepa Gopalan, MD

RSNA 2017 Explore. Invent. Transform.
103rd Scientific Assembly and Annual Meeting
November 26 to December 1
McCormick Place, Chicago
Explore Invent Transform

MSRO35

BOOST: Lung—Oncology Anatomy (An Interactive Session)

Tuesday, Nov. 28 8:30AM - 10:00AM Room: S103CD

CH OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Meng X. Welliver, MD, Columbus, OH (*Moderator*) Nothing to Disclose
Subba R. Digumarthy, MD, Boston, MA (*Presenter*) Nothing to Disclose
Henning Willers, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

sdigumarthy@partners.org

hwillers@partners.org

LEARNING OBJECTIVES

1) Teach radiological and cross sectional anatomy for planning radiation therapy. 2) Develop strategies to avoid radiation to sensitive organs. *New in 2017: PLEASE NOTE* - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

ABSTRACT

Common primary thoracic malignancies will be selected and important clinical aspects, anatomical aspects that influence management and treatment protocols will be highlighted

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

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

RC301

Lung Cancer Screening

Tuesday, Nov. 28 8:30AM - 10:00AM Room: E353C

CH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Caroline Chiles, MD, Winston-Salem, NC (*Moderator*) Advisory Board, ImBio, LLC

For information about this presentation, contact:

jerasmus@mdanderson.org

Sub-Events

RC301A Shared Decision Making and Smoking Cessation

Participants
Debra S. Dyer, MD, Denver, CO (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

DyerD@NJHealth.org

LEARNING OBJECTIVES

1) Identify who can provide Shared Decision Making and what documentation is required. 2) Identify options for Smoking Cessation services and what documentation is required. 3) Recognize optimal strategies for incorporating Shared Decision Making and Smoking Cessation services into a Lung Cancer Screening Program. 4) Identify current reimbursement for Shared Decision Making and Smoking Cessation Counseling.

RC301B Nodule Risk Predication and Stratification

Participants
James G. Ravenel, MD, Charleston, SC (*Presenter*) Consultant, Imbio, LLC

For information about this presentation, contact:

ravenejg@musc.edu

LEARNING OBJECTIVES

1) To understand various nodule prediction models as they pertain to lung cancer screening. 2) To describe how these prediction models can be utilized to help tailor patient follow up.

RC301C Nodule Management

Participants
Mylene T. Truong, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review nodule management strategies. 2) To understand risks and benefits of various management strategies. 3) To select management with incorporation of risk assessment. 4) To apply lung-RADs guidelines for nodule management. 5) To compare Lung-RADs with volume based model of NELSON. 6) To evaluate how nodules that do not fit into Lung-RADs are managed.

Honored Educators

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RC301D Atypical Screen-detected Lung Cancers

Participants
Caroline Chiles, MD, Winston-Salem, NC (*Presenter*) Advisory Board, ImBio, LLC

LEARNING OBJECTIVES

1) Recognize atypical presentations of screen-detected lung cancers.

RC301E Update on International Screening Trials

Participants

Mathias Prokop, PhD, Nijmegen, Netherlands (*Presenter*) Speakers Bureau, Bayer AG; Speakers Bureau, Bracco Group; Speakers Bureau, Toshiba Medical Systems Corporation; Research Grant, Toshiba Medical Systems Corporation;

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RC313

Pediatric Series: Chest/Cardiovascular Imaging

Tuesday, Nov. 28 8:30AM - 12:00PM Room: N226

CA CH MR PD VA

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.75

FDA Discussions may include off-label uses.

Participants
Robert J. Fleck JR, MD, Cincinnati, OH (*Moderator*) Nothing to Disclose
Shreyas S. Vasanawala, MD, PhD, Palo Alto, CA (*Moderator*) Research collaboration, General Electric Company; Consultant, Arterys Inc; Research Grant, Bayer AG;
Rajesh Krishnamurthy, MD, Columbus, OH (*Moderator*) Nothing to Disclose
David M. Biko, MD, Philadelphia, PA (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

Robert.Fleck@cchmc.org

bikod@email.chop.edu

Sub-Events

RC313-01 Imaging of Obstructive Sleep Apnea

Tuesday, Nov. 28 8:30AM - 8:50AM Room: N226

Participants
Robert J. Fleck JR, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Robert.Fleck@cchmc.org

Active Handout:Robert Joseph Fleck

http://abstract.rsna.org/uploads/2017/17000774/Active RC313-01.pdf

LEARNING OBJECTIVES

1) Describe the rational and usefulness that underlies cine MR imaging prior to surgery for obstructive sleep apnea. 2) Explain the anesthesia procedures for obtaining a safe, useful and accurate MRI during drug-induced sleep. 3) Construct an imaging protocol for your scanner. 4) Describe the typical findings of a study. 5) Synthesize the information from imaging into a report that will be helpful to the surgeon.

ABSTRACT

Obstructive sleep apnea (OSA) occurs in approximately 3% of the pediatric population and is usualy very treatable with tonsil and adenoidectomy. However, up to 25% of subjects may not be cured by this common, first line treatment. This is especially true in obese children and children with syndromes, especially Down syndrome. In patient with continued positive symptom review, polysomnography is indicated to confirm continued presence of OSA. Continuous positive airway pressure is the next step in treatment, but compliance is poor in some patient despite persistent attempts to help the patient adapt. Causes of continue airway obstruction during sleep include glossoptosis or hypopharygeal collapse from poor activation of the dilator muscles, recurrent adenoids, enlarged lingual tonsils and relative macroglossia. These can be addressed by removal of excess tonsil tissue, tongue reduction surgery, tongue suspension, or expansion pharyngoplasty. MR imaging can be critical to guide surgical planning.

RC313-02 Quantitative Characterization of Bronchopulmonary Dysplasia Severity Using Neonatal Pulmonary MRI and Correlation to Short-Term Outcomes

Tuesday, Nov. 28 8:50AM - 9:00AM Room: N226

Awards
Student Travel Stipend Award

Participants
Nara Higano, MS, Cincinnati, OH (*Presenter*) Nothing to Disclose
David Spielberg, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Robert J. Fleck JR, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Andrew Schapiro, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Laura Walkup, PhD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Andrew Hahn, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Jean A. Tkach, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Paul Kingma, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose

Stephanie Merhar, Cincinnati, OH (*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
Jason C. Woods, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

nara.higano@cchmc.org

PURPOSE

Bronchopulmonary dysplasia (BPD) is a serious pulmonary condition associated with premature birth, but the underlying parenchymal disease is poorly characterized, with unclear links between initial NICHD consensus severity diagnosis and clinical outcomes. This work relates MRI-based radiological scoring of structural parenchymal abnormalities in neonates to NICHD severity and short-term clinical outcomes, and demonstrates preliminary quantitative characterization of BPD severity via parenchymal intensity distributions.

METHOD AND MATERIALS

With IRB approval, 22 quiet-breathing neonates (11 severe BPD, 4 moderate, 4 mild, 3 non-BPD control; 27±3 wk birth PMA) underwent structural pulmonary MRI (ultrashort echo-time, UTE, TE~0.2ms; gradient echo, TE~2ms) in a NICU-sited, neonatal-sized 1.5T scanner, with no procedurally-ordered sedation. MRI-based BPD severity was scored by one radiologist with a modified Ochiai system (7 categories, range 0-14). Scores were compared to NICHD severity and short-term outcomes. Separately, whole-lung segmentations from UTE images for a cohort subset (5 severe; 2 moderate; 4 mild) and 1 additional term control yielded normalized lung intensity distributions, a measurement akin to volumetric density (range 0-1 g/cm3).

RESULTS

MRI scores correlate significantly with NICHD severity ($P<0.0001$, $R2=0.71$), respiratory support at discharge (room air, oxygen, ventilator, death; $P<0.0001$, $R2=0.84$), and length of hospital stay (slope=0.06[score]/day, $P<0.0001$, $R2=0.60$). Qualitatively, lung intensity distributions for controls demonstrated a homogenous peak at ~0.5 g/cm3 (expected in healthy newborns), with this peak broadening toward increased density with severity through moderate BPD (representative subjects shown in Figure); severe BPD subjects exhibited prominent low- and high-density regions, particularly for deceased subjects.

CONCLUSION

Pulmonary neonatal MRI can assess structural determinants of BPD without sedation or ionizing radiation, with predictive measurements for severity and short-term outcomes. Importantly, structural and regional quantification from MRI yields the ability to phenotype BPD, with the potential to personalize clinical care via serial evaluation.

CLINICAL RELEVANCE/APPLICATION

Pulmonary neonatal MRI can classify underlying features in infants with bronchopulmonary dysplasia and may provide image-based disease phenotyping with relationship to short-term outcomes.

RC313-03 Evaluation of Tracheobronchial Tree Using Three-dimensional Turbo Field Echo Magnetic Resonance Imaging Sequence

Tuesday, Nov. 28 9:00AM - 9:10AM Room: N226

Participants
Qiaoru Hou, MD, Shanghai, China (*Presenter*) Nothing to Disclose
Yumin Zhong, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

houqiaoru@163.com

PURPOSE

Tracheobronchial anomalies including tracheobronchial stenosis, tracheal bronchus, cardiac bronchus, and bronchial isomerism are common in congenital heart disease(CHD). It is necessary to assess tracheobronchial tree and make a preoperative airway evaluation.Our study intend to evaluate tracheobronchial tree using Three-dimensional Turbo Field Echo(3D-TFE) Magnetic Resonance Imaging Sequence

METHOD AND MATERIALS

Institutional Review Board exemption was obtained. Sixty-two consecutive children (32 males; mean age: 30 months, age range: 2-141 months) were enrolled from September 2016 to December 2016, who were diagnosed congenital heart disease by echocardiography.MR was performed to provide preoperative information about anatomy or/and function evaluation. 3D-TFE and 3D-B-TFE as well as CE-MRA sequences were performed to evaluate tracheobronchial anatomy. Image quality was objectively evaluated including contrast-to-noise ratio (CNR), signal intensity and tracheal-bronchial sharpness measurements. Two independent observers subjectively evaluated image quality and image noise using a 5-point scale.

RESULTS

The CNR and signal intensity of 3D-TFE(26.62±5.72, 539.92±54.17)in trachea was higher than that of 3D-B-TFE(9.39±3.09, 131.81±22.73) and CE-MRA(6.11±2.58, 63.30±11.85) (both $P<0.005$). The image quality scores of 3D-TFE(4.65±0.19) in tracheal-bronchial tree were also higher than those on 3D-B-TFE(3.83±0.20) and CE-MRA(2.64±0.31) ($P<0.005$). Tracheal-bronchial sharpness delineation of 3D-TFE was better than that of 3D-B-TFE and CE-MRA , and had significant difference.

CONCLUSION

3D-TFE had significantly higher CNR, signal intensity and image quality scores than 3D-B-TFE and CE-MRA. 3D-TFE can supply helpful information for preoperative strategies and postoperative follow-up.

CLINICAL RELEVANCE/APPLICATION

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RC313-04 Differing Pulmonary Structural Abnormalities Detected on MRI in Cystic Fibrosis Patients with Varying Pancreatic Function

Tuesday, Nov. 28 9:10AM - 9:20AM Room: N226

Participants
Mareen S. Kraus, MD, Tubingen, Germany (*Presenter*) Nothing to Disclose
Matthias Teufel, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Joachim Riethmuller, MD, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Esser, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Sven Schneeweiss, MD, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Nadja Selo, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Speakers Bureau, Bayer AG
Ilias Tsiflikas, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Juergen F. Schaefer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Cystic fibrosis (CF) patients with sufficient pancreatic function (PS) are known to exhibit milder lung disease compared to CF patients known to have insufficient pancreatic function (PI). We aimed to evaluate and correlate differences in the severity, type and distribution of pulmonary manifestations in CF patients with differing pancreatic status using standardized pulmonary magnetic resonance imaging (MRI).

METHOD AND MATERIALS

Twenty patients of our CF database were selected, ten with PS (mean age 11.8 years; six male; BMI 17.04 kg/m2; FeV1 102%), that were matched by gender, age and similar lung function with ten PI patients. We evaluated changes in each individual lung lobe on MRI. Experienced observers semi-quantitatively assessed whether bronchiectasis, mucus plugging, centrilobular opacity, consolidation, sacculation, and air trapping were present using an established 'MRI-CF-Score'. The severity and distribution of pulmonary disease were compared using nonparametric Kruskal-Wallis tests.

RESULTS

Patients with CF-PS had overall significantly lower MRI-CF scores (with 7.5; p=0.024), and therefore milder lung disease, compared to CF-PI. The differences were most significant in scores for bronchiectasis (p=0.0047) and air trapping (p=0.0336). In general the upper lobes were more affected, however there was a significant difference in PS and PI patients for both upper and lower lobes (p=0.0273 and 0.0217) and no predominant area for lung manifestation in PS patients.

CONCLUSION

Pulmonary MRI can depict significant differences in pathologic lung manifestations in patients with CF-PS compared to CF-PI. In PI the severity was higher, especially with respect to bronchiectasis and air trapping.

CLINICAL RELEVANCE/APPLICATION

Pulmonary MRI can identify differences in pathologic lung manifestation in cystic fibrosis patients with varying pancreatic function.

RC313-05 What Can the Single Axial Rotation with 16cm Wide-Detector Bring in Imaging Infant Lungs? Comparison between 256-Raw CT and 64-Raw CT

Tuesday, Nov. 28 9:20AM - 9:30AM Room: N226

Participants
Yanan Zhu, Ankang, China (*Abstract Co-Author*) Nothing to Disclose
Zhian Pi, Ankang, China (*Abstract Co-Author*) Nothing to Disclose
Zhengjun Li, Ankang, China (*Abstract Co-Author*) Nothing to Disclose
Xianfeng Qu, Ankang, China (*Presenter*) Nothing to Disclose
Mingxing Xu, Ankang, China (*Abstract Co-Author*) Nothing to Disclose
Heping Zhou, MD, Ankang, China (*Abstract Co-Author*) Nothing to Disclose
Jianying Li, Beijing, China (*Abstract Co-Author*) Employee, General Electric Company

For information about this presentation, contact:

zhuyanan1977@163.com

PURPOSE

To explore the clinical value of using a single axial rotation with 16cm wide-detector CT in imaging infant lungs.

METHOD AND MATERIALS

Prospectively enrolled 32 infants (Group 1) for non-enhanced chest CT without sedation using a single axial rotation of 0.35s on a 16cm wide-detector Revolution CT scanner. Patients were scanned with automatic tube current modulation (ATCM) and tube voltages of 80kVp for patients <5 kg and 100 kVp for patients >5 kg to achieve a noise index (NI) of 8.5 HU. The subjective image quality was evaluated by 2 radiologists using a 3 point scoring system with scores equal or greater than 2 being clinically acceptable. Patient preparation time, radiation dose and the quantitative and qualitative image quality were compared with those of 30 infants in Group 2 who underwent a conventional helical scan with sedation using a 64-row VCT with 60 mAs tube current and 120 kVp tube voltage.

RESULTS

There was no statistical difference in body weight and age between the two groups. There was no significant difference between Group 1 and Group 2 in the mean CT value (41.00±11.49HU vs. 39.60±9.95HU), noise (12.40±4.67HU vs. 11.55±2.98HU) and signal-

to-noise ratio (3.70±1.60 vs. 3.64±1.24) in the descending aorta and average subjective image quality score (2.80±0.35 vs. 2.81±0.24) (all p>0.05). While no sedation was used in Group 1, 14 of the 30 (46.7%) patients in Group 2 required sedation. Compared with the conventional group (Group 2), Group 1 significantly reduced the scan time by 82.6% (0.35s vs. 2.01±0.21s), preparation time by 57.4% (41.25±103.78min vs. 96.5±151.77min), and effective radiation dose by 53.7% (0.81±0.28mSv vs. 1.75±0.49mSv) (P<0.05).

CONCLUSION

The use of axial CT mode in a single rotation for imaging infant lung without sedation on a 16cm wide-detector CT scanner provides same image quality as the conventional helical CT with sedation while effectively reduces radiation dose, patient preparation time to optimize scanning procedures, avoids the complications as well as potential risks of sedation.

CLINICAL RELEVANCE/APPLICATION

The single rotation, axial CT with 16cm wide-detector can be used in imaging infant chest to avoid sedation, optimize scanning procedures and provide good image quality with reduced radiation dose.

RC313-06 Towards Endotracheal Tube Sizing By Measurement on Neonatal Radiographs

Tuesday, Nov. 28 9:30AM - 9:40AM Room: N226

Participants
William F. Sensakovic, PhD, Orlando, FL (*Presenter*) Speaker, Bayer AG; Grant, Mazor Robotics Ltd
Hussnain Mirza, MD, Orlando, FL (*Abstract Co-Author*) Nothing to Disclose
Kimberly Beavers, MD, Orlando, FL (*Abstract Co-Author*) Nothing to Disclose
Laura J. Varich, MD, Orlando, FL (*Abstract Co-Author*) Nothing to Disclose
Vincent Grekoski, Orlando, FL (*Abstract Co-Author*) Nothing to Disclose
Gregory A. Logsdon, MD, Orlando, FL (*Abstract Co-Author*) Nothing to Disclose
Kultar Singh, Orlando, FL (*Abstract Co-Author*) Nothing to Disclose
William Oh, MD, Orlando, FL (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

wfsensak@gmail.com

PURPOSE

To determine if radiographic measurements are accurate and repeatable enough to be used for sizing endotracheal tubes (ETTs) in the neonatal population. Further, to determine if image processing can improve measurement.

METHOD AND MATERIALS

Database: Radiographs were acquired for two phantoms. Phantom 1: Gammex 610 neonatal chest (trachea diameter: 4.57mm). Phantom 2: Solid water block with 10 air-filled tubes ranging 1.57mm to 9.13mm diameter. Phantoms were scanned with our standard clinical chest protocol. Patient data consisted of 12 chest and/or neck radiographs of children (<3months) acquired with our standard clinical protocol. A second set of radiographs was created by applying local normalization image processing to the original unenhanced images. Three observers independently measured the trachea in all images using digital calipers. Measurement accuracy, precision, and linearity with trachea size were assessed using phantom images with known trachea size. Precision was further measured on clinical images. Observers made 3 measurements for each patient image, above the carina, mid-trachea, and upper shoulder/neck, to assess the impact of measurement position on trachea diameter. ETTs are sized in 0.5mm increments, thus radiographic sizing was considered acceptable if mean absolute differences (MADs) were less than 0.5mm and ideal if 95% CI <0.5mm.

RESULTS

Phantom Data: MAD between measurement and true diameter was 0.2mm (95%CI [0.15,0.25]) for both phantoms. Measurements were linear over the investigated range with regression between true and measured values of Y = 1.02X (r2=0.99). Local normalization did not produce significant measurement differences (p=0.4). Patient Data: MAD among observer measurements was 0.48mm (95%CI [0.40, 0.56]). Diameter significantly changed with position of measurement (p<0.05). Measurements near the carina were 0.5mm larger than neck/upper shoulder measurements. Mid-trachea measurements were 0.3mm smaller than neck/upper shoulder measurements.

CONCLUSION

Radiographic trachea measurement has acceptable accuracy and precision for clinical use. Measurement position must be standardized since position substantially alters measured diameter. Local normalization did not improve measurement, but future work should investigate other enhancement methods.

CLINICAL RELEVANCE/APPLICATION

Radiographic measurement is suitable for determining trachea diameter for ETT sizing in neonates.

RC313-07 Ferumoxytol for Pediatric Vascular Imaging

Tuesday, Nov. 28 9:40AM - 10:00AM Room: N226

Participants
Shreyas S. Vasanawala, MD, PhD, Palo Alto, CA (*Presenter*) Research collaboration, General Electric Company; Consultant, Arterys Inc; Research Grant, Bayer AG;

LEARNING OBJECTIVES

1) Know advantages of ferumoxytol for pediatric cardiovascular imaging. 2) Know risks of ferumoxytol. 3) Know method of ferumoxytol administration.

ABSTRACT

Ferumoxytol is an iron oxide nanoparticle approved by the FDA for iron replacement therapy in adults. This presentation will discuss

Ferumoxytol is an iron oxide nanoparticle approved by the FDA for iron-replacement therapy in adults. This presentation will discuss off-label use of ferumoxytol for pediatric cardiovascular MRI. The most significant advantages of feruomoxytol are high signal enhancement in the blood pool and long blood pool residence time. These advantages can enable very high resolution imaging with less anesthesia. However, ferumoxytol has risks of hypotension and anaphylaxis. Hence, a slow dilute administration under direct visualization of the patient in a setting optimized for resuscitation is recommended. Compelling applications include congenital heart disease, peripheral MRV including vascular malformations, and pre-surgical mapping.

RC313-08 Extracardiac Complications of Cavopulmonary Bypass

Tuesday, Nov. 28 10:20AM - 10:40AM Room: N226

Participants
Rajesh Krishnamurthy, MD, Columbus, OH (*Presenter*) Nothing to Disclose

Honored Educators

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RC313-09 Assessment of Daunorubicin-Induced Cardiotoxicity in Childhood Acute Leukemia by Cardiac Magnetic Resonance Tissue Tracking

Tuesday, Nov. 28 10:40AM - 10:50AM Room: N226

Participants
Rong Xu, Chengdu, China (*Presenter*) Nothing to Disclose
Zhigang Yang, MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Ke Shi, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Kaiyue Diao, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Yingkun Guo, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

Xrongdoctor@163.com

PURPOSE

To evaluate the deformation and dysfunction in children with acute leukemia caused by daunorubicin-induced cardiotoxicity using cardiac magnetic resonance (CMR) imaging tissue tracking.

METHOD AND MATERIALS

Forty-three children with acute leukemia were prospectively enrolled in the study (19 males and 24 females; mean age, 6.5years; range, 1-12 years), the clinical dose of daunorubicin was 25mg/kg and cumulative dose were 175mg/kg. Prior to chemical therapy, the baseline characteristics of heart were collected, including the biochemistry index and the CMR data. At the end of first-stage daunorubicin-containing therapy (32th weeks), the above mentioned data were recollected and compared, respectively. The imaging data were analyzed including the left ventricular ejection fraction (LVEF), tissue-tracking parameters (radial, circumferential, longitudinal peak strain (PS) and peak displacement (PD)) using dedicated post-processing software (cmr42; version, 5.2.2; Circle Cardiovascular Imaging Inc.; Calgary; Canada).

RESULTS

The decreased LVEFs was found in the 32th weeks during therapy (66.89±4.03% vs. 49.74±3.27%, $P < 0.05$) when compared with the LV function before therapy. At 32 weeks after the first-stage therapy, there are 11 children (approximately 26%) with impaired LV function (EF <50%), and 32 patients (74%) with a preserved LV function (EF >=50%). The regional radial, circumferential, longitudinal PS and radial PD decreased significantly in the 32 patients before-therapy compared with the 32th weeks therapy ($p< 0.05$), and the results were similar to the 11 patients before-therapy and 32th weeks agents, and the strain were all lower in the impaired EF group than in the preserved group (all $p< 0.05$). Furthermore, the radial direction of PS was associated with the LVEF ($r = 0.349$); circumferential and longitudinal PS were positive correlates with troponin T ($r= -0.151$).

CONCLUSION

CMR can monitor the myocardial deformation and dysfunction for early detection myocardial daunorubicin-induced cardiotoxicity in children with acute leukemia. Further follow-up of our subjects in children patients is underway.

CLINICAL RELEVANCE/APPLICATION

CMR strain can monitor the myocardial biomechanics in children daunorubicin-induced cardiotoxicity and is recommended as part of a MR study prior to left ventricle function.

RC313-10 Automatic Quantification of Left Ventricular Noncompaction using Fractal Analysis and Perimetric Ratio in Pediatric Population

Tuesday, Nov. 28 10:50AM - 11:00AM Room: N226

Participants
Amol Pednekar, PhD, Houston, TX (*Presenter*) Former Employee, Koninklijke Philips NV
Tobias Schlingmann, MD,PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Cory Noel, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Prakash M. Masand, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Left ventricular noncompaction (LVNC) is being diagnosed more frequently due to robust imaging techniques such as cardiac MR.

The purpose of this study is to quantify left ventricular noncompaction (LVNC) by fractal analysis and perimetric ratio using a novel automated analysis tool in a pediatric population.

METHOD AND MATERIALS

Short-axis stack of end-diastolic balanced SSFP images from 22 (age 14±4.7, range 2-21yrs) LVNC positive and 20 (age 15±10.5, range 5-46yrs) LVNC negative patients were analyzed retrospectively using a novel automated tool; only user interaction required was to select the most basal and apical slices to be included in the analysis. Geometric constraint based automatically tracked and cropped LV images were thresholded using an Otsu algorithm to obtain edges delineating papillary and trabeculae muscles. Fractal dimensions (FD) were computed on the edge images using the box counting method for all slices. A piecewise closed Bézier curve of 2nd order geometric continuity was fitted through the salient points of the convex hull of edges to delineate the endocardial contours (Fig 1). The ratio of blood pool to endocardial contour perimeter (PR) is computed for each slice and also as a cumulative value for all slices (cPR). Mean (mFD,mPR) and mean+std.dev (msFD,msPR) of the FD and PR were used as LVNC indices along with cPR.

RESULTS

Total computation time per subject was 7+/2 sec. All three indices, were significantly lower ($p<0.001$) in LVNC+ (mFD: 1.40±0.02, mPR:1.34±0.06, cPR: 1.37±0.07) than in LVNC- (mFD:1.47±0.04 , mPR:1.90±0.30, cPR: 1.93±0.30) patients. One to one line plot and Box plots for msFD, msPR and cPR indices is depicted in Fig 2. Correlation coefficients between msFD and msPR/cPR for LVNC- (2.27/0.86) and LVNC+(6.87/6) indicate enhanced dynamic range of msPR & cPR. Distribution of mFD-mPR for LVNC-/+ over the long-axis was: basal(1.4/1.42-1.3/1.7), mid (1.4/1.5-1.5/2.2), apical(1.3/1.5-1.1/1.7).

CONCLUSION

In this study, we described a novel automatic tool as well as a novel index to quantify LV trabecular complexity and irregularity. Both fractal analysis and perimetric ratio indices distinguish LVNC patients from negative controls, while the perimetric ratio provides a six times higher dynamic range.

CLINICAL RELEVANCE/APPLICATION

This novel tool can be used in an automated fashion to provide two quantitative indices that successfully distinguish between LVNC patients and negative controls.

RC313-11 Diagnostic Accuracy of Non-Contrast, Self-Navigated, Free-Breathing Coronary MR Angiography in Children with Coronary Anomalies: Prospective Comparison with Coronary CT Angiography

Tuesday, Nov. 28 11:00AM - 11:10AM Room: N226

Participants
Moritz H. Albrecht, MD, Charleston, SC (*Presenter*) Nothing to Disclose
Akos Varga-Szemes, MD, PhD, Charleston, SC (*Abstract Co-Author*) Research Grant, Siemens AG
Domenico Mastrodicasa, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Philipp L. von Knebel Doeberitz, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
U. Joseph Schoepf, MD, Charleston, SC (*Abstract Co-Author*) Research Grant, Astellas Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; Consultant, Guerbet SA; ; ;
Davide Piccini, Lausanne, Switzerland (*Abstract Co-Author*) Employee, Siemens AG
Christian Tesche, MD , Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
John W. Nance JR, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Megha Penmetsa, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Carlo N. De Cecco, MD, PhD, Charleston, SC (*Abstract Co-Author*) Research Grant, Siemens AG
Marwen Eid, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Domenico De Santis, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Arni C. Nutting, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Anthony M. Hlavacek, MD, Charleston, SC (*Abstract Co-Author*) Investigator, Siemens AG Research Grant, Siemens AG

For information about this presentation, contact:

schoepf@musc.edu

PURPOSE

To evaluate the diagnostic accuracy of a non-contrast, free-breathing, self-navigated 3D (SN3D) coronary MR angiography (cMRA) technique for the evaluation of coronary artery (CA) anatomy in children with known or suspected coronary abnormalities, using coronary CT angiography (cCTA) as the reference standard.

METHOD AND MATERIALS

We prospectively enrolled 21 pediatric patients (15 male, 12.3±2.6 years) in this IRB-approved, HIPAA-compliant study. Patients underwent same-day unenhanced SN3D cMRA and contrast-enhanced cCTA. Two radiologists scored the depiction of CA segments and reader confidence using a 3-point scale: 1=insufficient, 2=moderate, and 3=excellent. Readers assessed CAs for anomalies, high CA origin, and both inter-arterial and intra-mural CA course. Sensitivity, specificity, positive and negative predictive values (PPV, NPV) were calculated to evaluate diagnostic accuracy. Inter-observer agreement was assessed using Intra-class Correlation Coefficients (ICC).

RESULTS

Fourteen children showed CA anomalies or pathologies on cCTA images. Depiction of CA segments was scored higher for cCTA compared to cMRA ($P<0.015$), except regarding the left main CA ($P=0.301$), with good (ICC=0.62) to excellent (ICC=0.94) inter-observer agreement. Diagnostic confidence was higher for cCTA evaluation ($P=0.046$). Sensitivity, specificity, PPV and NPV of cMRA were 92%, 92%, 96% and 87% for the detection of CA anomalies, 85%, 85%, 74% and 92% for high CA origin, 71%, 92%, 82% and 87% for inter-arterial course, and 41%, 96%, 87% and 80% for intra-mural course.

CONCLUSION

SN3D cMRA is highly accurate for the detection of CA anomalies and inter-arterial course in children without radiation exposure

SN3D cMRA is highly accurate for the detection of CA anomalies and inter-arterial course in children without radiation exposure, contrast administration, or need for breathing commands. Diagnostic confidence and CA visualization, however, are still inferior in comparison with cCTA.

CLINICAL RELEVANCE/APPLICATION

SN3D cMRA can be used instead of cCTA in pediatric patients with suspected CA anomalies in order to avoid both ionizing radiation and contrast media administration. This cMRA technique is feasible, allows for excellent diagnostic accuracy and is especially useful for the evaluation of the proximal CA course.

RC313-12 Global Strain Analysis Using Cardiovascular Magnetic Resonance Feature Tracking to Predict Deterioration of Ventricular Function in Patients with Repaired Fontan at Follow Up: A Feasibility Study

Tuesday, Nov. 28 11:10AM - 11:20AM Room: N226

Participants
Li Wei Hu, BEng, Shanghai, China (*Presenter*) Nothing to Disclose
Qian Wang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Ai-Min Sun, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Guo Chen, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Rong-Zhen Ouyang, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Xiao Fen Yao, MENG, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Yumin Zhong, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Ventricular dysfunction is common complication in young survivors with the Fontan circulation and has been identified as a risk factor for mortality. We hypothesized that the global ventricular strain would predict deterioration of ventricular function in patients with repaired Fontan.

METHOD AND MATERIALS

27 patients who haven't had interventional surgical or catheter procedures in 6 months after Fontan procedures were enlisted. CMR imaging was conducted on a 1.5 Tesla scanner (Achiva, Philips, the Netherlands) using a 8-channel phased-array cardiac coil. Global longitudinal(GLS), global radial(GRS) and global circumferential(GCS) strains of the left or dominant ventricle were measured using a CMR-Feature Tracking(FT) software(Circle Cardiovascular Imaging, Calgary, Canada). To compare ejection fraction and follow-up duration using Pearson's correlation and Paired sampled test (two tailed) on GraphPad Prism. We constructed ROC curved analysis to assess the independent effect of CMR-FT on subsequent risks of ventricular dysfunction. Bland-Altman method using MedCalc (Mariakerke, Belgium) to identify possible bias and the limits of agreement of the global strain between two observers.

RESULTS

The mean age of 27 patients was 9.6 ± 2.92 years,60% maleThe mean follow-up duration between the time of surgery and previous CMR scanning was 5.1 ± 1.9 years. Of the 27 patients, clinical diagnosis of suspected patients was cardiac dysfunction in 14 cases (NT-proBNP>125pg/ml).The correlations between follow-up duration and LVEF measured using the conventional method were negative weak but still significant($r=-0.45$, $p<0.05$). GCS(AUC=0.82) and GLS(AUC=0.78) were the best predict subsequent risks of ventricular dysfunction in 27 cases($p<0.05$,respectively).Bland Altman analysis of global strain inter-observer reproducibility yielded a better agreement (bias -0.08 and 95% CI -0.25 to 0.07 for GLS,bias -0.15 and 95% CI -0.28 to 0.02 for GCS, bias 0.28 and 95% CI -0.19 to 0.75 for GRS).

CONCLUSION

Feature Tracking strain analysis is clinically feasible and accessible tool for ventricular chamber quantification. GCS and GLS provides strengthen prognostic Information compared to conventional EF for predicting deterioration of ventricular function.

CLINICAL RELEVANCE/APPLICATION

CMR global strain analysis has the potential to detect myocardial motion using cardiovascular magnetic resonance. It is a new tool in following up patients after Fontan operation.

RC313-13 Assessing the Precision and Reproducibility of Novel MRI Sequence in Pediatric Congenital Heart Disease with Cardiac Volumetry and Function

Tuesday, Nov. 28 11:20AM - 11:30AM Room: N226

Awards
Student Travel Stipend Award

Participants
Bill Zhou, Los Angeles, CA (*Presenter*) Nothing to Disclose
Takegawa Yoshida, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Peng Hu, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Kim-Lien Nguyen, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
J. Paul Finn, MD, Los Angeles, CA (*Abstract Co-Author*) Speakers Bureau, Bayer AG; ; ;

For information about this presentation, contact:

BZhou@mednet.ucla.edu

PURPOSE

We have developed a novel 4D, multiphase, steady state imaging with contrast enhancement (MUSIC) MR sequence for pediatric congenital head disease (CHD) imaging that captures both detailed anatomy and 3D cardiac function in a single scan. It is hypothesized that with its higher resolution and phase-resolved 3D data, 4D MUSIC will allow for highly precise and reproducible measurements of ventricular volumetry and function.

METHOD AND MATERIALS

50 children with CHD (ages 2 days to 18 years, 25 females) who underwent MRI at 3.0T with 4D MUSIC sequence between 2013-2017 were included in the study. DICOM data were analyzed for cardiac volume and function with a 2D image processing software (Medis QMass) after reformatting into short-axis images as well as with a 3D image processing software (Materialise Mimics). The trabeculae, papillary muscles, and right ventricular outflow tracts were purposely excluded from the blood pool. 10 randomly selected patients were repeated for intrarater reliability and measured by a second observer for interrater reliability. Five sets of measurements (2D versus 3D software, intrarater for 2D and 3D, interrater for 2D and 3D) were compared for statistical differences using Wilcoxon signed-rank test, intraclass correlation coefficients, and Bland-Altman plots.

RESULTS

There was a high degree of reliability between measurements made on the 2D and 3D softwares. The intraclass correlation coefficient (ICC) between the two methods was 0.997 for LV (left ventricular) EDV (end-diastolic volume), 0.997 for LV ESV (end-systolic volume), 0.961 for LV EF% (ejection fraction), 0.998 for RV (right ventricular) EDV, 0.999 for RV ESV, 0.941 for RV EF%, and 0.996 all variables. The intrarater reliability for the 2D and 3D softwares were 0.985 and 0.998, respectively; similarly, the interrater reliability were 0.997 and 0.998, respectively.

CONCLUSION

This study demonstrates the clinical utility of 4D MUSIC as a MR sequence with both high precision and reproducibility across different image processing softwares and different readers. Both intrarater and interrater reliability were higher with the 3D software than with the 2D. 4D MUSIC has the potential to become the new standard of care in pediatric CHD diagnosis and surveillance.

CLINICAL RELEVANCE/APPLICATION

Novel MR sequence enables precise and reproducible cardiac volumetry and function measurements and is recommended for imaging pediatric congenital heart disease.

RC313-14 Low-Dose Dual-Source Computed Tomography for Evaluating Right Ventricle and Pulmonary Artery in Infant Patients with Tetralogy Of Fallot: Correlation with Post-Operative Pulmonary Regurgitation

Tuesday, Nov. 28 11:30AM - 11:40AM Room: N226

Participants
Yue Gao, Chengdu, China (*Presenter*) Nothing to Disclose
Ke Shi, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Yingkun Guo, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Kaiyue Diao, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Huayan Xu, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Zhigang Yang, MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

yuegao815@qq.com

PURPOSE

The aim of this study was to assess the influence of pre-operative right ventricle (RV) and pulmonary artery (PA) imaging characteristics by low-dose dual-source computed tomography (DSCT) on post-operative pulmonary regurgitation (PR).

METHOD AND MATERIALS

Fifty-five patients after tetralogy of Fallot (TOF) repair were recruited. The RV and PA parameters evaluated by pre-operative DSCT were compared between the PR and non-PR groups. Spearman's rank correlation was used to determine the correlations between the pre-operative parameters and PR. Receiver operating characteristic (ROC) analysis was used to predict the possibility of PR using individual effective parameters.

RESULTS

There were 20 patients in the PR group and 35 patients in the non-PR group. The pre-operative left PA (LPA) diameter, McGoon ratio, and Nakata index showed significant differences between the two groups (20.40 ± 6.13 mm/m2 vs. 16.41 ± 4.69 mm/m2, $p = 0.0025$; 2.18 ± 0.53 vs. 1.76 ± 0.49, $p = 0.005$; 399.95 ± 150.38 mm2/m2 vs. 275.50 ± 81.93 mm2/m2, $p < 0.0001$). The results showed a significant correlation between PR and LPA diameter, McGoon ratio and Nakata index ($r = 0.350$, 0.338, and 0.426, respectively; all $p < 0.05$). ROC analysis revealed that sensitivity and specificity were obtained for predicting the occurrence of PR with LPA (70.0%,77.1%), McGoon ratio (75.0%,57.1%) and Nakata index (50.0%,91.4%).

CONCLUSION

For TOF patients, the pre-operative LPA diameter and PA development indexes by DSCT are associated with post-operative PR. These pre-operative imaging characteristics can be new predictive factors for the occurrence of PR.

CLINICAL RELEVANCE/APPLICATION

Pre-operative right ventricle (RV) and pulmonary artery (PA) imaging characteristics on DSCT can be new predictive factors for the occurrence of post-operatively PR.

RC313-15 Lymphatic System in Congenital Heart Disease

Tuesday, Nov. 28 11:40AM - 12:00PM Room: N226

Participants
David M. Biko, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

bikod@email.chop.edu

bikod@email.chop.edu

LEARNING OBJECTIVES

1) Improve knowledge of MR techniques to image the lymphatic system in pediatric congenital heart disease. 2) Understand the relationship between the complictions of surgical pallation of congenital heart disease and the lymphatic system. 3) Expand knowledge of lymphatic disorders and how they relate to congenital heart disease.

RC314

Interventional Series: Venous Disease

Tuesday, Nov. 28 8:30AM - 12:00PM Room: E353A

CH VA IR

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.75

FDA Discussions may include off-label uses.

Participants
Robert J. Lewandowski, MD, Chicago, IL (*Moderator*) Consultant, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Advisory Board, ABK Medical Inc; Advisory Board, Accurate Medical
Brian S. Funaki, MD, Chicago, IL (*Moderator*) Data Safety Monitoring Board, Novate Medical Ltd

For information about this presentation, contact:

r-lewandowski@northwestern.edu

LEARNING OBJECTIVES

1) Describe the use of radio frequency wire in central venous occlusion. 2) List rationale for venous thrombolysis. 3) Describe the indications for balloon retrograde transvenous occlusion (BRTO). 4) Discuss one approach to establishing a PE response team.

Sub-Events

RC314-01 PE I: Diagnosis and Triage of Pulmonary Embolism

Tuesday, Nov. 28 8:30AM - 8:45AM Room: E353A

Participants
Akhilesh K. Sista, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Be able to distinguish between the Wells criteria and the simplified PESI score. 2) Be able to distinguish between massive, submassive, and low-risk PE. 3) Know the major prospective trials of CDT for pulmonary embolism.

RC314-02 PE Treatment Options and PERT

Tuesday, Nov. 28 8:45AM - 9:00AM Room: E353A

Participants
Ryan P. Lokken, MD, Chicago, IL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

plokken@uic.edu

LEARNING OBJECTIVES

1) Discuss indications and techniques for catheter-based therapy for PE. 2) Discuss models for PE response teams.

RC314-03 Mortality Benefit of IVC Filters in Patients with Pulmonary Embolism and Coagulopathies

Tuesday, Nov. 28 9:00AM - 9:10AM Room: E353A

Participants
Vibhor Wadhwa, MBBS, MD, Little Rock, AR (*Presenter*) Nothing to Disclose
Narendra B. Gutta, MBBS, MD, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Premal S. Trivedi I, MSc, MD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
Kshitij Chatterjee, MD, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Robert K. Ryu, MD, Chicago, IL (*Abstract Co-Author*) Consultant, Cook Group Incorporated Stockholder, EndoVention Inc Consultant, IORAD
Avneesh Chhabra, MD, Dallas, TX (*Abstract Co-Author*) Consultant, ICON plc; Author with royalties, Wolters Kluwer nv; Author with royalties, Jaypee Brothers Medical Publishers Ltd
Sanjeeva P. Kalva, MD, Dallas, TX (*Abstract Co-Author*) Consultant, General Electric Company; Royalties, Reed Elsevier; Royalties, Springer Nature; Investor, Althea Healthcare

For information about this presentation, contact:

vibhorwadhwa90@gmail.com

PURPOSE

We sought to evaluate if patients with coagulopathy and pulmonary embolism (PE) receive any mortality benefit from IVC filter

placement in the inpatient setting.

METHOD AND MATERIALS

The 2005-2014 Nationwide Inpatient Sample was used for this study. Patients with PE were identified using corresponding ICD9 diagnosis codes. Patients with coagulopathy were identified using the Elixhauser comorbidity variable in the NIS database. Only patients >18 years of age were included. IVC Filter placement was identified using ICD9 procedure code (38.7, interruption of the vena cava). Case fatality rates were calculated and logistic regression modeling was used to determine the difference in mortality between patients with and without filter placements. Covariates included in the regression model were all other Elixhauser Comorbidities, age, race, gender, hospital characteristics, severity indices for massive PE (presser dependence, mechanical ventilation, shock and thrombolytic therapy) and anticoagulation use.

RESULTS

During study years 2005-2014, a total of 212360 were hospitalized with PE and coagulopathy (52.2% male, 47.8% female; median age years), with 48538 (22.90%) of them receiving filters. 31353 (14.80%) patients died during the hospital stay. The all cause fatality rate amongst patients who received a filter was 12.5% (6085 of 31352), compared to 15.4% (42453 of 181009) (two tailed $p<0.001$) without a filter, with an absolute risk reduction of 2.9%. Using the regression model, the odds ratio of mortality associated with IVC filter placement was 0.511 (95% CI: 0.493 - 0.531, $p < 0.001$).

CONCLUSION

Patients with coagulopathy and PE who received an IVC Filter during the hospital stay had a lower all-cause mortality rate compared to patients who did not receive a filter.

CLINICAL RELEVANCE/APPLICATION

In the absence of randomized controlled trials, this study using an administrative database suggests that IVC filter could potentially be beneficial in preventing death from recurrent PEs in coagulopathy patients.

RC314-04 Mortality Benefit of IVC Filters in Patients with Pulmonary Embolism and Congestive Heart Failure

Tuesday, Nov. 28 9:10AM - 9:20AM Room: E353A

Participants
Vibhor Wadhwa, MBBS, MD, Little Rock, AR (*Presenter*) Nothing to Disclose
Narendra B. Gutta, MBBS, MD, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Premal S. Trivedi I, MSc, MD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
Kshitij Chatterjee, MD, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Robert K. Ryu, MD, Chicago, IL (*Abstract Co-Author*) Consultant, Cook Group Incorporated Stockholder, EndoVention Inc Consultant, IORAD
Avneesh Chhabra, MD, Dallas, TX (*Abstract Co-Author*) Consultant, ICON plc; Author with royalties, Wolters Kluwer nv; Author with royalties, Jaypee Brothers Medical Publishers Ltd
Sanjeeva P. Kalva, MD, Dallas, TX (*Abstract Co-Author*) Consultant, General Electric Company; Royalties, Reed Elsevier; Royalties, Springer Nature; Investor, Althea Healthcare

For information about this presentation, contact:

vibhorwadhwa90@gmail.com

PURPOSE

Pulmonary embolism (PE) is associated with a higher mortality in patients with congestive heart failure (CHF) compared to those without heart failure. The purpose of this study was to evaluate if IVC Filter placement provides any mortality benefit in patients admitted with CHF and PE, compared to patients without filters.

METHOD AND MATERIALS

The 2005-2014 Nationwide Inpatient Sample was used for this study. Patients with PE were identified using respective ICD9 diagnosis codes. Patients with CHF were identified using the Elishauser comorbidity variable in NIS database. Only patients >18 years of age were included in the study. IVC Filter placement was identified using ICD9 procedure code (38.7, interruption of the vena cava). Logistic regression modeling was used to determine the difference in mortality between patients with and without filter placements. Covariates used in the regression model included all Elixhauser Comorbidities, age, race, gender, hospital characteristics and PE severity indices (presser dependence, mechanical ventilation, shock and use of thrombolytic therapy).

RESULTS

During study years 2005-2014, a total of 393264 patients were hospitalized with PE and CHF (44% male, 56% female; median age 74 years), with 64328 (16.4%) of them receiving filters. 47209 (12.0%) of the patients died during the hospital stay. The all cause fatality rate amongst patients who received a filter was 9.7% (6258 of 64330 patients), compared to 12.4% (40951 of 328935 patients) without a filter (two tailed $p<0.001$), with an absolute risk reduction of 2.7%. Using the regression model, the odds ratio of mortality associated with IVC filter placement was 0.515 (CI: 0.498 - 0.533, $p < 0.001$).

CONCLUSION

A lower all-cause mortality rate was observed in patients with CHF and PE who received an IVC Filter during the hospital stay, compared to patients who did not receive a filter.

CLINICAL RELEVANCE/APPLICATION

In the absence of randomized controlled trials, this study using an administrative database suggests that IVC filters could potentially be beneficial in preventing death from recurrent PEs in CHF patients.

RC314-05 Chronic Venous Recanalization

Tuesday, Nov. 28 9:20AM - 9:35AM Room: E353A

Participants
Brooke Spencer, MD, Lone Tree, CO (*Presenter*) Researcher, Cook Group Incorporated; Researcher, Veniti, Inc; Researcher, Medtronic plc; Medical Advisory Committee, Koninklijke Philips NV; Speaker, Koninklijke Philips NV

For information about this presentation, contact:

bspencer@mipscenter.com

LEARNING OBJECTIVES

1.) To understand the US and venographic correlation in chronic DVT2.) To learn techniques for crossing chronic venous obstructions3.) Review early experience and outcomes with recanalization of chronic DVT

ABSTRACT

While post thrombotic syndrome (PTS) occurs in approximately 50% of patients, we have not yet identified a clear treatment algorithm to significantly reduce the chronic effects of extensive DVT. As such there are many patients suffering from significant PTS. They often present years later and while a small percentage develop ulceration, the shear number of patients with chronic pain, wounds and CEAP 4-6 venous disease is staggering. Recanalization of chronic DVT is gaining favor, but can be very technically challenging. Rationale, techniques and adjutant therapies that lead to improved outcomes from these challenging procedures will be discussed.

RC314-06 Stenting for IVC Stenosis after Liver Transplantation: Meta-analysis

Tuesday, Nov. 28 9:35AM - 9:45AM Room: E353A

Awards
Student Travel Stipend Award

Participants
Jeffrey B. Donaldson, MD, MS, Cleveland, OH (*Presenter*) Nothing to Disclose
Nancy A. Obuchowski, PhD, Cleveland, OH (*Abstract Co-Author*) Research Consultant, Siemens AG Research Consultant, QT Ultrasound Labs Research Consultant, Elucid Bioimaging Inc
Rebecca Le, BSC, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Charles Martin III, MD, Pepper Pike, OH (*Abstract Co-Author*) Scientific Advisory Board, Boston Scientific Corporation
Amanjit S. Gill, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

j.barrett.donaldson@gmail.com

PURPOSE

To describe the determinants of outcomes for liver transplant patients with IVC stenosis treated by endovascular stenting, through meta-analysis. Outcomes of interest include symptom relief, mortality, duration of survival and cause of mortality.

METHOD AND MATERIALS

Using the PRISMA checklist, this meta-analysis searched databases including Medline and Pubmed for retrospective cohort studies, case series/case report studies, letters to the editor, and conference abstracts reporting on IVC stenting in the population of interest. Two reviewers independently evaluated the publications by the QUADAS-2 scale for bias and applicability. Data was extracted and compiled into a database, and verified by the two reviewers. Logistic and Cox proportional hazards regression were used to identify predictors of outcome; odds ratios and hazard ratios were estimated with 95% CIs.

RESULTS

Database search of 5277 records found 17 studies that met criteria for inclusion, totaling 73 patients. Technical success, defined as stent patency at most distant followup, was found in 98% of patients (85/87 stents). Clinical success, defined as symptom relief, was achieved in 85% of patients (46/54) . The reason for liver transplant was a statistically significant predictor of all-cause mortality (p=0.046). Subjects with HCC had a higher hazard of dying compared to the composite mortality in all other reasons for liver transplant (HR=3.95, with 95% CI of [1.3, 12], p=0.015). A marginally significant negative correlation was found between the number of stents and symptom relief, suggesting that stenoses more resistant to stenting may lead to refractory symptoms.

CONCLUSION

Between 1995 and 2014, 17 studies reported 73 patients were treated for IVC stenosis after a liver transplant by stenting. Meta-analysis of patient level data found a significantly increased risk of all-cause mortality in patients with HCC. This corresponds to increased mortality of patients with HCC the post-liver transplant patients described in multiple observational studies. Thus, patients treated for IVC stenosis after liver transplant through endovascular methods have similar outcomes to those without IVC stenosis.

CLINICAL RELEVANCE/APPLICATION

For IVC stenosis after liver transplantation, stenting is an effective and durable procedure for relieving symptoms of venous obstruction. Patients with HCC had significantly higher mortality, similar to existing literature.

RC314-07 Debate: Submassive PE: Should Catheter-directed Therapy be Used?

Tuesday, Nov. 28 9:45AM - 10:00AM Room: E353A

Participants
Akhilesh K. Sista, MD, New York, NY (*Presenter*) Nothing to Disclose

RC314-08 May-Thurner and Paget-Schroetter: Commonalities and Differences

Tuesday, Nov. 28 10:15AM - 10:30AM Room: E353A

Participants
Charles E. Ray JR, MD, PhD, Chicago, IL (*Presenter*) Editor, Thieme Medical Publishers, Inc; Consultant, W. L. Gore & Associates, Inc; ; ; ;

For information about this presentation, contact:

chray@uic.edu

LEARNING OBJECTIVES

1) To understand the commonalities and differences between May Thurner syndrome and Paget Schroetter syndrome. 2) To discuss the role of minimally invasive therapies in the treatment of both disease processes.

ABSTRACT

n/a

RC314-09 The Application of Combined Venography in the Diagnosis of Iliac Vein Compression Syndrome with Dual Source Computed Tomography

Tuesday, Nov. 28 10:30AM - 10:40AM Room: E353A

Participants
Li-Wei Wang, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Yu-Chen Chen, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Xindao Yin, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Jian-Ping Gu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Liyan Lu, Nanjing, Christmas Island (*Presenter*) Nothing to Disclose

PURPOSE

To explore the clinical value of the combined dual-source CT venography (CTV) for the diagnosis of iliac vein compression syndrome (IVCS).

METHOD AND MATERIALS

Forty-three patients with clinically suspected deep venous thrombosis (DVT) underwent CTV examination. Among them, 22 cases were assessed with combined CTV while 21 cases were given conventionally indirect CTV. The lower extremity deep vein was scanned from foot to head. The dual-energy technology is applied for data acquisition.

RESULTS

Two kinds of CTV methods could be used directly for diagnosing IVCS and checking the asymptomatic mild iliac vein compression. 32 IVCS patients were diagnosed by CTV. In 27 cases with DVT, the average diameter of the left iliac vein was 3.23±1.45 mm and the average compression rate was 67%. The differences were statistically significant in comparisons of the average diameter of left iliac vein between IVCS patients with or without DVT and patients without IVCS. The image quality scores of bidirectional CTV were higher than indirect CTV with statistically significant difference.

CONCLUSION

Combined CTV is a feasible technique for lower extremity venography. The image quality of combined CTV is better than conventionally indirect CTV with greater clinical value.

CLINICAL RELEVANCE/APPLICATION

Combined CTV is a feasible technique for lower extremity venography with greater clinical value.

RC314-10 IVC Filters: Evidence and Ongoing Trials

Tuesday, Nov. 28 10:40AM - 10:55AM Room: E353A

Participants
Matthew S. Johnson, MD, Indianapolis, IN (*Presenter*) Research Consultant, Argon Medical Devices, Inc; Research Consultant, Bayer AG; Research Consultant, Bristol-Myers Squibb Company; Research Consultant, Boston Scientific Corporation; Research Consultant, Cook Group Incorporated; Research Consultant, BTG International Ltd; Research support, BTG International Ltd; Research Consultant, Guerbet SA; Research Consultant, Surefire Medical, Inc; ;

For information about this presentation, contact:

matjohns@iupui.edu

LEARNING OBJECTIVES

1) Describe caval filters currently available for use in the United States. 2) Understand accepted indications for filter placement and areas of controversy in those indications. 3) Describe potential complications related to vena cava filter usage. 4) Discuss the rationale for the PRESERVE trial. 5) Apply understanding of the indications and potential complications of vena cava filters to their clinical use.

RC314-11 Trends in Inferior Vena Cava Filter Placement and Retrieval Amongst Radiologists and Other Specialists

Tuesday, Nov. 28 10:55AM - 11:05AM Room: E353A

Participants
David Guez, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
David R. Hansberry, MD,PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Carin F. Gonsalves, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
David J. Eschelman, MD, Bryn Mawr, PA (*Abstract Co-Author*) Nothing to Disclose
Laurence Parker, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Vijay M. Rao, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
David C. Levin, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

david.hansberry@jefferson.edu

PURPOSE

To evaluate inferior vena cava (IVC) filter placement and retrieval rates amongst radiologists, vascular surgeons, cardiologists, neurosurgeons, other surgeons, and all other healthcare providers in Medicare fee-for-service beneficiaries between the years 2012 and 2015.

METHOD AND MATERIALS

The nationwide Medicare Physician/Supplier Procedure Summary Master Files were used to determine the volume of IVC filter placement, IVC filter repositioning, and IVC filter retrieval, which correspond to procedure codes 37191, 37192 and 37193, respectively. Data was reviewed for all years that procedural code 37193 was available, which includes 2012 to 2015, as this code was not available prior to 2012.

RESULTS

The total volume of IVC filter placement decreased from 57,785 in 2012 to 44,378 in 2015 with radiologists placing the majority of them at 60%. Volume of IVC filter placement declined across all specialties, including radiologists who placed 33,744 in 2012 and 27,957 in 2015. However, total retrieval of IVC filters has increased over the same time period with 4,060 and 6,166 removals in 2012 and 2015, respectively. Radiologists have removed the bulk of the filters: 64% in both 2012 and 2015. Vascular surgeons, cardiologists, and other surgeons retrieved 20%, 10%, and 5%, respectively, of all IVC filters in 2012 and 22%, 9%, and 5%, respectively, in 2015.

CONCLUSION

From 2012 to 2015, IVC filter placement steadily decreased across all specialties; however, IVC filter retrieval rates have continued to rise over the same time period. Radiologists are responsible for the majority of IVC filters placed and retrieved. They have placed over 60% and retrieved over 63% of all IVC filters over the evaluated 4 year period. Given the results of the PREPIC trial and subsequent recommendations by the FDA, the retrieval rate of IVC filters has risen and likely will continue. Additionally, the implementation of structured IVC filter clinics has improved follow-up in patients who have IVC filters placed.

CLINICAL RELEVANCE/APPLICATION

Recent studies have shown complications related to filters that were implanted for longer periods. Although the number of filters being inserted is declining, the number retrieved is increasing.

RC314-12 DVT Lysis: An Update

Tuesday, Nov. 28 11:05AM - 11:20AM Room: E353A

Participants
Kush R. Desai, MD, Chicago, IL (*Presenter*) Speakers Bureau, Cook Group Incorporated; Consultant, Cook Group Incorporated; Consultant, The Spectranetics Corporation; Consultant, AngioDynamics, Inc; Consultant, Boston Scientific Corporation

For information about this presentation, contact:

kdesai007@northwestern.edu

LEARNING OBJECTIVES

1) To review the history, rationale, and the most recent data behind deep venous thrombolysis. 2) Discuss current practice, emerging technologies, and future directions.

RC314-13 IVC Filters: Past, Present, and Future

Tuesday, Nov. 28 11:20AM - 11:35AM Room: E353A

Participants
Matthew S. Johnson, MD, Indianapolis, IN (*Presenter*) Research Consultant, Argon Medical Devices, Inc; Research Consultant, Bayer AG; Research Consultant, Bristol-Myers Squibb Company; Research Consultant, Boston Scientific Corporation; Research Consultant, Cook Group Incorporated; Research Consultant, BTG International Ltd; Research support, BTG International Ltd; Research Consultant, Guerbet SA; Research Consultant, Surefire Medical, Inc; ;

RC314-14 How IVC Filters Fail: A Review of the FDA MAUDE Database

Tuesday, Nov. 28 11:35AM - 11:45AM Room: E353A

Awards
Student Travel Stipend Award

Participants
Ahmed Abbas, BS , Tracy, CA (*Presenter*) Nothing to Disclose
Furqan H. Syed, MBBS, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Nancy A. Obuchowski, PhD, Cleveland, OH (*Abstract Co-Author*) Research Consultant, Siemens AG Research Consultant, QT Ultrasound Labs Research Consultant, Elucid Bioimaging Inc
Jennifer Montgomery, MD, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Charles Martin III, MD, Pepper Pike, OH (*Abstract Co-Author*) Scientific Advisory Board, Boston Scientific Corporation
Gordon McLennan, MD, Chagrin Falls, OH (*Abstract Co-Author*) Research Grant, Siemens AG; Research Consultant, Medtronic plc; Advisory Board, Siemens AG; Advisory Board, Surefire Medical, Inc; Advisory Board, Stealth Medical; Advisory Board, Rene Medical; Data Safety Monitoring Board, B. Braun Melsungen AG
Amanjit S. Gill, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

ahmed.abbas@case.edu

PURPOSE

We hypothesized that inferior vena cava (IVC) filter reported adverse events are specific to filter type, brand, and geometry.

METHOD AND MATERIALS

The FDA MAUDE database was reviewed from 01/01/2013 to 12/31/2016 for reported adverse events (fracture, limb embolization, tilt, migration, IVC wall erosion, deployment problems, retrieval failure and distal thrombosis) for different filter type (retrievable filter (RF) vs. non-retrievable filter (NRF)), brand (ALN, Argon, Braun, Bard, Boston, Cook, Cordis, Rex and Volcano) and geometry (biconical, complex, conical, conical with cylindrical, conical with umbrella, and helical). Chi-square test was used to examine the null hypothesis and Holm's method was used to adjust the p-values to control the family-wise type I error rate.

RESULTS

Association was seen between complications and filter type (n= 3751, $p<0.001$): higher proportion of tilt in NRF than RF (14.4% vs. 3.5%, $p<0.001$); but more deployment problems in RF as compared to NRF (34.3% vs. 19.4%, $p<0.001$). There was an association between complications and filter brand (n= 4275, $p<0.001$): compared to other brands, Cook filters had a higher proportion of migration (11.5% vs. 7.7%) and erosion (26.1% vs. 20.8%) but fewer deployment problems (8.2% vs. 17.8%); Cordis filters had a higher proportion of thrombus (8.9% vs. 2.0%) and retrieval failure (18.6% vs. 9.0%), but fewer fractures (7.9% vs. 18.0%) and Bard filters had more deployment problems (25.0% vs. 17.8%). We also found an association between complications and filter geometry (n= 3969, $p<0.001$): when compared to others, biconical filters had a higher proportion of thrombus (10.9% vs. 2.1%) but fewer fractures (9.7% vs. 19.6%); Complex filters had a higher proportion of fractures (25.9% vs. 19.6%), migrations (11.1% vs. 5.9%), limb emboli (11.1% vs. 5.9%), and erosions (40.7% vs. 23.1%) but fewer deployment problems (0% vs. 19.1%).

CONCLUSION

There are significant differences in the proportion of reported adverse events based on the filter brand, geometry, and type.

CLINICAL RELEVANCE/APPLICATION

Knowledge of relative proportion of reported IVC filter adverse events with respect to the brand, geometry, and type may help guide the appropriate IVC filter selection based on patient characteristics to minimize the risk of adverse events.

RC314-15 Debate: Retrievable Filters: Get Them All Out!

Tuesday, Nov. 28 11:45AM - 12:00PM Room: E353A

Participants
Brian S. Funaki, MD, Chicago, IL (*Presenter*) Data Safety Monitoring Board, Novate Medical Ltd
Robert J. Lewandowski, MD, Chicago, IL (*Presenter*) Consultant, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Advisory Board, ABK Medical Inc; Advisory Board, Accurate Medical

For information about this presentation, contact:

r-lewandowski@northwestern.edu

LEARNING OBJECTIVES

1) Understand the importance of removing IVC filters that are no longer required. 2) Name the risks of potentially retrievable IVCfilters. 3) Cite literature demonstrating safety and efficacy of removing IVC filters with advanced techniques.

MSES32

Essentials of Chest Imaging

Tuesday, Nov. 28 10:30AM - 12:00PM Room: S100AB

CH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Sub-Events

MSES32A MRI of Thymic Lesions

Participants
Patricia J. Mergo, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

mergo.patricia@mayo.edu

LEARNING OBJECTIVES

1) Become familiar with the MR imaging appearance of various pathologic processes in the thymus and to understand their image features in correlation with pathologic findings. 2) Distinguish the MR imaging appearance of thymic lesions from other anterior mediastinal mass lesions when possible. 3) Become familiar with MR imaging techniques that facilitate the distinction of primary thymic lesions from other mediastinal masses.

ABSTRACT

Evaluation of anterior mediastinal lesions can be difficult with CT imaging alone. MRI can add utility as a diagnostic tool in the evaluation of thymic lesions and aid in their distinction from other anterior mediastinal mass lesions. The imaging features of various lesions of the thymus are presented in correlation with their pathologic features. Specific MR imaging techniques are presented as they relate to distinction of various pathologic entities, including the use of in-phase and out-of-phase imaging, contrast-enhanced imaging and diffusion-weighted imaging, when applicable.

MSES32B Occupational Lung Diseases

Participants
Cristopher A. Meyer, MD, Cincinnati, OH (*Presenter*) Investor, Elucent Medical; Investor, NeuWave Medical, Inc

For information about this presentation, contact:

cmeyer2@uwhealth.org

LEARNING OBJECTIVES

1) Describe the pathophysiology of dust deposition and clearance as an explanation for the different manifestations of particulate and fiber inhalation. 2) List three major categories of occupational lung disease and give an example of each. 3) Recognize the importance of a new pleural effusion in a patient with pleural plaque.

Active Handout:Cristopher A. Meyer

http://abstract.rsna.org/uploads/2017/17000057/Active MSES32B.pdf

MSES32C Imaging of Small Airways Disease

Participants
Gerald F. Abbott, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

gabbott@mgh.harvard.edu

LEARNING OBJECTIVES

1) To know the anatomic basis of small airways imaging. 2) To know the direct and indirect imaging signs of small airways disease. 3) To know the clinico-pathologic spectrum of small airways disease.

ABSTRACT

Small airways disease manifests with both direct and indirect imaging signs which reflect the underlying proliferative or fibrotic pathologic process of various disease entities. This presentation will review the underlying anatomy of the small airways and illustrate the imaging signs encountered in a spectrum of diseases involving the small airways.

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/ Gerald F. Abbott, MD - 2015 Honored Educator

MSES32D Imaging the Pneumothorax

Participants
Judith L. Babar, MBChB, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

judith.babar@addenbrookes.nhs.uk

LEARNING OBJECTIVES

1) Accurately identify a pneumothorax and differentiate from potential mimics on chest radiography. 2) Be familiar with causes of a spontaneous secondary pneumothorax, which may be the first presenting event of occult disease. 3) Employ a pattern-based approach to facilitate accurate diagnosis of congenital and acquired causes of pneumothoraces on MDCT, in particular with respect to cystic lung disease.

ABSTRACT

Radiologists will frequently encounter a pneumothorax on a chest radiograph or CT. Spontaneous pneumothroax occurs in the absence of trauma, and can be further divided into primary (individuals without clinically apparent lung disease) or secondary (pre-existing lung disease). This presentation aims to ensure that radiologists are familiar with the imaging appearances of common and rare causes of pneumothorax, encompassing COPD, infection, interstitial pulmonary fibrosis, connective tissue disorders and cystic lung disease, which may help in providing a specific diagnosis. The role and appropriateness of the use of MDCT in the diagnostic pathway, and management of pneumothoraces will also be discussed.

RSNA 2017 Explore. Invent. Transform.
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MSRO36

BOOST: Lung-Science Session with Keynote

Tuesday, Nov. 28 10:30AM - 12:00PM Room: S103CD

CH RO OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Meng X. Welliver, MD, Columbus, OH (*Moderator*) Nothing to Disclose
Matthew M. Harkenrider, MD, Maywood, IL (*Moderator*) Nothing to Disclose

Sub-Events

MSRO36-01 Invited Speaker:

Tuesday, Nov. 28 10:30AM - 10:50AM Room: S103CD

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

MSRO36-03 Therapeutic Response Prediction in Non-Small Cell Lung Cancer After Conservative Therapy: Utility of Multiparametric Approach by Quantitatively Assessed Dynamic First-Pass Contrast-Enhanced Perfusion MRI with FDG-PET/CT

Tuesday, Nov. 28 10:50AM - 11:00AM Room: S103CD

Participants
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Toshiba Medical Systems Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Fuji Pharma Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
Yuji Kishida, MD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinichiro Seki, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation
Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation
Masao Yui, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation
Shigeharu Ohyu, MEng, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation
Katsusuke Kyotani, RT,MSc, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Hisashi Tachizaki, Tustin, CA (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation

For information about this presentation, contact:

yosirad@kobe-u.ac.jp

PURPOSE

To directly compare the capability for therapeutic response prediction by among quantitatively assessed dynamic CE-perfusion MRI, FDG-PET/CT and multiparametric approach by both modalities in non-small cell lung cancer (NSCLC) patients treated with chemoradiotherapy.

METHOD AND MATERIALS

43 consecutive Stage IIIB NSCLC patients (25 men, 18 women; mean age 67 year old) underwent PET/CT, dynamic CE-perfusion MRI, chemoradiotherapy, and follow-up examination. In each patient, therapeutic outcomes were assessed as therapeutic effect based on RECIST guideline. Then, all patients were divided into two groups as follows: 1) responders (CR+PR cases: n=23) and 2) non-responders (SD+PD cases: n=20). In each patient, total perfusion (TP) and tumor perfusions from pulmonary (TPP) and systemic (TPS) circulations calculated from dynamic CE-perfusion MR data and SUVmax on PET/CT were assessed at each targeted lesion, and averaged to determine final values. To determine each index difference between two groups, Student's t-test was performed. Then, multivariate logistic regression analysis was performed to investigate the discriminating factors of responders. In addition, ROC analysis was performed to compare diagnostic performance between multiparametric approach and each radiological index. Finally, sensitivity, specificity and accuracy were compared among all methods by McNemar's test.

RESULTS

All indexes had significant differences between responder and non-responders ($p<0.05$). Multivariate regression analysis identified SUVmax (Odds ratio [OR]: 2.56) and TP (OR: 0.68) as significant differentiator of responder. ROC analysis showed area under the curve (Az)of multiparametric approach (Az=0.95) was significantly larger than that of TPP (Az=0.72, p=0.001). Sensitivity (95.7 [22/23] %) of multiparametric approach was significantly higher than that of TP (69.6 [16/23] %, p=0.03) and TPP (65.2 [15/23] %, p=0.02).

CONCLUSION

Multiparametric approach by dynamic CE-perfusion MRI and PET/CT can improve the capability for therapeutic response prediction as compared with each modality alone in NSCLC patients after conservative therapy.

CLINICAL RELEVANCE/APPLICATION

Multiparametric approach by dynamic CE-perfusion MRI and PET/CT can improve the capability for therapeutic response prediction as compared with each modality alone in NSCLC patients after conservative therapy.

MSRO36-04 Current Treatment Practices for Limited-Stage Small Cell Lung Cancer: A Survey of US Radiation Oncologists on Their Use of Prophylactic Cranial Irradiation

Tuesday, Nov. 28 11:00AM - 11:10AM Room: S103CD

Participants
Matthew J. Farrell, Portland, OR (*Presenter*) Nothing to Disclose
Jehan Yahya, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Catherine Degnin, PhD, MPH, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Yiyi Chen, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
John M. Holland, MD, Clackamas, OR (*Abstract Co-Author*) Nothing to Disclose
Mark A. Henderson, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
Jerry J. Jaboin, MD, PhD, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Matthew M. Harkenrider, MD, Maywood, IL (*Abstract Co-Author*) Nothing to Disclose
Charles R. Thomas JR, MD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Timur Mitin, MD, PhD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

farrelma@ohsu.edu

METHOD AND MATERIALS

We surveyed practicing US radiation oncologists via an online questionnaire. Questions covered background characteristics, self-rated knowledge of several key trials, and treatment recommendations for LS-SCLC.

RESULTS

We received 309 complete responses from practicing radiation oncologists. 98% recommend PCI for patients with LS-SCLC, 96% obtain a brain MRI prior to PCI, 33% routinely obtain serial brain imaging with MRI to detect new metastases, and 35% recommend memantine for patients undergoing PCI. Recommending memantine was associated with fewer years post residency training (p=0.0003), fewer lung cancer patients treated per year (p=0.045), and fewer LS-SCLC patients treated per year (p=0.024).

CONCLUSION

Practice patterns among US radiation oncologists strongly align with NCCN guidelines, which recommend brain MRI and PCI for patients with LS-SCLC who show a good response to initial therapy. These practices are not directly supported by the clinical trials that shaped them, as the trials used either CT scans of the brain or no brain imaging prior to PCI. Recent Japanese studies in patients with extensive-stage and limited-stage SCLC suggest that the benefits of PCI might disappear when brain MRI is incorporated. A third of respondents prescribe memantine to patients undergoing PCI; while no trials have studied memantine in the context of PCI for LS-SCLC patients, a phase III trial did show memantine delayed cognitive decline in patients treated with whole brain radiotherapy for brain metastases. Further research and a reevaluation of guidelines are warranted to determine the best treatment for patients with LS-SCLC.

CLINICAL RELEVANCE/APPLICATION

Our survey of practicing US radiation oncologists shows strong adherence to NCCN guidelines for the use of PCI in LS-SCLC, and it establishes a practice pattern baseline for future clinical trials.

MSRO36-05 Thoracic Radiation Therapy Significantly Improve the Survival of Extensive Stage Small Cell Lung Cancer after Chemotherapy

Tuesday, Nov. 28 11:10AM - 11:20AM Room: S103CD

Participants
Lei Deng, Oak Brook, IL (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Our study is aimed to evaluate the influence of Thoracic Radiation Therapy (TRT) on survival in extensive stage small cell lung cancer(SCLC) after chemotherapy.Materials/Methods: A retrospective review was conducted on extensive stage SCLC patients received chemotherapy±TRT from January 2007 to December 2012. Most patients received initial chemotherapy with carboplatin plus etoposide or chemotherapy with cisplatin plus etoposide. TRT was performed through three dimensional conformal Radiation Therapy (3D-CRT) or intensive modified radiotherapy(IMRT). The median thoracic radiation dose was 56 Gy (32~67 Gy) with 1.8~2.3 Gy per fractions. The effect of TRT on overall survival (OS) and progress free survival (PFS) was evaluated with Kaplan-Meier method and log-rank test. Statistically significant difference was set as pResults: Overall, 353 consecutive patients were enrolled. Follow-up rate was 95.5%. Patients reaching CR (complete response), PR (partial response), SD (stable disease), PD (progressive disease) after chemotherapy accounted for 2.3%, 62.6%, 21.8%, and 13.3% respectively. 130 cases of patients (36.8%) had conducted TRT. The characteristics were comparable between the TRT and non-TRT groups except that the patients conducting prophylactic cranial irradiation (PCI) were more prevalent in the TRT group. The median follow-up time for survival patients was 58.6 months. The median overall survival (OS) of the whole group was 13.3±0.5 months (95% CI: 12.3-14.3) and the median progression-free survival (PFS) was 9.0±0.3 months (95% CI: 8.3-9.7). TRT significantly improved the OS and PFS. The median OS was 20.0±1.3 months in TRT group, while 10.6±0.5 months in non-TRT group; the median PFS were 11.0±0.7 months and 7.2±0.3 months respectively in the two groups (pConclusion: For all extensive stage SCLC patients with different brain metastasis status and response after chemotherapy, TRT can significantly improve OS and PFS and decrease the loco-regional recurrence rate.

MSRO36-06 A Pilot Study Comparing the Value of 18F-Alfatide PET/CT and 18F-FDG PET/CT in Predicting Chemoradiotherapy Sensitivity in Patients with Advanced Non-Small Cell Lung Cancer

Tuesday, Nov. 28 11:20AM - 11:30AM Room: S103CD

Participants
Shuanghu Yuan, PhD, Jinan, China (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Both 18F-alfatide positron emission tomography/computed tomography(PET/CT) and 18F-fluorodeoxyglucose (18F-FDG) PET/CT were potential in predicting thearapy sensitivity, in this study, we recruited patients with advanced NSCLC to detect and compare the potential predictive vaue of them on the CRT sensitivity of patients with advanced non-small cell lung cancer (NSCLC).Materials/Methods: According to the design of Natural Science Foundation of China (NSFC) 81372413, twenty-four patients with advanced NSCLC accepted 18F-alfatide PET/CT before radiotherapy (T1), another thirty-nine patients underwent 18F-FDG PET/CT at both T1 and during CRT (40Gy of radiotherapy, T2). Logistic regression analysis was used to evaluate the correlations between PET parameters and CRT sensitivity providing an odds ratio (OR), 95% confidence interval (CI) and p value. Propensity score matching (PSM) approach was used to control confounding.Results: Logistic regression analyses showed that Karnofsky Performance Status (KPS) score was correlative with CRT sensitivity. After PSM, controlling KPS scores, twenty-four pairs of patients were matched. The results showed that SUVmax obtained from baseline 18F-alfatide PET/CT was associated with CRT sensitivity in both univariate and multivariable logistic regression analysis (OR: 0.532, 95% CI: 0.305–0.927, p=0.026; OR:0.376, 95% CI: 0.165-0.860, p= 0.021), but the baseline 18F-FDG PET/CT was not. Univariate analysis showed that the percent change in MTV of 18F-FDG PET/CT between T1 and T2 was correlative with CRT sensitivity (OR: 1.039, 95% CI: 1.003-1.077, p=0.036). When patients' KPS score was considered simultaneously, it was still related to CRT sensitivity (OR:1.038, 95% CI: 1.001-1.077, p=0.045).Conclusion: 18F-alfatide PET/CT may be better than 18F-FDG PET/CT in predicting CRT sensitivity, and 18F-FDG PET/CT is potential in monitoring the tumor response to CRT in patients with advanced NSCLC.

MSRO36-07 Tumor Ablation versus Stereotactic Body Radiation Therapy (SBRT) for Treatment of Stage 1 Non-Small Cell Lung Cancer: A Propensity Score Matching Analysis

Tuesday, Nov. 28 11:30AM - 11:40AM Room: S103CD

Awards
Student Travel Stipend Award

Participants
Jing Wang, BA , Providence, RI (*Presenter*) Nothing to Disclose
Aaron W. Maxwell, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Elaine M. Tran, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Richard N. Jones, PhD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Jaroslaw Hepel, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Thomas A. Dipetrillo, MD, Providence, RI (*Abstract Co-Author*) Research Consultant, Source Product Engineering Co Research Consultant, Accelerated Technologies
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

For information about this presentation, contact:

ddupuy@lifespan.org

PURPOSE

To compare patient- and treatment-level outcomes among patients with stage 1 non-small cell lung cancer treated with thermal ablation or stereotactic body radiation therapy (SBRT).

METHOD AND MATERIALS

This HIPAA-compliant study was performed following institutional review board approval with a waiver for informed consent. A retrospective review of the electronic medical record at our institution was performed to identify patients with biopsy-proven stage I non-small cell lung cancer who underwent treatment with thermal ablation or SBRT. A one-to-one propensity score-matched analysis was performed to identify intermodality differences in rates of overall disease progression, local tumor recurrence, and new metastatic disease. Overall survival was also compared between groups. Patient age, sex, tumor size, tumor stage, smoking history, and Charlson Comorbidity Index were used as matching variables. Statistical significance was set a priori at $a<0.05$.

RESULTS

A total of 249 patients met inclusion criteria, with 150 treated with thermal ablation and 99 treated with SBRT. 84 patients in each group were deemed satisfactory for matching. In the unmatched dataset, ablation patients were significantly older (75.33 years old vs 63.53 years, p<.001) and more likely to be current tobacco users. (23.3% vs 12.1%, p=0.027). Following propensity score matching, these differences became nonsignificant; all other matching factors were insignificant pre- and post-matching. Ablation and SBRT showed no significant difference in overall disease progression (47.6% for ablation vs 39.3% for SBRT, p=0.276). Ablation patients had a significantly higher local tumor recurrence rate (45.2% vs 20.2%, p=.001) but had a lower metastasis rate (2.4% vs 19.0%, p<.001). Overall mortality rates were comparable (15.5% for ablation vs 11.9% for SBRT, p=.501).

CONCLUSION

Among patients with stage I non-small cell lung cancer, thermal ablation and SBRT showed comparable rates of disease progression and overall survival using a propensity score-matched analysis. Observed local tumor recurrence rates were higher with ablation, while new metastatic disease occurred more frequently with SBRT.

CLINICAL RELEVANCE/APPLICATION

Thermal ablation yields comparable long-term clinical outcomes to stereotactic body radiation therapy among patients with stage I non-small cell lung cancer.

MSRO36-08 Participants

Role of Postoperative Radiotherapy (PORT) in Stage pN2 Non-Small-Cell Lung Cancer(NSCLC) Receiving Pneumonectomy

Tuesday, Nov. 28 11:40AM - 11:50AM Room: S103CD

Wenhui Wang, Zhengzhou, China (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): For patients with resected stage pN2 NSCLC, adjuvant chemotherapy followed by PORT is the standard treatment option. However, for those who received pneumonectomy, the use of PORT has no definitive evidence about its effectiveness. This study is to evaluate the effect of PORT on survival and explore the role of PORT for such population.Materials/Methods: Between Jan. 2003 and Mar. 2015, patients with stage pN2 NSCLC who underwent pneumonectomy were retrospectively reviewed. Those who received adjuvant chemotherapy with or without PORT were included in this study. Platinum-based doublet chemotherapy of 4 cycles was used. Radiotherapy was performed by 3D-CRT/ IMRT to the total dose of 50-60 Gy. The effect of PORT on survival was evaluated by Kaplan-Meier method and log-rank test. Pearson chi-Square test was used to compare the constituent ratios between groups. Statistically significant difference was set as pResults: Among 108 patients with stage pN2 NSCLC who underwent pneumonectomy, 64 patients received adjuvant therapy, including 14 patients receiving sequential adjuvant chemotherapy and PORT, and 50 patients receiving chemotherapy alone. The characteristics of patients between the two groups were comparable (p>0.05), which included gender, age, KPS, tumor site, preoperative lung function and pathological type, and et al. Of all the 64 patients, the median follow-up time was 25.5months. The 1-, 3- and 5-year cancer specific survival (CSS) rates were 79.4%,47.2% and 37%, respectively. The 1-, 3- and 5-year CSS rates were------ in the PORT group, which were significantly better than those of ------in the control group (p=0.041). The median CSS time has not reached yet in the PORT group and was 34 months in the control group. The overall survival (OS) and distant metastasis free survival (DMFS) trended to be significantly increased in the PORT group than those in the control group (p=0.084 and p=0.074, respectively). However, the local recurrence free survival (LRFS) between the two groups was not statistically different (p=0.481). Grade 3 or more radiation induced acute or chronic pneumonitis and esophagitis were not observed. There was no radiation toxicity related death.Conclusion: For patients with stage pN2 NSCLC after pneumonectomy and adjuvant chemotherapy, PORT may be considered as the treatment option, since it is safe and can improve the CSS, and trends to improve the OS and DMFS. Further verification of our result is needed in the future study.

MSRO36-09 Dosimetric Comparison on the Accuracy of Dose Calculation Algorithms Measured in Inhomogeneous Phantom in the Case of Lung SBRT

Tuesday, Nov. 28 11:50AM - 12:00PM Room: S103CD

Participants
Sarahatul Bahiah Yusoff, Singapore, Singapore (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

sarahyusoff@gmail.com

ABSTRACT

Purpose/Objective(s): Substantial dose inaccuracies can be shown in inhomogeneous regions due to loss of electronic equilibrium from loss of tissue or dose degradation at tissue interfaces. Lung SBRT typically is high dose in nature and therefore requires a sharp dose fall-off from the planning target volume (PTV) to the organs at risk (OAR). This study aims to evaluate the dosimetric comparison between dose distributions calculated with Acuros XB (AXB) grid-based Linear Boltzmann Transport Equation (LBTE) algorithm and X-ray Voxel Monte Carlo (XVMC) model based algorithm for patients undergoing lung SBRT.Materials/Methods: 12 Intensity Modulated Radiation Therapy (IMRT) and 12 Volumetric Modulated Arc Therapy (VMAT) treatment plans were created on the 0.1 cm CT study set slices of the inhomogeneous phantom targeting a 13.7cm3 PTV within the 598.1cm3 cedar insert (lung), 45 Gy at 9Gy/fraction was prescribed with 5 coplanar 6MV IMRT beams or 2 dynamic conformal arcs. Treatment planning variations included having more and different constraints onto the mock OARs. Plans were first optimized and calculated with AXB and then recalculated with XVMC utilising 0.3cm3 grid size. Dosimetric comparison for the 2 algorithms were performed and evaluated using independent software in terms of dose volume histogram(DVH) statistics related to PTV coverage and OARs doses, homogeneity (HI) and conformity (CI) indices. Dosimetric validation was performed with ion chamber measurements.Results: DVH results showed positive gains for IMRT calculated plans as compared to VMAT. AXB IMRT calculated plans yielded a minimum 95.0% coverage and global maximum of 113.0% for PTV; mean and maximum doses for lung at 20.8% and 114.0%; HI and CI at 0.123 and 1.017. XVMC IMRT calculated treatment plans yielded a minimum 94.8% coverage and global maximum of 125.8% for PTV, mean and maximum doses for lung at 20.2% and 128.5%; HI and CI of 0.245 and 1.022. Dosimetric validation showed that both algorithms agreed with measurements to within 3%.Conclusion: Both AXB and XVMC calculated treatment plans were able to meet our departmental requirements for treating lung SBRT cases. However, our experience found that AXB IMRT calculated plans showed optimal plans with better PTV coverage with lesser dose gradients, lowest lung dose as well as better Hi and CI. This study confirms that AXB algorithm adequately accounts for doses within tissue inhomogeneities.

SSG03

Chest (Dual energy/Radiomics)

Tuesday, Nov. 28 10:30AM - 12:00PM Room: S404CD

CH CT

AMA PRA Category 1 Credits ™: 1.50
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Participants
Mannudeep K. Kalra, MD, Boston, MA (*Moderator*) Nothing to Disclose
Mark L. Schiebler, MD, Madison, WI (*Moderator*) Stockholder, Stemina Biomarker Discovery, Inc; Stockholder, HealthMyne, Inc;

Sub-Events

SSG03-01 Assessment of Regional Xenon-Ventilation, Perfusion, and Ventilation-Perfusion Mismatch Using Dual-Energy Computed Tomography in Asthma-COPD Overlap Syndrome (ACOS): A Comparison with COPD

Tuesday, Nov. 28 10:30AM - 10:40AM Room: S404CD

Participants
Hye Jeon Hwang, MD,PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sang Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Beom Seo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Coreline Soft, Inc
Sang Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Young Oh, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Seung Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

umttette@hanmail.net

PURPOSE

To assess the regional ventilation (V) and perfusion (Q) status in patients with ACOS using combined xenon V and iodine Q dual-energy CT (DECT).

METHOD AND MATERIALS

Fourteen patients with ACOS and fifty-two patients with COPD underwent combined V and Q DECT. Virtual noncontrast image, V and Q maps were anatomically co-registered. After the normalization of V and Q values of each pixel, V/Qratio map was generated. In visual analysis, regional V and Q were determined as decreased, normal or increased, and V/Qratio pattern was determined as matched (-11), or reversed mismatched (V/Qratio<-1) on each maps, in combination of the regional disease patterns including emphysema with or without bronchial wall thickening, bronchial wall thickening and normal on VNC, at each segment. V/Qratio patterns and regional disease patterns were compared between two groups. Quantified CT parameters for V and Q were compared with pulmonary function test in ACOS patient.

RESULTS

The most common structural change in ACOS patients was emphysema with bronchial wall thickening (52.1%), and followed by bronchial wall thickening (27.1%), which were more frequently seen in ACOS patients than in COPD patients ($p < 0.001$). These segments commonly showed matched V/Qratio pattern in ACOS patients, while they commonly showed reversed mismatched V/Qratio pattern in COPD patients ($p < 0.001$). The segments with other structural changes commonly showed matched V/Qratio pattern in two groups. The matched V/Qratio patterns in ACOS patients commonly associated with decreased V and Q, while those in COPD patients commonly showed normal or increased V and Q. Quantified mean V, VQratio and standard deviation of V/Qratio were moderately correlated with 6MWT.

CONCLUSION

Regional V, Q and V-Q relationship can be assessed with combined V and Q DECT in ACOS patients. Regional structural abnormality and V and Q status may be different between the patients with ACOS and COPD.

CLINICAL RELEVANCE/APPLICATION

Regional structural abnormities, ventilation and perfusion status can be assessed simultaneously with combined xenon ventilation and iodine perfusion DECT in ACOS patients.

SSG03-02 Investigation of Regional Pulmonary Perfusion in Acute Lung Injury with Dual-Energy CT

Tuesday, Nov. 28 10:40AM - 10:50AM Room: S404CD

Participants

Fernando U. Kay, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Marcelo d. Beraldo, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Maria Aparecida Miyuki Nakamura, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Suhny Abbara, MD, Dallas, TX (*Abstract Co-Author*) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG
Marcelo B. Amato, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Edson Amaro Junior, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Roberta R. Santiago, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Vinicius Torsani, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Susimeire Gomes, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Rollin Roldan, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Mauro Roberto Tucci, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

fernando.kay@utsouthwestern.edu

PURPOSE

To investigate the ability of contrast-enhanced dual-energy CT (DECT) for assessing regional perfusion in a model of acute lung injury (ALI), using dynamic:first-pass perfusion CT (DynCT) as the gold standard. To evaluate if changes in lung perfusion caused by prone ventilation are similarly demonstrated by DECT and:DynCT.

METHOD AND MATERIALS

IRB-approved study, compliant with guidelines for humane care of:laboratory animals. An ALI protocol was applied to 6 landrace pigs. Perfused Blood Volume (PBV) and Pulmonary Blood Flow (PBF) were respectively quantified by DECT and:DynCT, in supine and prone positions. The lungs were segmented in equally-sized regions of interest, namely, dorsal, middle, and ventral. PBV and PBF values were normalized by lung density. Regional air-fraction (AF) was assessed by triple-material decomposition DECT. Per animal:correlation between PBV and PBF was assessed with Pearson's R. Regional differences in PBV, PBF, and AF were evaluated with one-way ANOVA and post hoc linear trend analysis (alpha=5%).

RESULTS

Mean correlation coefficient between PBV and PBF was 0.70 (range: 0.55 to 0.98). Higher PBV and PBF values were observed in dorsal vs ventral regions. Dorsal-to-ventral linear trend slopes (DVLTS) were -10.24 ml/100g/zone for PBV ($p<0.001$) and -223.0 ml/100 g/min/zone for PBF ($p<0.001$). Prone ventilation also revealed higher PBV and PBF in dorsal vs ventral regions. DVLTS were -16.16 ml/100 g/zone for PBV ($p<0.001$) and -108.2 ml/100 g/min/zone for PBF ($p<0.001$). By contrast, AF was lower in dorsal vs ventral regions in supine position, with DVLTS of +5.77%/zone ($p<0.05$). Prone:ventilation was associated with homogenization of AF distribution among different regions ($p=0.74$).

CONCLUSION

DECT-PBV is correlated with DynCT-PBF in a model of ALI, and able to demonstrate regional differences in pulmonary perfusion. Perfusion was higher in the dorsal regions, irrespectively to decubitus, with more homogeneous lung aeration in prone position.

CLINICAL RELEVANCE/APPLICATION

Our results support DECT-PBV as a surrogate for regional pulmonary perfusion in:ALI. Clinically important questions, such as the effectiveness of new drug regimens or ventilation strategies on lung perfusion in ALI could be assessed with DECT-PBV, with lesser radiation burden and extended z-axis coverage as compared with:DynCT-PBF.

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/ Suhny Abbara, MD - 2014 Honored EducatorSuhny Abbara, MD - 2017 Honored Educator

SSG03-03 Radiomics for Predicting NSCLC Recurrence after Surgery: Quantitative Analysis of the Tumor and Peritumoral Lung Parenchyma on MDCT

Tuesday, Nov. 28 10:50AM - 11:00AM Room: S404CD

Participants
Tugba Akinci D'Antonoli, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Alessandra Farchione, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Jacopo Lenkowicz, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Vincenzo Valentini, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Maria Teresa Congedo, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Anna Rita Larici, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Riccardo Manfredi, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

drtugba@hotmail.com

PURPOSE

Surgery is the standard treatment for early-stage non-small cell lung cancer (NSCLC); however, 30%-55% of patients develop recurrence despite resection. We aimed to define recurrence predictors for surgically treated early-stage NSCLC by applying Radiomics analysis to presurgical MDCT images.

METHOD AND MATERIALS

78 early-stage (stages I-IIIA) NSCLC patients who underwent surgery between 2008 and 2013 were retrospectively enrolled. A

follow-up of 3 to 5 years was considered. Tumor recurrence (TR), local recurrence (LR) or distant metastasis (DM), was defined on follow-up MDCT scans. On presurgical MDCT scans we semiautomatically contoured a region of interest (ROI) for the tumor (GTV; gross tumor volume), the peritumoral lung parenchyma (PTV; peritumor volume, 2 cm around the tumor), and the entire lobe(s) where the tumor resided. 88 statistical, morphological, and textural features were extracted from each ROI and analyzed with software developed at our institution. Significative features for univariate Cox analysis were first selected (P<0.05). All possible pairs were then used to build bivariate Cox regressions. Only the pairs that satisfied the proportional hazard hypotheses and whose Pearson's correlation coefficient was between -0.3 and 0.3 were kept. Histopathology, T-stage (T) and N-stage (N) were added as clinical covariates to the best pairs of features. Finally, stepwise regression and performance evaluation methods (bootstrap, k-fold validation, elastic nets) were applied to obtain the best model in terms of receiving operator characteristic curve and area under the curve (AUC).

RESULTS

46 patients remained disease-free; 13 had LR, 19 had DM. The best performances in predicting TR were obtained by combining covariates to morphological and textural features derived from GTV (histopathology+ROI volume+gray level co-occurrence matrix joint maximum) and PTV (N+ROI diameter+zone size) with AUC values of 0.769 and 0.767, respectively. Model based on the lobe analysis (histopathology+ROI center of mass) resulted in AUC value of 0.615.

CONCLUSION

Radiomics, especially utilizing GTV and PTV on presurgical MDCT images, has the potential to predict patient prognosis in surgically treated early-stage NSCLC.

CLINICAL RELEVANCE/APPLICATION

Prognosis prediction in NSCLC using Radiomics and MDCT images could be a useful tool for stratifying patients better at different recurrence risk and defining a personalized treatment.

SSG03-04 Dual-Energy Spectral CT Perfusion Imaging for Differentiating Various WHO Subtypes of Thymic Epithelial Tumors: A Preliminary Study

Tuesday, Nov. 28 11:00AM - 11:10AM Room: S404CD

Participants
Chunhai Yu, MD,MD, Taiyuan, China (*Presenter*) Nothing to Disclose
Xiaotang Yang, Taiyuan, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

chunhai2017@126.com

PURPOSE

To analyze some conventional computed tomography (CT) features, the quantitative parameters of perfusion and spectral of different WHO subtypes of thymic epithelial tumors(TET) using dual-energy spectral CT.

METHOD AND MATERIALS

81 patients with anterior mediastinal lesions underwent spectral CT perfusion imaging (n=48) and conventional CT enhancement scan (n=33) using Discovery CT750 HD scanner from June 2014 to March 2017 were enrolled in this study. Some morphological features (calcification; multiple nodular ,MN) and the maximal contrast-enhanced range (CEmax) derived from conventional CT scan, the quantitative metrics of perfusion (blood flow, BF; blood volume, BV; mean transit time, MTT; and permeability surface, PS), and spectral scan (water concentration, WC; iodine concentration, IC; normalized iodine concentration, NIC; and spectral HU curve slope, K) on the optimal arterial phase and venous phase of lesions were analyzed. Data statistics was performed using Kruskal-Wallis rank sum test and Spearman's rank correlation analysis.

RESULTS

The mean age of 81 patients with TET was 52.2±9.5 years (31-77 years. Calcification (22/81, 27.2%) could be found in each WHO types, while MN (12/44, 27.3%) only be found in A,AB,B1 and B2 TET. The CEmax values of A and AB TET were significant higher than those of other types (P<0.05). The WC values of A TET in arterial and venous phases were significant higher than those of B1,B2,B3 TET and TC (P<0.05), whereas BF,BV and other spectral parameters showed opposite trends, but without significant correlation between these groups (P>0.05). The PS values of low-risk TET(LRT, including A,AB,B1 TET) and high-risk TET(HRT, , including B2,B3 TET) were significant lower than those of TC, and mild correlation between these three groups were found (r=0.352, P<0.05). The BF,BV and all spectral parameters values of LRT*(A,AB) were significant lower than those of HRT* (B1,B2,B3) and TC. In addition, moderate and mild correlation were found for NIC in arterial phase and venous phase among above three groups, respectively (r=0.422, P<0.05;r=0.363, P<0.05). However, there were no significant difference between HRT*and TC.

CONCLUSION

The quantitative parameters of perfusion and spectral of dual-energy spectral CT perfusion imaging, combined with some conventional CT imaging features, have an important value in identifying different TET pathologic types.

CLINICAL RELEVANCE/APPLICATION

none

SSG03-05 Prediction of Pathological Nodal Involvement by CT-Based Radiomic Features of Primary Tumor in Clinical N0 Peripheral Lung Adenocarcinomas

Tuesday, Nov. 28 11:10AM - 11:20AM Room: S404CD

Participants
Ying Liu, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Jongphil Kim, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Yoganand Balagurunathan, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose

Samuel Hawkins, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Olya Stringfield, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Qian Li, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Fangyuan Qu, Tianjin, China (*Presenter*) Nothing to Disclose
Shichang Liu, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Alberto L. Garcia, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Zhao Xiang Ye, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Robert J. Gillies, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

tjliuying2009@163.com

PURPOSE

To investigate the potential of CT based radiomic features of primary tumor to predict pathological nodal involvement in clinical N0 peripheral lung adenocarcinomas.

METHOD AND MATERIALS

One hundred and eighty-seven patients with clinical N0 peripheral lung adenocarcinomas who underwent preoperative CT scan and subsequently received lobectomy or pneumonectomy with systematic lymph node dissection were retrospectively reviewed. 219 quantitative 3D features (known as "radiomic features") of the primary lung tumor were extracted; meanwhile, 8 radiological CT features (known as "semantic features") of the primary tumor were evaluated by three radiologists. Univariate and multivariate logistic regression analysis were used to explore the role of semantic features and radiomic features of primary tumor in predicting pathological nodal involvement. The areas under the ROC curves (AUCs) were compared between multivariate logistic regression models.

RESULTS

Of the 187 clinical N0 peripheral lung adenocarcinoma patients, 153 had pathological N0 status and 34 had pathological lymph node metastasis. On univariate analysis, fissure attachment and 17 radiomic features were significantly associated with pathological nodal involvement. Multivariate analysis revealed that semantic features of pleural retraction (p=0.048) and fissure attachment (p=0.023) were significant predictors of pathological nodal involvement (AUC=0.659); radiomic features of F185 (Histogram SD Layer 1) (p=0.0001) was independent prognostic factors of pathological nodal involvement (AUC= 0.73). The logistic regression model produced from combining radiomic feature (F185) and semantic feature (pleural retraction) showed the highest AUC of 0.758 (95% CI: 0.685-0.831), and the AUC value computed by 5-fold cross-validation method was 0.741 (95% CI: 0.0.735 - 0.748).

CONCLUSION

There are significant relationships between semantic features, radiomic features of primary lung tumor and pathological nodal involvement in clinical N0 peripheral lung adenocarcinomas. Prospective identification of predictors for nodal involvement may aid in selecting an appropriate population for lymph node dissection.

CLINICAL RELEVANCE/APPLICATION

Combined evaluation of semantic and radiomic features significantly improves prediction of the risk of a node's involvement with malignancy, and this modality could be easily added to clinical use due to its non-invasive nature.

SSG03-06 Somatic Mutations Drive Distinct Imaging Phenotypes in Lung Cancer

Tuesday, Nov. 28 11:20AM - 11:30AM Room: S404CD

Participants
Chintan Parmar, Boston, MA (*Presenter*) Nothing to Disclose
Emmanuel Rios Velazquez, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ying Liu, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Thibaud Coroller, MSc, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Gisele P. Cruz, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Olya Stringfield, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Zhao Xiang Ye, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
G. Mike Makrigiorgos, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Fiona M. Fennessy, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Raymond H. Mak, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Robert J. Gillies, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
John Quackenbush, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Hugo Aerts, PhD, Boston, MA (*Abstract Co-Author*) Stockholder, Sphera Inc

PURPOSE

Tumors are characterized by somatic mutations that drive biological processes, which are ultimately reflected in the tumor phenotype. Quantitative radiomics non-invasively characterizes tumor phenotypes by using a large panel of automatic image characterization algorithms. However, precise genotype-phenotype interactions through which somatic mutations influence radiographic phenotypes remain largely unknown. Here, we present an integrated analysis of four independent datasets of 763 lung adenocarcinoma patients with somatic mutation testing and quantitative computed tomography (CT) image analytics.

METHOD AND MATERIALS

In univariate analysis, we selected 26 variance retaining independent and stable features by using feature reproducibility (ICC) and PCA based analysis and statistically compared their distributions between mutated and non-mutated cases. We developed multivariate radiomic signatures capable of distinguishing between tumor genotypes in a discovery cohort (n=353) by using mRMR feature selection method and random forest classifier. The performance of the signatures was then validated in the validation cohort (n=352) using AUC. All analyses were performed using Matlab-R2012b and R-3.0.2.

RESULTS

We found sixteen and ten radiomic features to be significantly associated with EGFR and KRAS mutations respectively. We found a

We found sixteen and ten radiomic features to be significantly associated with EGFR and KRAS mutations respectively. We found a radiomic signature related to radiographic heterogeneity that could strongly discriminate between EGFR+ and EGFR- cases (AUC=0.69). Combining this signature with a clinical model of EGFR status (AUC=0.70) significantly improved the prediction accuracy (AUC=0.75). The highest performing signature was capable of distinguishing between EGFR+ and KRAS+ tumors (AUC=0.80) and when combined with a clinical model (AUC=0.81), substantially improved its performance (AUC=0.86). A KRAS+/KRAS- radiomic signature also showed significant, albeit lower, performance (AUC=0.63) and did not improve the accuracy of a clinical predictor of KRAS status.

CONCLUSION

These results suggest that certain somatic mutations drive distinct radiographic phenotypes that can be predicted using radiomics. Such radiomic-based tests can be applied non-invasively, repeatedly, and at low cost, providing an unprecedented opportunity for precision medicine applications.

CLINICAL RELEVANCE/APPLICATION

To establish a link between somatic mutations and the imaging phenotype in a large cohort of adenocarcinoma patients.

SSG03-07 Nodule Texture Predicts Response to Nivolumab Based Immunotherapy for Non-Small Cell Lung Cancer

Tuesday, Nov. 28 11:30AM - 11:40AM Room: S404CD

Participants
Mahdi Orooji, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose
Monica Khunger, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Mehdi Alilou, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Rajat Thawani, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Vamsidhar Velcheti, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Anant Madabhushi, PhD, Piscataway, NJ (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

morooji@gmail.com

PURPOSE

Nivolumab, a PD-1 inhibitor has shown clinical efficacy in patients with non-small cell lung cancer (NSCLC). It has been approved for treatment of patients with chemotherapy refractory, advanced NSCLC. The current standard clinical approach to evaluating tumor response is sub-optimal in defining clinical benefit from immunotherapy drugs. We sought to evaluate whether computer extracted radiomic features of nodule texture and shape from a baseline CT scan are predictive of response to nivolumab based immunotherapy.

METHOD AND MATERIALS

A cohort of 31 consecutive patients who were treated with nivolumab were included in the study. Patients who did not receive nivolumab after 2 cycles due to lack of response or progression as per RECIST were classified as 'non-responders'; patients who had radiological response per RECIST or had clinical benefit (defined as stable disease >10 cycles) were classified as 'responders'. The study team was provided with CT images from 10 patients who responded to nivolumab, 10 who did not and 11 Cases were blinded for validation. A total of 669 intra-tumoral texture (Gabor, Laws, Haralick) features were extracted and the top 4 features predictive of response on the training set (N = 20) were identified. Within the space of the top features, the optimal decision boundary for separating the training instances was identified via a Quadratic Discriminant Analysis (QDA) approach. The decision boundary was then used to evaluate the test cases (N = 11).

RESULTS

The top ranked features were the entropy, Kurtosis, and Variance of the Gabor texture feature and Variance of the Law-Laplacian feature. The QDA classifier trained with these top 5 features resulted in a 72.72% prediction accuracy on the test set.

CONCLUSION

Radiomic texture features extracted from the nodule on baseline CT scans were found to be predictive of response for NSCLC patients treated with immunotherapy. Multi-site validation is needed to establish the role of these features as predictive biomarker for response to immunotherapy in NSCLC patients.

CLINICAL RELEVANCE/APPLICATION

Our work suggests that we could better identify which patients are most likely to respond to and hence benefit from immunotherapy. From an economic perspective, identifying patients who are not likely to respond to immunotherapy could mean that expensive checkpoint inhibitor drugs would not be needlessly administered to these patients.

SSG03-08 Differentiation of Primary Lung Cancers and Benign Lung Nodules Using CT-Based Radiomic Features

Tuesday, Nov. 28 11:40AM - 11:50AM Room: S404CD

Participants
Fangyuan Qu, Tianjin, China (*Presenter*) Nothing to Disclose
Yuwei Zhang, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Ying Liu, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Zhao Xiang Ye, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate whether computed-tomography (CT) based radiomic features could differentiate between lung cancers and benign lung nodules.

METHOD AND MATERIALS

120 patients with peripheral lung nodules (<=3 cm) that were non pure ground-glass, and did not display obvious calcification or fat on pre-contrast CT images enrolled in this study. All patients received surgery and the lesions were histologically confirmed (55 adenocarcinomas, 3 squamous cell carcinomas, 20 pulmonary sclerosing hemangiomas, 20 tuberculomas and 22 pulmonary hamartochondromas). 867 radiomic features were extracted from whole-lesion volumetric 3D analysis, and 92 of these which were considered as mutually independent features were included in the analysis. Each feature between lung cancer and benign lesion were compared using two-sample t test or nonparametric Mann-Whitney U test. In order to eliminate errors generated in the process of multiple tests, q-value after the false discovery rate (FDR) correction?less than 0.05 was considered statistically significant. Lasso regression model was used for data dimension reduction and feature selection. Multivariate logistic regression model was built to identify independent factors of differentiating lung cancers and benign lung nodules. Receiver operating characteristic curves (ROC) were generated and the area under the curve (AUC) calculated with histopathology as outcome, then optimal threshold criteria were used to estimate sensitivity and specificity.

RESULTS

53 radiomic features showed significantly statistical differences between lung cancers and benign lung nodules (q<0.05), including 5 First-order statistical features, 23 Texture-based features, 8 LAWS Texture features, 10 Laplace of Gaussian features, and 7 3D Wavelet decomposition. The model generated by 6 radiomic features demonstrated excellent performance in differentiation between lung cancers and benign lung nodule, with an AUC value of 0.908 (95% CI: 0.859 - 0.958) by 10 fold cross-validation. Using the cut-off value of 0.665, the proposed CT-based radiomic feature predictors achieved 81.0% sensitivity, 85.5% specificity and 70.0% accuracy.

CONCLUSION

CT based radiomic features has the potential to differentiate primary lung cancers and benign lung nodules.

CLINICAL RELEVANCE/APPLICATION

CT-based radiomic analysis could provide useful information in the differentiation between lung cancers and benign lung nodules without adding additional cost.

SSG03-09 Radiomic Prediction of Survival in Patients with Rheumatoid Arthritis-Associated Interstitial Lung Disease Based on Hyper-Curvature Model

Tuesday, Nov. 28 11:50AM - 12:00PM Room: S404CD

Participants
Mikio Matsuhiro, Tokushima, Japan (*Abstract Co-Author*) Nothing to Disclose
Chinatsu Watari, MD, Boston, MA (*Presenter*) Nothing to Disclose
Janne J. Nappi, PhD, Boston, MA (*Abstract Co-Author*) Royalties, Hologic, Inc; Royalties, MEDIAN Technologies;
Yoshiki Kawata, PhD, Tokushima, Japan (*Abstract Co-Author*) Nothing to Disclose
Noboru Niki, PhD, Tokuhsima, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Yoshida, PhD, Boston, MA (*Abstract Co-Author*) Patent holder, Hologic, Inc; Patent holder, MEDIAN Technologies;

For information about this presentation, contact:

yoshida.hiro@mgh.harvard.edu

PURPOSE

To evaluate the comparative performance of a radiomic hyper-curvature (RHC) model of lung CT images in the prediction of the overall survival of patients with rheumatoid arthritis -associated interstitial lung disease (RA-ILD).

METHOD AND MATERIALS

We retrospectively collected 72 RA-ILD patients with thin-section lung CT and serial pulmonary function tests. The lung regions were extracted from the CT images using our previously developed method, after which the bronchi and aerated lungs were separated using histogram thresholding, region growing and mathematical morphology. To characterize the patients' lungs, we computed 120 RHC features that characterize the principal curvatures, curvedness, light/dark blobs, lines and sheets, and curvature scales of the bronchi and the aerated lungs. An elastic-net penalty method was used to select and combine these RHC features with a Cox proportional hazards model for predicting the survival of the patient. Evaluation was performed by use of bootstrapping with 2,000 replications, where concordance index (C-index) was used as a measure of prediction performance. The performances of the gender, age, and physiology (GAP) model; gender, age, and the RHC model; and GAP and RHC, were compared with that of the RHC by use of two-sided t-test.

RESULTS

Bootstrap evaluation yielded the following C-index values for the combinations of clinical and radiomic features: (a) GAP model: C-index 78.3%, [95% confidence interval (CI): 70.1, 86.5]; (b) RHC model: 80.8% [CI: 71.9, 89.7], P<0.0001 in comparison with (a); (c) gender, age, and RHC: 83.8% [CI: 77.1, 90.5], P<0.0001 in comparison with (b); and (d) GAP and RHC: 87.3% [CI: 81.3, 93.1], P<0.0001 in comparison with (c). Kaplan-Meier survival curves of patients stratified to low- and high-risk groups based on the RHC showed statistically significant (P < 0.0001) difference.

CONCLUSION

The RHC model yielded higher performance than that of GAP model in the prediction of overall survival. Addition of gender and age as well as GAP to the RHC further improved the performance of the RHC. Thus, RHC can be an effective imaging biomarker for predicting overall survival of patients with RA-ILD.

CLINICAL RELEVANCE/APPLICATION

Radiomic hyper-curvature features that are automatically calculated from lung CT images can provide an effective prognostic imaging biomarker for precise management of patients with RA-ILD.

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CHS-TUA

Chest Tuesday Poster Discussions

Tuesday, Nov. 28 12:15PM - 12:45PM Room: CH Community, Learning Center

CH

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Beth Zigmund, MD, Haddonfield, NJ (*Moderator*) Consultant, BioVentrix, Inc

Sub-Events

CH242-SD-TUA1 Radiation Dose Reduction and Improvement of Image Quality in Digital Chest Radiography by New Spatial Noise Reduction Algorithm

Station #1

Participants
Seungho Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research support, Samsung Electronics Co, Ltd ; Grant, Samsung Electronics Co, Ltd;
Semin Chong, MD, Seoul, Korea, Republic Of (*Presenter*) Research support, Samsung Electronics Co, Ltd; Research Consultant, Samsung Electronics Co, Ltd; Research Grant, Samsung Electronics Co, Ltd
Jongha Lee, Suwon-si, Korea, Republic Of (*Abstract Co-Author*) Employee, Samsung Electronics Co, Ltd
Wonje Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, Samsung Electronics Co, Ltd
Min Jae Cha, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yang Soo Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Samsung Electronics Co, Ltd

PURPOSE

To evaluate the image quality of low dose chest radiography with new spatial noise reduction algorithm by comparing with standard dose chest radiography with conventional denosing technique

METHOD AND MATERIALS

Seventy patients underwent standard dose chest radiography with conventional denoising technique (VConv) and low dose chest radiography with new denoising technique (VNew) (GC85A, Samsung Electronics, Seoul, Korea). Dose reduction was 60%, 50% and 40% of standard dose (A, B and C). All VNew and VConv images were assessed twice by two radiologists and scored according to 7 anatomic landmarks (radiolucency of lung, pulmonary vascularity (PV), trachea, edge of rib, heart boarder, intervertebral disc space and PV in retrocardiac area) using the five-point scale of image quality (IQ): 1= not relevant for diagnosis; 2 = poor; 3 = fair; 4 = good ; 5 = excellent (maximum score, 35). Between VNew and VConv images, the score was statistically analyzed using a non-inferiority test with estimated inferiority margin of 0.25 for 7 anatomic scores and 1.75 for total scores. Among the low dose groups, the total score difference between VNew and VConv images was analyzed by the repeated measured ANOVA.

RESULTS

Mean ESE of standard and low dose groups was 49±11μGy and 27±10μGy. In all standard, A, B and C groups, each score of 7 anatomic landmarks was statistically significantly > 3 points (fair IQ) (<0.0001). Using a non-inferiority test, VNew images of all low dose groups were similar to VConv images of standard dose except pulmonary vessels in a retro-cardiac area where group C was inferior to standard groups. For the total score, with non-inferiority margin as 1.75, the upper limit CI of difference in VNew images of all low dose groups was 1.18, 0.87 and 1.53, respectively, which were similar to VConv images of standard dose. The total score between VNew and VConv images was not significantly different from each other between A, B and C.

CONCLUSION

This new spatial noise reduction algorithm (VNew) improves the overall IQ of chest radiography with a radiation dose reduced to 40% of the original dose. A further study is awaited for the evaluation of abnormal findings on low dose chest radiography with VNew denosing technique.

CLINICAL RELEVANCE/APPLICATION

Even if the radiation dose is reduced, this new spatial noise reduction algorithm can achieve the good image quality, which ultimately contributes to further reduction of the radiation dose.

CH243-SD-TUA2 Detection of Solid Pulmonary Nodules in Micro-Dose CT (mDCT) with "Virtual" Higher-Dose (vHD) CT Technology: An Observer Performance Study

Station #2

Participants
Wataru Fukumoto, Hiroshima, Japan (*Presenter*) Nothing to Disclose
Kenji Suzuki, PhD, Chicago, IL (*Abstract Co-Author*) Royalties, General Electric Company; Royalties, Hologic, Inc; Royalties, MEDIAN Technologies; Royalties, Riverain Technologies; Royalties, Toshiba Medical Systems Corporation; Royalties, Mitsubishi Corporation; Royalties, AlgoMedica, Inc.; ; ; ; ; ; ; ;
Toru Higaki, PhD, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Yuji Zhao, BSC, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

Amin Zarshenas, MSc, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Kazuo Awai, MD, Hiroshima, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Research Grant, Daiichi Sankyo, Ltd; Research Grant, Eisai, Ltd; Medical Adviser, GE Healthcare; Research Grant, Fujitsu Ltd; ; ; ; ; ;

PURPOSE

We developed a radiation dose reduction technology based on deep-learning neural network convolution (NNC) that learned to convert mDCT images to higher-dose-like CT images; thus term vHDCT technology. Our purpose in this study was to investigate and compare nodule detectability in mDCT with our vHDCT technology and that in low-dose CT (LDCT) in lung cancer screening (LCS).

METHOD AND MATERIALS

Of 755 subjects underwent LCS with both mDCT and LDCT using a 320-detector-row CT scanner (Aquilion One, Toshiba, Japan), we selected 22 subjects with 1 or 2 solid nodules measuring 6-27 mm in diameter (24 nodules in total) and 20 subjects without a nodule for our observer performance study. LDCT were performed under our LCS protocol (120 kVp, automatic tube-current control with 22 noise index, 0.5 mm x 80 detector row, 1.39 pitch factor, 2 mm reconstruction slice thickness and interval), whereas mDCT were done with the same parameters except a tube-current-time-product of 5 mAs. Effective doses for LDCT and mDCT were approximately 2.0 and 0.2 mSv, respectively. We trained our NNC model with pairs of input mDCT images and the corresponding "teaching" high-dose CT images in a separate training set. Our trained NNC software was able to convert mDCT images of the 42 cases to vHDCT images where noise and artifacts were substantially reduced. Three radiologists interpreted 42 vHDCT and 42 LDCT images in a random order. They specified the locations of nodules and rated their confidence in identification of the nodules. We used receiver-operating-characteristic (ROC) analysis to compare between the observer performance with vHDCT images and that with LDCT images.

RESULTS

The mean values for the area under the ROC curve (AUC) for vHDCT (0.2 mSv) and LDCT (2.0 mSv) images were 0.86 ± 0.05 (standard deviation) and 0.84 ± 0.02, respectively. The difference was not statistically significant (P=.14).

CONCLUSION

Detectability of solid nodules in vHDCT obtained with our NNC technology at an mD level (0.2 mSv) would be comparable to that of LDCT (2.0 mSv); thus 90% dose reduction was achieved.

CLINICAL RELEVANCE/APPLICATION

LCS with mDCT (0.2 mSv) with our vHDCT technology may be feasible, and it would lower cumulative radiation exposure and lifetime risks of patients in LCS.

CH244-SD-TUA3 Usefulness of Volume Perfusion Computed Tomography in Differentiating Histologic Subtypes of Thymic Epithelial Tumors

Station #3

Participants
Yong Jing, Xian, China (*Presenter*) Nothing to Disclose
Yu-Chuan Hu, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Guang-Bin Cui, MD, Xian, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

5509773@qq.com

PURPOSE

To evaluate the performance of volume perfusion computed tomography (VPCT) parameters in differentiating the World Health Organization (WHO) subtypes of thymic epithelial tumours (TETs).

METHOD AND MATERIALS

This study was approved by the local Ethics Committee, and informed consent was waived. Fifty-five patients of TETs confirmed by histopathological analysis underwent conventional non-enhanced CT and a 48-s VPCT scan of the tumor bulk before any treatment. The VPCT parameters (blood volume (BV), blood flow (BF), mean transit time (MTT) and permeability (PMB)) were compared for differences among low-risk thymomas (LRT, types A, AB, and B1), high-risk thymomas (HRT, types B2 and B3) and thymic carcinomas (TC) based on one-way ANOVA and independent sample t test, respectively. Receiver operating characteristic curve (ROC) were performed to determine the potential efficiency for differentiating the LRT from HRT and TC by above parameters, respectively.

RESULTS

The mean BV, PMB and the max BV value in LRT were significant higher than the value from HRT and TC (mean BV, 13.76, 6.17 and 5.48 ml/100 ml; mean PMB, 22.47, 9.56 and 13.37 ml/100 ml/min; and max BV. 14.75, 6.87 and 6.06 ml/100 ml, respectively, all $P < 0.05$), while there were no significant difference between the HRT and TC ($P > 0.05$). The other perfusion value had no statistical difference to discriminate LRT from HRT and TC ($P > 0.05$). The optimal cutoff value of mean BV, mean PMB and max BV for differentiating LRT from HRT and TC were as follows: mean BV. 9.92 ml/100 ml; mean PMB. 17.33 ml/100 ml/min; and max BV. 9.88 ml/100 ml, and yielded the following: specificity. 96.4%, 92.9% and 92.9%; sensitivity. 73.9%, 73.9% and 78.3%; accuracy. 86.3%, 84.3%, and 86.3%, respectively.

CONCLUSION

These results suggest that VPCT could be used to preoperatively differentiate low-risk thymomas from the high-risk thymomas and thymic carcinomas.

CLINICAL RELEVANCE/APPLICATION

VPCT could be used to preoperatively differentiate low-risk thymomas from the high-risk thymomas and thymic carcinomas.

CH245-SD-TUA4 The Optimal Monochromatic Images with Low-Contrast Medium Dose in CT Pulmonary Angiography Using Dual-Energy Spectral CT

Station #4

Participants
Dong Han, MD, Xianyang, China (*Presenter*) Nothing to Disclose
Xiaoxia Chen, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Lei Yuxin, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Zhanli Ren, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Guangming Ma, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Jieli Zhou, Xian, China (*Abstract Co-Author*) Nothing to Disclose
He Taiping, MMed, Xian Yang City, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

147690660@qq.com

PURPOSE

To investigate the use of monochromatic images with optimal energy level in dual-energy Spectral CT to maintain image quality in low contrast medium dose CT pulmonary angiography (CTPA).

METHOD AND MATERIALS

The study was approved by the institutional review board. Patients gave written informed consent. In this prospective study, thirty patients (Table 1) who were suspected Pulmonary Embolism (PE) underwent dual-energy Spectral CTPA with low contrast medium dose, scanning protocol GSI-36: 260mA, pitch 1.375:1, CTDIvol 9.12mGy, contrast medium dose of 25ml (350mgI/ml) with 4.0ml/s injection speed, with timing bolus(8ml) monitoring. The monochromatic images from 60-80keV (with incremental of 5keV) were reconstructed using adaptive statistical iterative algorithm(50%ASiR) with thickness 1.25mm. The CT number and standard deviation (SD) of the main, right, left, right lower, left lower pulmonary arteries and back muscle were measured in the 60-80keV monochromatic images to calculate signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) for pulmonary arteries. The subjective evaluation of image quality for the five group images was performed by two experienced radiologists using 5-level scoring method independently.

RESULTS

The CT number of these pulmonary arteries decreased with the increase of energy level in the five groups monochromatic images, and the mean CT number of the pulmonary arteries with 60keV-70keV monochromatic energy images was more than 300HU, Figure 1A. The mean SNR and mean CNR of 65keV monochromatic images were the highest, while the mean SD was the lowest among the 5 image sets, which have significantly difference compared with 60keV and 70keV images (all $p<0.05$), Figure 1B, C and D. Two radiologists had better subjective evaluation (*Kappa*=0.885, $p<0.001$), The subjective scores for 65keV image quality was judged to be the highest by the two radiologists($\chi 2=62.78$,$p<0.001$), Table 2.

CONCLUSION

The 65keV monochromatic images exhibits the highest SNR and CNR while the lowest image noise and the highest subjective scores, which can be used as the optimal monochromatic images with low contrast medium dose in the dual energy spectral CTPA.

CLINICAL RELEVANCE/APPLICATION

The spectral CT monochromatic images at optimal energy level can be used in low contrast medium dose (total 33ml) CT pulmonary angiography to maintain image quality, thereby reduce the risk of contrast-induced nephropathy.

CH246-SD-TUA5 Detection of Pulmonary Nodules in 3T MR: Sequence Selection and Optimization

Station #5

Participants
ning zhang, shi Jiazhuang, China (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

476701627@qq.com

PURPOSE

To investigate the selection and optimization sequence of 3T MRI for detecting the pulmonary nodules.

METHOD AND MATERIALS

Patients with solitary pulmonary nodules were collected prospective. All patients undergo 3T MR scanning within 24 hours after CT scanning . Two radiologists analyzed images independently. The total detection rate, solid nodules' detection rate, ground-glass nodule' detection rate, CNR value and maximum diameter were calculated or measured. Compared with the gold standard ,CT. The total detection rate of nodules, the detection rate of solid nodules or ground glass nodules, the CNR and the maximum diameter were compared. All statistical analyses were performed using SPSS 21.0. The measurement data were analyzed by using Wilcoxon test, count data were compared using chi square test. P<0.05 was considered statistically significant differences. Kappa test was used to evaluate two readers agreement.

RESULTS

136 participants (74 male, 59.8±10.1 year-old; 62 female, 56.7±14.3 year-old) with 145 nodules were examined from December 2014 to December 2016. The maximum diameter was 15.2±6.1mm. Among them, 85 cases were solid nodules, 60 cases were GGN. The total detection rate was 84.1%. The detection rates of solid nodule in each sequence were T1-VIBE (60%), STAR-VIBE (72.9%), HASTE (81.1%), HASTE-IR (82.4%), T2-TSE (76.5%), T2-TSE-IR (83.5%) respectively. The detection rates of GGN in each sequence were T1-VIBE(11.7%),STAR-VIBE(15.0%),HASTE(75.0%),HASTE-IR(78.3%),T2-TSE(66.7%),T2-TSE-IR(81.7%)respectively. There was no significant difference in the total detection rate of solid nodules and ground-glass nodules . There was statistical difference among each CNR values(T1-VIBE(33.7±12.1),STAR-VIBE(95.1±33.2),HASTE(61.0±15.5),HASTE-IR(70.6±21.1),T2-TSE(47.3±12.2),T2-TSE-IR(71.9±22.1) respectively). The maximum diameter of the nodules in MRI was smaller

than that of the CT images. The Kappa value was 0.782 (P<0.001) of the two readers.

CONCLUSION

3T Magnetic resonance imaging has great potential in the detection of pulmonary nodules.

CLINICAL RELEVANCE/APPLICATION

HASTE-IR sequence and T2-TSE-IR sequence can be used for detecting the pulmonary nodules.

CH151-ED-TUA6 What CT Findings Besides the TNM Classification or Staging Can Radiologists Provide to Thoracic Surgeons for Safe Lung Cancer Surgery

Station #6

Awards

Certificate of Merit

Participants
Tsuneo Yamashiro, MD, Nishihara, Japan (*Presenter*) Research Grant, Toshiba Medical Systems Corporation
Hiroshi Moriya, MD, Fukushima-City, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukihiro Nagatani, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuji Oshiro, MD, Nishihara-Cho, Japan (*Abstract Co-Author*) Nothing to Disclose
Shoichiro Matsushita, MD, Kawasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Sadayuki Murayama, MD, PhD, Nishihara-Cho, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation

For information about this presentation, contact:

clatsune@yahoo.co.jp

TEACHING POINTS

Preoperative chest CT is routinely performed to assess cancer size/regional invasion, lymph node metastasis, and distant metastasis to determine the clinical stage of lung cancer. However, with careful interpretation of the preoperative CT, radiologists can denote many additional critical points that could prevent safe surgery. This exhibit aims to introduce the critical points (eg, anomalies of pulmonary structures, inflammatory adhesions between the parietal and visceral pleura, adhesion to/invasion of the aorta or pericardium) plus their importance for safe surgery and to demonstrate the use of cutting-edge techniques such as 4D dynamic-ventilation CT to detect these important findings.

TABLE OF CONTENTS/OUTLINE

1. Lung cancer surgery overview 2. Critical points and their CT findings —Unsuccessful intubation/separated pulmonary ventilation Upper airway stenosis Tracheal bronchus/abnormal tracheal bifurcation —Pulmonary edema by PAPVR in the contralateral lung —Pulmonary artery anomalies Mediastinal branching 'Artery of Sorrow' (the left A3 artery) —Combined arterial and bronchial anomalies —Unusual location of pulmonary lobes —Pulmonary vein anomalies —Incomplete interlobar fissures —Inflammatory adhesion between the parietal and visceral pleura (4D-CT diagnosis) —Cancer invasion of cardiovascular structures (4D-CT diagnosis)

CH196-ED-TUA7 PE or No PE: Alternative Diagnoses on CTA

Station #7

Participants
Kelly W. Capel, MD, Madison, WI (*Presenter*) Nothing to Disclose
Cristopher A. Meyer, MD, Cincinnati, OH (*Abstract Co-Author*) Investor, Elucent Medical; Investor, NeuWave Medical, Inc
Jeffrey P. Kanne, MD, Madison, WI (*Abstract Co-Author*) Research Consultant, PAREXEL International Corporation; ; Consultant, HealthMyne, Inc
Lynn S. Broderick, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Maria D. Martin, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

kcapel@uwhealth.org

TEACHING POINTS

Describe and showcase the most common and uncommon alternate diagnoses in patients undergoing CTA for possible PE Briefly outline diagnostic criteria for ordering CTA for evaluation for pulmonary embolism and potential nonadherence to these pretest probability tools Discuss the sensitivities and specificities in CTA for detecting PE as well as recognizing importance of local PE prevalence Present recent data on how effective CTA is for evaluating for PE as a diagnostic examination (rather than as a screening exam) and emphasize importance of obtaining a chest radiograph first

TABLE OF CONTENTS/OUTLINE

Introduction Disclosures Prevalence of various alternate diagnoses when evaluating for PE Imaging findings of various alternate diagnoses Diagnostic criteria for ordering CTA for pulmonary embolism (Wells, Geneva, PERC) Summary

CHS-TUB

Chest Tuesday Poster Discussions

Tuesday, Nov. 28 12:45PM - 1:15PM Room: CH Community, Learning Center

CH

AMA PRA Category 1 Credit ™: .50

Participants
Beth Zigmund, MD, Haddonfield, NJ (*Moderator*) Consultant, BioVentrix, Inc

Sub-Events

CH247-SD-TUB1 CT-Based Radiomics Signature: A Potential Postoperative Prognostic Marker for Patients with Lung Adenocarcinoma

Station #1

Participants
Motohiko Yamazaki, MD, Niigata, Japan (*Presenter*) Nothing to Disclose
Takuya Yagi, Niigata City, Niigata Prefecture, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Ishikawa, MD, Niigata, Japan (*Abstract Co-Author*) Nothing to Disclose
Hidefumi Aoyama, MD, PhD, Niigata, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the predictive value of radiomics signature for postoperative recurrence in patients with lung adenocarcinoma and to compare its predictive performance with that of conventional CT features.

METHOD AND MATERIALS

This study included 172 patients with pathological stage I lung adenocarcinoma who underwent surgical resection and whose solid component on preoperative CT image >5 mm. Tumor segmentation was manually performed on each axial CT image in which the lesion appeared. Subsequently, 107 radiomics features consisting of shape factors, first order statistics (histogram factors), second order statistics (gray-level cooccurrence matrix), and high order statistics (gray-level run length and gray-level size zone matrices) were computed. Conventional CT features such as the ratio of a solid component, spiculation, and air bronchogram were also evaluated. Multivariate Cox regression analysis was used to develop the following two prognostic models: radiomics model and conventional CT model. The predictive power for a 5-year disease-free survival (DFS) for the two models was compared using the area under the curve (AUC) of the time-dependent receiver operating characteristic curves. Internal validation of the model was performed by leave-one-out cross-validation (LOOCV).

RESULTS

During the follow-up period (median, 5.97 years), 28 patients experienced adenocarcinoma recurrence. In univariate analysis, 45 out of 107 radiomics features were significantly associated with DFS (all $P < 0.05$; univariate AUC range, 0.56-0.71). After multivariate analysis, five features (one shape factor, one first order statistics, and three high order statistics) were included in the radiomics model, which showed better predictive performance for a 5-year DFS than the conventional CT model consisting of the ratio of the solid components (AUC, 0.83 vs. 0.66; $P = 0.01$). LOOCV revealed that the radiomics model indicated good validation performance (AUC, 0.77; 95% confidence interval, 0.67-0.87).

CONCLUSION

Our results suggest that the radiomics signature has high potential for predicting postoperative recurrence in early-stage lung adenocarcinoma and shows better performance than conventional CT findings.

CLINICAL RELEVANCE/APPLICATION

This is the first study to compare the prognostic value of radiomics signature with that of conventional CT findings in lung adenocarcinoma.

CH248-SD-TUB2 Convolutional Neural Networks to Predict the Tumor Invasiveness of Pulmonary Adenocarcinomas Appearing as Pulmonary Ground-Glass Opacity Nodules

Station #2

Participants
Xing Xue, Hangzhou, China (*Presenter*) Nothing to Disclose
Yuan Hong, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Dexing Kong, PhD, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Feng Chen, MD, PhD, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zhan Feng Sr, Hang Zhou, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

xuexing_09@sina.com

PURPOSE

As a kind of artificial neural network, Convolutional Neural Network (CNN) is one of the most commonly used structures in deep

learning. In this study, CNN was applied to predict the invasiveness of pulmonary adenocarcinomas appearing as pulmonary ground-glass opacity nodules (GGNs) based on the imaging features in CT.

METHOD AND MATERIALS

From August 2012 to July 2016, 922 patients with 1004 GGNs who underwent routine chest CT scan were investigated retrospectively. All GGNs were pathologically confirmed after surgery, including 404 preinvasive lesions (atypical adenomatous hyperplasia, AAH; adenocarcinoma in situ, AIS) and 600 minimally invasive pulmonary adenocarcinoma and invasive pulmonary adenocarcinoma (IPAs). In this study, CNN were used to distinguish preinvasive lesions from IPAs in CT images. Our CNN has 7 layers, which consists of one input layer, two convolutional layers, two pooling layers and two fully connected layers. This network takes pulmonary nodule patches with size of 40*40 pixel as input layer. The first convolutional layer has sixteen 5*5 convolution kernels, the second convolutional layer has twelve 5*5 convolution kernels. We randomly selected 344 preinvasive lesions and 500 IPAs nodules as training set, 60 preinvasive lesions and 100 IPAs nodules as test set.

RESULTS

The results showed that 52 out of 60 nodules was detected correctly in preinvasive lesions and 92 out of 100 was detected correctly in IPAs. The accuracy was 86.67% and 92.00% respectively.

CONCLUSION

The weight sharing network structure makes CNN more similar to the biological neural network, which reduces the complexity of the network model. In GGNs, CNN may help to predict the tumor invasiveness of pulmonary adenocarcinomas.

CLINICAL RELEVANCE/APPLICATION

As a method of deep learning, Convolutional Neural Networks (CNN) has gained a lot of fame in many fields. With the mode of CNN, it may help radiologists to improve the clinical diagnostic level.

CH249-SD-TUB3 Whole-Lesion Evaluation of Lung Adenocarcinoma for Predicting Pathological Grade: Comparative Study between Histogram Parameters of ADC on DWI, and MTV as Well as TLG on 18F-FDG PET

Station #3

Participants
Mariko Doai, Ishikawa, Japan (*Presenter*) Nothing to Disclose
Hisao Tonami, MD, Kahoku, Japan (*Abstract Co-Author*) Nothing to Disclose
Naoko Tsuchiya, Kahoku, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsuo Usuda, Kahoku, Japan (*Abstract Co-Author*) Nothing to Disclose
Hidetaka Uramoto, Ishikawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Munetaka Matoba, MD, Isikawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study evaluated whole-lesion imaging parameters that could potentially be used to predict the pathological grade of lung adenocarcinoma, using a histogram analysis of apparent diffusion coefficient (ADC) values on diffusion-weighted MR imaging (DWI), and the metabolic volume (MTV) as well as total lesion glycolysis (TLG) on 18F-FDG positron emission tomography (PET).

METHOD AND MATERIALS

Twenty-five patients with surgically diagnosed lung adenocarcinoma were examined. DWI (b=0, 800 sec/mm2) was obtained using a spin-echo, echo-planar imaging sequence with respiratory triggering by the navigator-echo method. The ADC maps were placed on a 3D volume-of-interest (VOI) on the tumor, superimposing the low b-value DWI. The histogram parameters including mean, skewness, kurtosis, 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles of ADC were calculated. 18F-FDG PET was acquired 60 min after an administration of 185 MBq of 18F-FDG using the 3D method. MTVs were placed on a 3D VOI on the tumor. TLG values were calculated as the MTV the mean standard uptake value. The correlations between each histogram parameters of ADC, MTV as well as TLG and the pathological grades (grade 1-3) were examined. A receiver operating characteristics (ROC) analysis was performed for the different pathological grades.

RESULTS

The mean, 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles of ADC, and TLG showed significant differences among the three pathological grades. The results of ROC analysis between high-grade (grade 3) and low-grade (grades 1 and 2) tumors showed that the 90th and 95th percentiles of ADC achieved the highest area under curve (0.952), with a cut-off value of 1.520×10-6 mm2/sec with 0.810 sensitivity and 1.000 specificity, and 1.654×10-6 mm2/sec with 0.810 sensitivity and 1.000 specificity, respectively.

CONCLUSION

The 90th and 95th percentiles of the ADC on the basis of the entire tumor volume proved to be the most useful for predicting the pathological grade of lung adenocarcinoma.

CLINICAL RELEVANCE/APPLICATION

The 90th and 95th percentiles of the ADC are the most useful for predicting the pathological grade of the lung adenocarcinoma.

CH250-SD-TUB4 Radiomics for Predicting NSCLC Recurrence after Surgery: Quantitative Analysis of the Tumor and Peritumoral Lung Parenchyma on MDCT

Station #4

Awards
Student Travel Stipend Award

Participants
Tugba Akinci D'Antonoli, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Alessandra Farchione, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Jacopo Lenkowicz, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Vincenzo Valentini, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

Maria Teresa Congedo, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Anna Rita Larici, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Riccardo Manfredi, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

drtugba@hotmail.com

PURPOSE

Surgery is the standard treatment for early-stage non-small cell lung cancer (NSCLC); however, 30%-55% of patients develop recurrence despite resection. We aimed to define recurrence predictors for surgically treated early-stage NSCLC by applying Radiomics analysis to presurgical MDCT images.

METHOD AND MATERIALS

78 early-stage (stages I-IIIA) NSCLC patients who underwent surgery between 2008 and 2013 were retrospectively enrolled. A follow-up of 3 to 5 years was considered. Tumor recurrence (TR), local recurrence (LR) or distant metastasis (DM), was defined on follow-up MDCT scans. On presurgical MDCT scans we semiautomatically contoured a region of interest (ROI) for the tumor (GTV; gross tumor volume), the peritumoral lung parenchyma (PTV; peritumor volume, 2 cm around the tumor), and the entire lobe(s) where the tumor resided. 88 statistical, morphological, and textural features were extracted from each ROI and analyzed with software developed at our institution. Significative features for univariate Cox analysis were first selected ($P<0.05$). All possible pairs were then used to build bivariate Cox regressions. Only the pairs that satisfied the proportional hazard hypotheses and whose Pearson's correlation coefficient was between -0.3 and 0.3 were kept. Histopathology, T-stage (T) and N-stage (N) were added as clinical covariates to the best pairs of features. Finally, stepwise regression and performance evaluation methods (bootstrap, k-fold validation, elastic nets) were applied to obtain the best model in terms of receiving operator characteristic curve and area under the curve (AUC).

RESULTS

46 patients remained disease-free; 13 had LR, 19 had DM. The best performances in predicting TR were obtained by combining covariates to morphological and textural features derived from GTV (histopathology+ROI volume+gray level co-occurrence matrix joint maximum) and PTV (N+ROI diameter+zone size) with AUC values of 0.769 and 0.767, respectively. Model based on the lobe analysis (histopathology+ROI center of mass) resulted in AUC value of 0.615.

CONCLUSION

Radiomics, especially utilizing GTV and PTV on presurgical MDCT images, has the potential to predict patient prognosis in surgically treated early-stage NSCLC.

CLINICAL RELEVANCE/APPLICATION

Prognosis prediction in NSCLC using Radiomics and MDCT images could be a useful tool for stratifying patients better at different recurrence risk and defining a personalized treatment.

CH174-ED-TUB5 Evaluation of the Orthotopic Heart Transplant: What the Radiologist Should Know about the Early and Late Post-Transplant Periods

Station #5

Awards
Cum Laude
Identified for RadioGraphics

Participants
Jordan D. Smith, DO, Kansas City, MO (*Presenter*) Nothing to Disclose
Stephane Desouches, DO, Kansas City, MO (*Abstract Co-Author*) Nothing to Disclose
Santiago Martinez-Jimenez, MD, Kansas City, MO (*Abstract Co-Author*) Author, Reed Elsevier; Author, Oxford University Press
Melissa L. Rosado De Christenson, MD, Kansas City, MO (*Abstract Co-Author*) Author, Thieme Medical Publishers, Inc Author, Reed Elsevier Author, Oxford University Press
Justin Stowell, MD, Kansas City, MO (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. To highlight radiologic findings after heart transplantation, including common and uncommon complications. 2. To present a concise imaging approach to evaluation of complications occurring after heart transplantation.

TABLE OF CONTENTS/OUTLINE

1. Epidemiology 2. Expected findings in the immediate postoperative period Pneumomediastinum, pneumopericardium, mediastinal hematoma, pneumothorax, hemothorax, pleural effusion. 3. Early post-op complications (< 1 year) Acute (< 3 months): Pulmonary infection, acute allograft rejection, mediastinitis, mediastinal hematoma, sternal dehiscence. Subacute (> 3 months): Allograft rejection, infection, accelerated graft atherosclerosis. 4. Late post-op complications (> 1 year) Malignancy (Adenocarcinoma of lung or GI tract, skin cancer, lymphoma/post-transplant lymphoproliferative disease, etc.), aortic dissection, pseudoaneurysm, thromboembolism. 5. Conclusions / Prognostic implications

CH197-ED-TUB6 Helpful Tips for Identifying Incidental Pulmonary Emboli and Infarcts on Non-CTA Imaging Exams

Station #6

Participants
Kelly W. Capel, MD, Madison, WI (*Presenter*) Nothing to Disclose
Maria D. Martin, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Cristopher A. Meyer, MD, Cincinnati, OH (*Abstract Co-Author*) Investor, Elucent Medical; Investor, NeuWave Medical, Inc
Jeffrey P. Kanne, MD, Madison, WI (*Abstract Co-Author*) Research Consultant, PAREXEL International Corporation; ; Consultant, HealthMyne, Inc
Lynn S. Broderick, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

kcapel@uwhealth.org

TEACHING POINTS

Show variety of extra-thoracic presentations of pulmonary embolism (PE) and lung findings that lead to the diagnosis Understand which patient groups have increased prevalence of PE Identify limitations in identifying incidental PE, emphasizing importance of thin slices, optimizing viewing windows, and contrast bolus Demonstrate findings associated with venous infarcts

TABLE OF CONTENTS/OUTLINE

Introduction Disclosures Patients with various presentations of unsuspected PE Prevalence, treatment and prognosis of incidental PE in oncology patients and inpatients Patients with venous infarcts Summary References

MSRO37

Boost: Lung - The Confluence of Diagnostic Radiology and Radiation Oncology in Lung Cancer (An Interactive Session)

Tuesday, Nov. 28 1:30PM - 2:30PM Room: S103CD

CH OI RO

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Simon S. Lo, MD, Seattle, WA (*Moderator*) Research support, Elekta AB ;

For information about this presentation, contact:

simonslo@uw.edu

LEARNING OBJECTIVES

1) To describe the appropriate radiological evaluation of lung cancer for staging. 2) To describe the utilization of diagnostic/ functional imaging for target delineation and functional avoidance. 3) To describe treatment response evaluation after chest radiotherapy.

Sub-Events

MSRO37A Pre-treatment Radiological Evaluation of Lung Cancer

Participants
Michelle S. Ginsberg, MD, New York, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ginsberm@mskcc.org

LEARNING OBJECTIVES

**View learning objectives in main course title.

MSRO37B Utilization of Diagnostic/Functional Imaging for Target Delineation and Functional Avoidance

Participants
Feng-Ming Kong, MD, PhD, Augusta, GA (*Presenter*) Research Grant, Varian Medical Systems, Inc Speaker, Varian Medical System, Inc Travel support, Varian Medical System, Inc

LEARNING OBJECTIVES

**View learning objectives in main course title.

MSRO37C Imaging Evaluation of Treatment Response after Radiation Therapy for Lung Cancer

Participants
David Palma, MD, FRCPC, London, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

**View learning objectives in main course title

RSNA 2017 Explore. Invent. Transform.
103rd Scientific Assembly and Annual Meeting
November 26 to December 1
McCormick Place, Chicago
Explore Invent Transform

MSRO38

BOOST: Lung-Case-based Review (An Interactive Session)

Tuesday, Nov. 28 3:00PM - 4:15PM Room: S103CD

CH OI RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Simon S. Lo, MD, Seattle, WA (*Moderator*) Research support, Elekta AB ;
Philip A. Linden, Cleveland, OH (*Presenter*) Nothing to Disclose
Subba R. Digumarthy, MD, Boston, MA (*Presenter*) Nothing to Disclose
Jyoti D. Patel, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Feng-Ming Kong, MD, PhD, Augusta, GA (*Presenter*) Research Grant, Varian Medical Systems, Inc Speaker, Varian Medical System, Inc Travel support, Varian Medical System, Inc
Alexander Louie, MD, FRCPC, London, ON (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

simonslo@uw.edu

sdigumarthy@partners.org

Philip.linden@uhhospitals.org

LEARNING OBJECTIVES

1) Discuss the appropriate management of non-small cell lung cancer. 2) Discuss the appropriate management of small cell lung cancer.

ABSTRACT

Modern management of lung cancer typically involves interdisciplinary evaluation by radiologists, thoracic surgeons, medical oncologists, and radiation oncologists. This session reviews the most up-to-date multidisciplinary management of both non-small cell and small cell lung cancer through clinical cases.

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

SSJ05

Science Session with Keynote: Chest (Lung Nodule/MRI)

Tuesday, Nov. 28 3:00PM - 4:00PM Room: S404CD

CH MR OI

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants

Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Moderator*) Research Grant, Toshiba Medical Systems Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Fuji Pharma Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
Andrew J. Plodkowski, MD, Syracuse, NY (*Moderator*) Nothing to Disclose
Jurgen Biederer, MD, Heidelberg, Germany (*Moderator*) Nothing to Disclose

Sub-Events

SSJ05-01 Chest Keynote Speaker: Focal Lung Lesions: The Potential Role of MRI for the Assessment of Malignancy

Tuesday, Nov. 28 3:00PM - 3:10PM Room: S404CD

Participants
Jurgen Biederer, MD, Heidelberg, Germany (*Presenter*) Nothing to Disclose

ABSTRACT

In current practice, magnetic resonance imaging (MRI) of the lung is increasingly recognized as a valuable adjunct or even alternative to computed tomography (CT). Superior soft tissue contrast of morphologic sequences and the functional imaging capacities of MRI open new perspectives for detection and assessment of pulmonary malignancy. In a screening setting, applications range from lung MRI as the first choice screening modality to the role of an ad hoc on site test for the detailed evaluation of positive CT screening results with multi-parametric characterization of lung pathology. Malignant lung lesions, carcinoma, metastases, carcinoid and lymphoma usually show a nonspecific low or intermediate signal intensity on T1-weighted images and high signal intensity on T2-weighted images. Short tau inversion recovery (STIR) sequences achieve a sensitivity of approximately 80 % and a specificity of 60%. Dynamic contrast enhanced (DCE) MRI is based on the evaluation of contrast uptake in the assessed lesion after bolus injection. It achieves specificities of 50-95% and sensitivities of 50-100% with diagnostic accuracies of 75-94%, hence coming close to the accuracies of contrast enhanced MDCT and FDG PET/CT. As in dynamic CT, it can be assumed that DCE MRI of solid pulmonary lesions has a high negative predictive value in cases of very low or missing enhancement after intravenous contrast application. More recently, diffusion weighted imaging (DWI) has been advocated for the assessment of focal lung lesions. DWI yields sensitivities between 70% and 90% and specificities of 60-95% for malignancy. However, DCE and DWI MRI cannot yet be considered robust, highly standardized and simple techniques for clinical use. The applied protocols vary widely and solutions for basic problems such as compensation for respiratory motion and for the non-linearity of blood/tissue-signal with gadolinium-concentration are still subject to research. Further methods to evaluate tumor viability based on multi-parametric MRI are on an early, experimental level. The presentations comprised within this scientific session will contribute valuable insights into the further development, application, performance and diagnostic yield of these emerging techniques.

SSJ05-02 Diagnostic Performance of Diffusion-Weighted Imaging with Multiple Parameters for Assessment and Characterization of Pulmonary Lesions: A Meta-Analysis

Tuesday, Nov. 28 3:10PM - 3:20PM Room: S404CD

Participants
Guohua Shen, MD,PhD, Chengdu, China (*Presenter*) Nothing to Disclose
Anren Kuang, MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Regarding DWI application in thoracic disease, several appropriate parameters have been reported, commonly including 5-point rank scale, lesion-to-spinal cord ratio (LSR) and apparent diffusion coefficient (ADC). This study aimed to evaluate the diagnostic performance of diffusion-weighted imaging (DWI) using these three parameters for the characterization of pulmonary lesions.

METHOD AND MATERIALS

After literature search in several databases (the PubMed, EMBASE, Cochrane library and China National Knowledge Infrastructure databases), two investigators independently selected studies, assessed methodological quality, and extracted data. On a per-lesion basis, we pooled and compared three parameters between malignant and benign pulmonary lesions. Then, we determined pooled sensitivity and specificity with individual 95% confidence intervals (CIs). In addition, the summary receiver operation characteristic curves (SROC) for DWI with area under the curve (AUC) and Q* index were constructed.

RESULTS

In total, 31 articles involving 2368 lesions were included. The score of 5-point scale of malignant and benign lesions were 3.83

(3.71-3.96) and 2.36 (2.18-2.54), respectively. The LSR of malignant and benign lesions were 1.15 (1.07-1.24) and 0.71 (0.62-0.79), respectively. The ADC values of malignant lesions and benign lesions were 1.23 (1.21-1.24) and 1.72 (1.68-1.77), respectively. All of three parameters differed significantly between malignant and benign lesions (Figure 1) ($p<0.05$). With a cut-off value of 3, the pooled sensitivity and specificity were 0.88 (0.84-0.91) and 0.75 (0.68-0.80) for 5-point scale. The SROC curve displayed AUC of 0.9107 and Q* index of 0.8429, respectively. For LSR, the pooled sensitivity, specificity, AUC and Q* index were 0.80 (0.75-0.85), 0.85 (0.76-0.92), 0.9159 and 0.8487, respectively. The ADC measurements yielded the pooled sensitivity of 0.84 (0.82-0.86), pooled specificity of 0.84 (0.81-0.87), AUC of 0.9198, and Q* index of 0.8532.

CONCLUSION

DWI can help to distinguish malignant from benign pulmonary lesions based on visual parameter (5-point scale), semiquantitative parameter (LSR) and quantitative parameter (ADC).

CLINICAL RELEVANCE/APPLICATION

In clinical practice, 5-point scale, LSR, and ADC were useful diagnostic parameters for pulmonary lesions, and the diagnostic performances of them did not show any significant differences.

SSJ05-03 Assessment of Intravoxel Incoherent Motion Diffusion-Weighted MR Imaging in Solitary Pulmonary Nodules: Comparison and Correlation with Dynamic Contrast-Enhanced MR Imaging

Tuesday, Nov. 28 3:20PM - 3:30PM Room: S404CD

Participants
Shuchang Zhou, Wuhan, China (*Presenter*) Nothing to Disclose
Liming Xia, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

zhoushuchang@hust.edu.cn

PURPOSE

To compare intravoxel incoherent motion (IVIM) and dynamic contrast-enhanced MR imaging (DCE-MRI) in their ability to discriminate lung cancer(LC) from benign pulmonary lesions.

METHOD AND MATERIALS

57 consecutive patients with solitary pulmonary nodules underwent DW-IVIM (multi-b-factor DWI with b values of 0, 20,50, 100, 150,200, 400, 600, and 1000 s/mm2) and DCE-3.0T MRI. ADCtotal, Tissue diffusivity (D), pseudo-diffusion coefficient (D*), and perfusion fraction (F) were calculated with mono--exponential and IVIM models. MER,Tmax, SLE and washout were calculated with semi-quantitative DCE analysis. Receiver operating characteristic (ROC) curves was constructed to estimate the diagnostic performance of both methods in differentiating diagnosis and the optimal cut-off values were obtained.

RESULTS

ADCtotal and D were significantly higher for benign lesions than for LC ([1.83?±?0.66]?×?10-3 mm2/s vs. [1.30?±?0.40]?×?10-3 mm2/s; P?=?0.005; [1.33?±?0.43]?×?10-3 mm2/s vs. [0.88?±?0.29]?×?10-3 mm2/s; P?=?0.002). D*was found to be significantly higher in LC than benignity ([50.65?±?46.08] ×?10-3 mm2/s vs. [19.68?±?30.54] ×?10-3 mm2/s; P?=?0.005). No difference was observed in F between LC and benignity (P?=?0.06).By DCE-MRI,Tmax were significantly shorter in LC than that of benignity([131.6?±?83.4]?s vs. [309.7?±?126.0]?s; P? **CONCLUSION**

Both IVIM model based on DWI and DCE-MRI were useful for discriminating benign lesions from malignant pulmonary nodules, and can provide quantitative diffusion and perfusion information by multiple parameters. We suggest that a combined DCE and IVIM could provide a more promising way in determination microstructure characteristics of solitary pulmonary nodules.

CLINICAL RELEVANCE/APPLICATION

Combination of DCE and IVIM could provide an alternative noninvasive method for diagnosis of SPN without radiation explosure.

SSJ05-04 How to Apply Computed Diffusion-Weighted Image for Improving Diagnostic Performance of Chest MR Imaging in Patients with Pulmonary Nodules?

Tuesday, Nov. 28 3:30PM - 3:40PM Room: S404CD

Participants
Yuji Kishida, MD, Kobe, Japan (*Presenter*) Nothing to Disclose
Shinichiro Seki, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation
Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation
Yoshimori Kassai, MS, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation
Katsusuke Kyotani, RT,MSc, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Fuji Pharma Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;

For information about this presentation, contact:

yjk121@med.kobe-u.ac.jp

PURPOSE

To determine the utility of computed diffusion-weighted image (cDWI) for improving diagnostic performance on chest MR imaging in patients with pulmonary nodules.

METHOD AND MATERIALS

61 consecutive patients (38 men and 23 women; mean age, 69.1±9.7 years) with 82 pulmonary nodules underwent DWIs,

transbronchial or CT-guided biopsies, surgical resection, pathological, microbaclterial and follow-up examinations. All DWI were obtained at a 3T MR system by using fast advanced spin-echo (FASE) sequence with b values at 0 and 1000s/mm2. As well as actual DWI at 1000s/mm2 (aDWI), cDWIs were generated at b value as 400 (cDWI400), 600 (cDWI600), 800 (cDWI800), 1000 (cDWI1000), 1500 (cDWI1500) and 2000 (cDWI2000) s/mm2 by commercially available software. According to results of pathological and follow-up examinations, all nodules were divided into malignant (n=41) and benign (n=41) nodule groups. Then, signal-to-noise ratio (SNR) and contrast ratio (CR) between nodule and thoracic muscles were determined by ROI measurement at each nodule. To compare image quality between aDWI and each cDWI, SNRs were compared by Dunnett multiple comparison test. To determine the utility of cDWI with aDWI, the logistic regression analysis was also performed with aDWI and all cDWIs. To compare diagnostic performance of pulmonary nodule, ROC analyses were performed among aDWI, each DWI and combined aDWI with appropreate cDWI determined by logistic regression analysis. Finally, sensitivity, specificity and accuracy were compared by McNemar's test.

RESULTS

SNRs of cDWI400 (p=0.002) and cDWI600 (p=0.008) were significantly higher than that of aDWI1000, although that of cDWI1500 (p<0.001) and cDWI2000 (p<0.001) were significantly lower than that of aDWI1000. Logistic regression analysis showed aDWI and cDWI600 were significant predictors for diagnosis of malignancy (p<0.05). Accuracy of aDWI with cDWI600 (86.6 [71/82] %) was significantly higher than that of aDWI (81.7 [67/82] %, p<0.05).

CONCLUSION

Computed DWI has a potential to improve diagnostic performance of DWI in patients with pulmonary nodules, when generated at appropriate b value.

CLINICAL RELEVANCE/APPLICATION

Computed DWI has a potential to improve diagnostic performance of DWI in patients with pulmonary nodules, when generated at appropriate b value.

SSJ05-05 The Value of Differential Diagnosis the Invasive Adenocarcinoma of Lung in 3T MRI

Tuesday, Nov. 28 3:40PM - 3:50PM Room: S404CD

Participants
ning zhang, shi Jiazhuang, China (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

476701627@qq.com

PURPOSE

To investigate the value of magnetic resonance imaging (MRI) in differential diagnosis of invasive pulmonary adenocarcinoma (IPA) appearing as ground-glass nodules

METHOD AND MATERIALS

Retrospective analysis was performed on CT and MRI findings in patients with pulmonary ground-glass nodules from December 2014 to December 2016. All patients were undergo the surgery and pathologically proved, they were pre-cancerous lesions or clinical stage 1 of lung adenocarcinoma. The image features of the lesions were analyzed by two readers who did not know the pathological results. Maximum diameter, T2 signal intensity and ADC value were measured. According to the pathology, the lesions were divided into two groups. One included pre-invasive lesion (AAHs and AISs) and MIAs, another included IPAs. Compared the 3 indicators between two groups . All statistical analyses were performed using SPSS 21.0. The measurement data were analyzed by using two independent samples t test,If it was suitable for the normal distribution, otherwise using Mann-Whitney U test. Count data were compared using chi square test. Receiver operating characteristic (ROC) curve analysis were performed to evaluate diagnostic test.

RESULTS

A total of 34 participants (14 male, 57.1±14.7 year-old; 20 female, 54.9±10.1year-old) with 34 nodules were enrolled in the study. There were 15 cases in group A , including 4 AAH, 2 AIS and 9 MIA, and19 cases in group B. There was no significant differences in the age of patient and gender between the two groups. The maximum diameter of lesions in group A was significantly less than that in group B(9.9±2.6mm vs 13.1±2.7mm). The T2 signal intensity of lesions in group A was significantly lower than that in group B(93.0±8.3 vs 113.6±22.9).The ADC value in group A(1.0±0.2*10-3 mm2/s) was also significantly lower than that in group B (1.3±0.3*10-3 mm2/s). The best index to distinguish the two groups is the maximum diameter of lesions The optimal cut-off value for maximum diameter was 11.5mm (sensitivity, 73.7%; specificity, 73.3%).The AUC for maximum diameter was 0.791 (95% confidence interval: 0.640,0.942)

CONCLUSION

The maximum diameter of the nodule, T2 signal intensity and ADC value are helpful for differential diagnosis of invasive lung adenocarcinoma.

CLINICAL RELEVANCE/APPLICATION

The maximum diameter of the nodule, T2 signal intensity and ADC value are helpful for differential diagnosis of invasive lung adenocarcinoma.

SSJ05-06 Primary Tumor Cellularity Assessed on Diffusion Weighted MRI and Metabolism Assessed on PET/CT as Predictive Factors for Lymph Node Involvement in Non-Small Cell Lung Cancer (NSCLC)

Tuesday, Nov. 28 3:50PM - 4:00PM Room: S404CD

Participants
Lucio Calandriello, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Anna Rita Larici, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

Maura Micco, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Mario Ciliberto, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Lucia Leccisotti, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Maria Teresa Congedo, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Giordano, Roma, Italy (*Abstract Co-Author*) Nothing to Disclose
Riccardo Manfredi, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

lucio.calandriello@policlinicogemelli.it

PURPOSE

The aim of this study was to prospectively analyze the potential role of primary tumor apparent diffusion coefficient (ADC) derived from whole body MRI (WB-MRI) with diffusion weighted imaging (DWI) and metabolic parameters derived from FDG PET/CT in predicting pathologically assessed lymph node metastasis in non-small cell lung cancer (NSCLC) patients before treatment.

METHOD AND MATERIALS

Ethic committee approval was obtained for this prospective study as well as written informed consent from every patient. The study group comprised 32 consecutive patients (mean age: 67yrs) with histologically proven NSCLC (SCC n= 8 and AC n=24) who underwent 1.5 T WB-MRI with DWI and FDG PET/CT before treatment. Maximum diameter (maxTD) and minimum and mean ADC (ADCmin and ADCmean) of primary tumor were calculated on DWI images (b-values 0-1000). Maximum standardized uptake value (SUVmax), metabolic tumor volume (MTV) and total lesion glycolysis (TLG) were measured on FDG PET/CT. Presence of lymph node (LN) metastases was pathologically assessed and served as reference standard. Relationships between imaging metrics and LN status were evaluated using the Mann-Whitney U test. The area under the receiver operating characteristic (ROC) curve was used to evaluate accuracy.

RESULTS

Lymph node metastasis were documented in 11 patients (34%). There were significant correlations between primary tumor maxTD, ADCmean, MTV, TLG and presence of LN metastasis (p: 0.05, 0.05, 0.04 and 0.04 respectively). ADCmin and SUVmax were not associated with LN metastasis. On ROC curve analysis, the areas under the curve (AUC) for maxTD, ADCmean, MTV and TLG for were 0.71, 0.70, 0.71 and 0.73 respectively, for predicting LN status.

CONCLUSION

Parameters derived from pre-treatment WB-MRI with DWI (maxTD and ADCmean) and from FDG PET/CT (MTV and TLG) may serve as predictive biomarkers of lymph node metastasis in patients with non small cell lung cancer.

CLINICAL RELEVANCE/APPLICATION

Diffusion weighted MRI and FDG PET/CT functional characteristics of the primary tumor can be used for predicting pathologic lymph-node involvement in NSCLC patients.

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MSCC34

Case-based Review of Nuclear Medicine: PET/CT Workshop-Immune Response and Lung Cancer on PET/CT (In Conjunction with SNMMI) (An Interactive Session)

Tuesday, Nov. 28 3:30PM - 5:00PM Room: S406A

BQ CH CT NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Katherine A. Zukotynski, MD, Hamilton, ON (*Director*) Nothing to Disclose
Samuel E. Almodovar-Reteguis, MD, Orlando, FL (*Director*) Nothing to Disclose
Samuel E. Almodovar-Reteguis, MD, Orlando, FL (*Moderator*) Nothing to Disclose

Sub-Events

MSCC34A Lung Cancer

Participants
David M. Naeger, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

david.naeger@ucsf.edu

LEARNING OBJECTIVES

1) Describe the classic PET/CT appearance of various types of lung cancer. 2) Compare the imaging features that are similar between different types of lung cancer.

ABSTRACT

The classic PET/CT appearance of various types of lung cancers will be reviewed. Similaries and differences between different types of lung cancer will be presented in an effort to help attendees interpret thoracic imaging with more confidence and be more helpful in interdisciplinary settings.

MSCC34B Immune Response/Melanoma

Participants
Rathan M. Subramaniam, MD, PhD, Dallas, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

rathan.subramaniam@utsouthwestern.edu

LEARNING OBJECTIVES

1) To review the basics of immune modulation therapies. 2) To review the immune therapy response methods using PET/CT. 3) To review complications of immune modulation therapies.

RC401

Pulmonary Vascular Imaging

Tuesday, Nov. 28 4:30PM - 6:00PM Room: N227B

CH CT MR VA

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

For information about this presentation, contact:

jerasmus@mdanderson.org

Sub-Events

RC401A Imaging of Acute Pulmonary Embolism

Participants
Ioannis Vlahos, MRCP, FRCR, London, United Kingdom (*Presenter*) Research Consultant, Siemens AG; Research Consultant, General Electric Company;

For information about this presentation, contact:

johnny.vlahos@stgeorges.nhs.uk

LEARNING OBJECTIVES

1) Overview current imaging strategies and key facts in acute pulmonary embolism imaging. 2) Provide an update on current issues and challenges in acute pulmonary embolism imaging.

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

RC401B Imaging of Chronic Pulmonary Embolism and Pulmonary Hypertension

Participants
Carole J. Dennie, MD, Ottawa, ON (*Presenter*) Speaker, Bayer AG; Spouse, Consultant, Abbott Laboratories

For information about this presentation, contact:

cdennie@toh.ca

LEARNING OBJECTIVES

1) To outline the role of CT and MR imaging in the diagnostic work-up and management of patients with suspected chronic pulmonary embolism and pulmonary hypertension (PH). 2) To list the CT and MRI features of PH. 3) To illustrate diseases that cause PH and have typical imaging findings.

Active Handout:Carole Jeanne Dennie

http://abstract.rsna.org/uploads/2017/17000299/Active RC401B.pdf

RC401C Imaging of Pulmonary Arteriovenous Malformations

Participants
Kristopher W. Cummings, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Cummings.Kristopher@mayo.edu

LEARNING OBJECTIVES

1) Explain the role MDCT plays in the evaluation of suspected hereditary hemorrhagic telangiectasia. 2) List the most important information provided by MDCT for management of pulmonary arteriovenous malformations.

RC401D Pulmonary MRA: Practical Applications

Participants
Christopher J. Francois, MD, Madison, WI (*Presenter*) Departmental research support, General Electric Company;

For information about this presentation, contact:

cfrancois@uwhealth.org

cfrancois@uwhealth.org

LEARNING OBJECTIVES

1) Identify roles for magnetic resonance angiography (MRA) in imaging patients with pulmonary artery disease, particularly on the use of MRA in pulmonary embolism. 2) Describe techniques and protocols for robust, clinical pulmonary MRA. 3) Summarize the evidence supporting the use of pulmonary MRA for pulmonary embolism.

ABSTRACT

1. Pulmonary MRA is appropriate for imaging patients suspected of having pulmonary embolism who have contra-indications to CTA, particularly those in whom avoiding iodinated contrast (due to allergy or decreased renal function) or minimizing radiation exposure (younger patients) would be beneficial. 2. Current, commercially available MRA sequences that take advantage of newer parallel imaging techniques help ensure consistent pulmonary MRA in a clinical setting. 3. Following multi-center studies (using older MRA techniques and protocols) in the last decade that indicated that pulmonary MRA may not be accurate enough for routine clinical use, more recent studies suggest that pulmonary MRA is effect in identifying clinically significant pulmonary embolism.

Active Handout:Christopher Jean-Pierre Francois

http://abstract.rsna.org/uploads/2017/17000303/Active RC401D.pdf

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RC501

High Resolution CT of Diffuse Lung Disease: Read Cases with the Experts (An Interactive Game)

Wednesday, Nov. 29 8:30AM - 10:00AM Room: E450A

CH CT

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Georgeann McGuinness, MD, New York, NY (*Moderator*) Nothing to Disclose
Brett M. Elicker, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Daria Manos, MD, FRCPC, Halifax, NS (*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

For information about this presentation, contact:

daria.manos@nshealth.ca

brett.elicker@ucsf.edu

jerasmus@mdanderson.org

LEARNING OBJECTIVES

1) Understand the applications and limitations of HRCT in detecting and characterizing diffuse lung disease through the review and discussion of cases. 2) Apply correct usage of the HRCT lexicon to specific findings, to better elucidate pathophysiology and to refine differential considerations. 3) Develop diagnosis and management algorithms by working through problematic cases with the expert discussants.

ABSTRACT

This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

SSK05

Science Session with Keynote: Chest (Diffuse Lung Disease)

Wednesday, Nov. 29 10:30AM - 12:00PM Room: S404CD

CH CT

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Jonathan D. Dodd, MD, Dublin 4, Ireland (*Moderator*) Nothing to Disclose
Seth J. Kligerman, MD, Denver, CO (*Moderator*) Nothing to Disclose

Sub-Events

SSK05-01 Chest Keynote Speaker: Current Challenges in ILD Analysis

Participants
Joseph Jacob, MBBS, MRCP, Rochester, MN (*Presenter*) Consultant, Boehringer Ingelheim GmbH

For information about this presentation, contact:

joseph.jacob@nhs.net

SSK05-02 Assessment of Interstitial Lung Disease Using Lung Ultrasound Surface Wave Elastography (LUSWE) and Validation with Quantitative CT and Pulmonary Function

Wednesday, Nov. 29 10:40AM - 10:50AM Room: S404CD

Participants
Brian J. Bartholmai, MD, Rochester, MN (*Presenter*) License agreement, ImBio, LLC Scientific Advisor, ImBio, LLC
Ryan Clay, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Boran Zhou, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Thomas G. Osborn, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
James Greenleaf, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Sanjay Kalra, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Xiaoming Zhang, PhD, Rocehster, MN (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

bartholmai.brian@mayo.edu

PURPOSE

Lung ultrasound surface wave elastography (LUSWE) may be useful for assessing interstitial lung disease (ILD) as LUSWE measures superficial lung tissue properties. We investigated surface wave speed in ILD and compared results to pulmonary function and quantitative parenchymal features.

METHOD AND MATERIALS

77 subjects with connective tissue disease and 19 healthy, never-smoking volunteers had PFTs within one year of LUSWE. All controls and 54 subjects had CT within 1 year of LUSWE. LUSWE measures are performed in seated upright at full inspiration. A 0.1s vibration at 100 Hz, 150 Hz, and 200 Hz is generated using a handheld indenter, and velocity is measured with an ultrasound probe at the same intercostal space. Bilateral upper lungs were measured anteriorly, mid-lungs laterally and lower lungs posteriorly. CALIPER (computer-aided lung informatics for pathology evaluation and rating) determined percent parenchymal interstitial abnormalities in a 15mm diameter hemisphere in CT regions studied by LUSWE. Categorical data were compared by chi square and continuous data by Wilcoxon Rank Sum.

RESULTS

The cases were significantly older ($p < 0.0001$) with a higher BMI ($p = 0.05$) and no difference in sex. Cases had lower FEV1 and FVC ($p < 0.0001$). Sonographic velocities were higher in all lung regions at all frequencies for cases, however the difference was greatest in the mid-lung at the 200Hz frequency. Median velocity in m/s was 5.84 vs 4.11 and 5.96 vs. 4.27 ($p<0.00001$) for case vs. control, left and right middle lung zones, respectively (see Table 1). LUSWE in the right mid-lung negatively correlated with FVC ($R = -0.23$, 95% CI -0.42 - -0.03) and also positively correlated with CALIPER percent ILA ($R = 0.35$, 95% CI 0.12 - 0.53). Nominal logistic regression was used in univariate analysis and found that mid-lung LUSWE at 200Hz was predictive of CT-ILD with an AUC of 0.94, $p < 0.0001$. A multivariate model including age was predictive with AUC of 0.96. For a model including right mid-lung LUSWE velocity at 200Hz, right lower %ILA, FVC and age to predict CT-ILD, the AUC approached 100.

CONCLUSION

LUSWE is a safe and noninvasive technique that may be useful for assessing the presence of ILD and correlates with function and quantitative CT.

CLINICAL RELEVANCE/APPLICATION

LUSWE could potentially be used as a screening tool to detect ILD in patients at risk without use of ionizing radiation or functional

testing.

SSK05-03 Reduced Lung Elasticity in Female Patients with Interstitial Lung Disease: Histogram Analysis and Comparison with Age, Sex-Matched Normal Controls

Wednesday, Nov. 29 10:50AM - 11:00AM Room: S404CD

Participants
Junghoan Park, MD , Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Soon Ho Yoon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Samsung Electronics Co, Ltd; Research Grant, DRTECH Co, Ltd
Helen Hong, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Julip Jung, MS, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jeong-Hwa Yoon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate lung elasticity at the level of vital capacity in female patient with interstitial lung disease (ILD) using a histogram analysis by image registration of paired full inspiratory and expiratory CT scans.

METHOD AND MATERIALS

A total of 16 female patients with ILD and 8 age- and sex-matched normal controls who underwent paired CT scans at full inspiration and full expiration were included. Initially, the paired segmented CT images were aligned using surface-based affine registration. Second, landmark-based registration was sequentially performed using bronchial and pulmonary vascular landmarks (31 to 34 branching points of bronchus and peripheral pulmonary vessel for each lung) which were marked manually by one radiologist using in-house software. Then, lung attenuation-based deformable registration was applied. We obtained the x-, y-, z-axis and 3D distance of movement (mm) of each pixel for image registration between inspiration and expiration CT scans. Histogram analysis of those distances was performed in each axis. Nonparametric repeated-measures ANOVA was used for comparison and Spearman's correlation coefficient was used to assess relationships between the distance of movement and visual fibrosis score and pulmonary function test (PFT) results.

RESULTS

Mean distance error was 1.72 ± 1.32 mm in whole lung. Mean 3D distance of movement was significantly lower in the patient group (27.4 mm vs. 41.8 mm; p=.017), as well as percentile values of 3D distance of movement from 10th to 95th percentile (p<.05). Standard deviation (SD) and Entropy of 3D distance of movement were also significant lower in patient group (p=.017). When analyzed for each axis, mean, SD, entropy and 20th to 95th percentile of distance of movement were significantly lower in the patient group for y-axis (p<.05). The same trend was also observed for x- and z-axis, although not statistically significant. When compared with PFT results, forced vital capacity (FVC) showed significant positive correlation (R2=.271; p=.039) with mean 3D distance of movement.

CONCLUSION

Lung elasticity was significantly decreased in terms of absolute value and heterogeneity at the level of vital capacity in ILD patients.

CLINICAL RELEVANCE/APPLICATION

Decreased lung elasticity in ILD patients can be evaluated quantitatively by full inspiratory and expiratory CT scan, and it can be a potential biomarker of ILD with future investigation.

SSK05-04 HRCT Texture Feature Selection and Imaging Pattern Prediction of IPF using Quantum Particle Swarm Optimization

Wednesday, Nov. 29 11:00AM - 11:10AM Room: S404CD

Participants
Yu Shi, Los Angeles, CA (*Presenter*) Nothing to Disclose
Jonathan G. Goldin, MBChB, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Weng Kee Wong, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Joshua Lai, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Matthew S. Brown, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Hyung J. Kim, PhD, Los Angeles, CA (*Abstract Co-Author*) Research Consultant, MedQIA

For information about this presentation, contact:

nicoleshi@ucla.edu

PURPOSE

Idiopathic Pulmonary Fibrosis (IPF) is a fatal lung disease with a heterogeneous natural history. Some predictive clinical models have been developed but few incorporate High-resolution Computed Tomography (HRCT) information. We propose an algorithm leveraging HRCT imaging data to build a model that predicts IPF progression at an early stage.

METHOD AND MATERIALS

We collect anonymized longitudinal serial volumetric HRCT scans from patients with IPF. Radiologists visually contoured regions of interest (ROI) and annotated lung morphology types into progression or non-progression, at the previous visits before the changes occurred. Within ROIs at baseline, 71 imaging texture features were extracted from the grid sampled voxels. Quantum particle swarm optimization (QPSO) was used to select important features, coupled with a resampling technique and random forest. In QPSO algorithm, particles iteratively search the space and communicate within swarm so that important features can be found quickly. QPSO was inspired by quantum mechanics in physics and it exhibits superior searching capabilities by using an iterative probability density function. We utilize QPSO to search the feature space and build a random forest classifier based on the QPSO selected features.

RESULTS

The algorithm yields an interpretable model with 19 texture features and achieves 77.27% sensitivity, 85.15% specificity and 83.74% accuracy at ROI level on test set in predicting progression of 6 months to 1 year follow-ups. Compared to other state-of-the-art algorithms, our approach selects a smaller feature subset, has higher prediction accuracy and achieves more balanced classification.

CONCLUSION

We propose an integrated feature selection and pattern recognition algorithm powered by QPSO that achieves superior prediction performance. The algorithm is widely extensible and has great potentials on offering IPF patients timely treatments as HRCT is inherent to the diagnosis of IPF.

CLINICAL RELEVANCE/APPLICATION

Idiopathic pulmonary fibrosis exhibits a heterogeneous natural history. We build a predictive model to anticipate disease courses and help clinicians make timely decisions.

SSK05-05 Evaluating Treatment Response in Patients with Systemic Sclerosis and Diffuse Interstitial Lung Involvement: Quantitative CT as a New Outcome Measure

Wednesday, Nov. 29 11:10AM - 11:20AM Room: S404CD

Participants
Mariaelena Occhipinti, MD, Florence, Italy (*Presenter*) Consultant, ImBio, LLC
Silvia Bosello, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Michael S. Westmore, PhD, Delafield, WI (*Abstract Co-Author*) Employee, ImBio, LLC
Giuseppe Cicchetti, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Leuconoe G. Sisti, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Chiara De Waure, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Anna Rita Larici, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mariaelena.occhipinti@unifi.it

PURPOSE

To compare semi-quantitative analysis (semi-QA) and quantitative analysis (QA) in the evaluation of treatment response in patients with interstitial lung involvement in systemic sclerosis (SS).

METHOD AND MATERIALS

31 patients with interstitial lung involvement in SS underwent functional evaluation,echocardiography and chest CT scan before and after treatment with rituximab and common anti-inflammatory drugs.Two chest radiologists evaluated the CT scans in consensus for a semi-QA by applying the international Goh score at 5 lung levels.QA was performed by CALIPER,a lung texture analysis program quantifying the relative volume of Normal, Ground-glass(GG), Reticular, and Honeycombing patterns in the whole lungs.Data obtained from semi-QA and QA were compared and correlated with clinical data (Pearson correlation, intraclass correlation coefficient, t-test). Analysis of ROC curves was performed to assess the predictability of a decline in FVC>10% or DLco>15%, commonly used to define lung disease progression.

RESULTS

Most patients (23/31,74.2%) had diffuse disease.By analyzing all 62 CT scans semi-QA and QA had a good reproducibility (ICC:0.67) for GG and only weak (ICC:0.27) for Reticular.Correlations between FVC,TLC,RV,DLco,Kco and semi-QA scores were lower (r=0.3 to 0.4) than QA scores, all statistically significant with the strongest correlations for GG or GG+Reticular and FVC (both r=-0.71).A main pulmonary artery >29mm distinguished patients with higher QA scores in GG, Reticular, GG+Reticular (p<.001),while echographic PASP did not. ΔFVC had a weak correlation with ΔDLco(r=0.4).Semi-QA scores and QA scores were not accurate in predicting a decline in FVC>10%, DLco>15%,or both combined (AUC: 0.33 to 0.70,p>0.05).

CONCLUSION

ΔFVC and ΔDLco reflect different aspects of disease progression, including impairment of volumes and diffusing capacity. QA allows an objective and reproducible evaluation of both aspects contemporary, quantifying changes in lung patterns during treatment follow-up and correlating with lung function and pulmonary hypertension better than semi-QA. QA is a promising imaging biomarker in evaluating treatment response in patients with SS to add to ΔFVC and ΔDLco, likewise recently recommended in IPF.

CLINICAL RELEVANCE/APPLICATION

QA can help multidisciplinary teams in daily practice in evaluating treatment response in SS patients with interstitial involvement.QA with its reproducibility is a promising outcome measure for RCT.

SSK05-06 Diagnostic Significance of Fibrotic CT Patterns Not Addressed in Current Guidelines

Wednesday, Nov. 29 11:20AM - 11:30AM Room: S404CD

Participants
Jonathan H. Chung, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Steven M. Montner, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Ayodeji Adegunsoye, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Justin Oldham, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Aliya N. Husain, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Imre Noth, MD, Chicago, IL (*Abstract Co-Author*) 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
Rekha Vij, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

Mary Strek, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

jonherochung@uchicago.edu

PURPOSE

A small but substantial proportion of CT scans in patients with pulmonary fibrosis cannot be classified using current guidelines. The purpose of this study was to assess the diagnostic significance of these "indeterminate" cases on CT relative to pathologic findings.

METHOD AND MATERIALS

Subjects with a multidisciplinary diagnosis of IPF, interstitial pneumonia with autoimmune features (IPAF), and hypersensitivity pneumonitis (HP); pathological data from open lung biopsy; and chest CT within one year of biopsy were included in the study. Chest CT scans were analyzed by 2 chest radiologists. Cases were classified as interstitial pneumonia (UIP), possible UIP, or inconsistent with UIP on chest CT as per guidelines. Cases which could not be confidently categorized using strict adherence to current guidelines were additionally annotated as "indeterminate" for subset analysis. Lung biopsies were read by a pathologist with expertise in the diagnosis of interstitial lung diseases.

RESULTS

CT UIP patterns were as follows: UIP (102, 39.4%), possible UIP (54, 21.0%), and inconsistent with UIP (103, 25.4%); 19 (11.9%) CT scans scored as possible UIP were also annotated as "indeterminate," mostly due to diffuse distribution in the axial and/or zonal planes. UIP, possible UIP, and inconsistent with UIP CT patterns were associated with pathological UIP in 90.2%, 81.5%, and 52.4% of subjects; respectively. Those with an "indeterminate" CT pattern showed UIP on pathology in 68.4% of cases, which was not statically different compared to the inconsistent with UIP group on CT (p=0.198) but was different from the CT UIP group (p=0.010). After exclusion of these cases, the high confidence possible UIP subset showed a UIP pattern on pathology in 88.6% of subjects, which was not statistically different compared to the UIP CT group (p=0.784) but did differ from the inconsistent with UIP group (p<0.001). The difference between pathology in the "indeterminate" and high confidence possible UIP CT patterns approached statistical significance (p=0.069).

CONCLUSION

There are a substantial number of cases which cannot be confidently categorized using current CT guidelines in IPF. These cases are often classified as possible UIP but differ from the high confidence cases of possible UIP in regard to their pathological UIP diagnosis.

CLINICAL RELEVANCE/APPLICATION

Our data suggests that a 4th UIP CT category may be necessary for optimal diagnosis in suspected IPF.

SSK05-07 Lung Density Analysis Using Quantitative Chest CT for Early Diagnosis of Chronic Lung Allograft Dysfunction (CLAD)

Wednesday, Nov. 29 11:30AM - 11:40AM Room: S404CD

Awards
Student Travel Stipend Award

Participants
Miho Horie, MSc, Toronto, ON (*Presenter*) Research Grant, Toshiba Medical Systems Corporation
Pascal Salazar, Minnetonka, MN (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation;
Tomohito Saito, MD, PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Tereza Martinu, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Shafique Keshavjee, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Narinder S. Paul, MD, Toronto, ON (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation; Research Grant, Carestream Health, Inc

For information about this presentation, contact:

miho.horie@uhn.ca

PURPOSE

CLAD and its sub-types, bronchiolitis obliterans syndrome (BOS) and restrictive allograft syndrome (RAS) limit long-term survival following lung transplantation (LTx). Early diagnosis may allow earlier intervention to improve ultimate prognosis. The purpose of this study was to investigate the utility of quantitative CT lung density analysis in early diagnosis of CLAD.

METHOD AND MATERIALS

A retrospective study was conducted of 82 patients having routine periodic surveillance with pulmonary function tests (PFT) and low dose CT (120kV, 25mAs) following LTx. CLAD was defined as FEV1 <80% of baseline. BOS was defined as CLAD with TLC >=90% and RAS was defined as CLAD with TLC <90%. For the CT analyses, following definitions were applied: pre-onset CT when FEV1 <=90% (pre-CLAD). Control (No-CLAD) CT was defined when FEV >90% without Tx lung complications on the latest CT. CT scans were evaluated for 30 single LTx (15 CLAD: 3 RAS and 12 BOS, 15 Control) and 52 bilateral LTx (29 CLAD:12 RAS and 17 BOS, 23 Control). The contributions of low and high-density from each lung were determined from a CT histogram. Nonparametric indices were calculated; including the right tail weight (rqw) and the left tail weight (lqw) of the CT density distribution as well as the ratio: log (rqw0.875/lqw0.125). The area under the Receiver Operating Characteristic curve (AUC) and the Mann-Whitney test were used to evaluate the significance of difference in the metric; log (rqw0.875/lqw0.125) between CLAD and No-CLAD patients before CLAD onset.

RESULTS

Comparison of single LTx: CLAD and No-CLAD, the AUC was 0.80 [95% CI: 0.62- 0.93] (Figure 1a). Bilateral LTx: RAS and No-CLAD, the AUC was 0.80 [95% CI: 0.63-0.91] (Figure 1b), and BOS and No-CLAD, the AUC was 0.78 [95% CI: 0.62-0.89] (Figure 1c). There was a statistical significance between CLAD, RAS, BOS vs No-CLAD (P < 0.05) for both single and bilateral LTx patients.

There was no statistical significance between single and bilateral No-CLAD, tail ratio (P=0.42).

CONCLUSION

Quantitative CT parameters derived from a lung density histogram may help early diagnosis of CLAD in patients with single and bilateral lung transplantation.

CLINICAL RELEVANCE/APPLICATION

A quantitative density metric for CLAD patients might improve early detection of CLAD. It can allow earlier intervention to influence patient management and help to improve clinical outcomes.

SSK05-08 Non-Contrast Computed Tomography in Asthmatics Shows That Sarcopenia Correlates Measured In the Paraspinous Muscle on Non-Contrast CT Is Inversely Correlated With IL-6 and Asthma Exacerbations: Results from the Severe Asthma Research Program

Wednesday, Nov. 29 11:40AM - 11:50AM Room: S404CD

Participants
Mark L. Schiebler, MD, Madison, WI (*Presenter*) Stockholder, Stemina Biomarker Discovery, Inc; Stockholder, HealthMyne, Inc;
Michael Peters, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
John Fahy, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Loren Denlinger, MD,PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Clara Chow, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Micheal Evans, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Nizar Jarjour, MD, 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

For information about this presentation, contact:

mschiebler@uwhealth.org

PURPOSE

We sought to determine if a novel imaging biomarker for sarcopenia, found on non contrast CT of the paraspinous musculature, had any relationship to interluekin-6 (IL-6) and asthma exacerbation.

METHOD AND MATERIALS

:This was an IRB approved and HIPAA compliant study involving 173 patients enrolled in the Severe Asthma Research Program. There were 21 normal volunteers, 72 non-severe asthmatics, and 79 severe asthmatics (age range 2 - 72 years). Each patient's diastolic blood pressure, BMI, total cholesterol, triglyceride levels, HDL, LDL, fasting glucose, IL-6 plasma levels, asthma exacerbation frequency and steroid dosage per day were recorded. Region-of-interest Hounsfield unit (HU) measurements were obtained in liver density (LD), trabecular density at vertebrae levels T12 and L1, and paraspinal muscle density. Kruskal-Wallis and Fisher's exact test were used ($P<0.05$) to compare groups for continuous and discrete variables, respectively.

RESULTS

. For males and females combined (and individually), patients with MetS had lower liver density than those without MetS. Severe and non-severe asthmatics had lower liver HU (p-value = 0.0097), lower trabecular HU (p-value = 0.0006), and lower paraspinal muscle HU (p-value = 0.00002) when compared with normal volunteers. Females had stronger correlations between MetS, asthma severity, and liver density than males. Steroid dosage per day did not correlate with liver density or MetS. A lower LD, lower T12 and L1 BMD, and lower PSMD was found in severe asthmatics. IL6 was strongly correlated with PSMD (Spearman r= -0.62, p< 0.0001) and moderately correlated with hepatic density (Spearman r = -0.35, p < 0.03) Ashtma exacerbations trended to be more common with progressive sarcopenia.

CONCLUSION

IL=6 is strongly correlated with PSMD. The presence of MetS was inversely related to vertebral body BMD and PSMD.. The use of inhaled or oral steroids was not found to be associated with MetS or LD, as there may not be a detectable dose-effect.

CLINICAL RELEVANCE/APPLICATION

A simple imaging biomarker for sarcopenia is now available from routine non contrast CT chest exams that is negatively correlated with IL-6. This is confirmatory evidence that the progressive deposition of intramuscular fat is detrimental to normal health and promotes an underlying increase in inflammatory cytokines.

SSK05-09 Low-dose CT Using Model Based Iterative Reconstruction at Chest Radiography Dose Levels: A Pilot Study in Patients with Cystic Fibrosis Undergoing Treatment with Ivacaftor (Kalydeco)

Wednesday, Nov. 29 11:50AM - 12:00PM Room: S404CD

Participants
Fiachra G. Moloney, MBBCh, MRCPI, Cork, Ireland (*Abstract Co-Author*) Nothing to Disclose
Karl James, FFR(RCSI),FRCR, Cork, Ireland (*Presenter*) Nothing to Disclose
Maria Twomey, MBChB, FFR(RCSI), Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Niamh Moore, Cork, Ireland (*Abstract Co-Author*) Nothing to Disclose
Owen J. O'Connor, MBBCh, Cork, Ireland (*Abstract Co-Author*) Nothing to Disclose
Michael M. Maher, MD, FRCR, Cork, Ireland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this prospective feasibility study was to assess the utility of a modified low-dose CT thorax protocol reconstructed with Model Based iterative reconstruction (MBIR) for the surveillance of pulmonary disease in patients with cystic fibrosis (CF).

METHOD AND MATERIALS

Following institutional review board approval, 15 patients with CF underwent routine quarterly radiological follow-up with low-dose CT thorax for 12 months with a final low-dose CT thorax at 24 months following initiation of Ivacaftor therapy. A modified 7-section, low-dose axial CT protocol reconstructed with adaptive statistical iterative reconstruction (IR) (LD-ASIR) was used for the first 12-month quarterly studies. A modified low-dose volumetric protocol reconstructed with model-based IR (LD-MBIR) was used at 24 months. The image quality of both techniques was assessed quantitatively and qualitatively by 2 experienced readers who also quantified disease severity using a validated scoring system (Bhalla score).

RESULTS

15 patients (7 female, 8 male) with a mean age of 26.5±6.1 years of age were included in the study. No significant change was observed in mean Bhalla score over the study period (p=0.51). Body mass index and pulmonary function measures increased significantly after 1 and 2-years of treatment. LD-MBIR studies were performed at a significantly lower mean effective dose (0.09±0.01mSv) than LD-ASIR studies (0.10±0.02mSv)(p=0.02). Quantitative measures of image noise and signal-to-noise ratios did not differ significantly between each low-dose protocol. Subjective image assessment of mediastinal structures was significantly worse with the LD-MBIR studies compared to the modified LD-ASIR studies however diagnostic acceptability of lung assessment was similar in both imaging techniques.

CONCLUSION

The use of MBIR with a volumetric low-dose protocol enabled the acquisition of diagnostic quality lung CT images at a dose equivalent to that of a PA and lateral chest radiograph with the added advantage of full volumetric imaging of the entire lungs

CLINICAL RELEVANCE/APPLICATION

This LD MBIR technique provides full volumetric imaging of the lungs and allows earlier and more reliable detection of bronchiectasis, mucus plugging and other subtle findings than with chest radiography at similar radiation doses and is ideally suited for follow-up of younger patients with chronic lung conditions

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CHS-WEA

Chest Wednesday Poster Discussions

Wednesday, Nov. 29 12:15PM - 12:45PM Room: CH Community, Learning Center

CH

AMA PRA Category 1 Credit ™: .50

Participants
Brett W. Carter, MD, Houston, TX (*Moderator*) Editor, Reed Elsevier

Sub-Events

CH251-SD-WEA1 Clinical and Radiologic Features of Primary Lung Cancer in Patients with Primary Breast Malignancy

Station #1

Participants
Hyun Ju Seon, MD, Gwangju, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate clinical and radiologic features of primary lung cancer in patients with a primary breast malignancy.

METHOD AND MATERIALS

Among all breast cancer patients receiving chest CT (n = 1626) during a 10-year period at a single tertiary center, 21 also had primary lung cancer (with one patient having two primary lung malignancies). Clinical and radiological features of 22 primary lung malignancies were retrospectively analyzed.

RESULTS

The most common histologic subtype of lung cancer was adenocarcinoma (90.9%, 20/22). Features included a speculated or lobulated margin (50%, 11/22; 86.4%, 19/22), patent air bronchogram (63.6%, 14/22), subsolid density (50%, 11/22), and a peripheral location 77.3%, 17/22). Ten of 18 available lung cancer specimens (5.6%) showed EGFR mutation. EGFR mutation was not detected in any breast cancer specimen. Eleven cases (50%, 11/22) of primary lung cncer were either missed (n = 4) or misdiagnosed (n = 7) on initial chest CT. Twelve of 20 cases (2 cases had no suitable PET-CT scans) were missed (n = 6) or misdiagnosed (n = 6) on PET/CT. All missed or misdiagnosed cases of lung cancer on initial chest CT were later correctly diagnosed by designated chest radiologists.

CONCLUSION

The most common histologic type of primary lung caner in patients with breast malignancy was peripheral adenocarcinoma, and more than half of primary lung cancer specimens showed a EGFR gene mutation. Primary lung cancer in patients with breast malignancy can be missed or misdiagnosed based on early imaging findings.

CLINICAL RELEVANCE/APPLICATION

The results of this study would provide helpful information including characteristic imaging findings to improve the early and correct diagnosis of double primary lung cancer in patients with primary breast cancer.

CH252-SD-WEA2 CT Characteristics of Non-Small Cell Lung Cancer with ALK Gene Rearrangement: Comparison with EGFR Mutation and ALK/EGFR Negative Lung Cancer

Station #2

Participants
Mio Mori, Nagasaki, Japan (*Presenter*) Nothing to Disclose
Kazuto Ashizawa, MD, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Hideyuki Hayashi, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Minoru Fukuda, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Masataka Uetani, MD, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Sumihisa Honda, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuhiro Tabata, MD, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Mayumi Otsubo, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Naohiro Matsuyama, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Mikiko Hashisako, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the differences in computed tomographic (CT) characteristics among patients with non-small cell lung cancer (NSCLC) who have anaplastic lymphoma kinase (ALK) gene rearrangement, those who have epidermal growth factor receptor (EGFR) mutation, and those who have neither ALK rearrangement nor EGFR mutation.

METHOD AND MATERIALS

This retrospective study enrolled 21 patients with ALK gene rearrangement (A), 125 patients with EGFR mutation (E) and 59 patients without them (N) from June 2012 to December 2014. Two radiologists evaluated with consensus the main tumor on CT, and determined its size, type, margin, location, contrast enhancement pattern and metastases (lymph node, lung, pleura, adrenal gland,

liver, and bone). Emphysema, interstitial pneumonia and pleural effusion were also evaluated. Statistical analyses were performed between (A) and (E), and (A) and (N).

RESULTS

In comparison (A) with (E), the differences of the age (A:63±13 years old, E:68±9, P=0.0159), tumor size (A:39±19 mm, E:31±13, P=0.0186), the proportion of solid component (A:100%, E:65%, P=0.005), air-bronchogram (A:29%, E:58%, P=0.0136), central location (A:39%, E:18%, P=0.0315), and lymphadenopathy (A:67%, E:41%, P=0.0327) were statistically significant. In comparison (A) with (N), the differences of the proportion of female (A:62%, N:27%, P=0.0044), and emphysema (A:24%, N:56%, P=0.0114) were statistically significant.

CONCLUSION

ALK-rearranged NSCLC with gene rearrangement are more frequently seen in relative younger female without emphysema. Their characteristic CT findings include larger solid lesions, central location, lymphadenopathy and low incidence of air bronchogram.

CLINICAL RELEVANCE/APPLICATION

Characteristic CT findings combined with clinical information of ALK-rearranged NSCLC can contribute to decide appropriate therapeutic strategy for personalized cancer therapy.

CH253-SD-WEA3 Performance of Lung Nodule Detection of Free-Breathing versus Breath-Hold 3D Ultrashort Echo Time (UTE) Spiral MRI Compared to Low-Dose CT

Station #3

Participants
Alexander Rotaermel, MD, Hannover, Germany (*Presenter*) Research Grant, Siemens AG
Heiko Golpon, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Thorsten Derlin, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Marcel Gutberlet, DIPLPHYS, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank K. Wacker, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Jens Vogel-Claussen, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

rotaermel.alexander@mh-hannover.de

PURPOSE

To evaluate the performance of lung nodule detection using 3D free-breathing and breath-hold UTE spiral MRI compared to low dose CT as reference standard in patients with known or suspected lung nodules and a clinical indication for PET-CT.

METHOD AND MATERIALS

111 nodules in eight patients (mean age: 57 years) were evaluated. MR lung imaging at 1.5T (Aera, Siemens, Germany) was performed on the same day of the PET-CT (Biograph mCT-128 Flow, Siemens, Germany) exam. For free breathing UTE MRI the following scan parameters were applied: TE 50 µs, TR 3.59 ms, 1.5 x 1.5 x 1.5 mm spatial resolution, acquisition time 4 min; and for breathhold UTE MRI: TE 50 µs, TR 3.37 ms, 2.0 x 2.0 x 2.5 mm spatial resolution, acquisition time 15 sec each for inspiratory and expiratory breathhold. The nodules were categorized into three subgroups depending on the mean diameter: <4.0 mm, 4.0 mm to <8.0 mm, and >=8.0 mm. The McNemar test was used to determine differences in detection rates.

RESULTS

Mean nodule diameter ± standard deviation was 8.6 mm ± 10.5 mm. The overall detection rate using the free-breathing UTE MRI (66%, 73 of 111 nodules) was significantly higher than inspiratory (55%, 61 of 111 nodules, $p < 0.01$) and expiratory (55%, 61 of 111 nodules, $p < 0.01$) breathhold UTE MRI. The free-breathing UTE sequence had the highest detection rate of 100% (41 of 41 nodules) within the >=8 mm nodule subgroup without a significant difference compared to the breath-hold subgroups (95% for both, 39 of 41 nodules, $P = 0.48$). Lower nodule detection rates were observed in the subgroup smaller than 4 mm (free-breathing: 33%, 8 of 24 nodules; inspiration: 8%, 2 of 24 nodules; expiration: 13%, 3 of 24 nodules).

CONCLUSION

Free-breathing and breath-hold UTE sequences showed 95-100% detection rates of lung nodules >=8.0 mm without significant differences between the breathhold and free breathing techniques.

CLINICAL RELEVANCE/APPLICATION

Spiral UTE MRI of the lung without i.v. contrast agent and <10 min examination time is ready to be tested in larger multicentre cohorts for lung cancer screening with close to 100% detection rates of lung nodules >=8mm.

CH254-SD-WEA4 Non-contrast MR Angiography at 1.5 Tesla for Aortic Monitoring in Marfan Patients after Aortic Root Surgery

Station #4

Awards
Student Travel Stipend Award

Participants
Simon Veldhoen, MD, Wurzburg, Germany (*Presenter*) Nothing to Disclose
Cyrus Behzadi, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander Lenz, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank Oliver G. Henes, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Meike Rybczinsky, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Yskert von Kodolitsch, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Thorsten A. Bley, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Bannas, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Contrast-enhanced magnetic resonance angiography (CE-MRA) is the established imaging modality for patients with Marfan syndrome (MFS) requiring life-long annual imaging before and after aortic root replacement. Contrast-free MRA techniques have not been evaluated in the postoperative setup of MFS. The purpose of the study was to assess the feasibility of non-contrast steady-state free precession (SSFP) magnetic resonance imaging for aortic monitoring of postoperative MFS patients.

METHOD AND MATERIALS

Sixty-four adult MFS patients after aortic root replacement were prospectively included. Fourteen patients (22%) had a residual aortic dissection after surgical treatment of type A dissection. SSFP imaging and CE-MRA were performed at 1.5 Tesla. Two radiologists evaluated the images regarding image quality (1=poor, 4=excellent), artifacts (1=severe, 4=none) and aortic pathologies. Readers measured the aortic diameters at defined levels in both techniques. Statistics included observer agreement for image scoring and diameter measurements and ROC analyses for comparison of the diagnostic performance of SSFP and CE-MRA.

RESULTS

Both readers observed no significant differences in image quality between SSFP and CE-MRA and found a median image quality score of 4 for both techniques (all p>.05). No significant differences were found regarding the frequency of image artifacts in both sequences (all p>.05). Sensitivity and specificity for detection of aortic dissections was 100% for both readers and techniques. Compared to SSFP imaging, CE-MRA resulted in higher diameters (mean bias, 0.9 mm; p<.05). The inter-observer biases of diameter measurements were not significantly different (all p>.05), except for the distal graft anastomosis (p=.001). Using both techniques, the readers correctly identified a graft suture dehiscence with aneurysm formation requiring surgery.

CONCLUSION

Unenhanced SSFP MR imaging allows for riskless aortic monitoring with high diagnostic accuracy in MFS patients after aortic root surgery.

CLINICAL RELEVANCE/APPLICATION

Contrast-free 2D SSFP imaging of the thoracic aorta is an appropriate alternative for monitoring of MFS patients after aortic root surgery. Renouncement of intravenous gadolinium contrast avoids adverse effects and facilitates patient management. Only when aortic dissection is known to be present or newly detected on unenhanced SSFP images, additional acquisition of a 3D CE-MRA should be performed for exact evaluation of contrast dynamics and its extent within a three-dimensional data set.

CH255-SD-WEA5 Predicting Time to Decline in FVC Using Baseline Visual and Computer-Based CT Analysis and Baseline Functional Indices

Station #5

Participants
Joseph Jacob, MBBS, MRCP, Rochester, MN (*Presenter*) Consultant, Boehringer Ingelheim GmbH
Brian J. Bartholmai, MD, Rochester, MN (*Abstract Co-Author*) License agreement, ImBio, LLC Scientific Advisor, ImBio, LLC
Andre Altmann, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Angelo De Lauretis, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Srinivasan Rajagopalan, PhD, Rochester, MN (*Abstract Co-Author*) Patent agreement, Imbio, LLC
Maria Kokosi, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ryoko Egashira, MD,PhD, Saga, Japan (*Abstract Co-Author*) Nothing to Disclose
Athol U. Wells, London, United Kingdom (*Abstract Co-Author*) Speaker, F. Hoffmann-La Roche Ltd Speaker, Boehringer Ingelheim GmbH Speaker, Gilead Sciences, Inc Speaker, Merck & Co, Inc Speaker, Bayer AG Speaker, Chiesi Farmaceutici SpA

For information about this presentation, contact:

joseph.jacob@nhs.net

PURPOSE

To aid clinical management of IPF patients and enable cohort enrichment in IPF drug trials, it is imperative that patients with disease likely to be progressive, are recognized at an early stage. We evaluated a consecutive population of IPF patients, fulfilling drug trial entry criteria. We used functional and visual and quantitative (CALIPER) CT scores to identify indices that predict a 10%FVC decline at 1 year.

METHOD AND MATERIALS

159 IPF patients with 30-79% DLco had baseline FVC, DLco and CPI, GAP score and GAP index and the following visual and CALIPER CT indices evaluated: Visual and CALIPER ILD extent, fibrosis extent, honeycombing, reticulation, ground glass and emphsyema scores. Traction bronchiectasis extent and severity were examined visually. CALIPER-derived pulmonary vessel volume (PVV) was examined as a percentage of the whole lung, and as percentages of the upper, middle and lower zones. PVV vessel sizes: <5mm2, 5-10mm2, 10-15mm2, 15-20mm2, >20mm2 were also examined on a zonal basis. The slope of annual FVC change (in ml) per subject was estimated using linear regression. Variables were tested using logistic regression to predict estimated 10%FVC decline at year 1. All models were adjusted for patient age, gender, smoking history and pack year status.

RESULTS

The mean DLco for the study population (n=159) was 42.7% predicted, similar to previously described drug trial cohorts. Across all patients, CALIPER vessel scores and fibrosis extent were the strongest predictors of a 10%FVC decline (Figure 1a). The population was then divided into three equal-sized disease severity groups (n=53) based on DLco values. When variables predicting a 10%FVC decline were examined in patients with mild+moderate disease (DLco >35.8%;n=106), and separately in patients with mild disease (DLco>46.5%;n=53) the results were unchanged. CALIPER vessel scores and fibrosis extent remained the strongest predictors of a 10%FVC decline (Figure 1b+c).

CONCLUSION

Quantitative CT imaging, particularly pulmonary vessel volumes outperform functional indices and the GAP index at predicting a 10% decline in FVC at 12 months. Quantitative CT may represent a powerful new index for cohort enrichment in future IPF drug trials.

CLINICAL RELEVANCE/APPLICATION

Quantitative CT may represent a powerful new index for cohort enrichment in future IPF drug trials.

CH256-SD-WEA6 Differentiation of Benign Thymic Cystic Lesion from Thymic Epithelial Tumor: MDCT and 18F-FDG PET

Station #6

Participants
Sanghyup Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Soon Ho Yoon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ju G. Nam, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Gi Jeong Cheon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hwan H. 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, Samsung Electronics Co, Ltd; Research Grant, DRTECH Co, Ltd
Chang Min Park, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun-Ju Lee, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chang Hyun Lee, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the CT and PET findings for differentiating small anterior mediastinal cystic lesions from thymic epithelial tumors

METHOD AND MATERIALS

We included 262 consecutive patients with pathologically proven anterior mediastinal benign cyst(thymic cyst or bronchogenic cyst) and thymic epithelial tumors less than 5cm in diameter who underwent pre-operative MDCT scan. In additional to conventional morphologic CT findings, two radiologists evaluated abutment to mediastinal pleura, protrusion length and ratio as follows: protrusion length, a perpendicular distance(mm) from the mediastinal pleura to the top of protruding apex in the lung; protrusion ratio, the protrusion length divided by the length(mm) of abutment to mediastinal pleura. In 97 cases who underwent pre-contrast and contrast-enhanced CT scans, mean attenuation was measured in the largest cross-sectional area. Maximum SUV was measured in 40 cases having FDG-PET scan. After statistical comparison of CT and PET findings between groups, multi-variate logistic regression analysis was performed for differentiation of thymic cyst from thymic epithelial tumor with the optimum cutoff for continuous variables derived from ROC analysis.

RESULTS

Thymic epithelial tumors were more likely to have inferior location, lobulation, ill-defined contours, calcifications, organ invasion, metastasis, heterogeneous enhancement, higher maximum SUV, abutment, higher protrusion length, and protrusion ratio (their P< .05 on uni-variate analysis). The optimum cutoff for mean attenuation was 35HU (OR=5.26, [95%CI, 2.03-13.65], P=0.0006; 51.1% of thymic cysts) at pre-contrast image and 60HU (OR=29.73, [95%CI, 9.86-89.65], P<0.0001; 17.8% of thymic cysts) at post-contrast image. Multivariate analysis showed that protrusion ratio (cutoff, 0.13; OR=22.73, P=0.0001), mean post-contrast CT attenuation (cutoff, 60HU; OR=4.60, P=0.0013), and lobulation(OR=7.27, P=0.0277) were independent variables for thymic epithelial tumors. The optimum cutoff for maximum SUV was 1.43.

CONCLUSION

Not only CT features including protrusion ratio, lobulation and post-contrast CT attenuation but also maximum SUV on PET scan were useful imaging features in distinguishing thymic epithelial tumor from cyst in the anterior mediastinum.

CLINICAL RELEVANCE/APPLICATION

Futile thymectomy for thymic cyst is potentially avoided with the help of characteristic MDCT and PET findings.

CH179-ED-WEA7 MRI Evaluation of Thymic Pathology

Station #7

Participants
Pablo Bartolome, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose
Russel Wnek, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
Jordan LeGout, MD, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose
Andrew Bowman, MD, PhD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
Mathew Thomas, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
Patricia J. Mergo, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To review the embryology and anatomy of the normal thymus 2. To explain the utility of MRI as opposed to CT in the diagnosis of thymic pathology, and particularly the role of DWI and in-phase and out-of-phase sequences 3. To show the MRI imaging characteristics of the normal and pathologic thymus

TABLE OF CONTENTS/OUTLINE

A. The normal thymus -Embryology -Anatomy B. MRI in the evaluation of the thymus - MRI vs CT: advantages and disadvantages -MRI protocol and sequences C. MRI appearance of the spectrum of thymic diseases -Thymic hyperplasia -Thymic epithelial neoplasms -Lymphoma -Thymic cysts -Thymolipoma -Thymic carcinoid D. Pitfalls and mimics

LL40

Lunch and Learn: A Novel Machine Learning Application for Chest CT: Presented by Riverain Technologies (invite-only)

Wednesday, Nov. 29 12:30PM - 1:30PM Room: S403A

PARTICIPANTS

Steve Worrell, Riverain CEO, Miamisburg, OH

PROGRAM INFORMATION

Please join Riverain Technologies' Lunch and Learn on machine learning technologies in thoracic imaging. As a company dedicated to creating tools to aid clinicians in the efficient and early detection of lung disease, we will share lessons learned and insights critical to achieving user acceptance of applications employing state-of-the-art machine learning.

RSVP

https://riveraintech.com/rsna-lunch-learn/

CHS-WEB

Chest Wednesday Poster Discussions

Wednesday, Nov. 29 12:45PM - 1:15PM Room: CH Community, Learning Center

CH

AMA PRA Category 1 Credit ™: .50

Participants
Brett W. Carter, MD, Houston, TX (*Moderator*) Editor, Reed Elsevier

Sub-Events

CH257-SD-WEB1 Low Radiation Dose, Low Contrast Dose CT Pulmonary Artery Imaging: The Application of Volume Helical Shuttle Technique with Low Tube Voltage Combined with Iterative Reconstruction

Station #1

Participants
Qi Yang, Xianyang, China (*Presenter*) Nothing to Disclose
Haifeng Duan, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Chenglong Ren, Shanxi, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoxia Chen, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Tian Xin, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

847798794@qq.com

PURPOSE

To investigate the application of volume helical shuttle technique with low tube voltage and adaptive statistical iterative reconstruction (ASIR) for reduced radiation dose and contrast dose in CT pulmonary angiography (CTPA).

METHOD AND MATERIALS

78 patients underwent CTPA from thoracic entrance to the top of the diaphragm on a GE HD750CT. Patients were randomly divided into 2 groups according to different scanning mode and contrast agent dosage: Group A (n=39) used 3-pass volume helical shuttle mode for CTPA scan with 6s delay time. Tube voltage was 80kV, tube current was 100mA, A total of 15ml contrast dosage (iohexol, 350mgI/ml) was administered at 4ml /s followed 30ml saline injection. Images were reconstructed with 80%ASIR at 0.625mm slice thickness.Group B (n=39) was scanned using the conventional mode of 120kVp tube voltage automatic tube current modulation. The scan delay was determined by monitoring the pulmonary artery trunk with 15ml contrast dose and CTPA was performed by administering 55ml iohexol at 4ml/s. The original data was reconstructed at 0.625mm with FBP algorithm.CT values in pulmonary arteries, and the back muscles in the two groups were measured to calculate the signal-to-noise ratio (SNR) and contrast noise ratio (CNR) were measured by two radiologists. The CT values and CNR values of pulmonary arteries as well as the effective dose and total contrast dose were compared between the two groups using T-test . Kappa statistics was used to test the measurement consistency of the two radiologists.

RESULTS

The CT values in the pulmonary arteries were significantly higher in group A than those in group B ($P < 0.05$). There was no significant difference in the SNR and CNR between the two groups ($P > 0.05$). The radiation dose of group A was about 54% lower than that of group B, and the dosage of contrast agent in group A decreased by about 79%. The agreement between the two radiologists was good.

CONCLUSION

Volume helical shuttle technique with low tube voltage combined with ASIR can be used to effectively reduce radiation dose and contrast dosage with high image quality for CTPA.

CLINICAL RELEVANCE/APPLICATION

Volume helical shuttle technique with low voltage combined with iterative reconstruction can effectively reduce pulmonary artery CTA radiation dose and contrast agent dosage

CH258-SD-WEB2 Radiologic Predictor of Metabolic Syndrome: Devising a Simple Metric Tool for Routine Use

Station #2

Participants
Swapnil C. Patel, MD, Rochester, NY (*Presenter*) Nothing to Disclose
Hakan Sahin, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Axel Wismueller, MD, PhD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Luis Monterroso, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

swapnil_patel@urmc.rochester.edu

PURPOSE

Intrathoracic fat content has been shown to correlate with presence of metabolic syndrome, due to circulating inflammatory mediators secreted by the visceral adipose tissue, leading to diabetes and cardiovascular disease. The goal of this study was to develop a simple and reproducible radiologic metric to suggest presence of metabolic syndrome based on routine Chest CT exams without the need for time-consuming segmentation analysis or volumetric measurements of fat tissue.

METHOD AND MATERIALS

In an IRB approved study protocol, Chest CT exams performed on adult patients over a 60 day period in early 2017 were retrospectively analyzed and measurements of five predefined quantitative metrics of intrathoracic fat depots were recorded. Metrics included AP, transverse, and craniocaudal dimensions of anterior mediastinal fat, as well as transverse dimensions of the middle mediastinal and paravertebral fat depots. Clinical data as set forth in the 2001 NCEP ATPIII criteria for metabolic syndrome was collected on an initial set of 100 patients by an independent clinical investigator who was blinded to the radiologic measurements. Patients with extensively altered mediastinal anatomy due to surgery were excluded. Radiologic measurements and clinical data of the patients were compared using Mann-Whitney test and ROC analysis during initial statistical review.

RESULTS

Preliminary statistical analysis reveals a significantly larger intrathoracic fat depot in patients who met criteria for metabolic syndrome compared with those who do not ($p<0.001$, see attached table). Additionally, this significant relationship extends across all five studied measurements with the highest rate of concordance in the AP mediastinal metric (AUC = 0.78). The optimal threshold for the AP mediastinal measurement was determined to be 1.95 cm, with sensitivity of 71% and specificity of 70%.

CONCLUSION

Playing a supplementary role to the biomorphologic metrics traditionally used by clinicians to characterize metabolic syndrome, this proposed radiologic-based metric of intrathoracic fat depot quantification is a simple standardized tool that can be applied by the radiologist in everyday practice to identify association with metabolic syndrome.

CLINICAL RELEVANCE/APPLICATION

Radiologic-based identification of patients with metabolic syndrome during routine chest CT evaluation can serve as a value-added service leading to earlier diagnosis and therapeutic management.

CH259-SD-WEB3 Radiomics Model to Predict the Invasiveness of Pulmonary Adenocarcinomas Appearing as Pulmonary Ground-Glass Opacity Nodules

Station #3

Participants
Xing Xue, Hangzhou, China (*Presenter*) Nothing to Disclose
Jianhua Yan, PhD, Taiyuan, China (*Abstract Co-Author*) Nothing to Disclose
Siying Zhang, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Xin Li, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Peipei Pang Jr, RT,RT, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Feng Chen, MD, PhD, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

xuexing_09@sina.com

PURPOSE

To predict invasiveness of pulmonary adenocarcinomas manifest as pulmonary ground-glass opacity nodules (GGNs) by using a radiomics model combined clinical and CT imaging features.

METHOD AND MATERIALS

From August 2012 to July 2016, 560 patients with 599 GGNs who underwent chest CT scan were investigated retrospectively. 202 preinvasive lesions (atypical adenomatous hyperplasia, AAH; adenocarcinoma in situ, AIS) and 397 minimally invasive adenocarcinoma and invasive pulmonary adenocarcinoma (IPAs) were pathologically confirmed after surgery. Clinial and CT features were gathered to distinguish preinvasive lessions from IPAs. The patients between August 2012 to Dec 2015 were assigned to a primary cohort, patients after Jan 2016 were in validation cohort. The features of radiomics nomogram were selected after using one-variate analysis, multi-variate analysis and linear logistic regression. We use the feature FD to develop the prediction nomogram. Receiver operating characteristic (ROC) analysis was used to evaluate predictive performance.

RESULTS

In primary cohort, preinvasive lesions were significantly different in solid component of lesion, lesion shape, lobulated border, pleural retraction, and 35 qantitative parameters from IPAs ($P<0.05$) by one-variate analysis. In multi-variate analysis, solid component of lesion, lobulated border, pleural retraction and fractal dimension (FD) were significantly different between preinvasive lesions and IPAs ($P<0.05$). The AUC for the primary and validation cohort was 0.757(95% confidence interval: 0.711 to 0.8031) and 0.793 (95% confidence interval: 0.708-0.877), respectively. In terms of clinical usefulness, decision curve analysis demonstrated the radiomics model was useful.

CONCLUSION

In GGNs, solid component of lesion, lobulated border, pleural retraction and FD were significant features to discriminate from preinvasive lesions and IPAs. Also, to build a radiomics nomogram with the feature FD may predict the invasiveness of pulmonary adenocarcinomas appearing as GGNs.

CLINICAL RELEVANCE/APPLICATION

The radiomics model can help to diagnose preinvasive lesions and IPAs before operation. So, it can help the patients to make a choice Whether to choose surgery.

CH261-SD- Quantitative Assessment of Respiratory Deformation Associated with Pulmonary Function in IPF

WEB5 **Patients**

Station #5

Participants
Seunghyun Choi, MSc , Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Beomhee Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
June-Goo Lee, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Coreline Soft, Inc
Joon Beom Seo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

gumnmir@gmail.com

PURPOSE

To investigate whether the respiratory deformation in idiopathic pulmonary fibrosis (IPF) patient can quantitatively assess the pulmonary function from inspiration/expiration CTs and registration based physical motion analysis.

METHOD AND MATERIALS

Thirty IPF patients with pulmonary function test (PFT) results and inspiration/expiration CT scans were included in this study. Mixed (Rigid & non-rigid) multi-step registration technique were used to extract the physical deformations of lung from the inspiration and expiration CT scans. Following the restrictive character of IPF, average air volume change (AAVC) of whole lung was selected as the primary measure, and additionally AAVC in 4 high attenuation areas (HAAs) augmented by the HAAs' volume fraction were investigate to check the effect the regional fibrosis. The lower thresholds for HAAs were selected from -900 to -600 in HU by the step of 100 HU, to access fibrosis-rich proportion of lung. The 5 deformation measures were compared to the forced vital capacity (FVC) through Pearson's correlation coefficient.

RESULTS

The enrolled 30 IPF patients (Age 68.3±5.13, 27 male, 3 female) showed middle to relatively high ranged FVC (70.0±16.9). The AAVCs in whole lung showed positive correlation with FVC (AAVC in whole lung ~ FVC r2 = -0.411, $p < 0.001$). The correlation between AAVC and FVC goes higher when AAVC were thresholded by HAA at -800, -700 and showed the best at -600 HU (AAVC in HAA -600 ~ FVC r2 = -0.640, $p < 0.001$, AAVC in HAA -700 HU ~ FVC r2 = -0.600, $p < 0.001$, AAVC in HAA -800 HU ~ FVC r2 = -0.488, $p < 0.001$), whereas AAVC in HAA -900 HU showed no considerable correlation with FVC (AAVC in HAA -900 ~ FVC $p = 0.553$).

CONCLUSION

The AAVC thresholded by HAA showed significant correlation with FVC, providing possible way of augmentation to the respiratory deformation analysis in IPF patients. The optimal threshold level for AAVC augmentation was found to be -600 HU as a lower bound for HAA.

CLINICAL RELEVANCE/APPLICATION

Air volume change augmented by the portion of high attenuation area may be useful to explain the restrictive pathophysiological characteristics of fibrotic lung diseases.

SSM05

Chest (Thoracic Malignancy/Thymic and Esophageal)

Wednesday, Nov. 29 3:00PM - 4:00PM Room: S404AB

CH CT MR OI

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Moderator*) Research Grant, Samsung Electronics Co, Ltd; Research Grant, DRTECH Co, Ltd
Carol C. Wu, MD, Houston, TX (*Moderator*) Author, Reed Elsevier

Sub-Events

SSM05-01 Whole-Tumor Histogram Analysis of Apparent Diffusion Coefficient Maps for the Differentiation of Thymic Carcinoma from Lymphoma

Wednesday, Nov. 29 3:00PM - 3:10PM Room: S404AB

Participants
wei zhang, nan jing, China (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

fskzhangwei@126.com

PURPOSE

To assess the performance of whole-tumor histogram analysis of apparent diffusion coefficient (ADC) maps in differentiating thymic carcinoma from lymphoma, and compare with that of commonly used hot-spot region of interest (ROI) based ADC measurement.

METHOD AND MATERIALS

Diffusion weighed imaging (DWI) data of 15 patients with thymic carcinoma and 13 patients with lymphoma were retrospectively collected and processed with mono-exponential model. The measurement of ADCs were performed by using histogram-based and hot-spot ROI based approach. In histogram-based approach, following parameters were generated, including mean ADC (ADCmean), median ADC (ADCmedian), 10 and 90 percentile of ADC (ADC10 and ADC90), kurtosis and skewness. The difference of ADCs between thymic carcinoma and lymphoma was compared using t test. Receiver operating characteristic analyses were conducted to determine and compare the differentiating performance of ADCs.

RESULTS

Lymphoma demonstrated significantly lower ADCmean, ADCmedian, ADC10, ADC90 and hot-spot ROI based (mean) ADCs than thymic carcinoma (all p values < 0.001), while no differences were found on kurtosis (P=0.412) and skewness (P=0.273). ADC10 demonstrated optimal differentiating performance [cut-off value, 0.403×10-3 mm2/s; area under curve (AUC), 0.977; sensitivity, 92.31%; specificity, 93.33%], followed by ADCmean, ADCmedian, ADC90 and hot-spot ROI based ADC. The AUC of the ROC curve of ADC10 was significantly higher than that of hot-spot ROI based ADC (0.977 vs 0.797, P=0.036).

CONCLUSION

Compared with commonly used hot-spot ROI based ADC measurement, histogram analysis of ADC maps holds the promise in improving the differentiating performance between thymic carcinoma and lymphoma.

CLINICAL RELEVANCE/APPLICATION

our preliminary study results indicated that histogram analysis of ADC maps could be a promising approach to improve the differentiating performance between thymic carcinoma and lymphoma.

SSM05-02 Can CT Textural Analysis Predict the World Health Organization (WHO) Classification of Thymic Epithelial Neoplasms?

Wednesday, Nov. 29 3:10PM - 3:20PM Room: S404AB

Participants
Shaunagh McDermott, FFR(RCSI), Boston, MA (*Presenter*) Nothing to Disclose
Florian J. Fintelmann, MD, Boston, MA (*Abstract Co-Author*) Consultant, McKesson Corporation; Royalties, Reed Elsevier
Valentina Nardi, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael Lanuti, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Azadeh Tabari, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate if CT textural analysis (CTTA) can differentiate between low-risk and high-risk thymic epithelial neoplasms (TENs) on routine CT images.

METHOD AND MATERIALS

The preoperative CT scans of 48 patients diagnosed with a TEN over a 10-year period were reviewed with respect to contour, enhancement pattern, degree of enhancement (relative to skeletal muscle), calcification, pleural effusion, pleural seeding, pericardial effusion, and invasion of local structures. CTTA was performed with commercially available software (TexRAD) that applies a filtration-histogram technique for characterizing tumor heterogeneity. TENs were divided into two groups based on the WHO classification (low-risk = types A, AB and B1; high-risk = types B2, B3 and C). Student t-test was used to compare the mean value of each texture parameter between the two groups. Receiver operating characteristics (ROC) analysis was performed and area under the curve (AUC) was calculated for texture parameters that differed significantly. Sensitivity and specificity were calculated using the cut-off value with the highest AUC.

RESULTS

28 low-risk TENs (3 type A, 18 type AB, 7 type B1) and 20 high-risk TENs (11 type B2, 6 type B3, 3 type C) were included. The degree of enhancement differed significantly between the two groups (p=0.021). No significant difference was identified with respect to contour, enhancement pattern, calcification, pleural effusion or seeding, pericardial effusion, or invasion of local structures. Histogram analysis of CT values showed statistically significant differences in average Mean (SSF0, p=0.03) standard deviation (SD)(SSF0,p=0.006), entrophy (SSF0, p=0.04), mean positive pixels (MPP)(SFF6, p=0.008) and kurtosis (SSF3, p=0.02) values between the low-risk group (Mean 67.1 +/- 20.2/SD 21.2 +/- 6.5/entropy 4.3 +/- 0.3/MPP 32.8 +/- 21.1/kurtosis 0.23 + 0.75) and high-risk group (Mean 55.4 +/- 12.6/SD 16.6 +/- 3.6 /entrophy 4.1 +/- 0.2/MPP 21.1 +/- 6.4/kurtosis 1.14 +/- 1.83). Using an MPP threshold of 26.5, the sensitivity and specificity for differentiating low-risk from high-risk lesions was 90% and 54%, respectively (AUC 0.72).

CONCLUSION

CTTA may be able to separate TENs into low- and high-grade WHO histologic subtypes.

CLINICAL RELEVANCE/APPLICATION

The ability to preoperatively predict the WHO subtype of thymic epithelial neoplasms may help determine the need for preoperative adjuvant treatment.

SSM05-03 A Comparison between 3T MR and Endoscopic Ultrasound for Preoperative T Staging of Potentially Resectable Esophageal Cancer with Histopathological Correlation

Wednesday, Nov. 29 3:20PM - 3:30PM Room: S404AB

Participants
Jia Guo, Zhengzhou, China (*Presenter*) Nothing to Disclose
Hongkai Zhang, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zhaoqi Wang, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Hui Liu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Xu Yan, Shanghai, China (*Abstract Co-Author*) Employee, Siemens AG
Dominik Nickel, Erlangen, Germany (*Abstract Co-Author*) Employee Siemens AG
Hailiang Li, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jinrong Qu, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

qjryq@126.com

PURPOSE

To compare the value of 3T magnetic resonance imaging (MRI) and endoscopic ultrasonography (EUS) in the preoperative T staging of potentially resectable esophageal cancer.

METHOD AND MATERIALS

Patients with resectable EC diagnosed by clinical and pathological biopsy were prospectively collected. All patients underwent MRI (including T2-TSE-BLADE, DWI and a radial-VIBE sequence prototype) and EUS within one week before surgery. T staging was assigned on MR and EUS by two independent radiologists and one endoscopist in accordance with the 7th edition of AJCC TNM Classification for EC. Two readers separately determined the EC segment and evaluated the MR image quality using a 5-point score. The consistency of image quality score between two MRI readers and the correlation coefficient between image quality and EC segment were calculated using SPSS 20.0. Considering postoperative pathological T staging results as the gold standard, the performance of MRI (T2-TSE-BLADE + DWI + radial-VIBE) and EUS was evaluated based on the calculation of sensitivity, specificity, positive predictive value and negative predictive value.

RESULTS

A total of 70 patients were enrolled in the study, 16 cases were stage T1, 18 cases were stage T2, 30 cases were stage T3, and 6 cases were stage T4a. The evaluation of the image quality by two readers was almost identical (Kappa=0.825, P <0.001). The correlation coefficients between image quality score and EC segment by two readers were (r = -0.665, P <0.01)and (r = -0.619, P <0.01). The sensitivity values obtained by the two MRI readers for T1-T4a staging were 93.75%, 100%, 90%, 100% and 81.25%, 94.44%, 93.33%, 100%, and the specificity values were 100%, 94.23%, 100%, 98.44% and 100%, 90.38%, 97.50%, 100%; using EUS, the sensitivity and specificity values for T1-T4a staging were 81.25%, 83.33%, 53.33%, 50% and 96.3%, 67.31%, 92.50%, 98.44%.

CONCLUSION

MRI was comparable to EUS in the staging of T1 and T2, and showed advantage over EUS for T3 and T4a staging. MRI can accurately assess the depth of invasion of EC, which can be used as a routine examination for preoperative staging of EC and provide the basis for the formulation of a clinical treatment plan.

CLINICAL RELEVANCE/APPLICATION

(dealing with preoperative T staging of esophageal cancer)"MRI was comparable to EUS in the staging of T1 and T2, and showed

advantage over EUS for T3 and T4a staging."

SSM05-04 Accuracy of a Machine Learning Algorithm for Anterior Mediastinal Mass Diagnosis

Wednesday, Nov. 29 3:30PM - 3:40PM Room: S404AB

Awards
Student Travel Stipend Award

Participants
Nityanand Miskin, MD, Boston, MA (*Presenter*) Nothing to Disclose
Rachna Madan, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Andetta R. Hunsaker, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Mark M. Hammer, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

nmiskin@partners.org

PURPOSE

The purpose of this study is to evaluate the accuracy of a machine learning algorithm as a diagnostic aid for anterior mediastinal masses (AMM), and to compare the accuracy to expert clinical assessment.

METHOD AND MATERIALS

Cases were identified by searching our medical record for patients with an AMM evaluated with CTs, from 2012-2015. 223 cases were found: 103 thymomas, 40 lymphomas, 12 germ cell tumors, 65 benign lesions (cyst, thymic hyperplasia), and 3 fibrosing mediastinitis. The latter group was excluded as there were too few for reliable diagnosis. We divided the remaining 220 cases into 122 training and 98 test cases. One thoracic radiologist reviewed the training cases for the following: size, attenuation in Hounsfield Units, attenuation homogeneity, shape, midline location, intralesional fat, calcification, vascularity, cystic spaces, preservation of fatty septum, supraclavicular, mediastinal, or internal mammary lymphadenopathy (LAD), chest wall invasion, lung invasion, pulmonary metastases, pleural metastases, and pleural effusion. We evaluated the predictive efficacy of each parameter, as well as age and sex, using the Weka machine learning software. Parameters most predictive of diagnosis were then used to generate a ruleset-based classifier using the JRip algorithm. A thoracic radiologist then blindly reviewed the 98 test cases for the presence of each parameter, to be fed into the classifier, and provided a best-guess diagnosis. A related-samples McNemar test was performed to assess differences in accuracy.

RESULTS

Using the machine learning software, the most predictive parameters for the diagnosis of an AMM were: age, sex, size, attenuation, shape, midline location, internal mammary LAD, mediastinal invasion, and pleural effusion. For the training set, the ruleset classifier correctly diagnosed 103/122 cases (84%). For the test set, the radiologist's best-guess diagnosis achieved an accuracy of 72/98 (74%). The ruleset classifier achieved an accuracy of 79/98 (81%). No significant difference in accuracy was seen (p=0.23). A ruleset-based classifier was constructed from the data.

CONCLUSION

A ruleset-based classifier can achieve accuracy comparable to a thoracic radiologist when evaluating the diagnosis of an anterior mediastinal mass.

CLINICAL RELEVANCE/APPLICATION

This algorithm is a potential semi-automated tool for accurate anterior mediastinal mass diagnosis in resource poor areas.

SSM05-05 Combination of DCE-MRI and DWI in Predicting the Treatment Effect of Concurrent Chemoradiotherapy in Esophageal Carcinoma

Wednesday, Nov. 29 3:40PM - 3:50PM Room: S404AB

Participants
Changmin Liu, RT,RT, BinZhou, China (*Presenter*) Nothing to Disclose
Shaoshui Chen, RT,RT, Binzhou, China (*Abstract Co-Author*) Nothing to Disclose
Fangling Ning, Binzhou, China (*Abstract Co-Author*) Nothing to Disclose
Shuanghu Yuan, PhD, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Qing Lei Shi, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Judong Luo, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Yanzhang Hao, Binzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zhenbo Wang, Binzhou, China (*Abstract Co-Author*) Nothing to Disclose
Dianzhong Geng, Jinan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study the value of dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) combined with diffusion-weighted imaging (DWI) in evaluating the effect of concurrent chemoradiotherapy (CCRT) in patients with esophageal carcinoma.

METHOD AND MATERIALS

A total of 76 patients with newly diagnosed esophageal carcinoma were enrolled in this study. All the participants were examined with DCE-MRI and DWI at baseline (pre-treatment) and during the third week after the start of CCRT (post-treatment). The volume transfer constant (Krans), rate contrast (Kep), the contrast agent percentage in the extracel¬lular fluid space (Ve), and the apparent diffusion coefficient (ADC) were measured by two radiologists with greater than 10 years' individual experience. The changes in lesion volume on CT were measured at the completion of radiotherapy and was used as an endpoint to evaluate the predictive ability of DCE-MRI and DWI. All the quantitative parameters were analyzed with the paired t-test and a p-value of less than 0.05 indicated statistical significance.

RESULTS

A total of 76 and 56 DCE-MRI and DWI scans were available for analysis at baseline and at the third week, respectively. Pre-treatment Krans, pre-treatment Kep, pre-treatment ADC ($P < 0.05$), and post-treatment Krans ($P < 0.05$) and ΔKrans, ΔADC ($P < 0.05$) were significantly different after CCRT. Based on the binary logistic model, the ROC analysis demonstrated that the combined predictors demonstrated a high diagnostic performance with a threshold of 0.211 and an AUC of 0.939. The sensitivity and specificity were 98.6% and 73.8%, respectively.

CONCLUSION

The combination of DCE-MRI and DWI, as a noninvasive method, allows for the visualization of esophageal carcinoma lesions and can be used as an early biomarker in the prediction of the effect of CCRT three weeks after treatment initiation.

CLINICAL RELEVANCE/APPLICATION

DCE-MR can detect the effects of radio- and chemotherapy at early time points and is recommended as part of a MR study prior to esophageal carcinoma.

SSM05-06 CT Features of Thymic Epithelial Tumors: Correlation with the Clinical Stage Classification Using the Recently Proposed TNM Staging System

Wednesday, Nov. 29 3:50PM - 4:00PM Room: S404AB

Participants
Akiko Sumi, MD, Kurume, Japan (*Presenter*) Nothing to Disclose
Kiminori Fujimoto, MD, PhD, Kurume, Japan (*Abstract Co-Author*) Nothing to Disclose
Asako Kuhara, Kurume, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsushi Kawaguchi, Kurume, Japan (*Abstract Co-Author*) Nothing to Disclose
Naoko Ikehara, MD, Kurume, Japan (*Abstract Co-Author*) Nothing to Disclose
Shuji Nagata, MD, Kurume, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshi Abe, MD, Kurume, Japan (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

sumi_akiko@kurume-u.ac.jp

PURPOSE

To evaluate the CT features of thymic epithelial tumors with recently proposed TNM staging system and to determine the CT features helpful in predicting patient outcome.

METHOD AND MATERIALS

This retrospective study included 116 patients with thymic epithelial tumor surgically treated. Two radiologists interpreted independently the 21 categories of CT findings and finally classified each category into two groups. Correlation of these categories with new TNM staging system and with prognosis were assessed.

RESULTS

The patients were 68 women and 48 men (median age, 59 years; range, 27-82 years). WHO histologic classification included Type A in 10, Type AB in 22, Type B1 in 28, Type B2 in 24, Type B3 in 10, and Carcinoma in 22 patients. The clinical stage using by TNM staging system were stage I in 92, stage II in 3, stage IIIa in 10, stage IIIb in 2, stage IVa in 3, and stage IVb in 6 patients. In the present study, stage II and greater (stage II-IV) tumors were considered an invasive tumor. There was statistically significant relationship between WHO histologic classification and tumor invasiveness (Fisher, $P < .001$). In multivariable analysis, there were statistically significant differences in tumor contour, adjacent chest wall change, pericardial thickness, and vascular invasion between stage I and stage II-IV (all, $P < .05$). Multivariate analysis using a stepwise forward Cox proportional hazards regression model showed that tumors with lobulated and irregular contour, lobulated and irregular contour with mediastinal fat, presence of hemorrhage/cyst/necrosis, and presence of band-like opacity in the lung were significantly associated with disease progression (all, $P < .05$). Patients with three or four of these factors had a significantly shorter cause-specific survival than the other patients ($P < .001$).

CONCLUSION

CT characteristics of thymic epithelial tumors may be helpful in the classification of the new TNM staging system and the prediction of the worse prognosis.

CLINICAL RELEVANCE/APPLICATION

CT features suggestive of invasiveness in thymic epithelial tumor were irregular contour, absence of chest wall's fat layer, presence of pericardial thickness or vascular invasion. Patients with these factors had the worse prognosis.

SSM06

Chest (Vascular)

Wednesday, Nov. 29 3:00PM - 4:00PM Room: S406B

CH CT VA

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Jonathan H. Chung, MD, Chicago, IL (*Moderator*) Nothing to Disclose
Archana T. Laroia, MD, Fargo, ND (*Moderator*) Nothing to Disclose

Sub-Events

SSM06-01 Diagnostic Accuracy of Non-ECG-Gated Chest CT in the Assessment of Cardiac Chamber Enlargement and Hypertrophy Compared to Cardiac MRI

Wednesday, Nov. 29 3:00PM - 3:10PM Room: S406B

Awards
Student Travel Stipend Award

Participants
Diego A. Eifer, MD,MSc, Toronto, ON (*Presenter*) Nothing to Disclose
Elsie Nguyen, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Paaladinesh Thavendiranathan, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, FRCPC, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

kate.hanneman@uhn.ca

PURPOSE

To establish gender specific cut-off values for cardiac chamber enlargement and left ventricular hypertrophy (LVH) on non-ECG-gated chest CT using cardiac MRI as the reference standard.

METHOD AND MATERIALS

218 patients who had contrast enhanced non-ECG-gated chest CT (64-320 detector) and cardiac MRI (1.5-3T) performed within 7 days were identified retrospectively (53% male, 52.9±15.8 years, mean interval between CT and MRI 3.4±2.2 days). The presence of cardiac chamber enlargement and left ventricular hypertrophy (LVH) was established by cardiac MRI as the reference standard, according to current guidelines. Multiple measurements were obtained on axial CT images to evaluate left atrial (LA), left ventricular (LV), right atrial (RA) and right ventricular (RV) chamber size, and LV wall thickness, blinded to the reference standard. ROC analysis was performed to determine optimal gender-specific CT measurement cut-off values for the diagnosis of chamber enlargement (LAE, LVE, RAE, and RVE, respectively) and LVH, with specificity (Sp) >=90%. Inter-observer agreement was evaluated with intra-class correlation (ICC) in a random subset (n=40).

RESULTS

LAE was present in 69 (34%), LVE in 47 (23%), RAE in 45 (21%), RVE in 32 (15%) and LVH in 38 (19%). The following CT measurements were the best discriminators. For LAE, LA anterior-posterior (AP) diameter >=50 mm for males (sensitivity (Sn)=47%, Sp=92%, AUC=0.795) and >=44 mm for females (Sn=54%, Sp=92%, AUC=0.839). For LVE, LV transverse diameter >=58 mm for males (Sn=55%, Sp=92%, AUC=0.842) and >=53 mm for females (Sn=29%, Sp=93%, AUC=0.771). For RAE, RA transverse diameter >=67 mm for males (Sn=59%, Sp=91%, AUC=0.825) and >=63 mm for females (Sn=75%, Sp=92%, AUC=0.925). For RVE, RV transverse diameter >=58 mm for males (Sn=56%, Sp=90%, AUC=0.805) and >=57 mm for females (Sn=57%, Sp=91%, AUC=0.850). For LVH, LV maximal wall thickness >=17 mm for males (Sn=55%, Sp=91%, AUC=0.881) and >=15 mm for females (Sn=78%, Sp=92%, AUC=0.910). Inter-observer agreement was excellent (ICC range 0.887-0.973).

CONCLUSION

Cardiac chamber enlargement and LVH can be reliably identified on contrast enhanced non-ECG-gated chest CT with moderate sensitivity and high specificity.

CLINICAL RELEVANCE/APPLICATION

This study provides gender-specific cut-off values for measurements that can easily be obtained on axial non-ECG-gated CT images to identify cardiac chamber enlargement and LVH with high specificity.

SSM06-02 Correlating Computed Tomography Test Bolus Imaging Dynamics with Pulmonary Vascular Resistance in Pulmonary Hypertension

Wednesday, Nov. 29 3:10PM - 3:20PM Room: S406B

Participants

Dhiraj Baruah, MD, Milwaukee, WI (*Presenter*) Nothing to Disclose
Kaushik S. Shahir, MD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

dbaruah@mcw.edu

PURPOSE

Pulmonary vascular resistance (PVR) is an important parameter in the management of pulmonary hypertension and serves as a primary endpoint to assess the treatment efficacy in several newer targeted therapies. Currently, invasive cardiac catheterization is the gold standard to accurately assess the severity of pulmonary hypertension by providing hemodynamic measures such as PVR and mean pulmonary artery pressure (mPAP). Currently there are no established CT parameters to correlate with PVR. We propose an innovative method using test bolus imaging parameters performed for routine CTPA to correlate with PVR.

METHOD AND MATERIALS

This is an IRB approved retrospective study performed in two separate institutions. Patients included are with known pulmonary hypertension who had a CTPA study within one month of right heart catheterization. CTPA were performed on a 64 slice multidetector CT. Bolus dynamics with 15 mL of intravenous nonionic contrast (Omnipaque 350) and repeated axial images with breath hold at the level of the main pulmonary artery. Full width at half maximum (FWHM) of the test bolus is the width of the main pulmonary artery enhancement curve at half its maximum density.

RESULTS

Out of 221 patients who had undergone CTPA study between January 2010 to December 2013 for evaluation of pulmonary hypertension, 52 of them also had a right heart catheterization within one month of CTPA. Of these 52 patients, 37 fulfilled the selection criteria. A correlation of established size parameters and also FWHM was obtained with catheter angiographic data. There was a strong correlation between FWHM and mPAP ($r=0.65$, p value<0.00001), PVR ($r=0.8$, p value<0.00001) and PVR ($r=0.75$, p value<0.00001) (Fig. 3a, 3b and 3c). There was a poor correlation between MPA, RPA, LPA, MPA/Aorta ratio, A/B and RV/LV and mPAP, PVR and PVRI.

CONCLUSION

This innovative study shows routine CT test bolus dynamic information (FWHM) from CTPA is a simple, reliable and easily available noninvasive method that has a very strong correlation with mPAP and PVR/PVRI as compared with conventional CTPA parameters.

CLINICAL RELEVANCE/APPLICATION

Being noninvasive, these CTPA test bolus parameters are potentially helpful for follow up of patients with pulmonary hypertension, mainly to assess treatment response and progression. Among all the parameters we evaluated the FWHM of test bolus correlates strongly with catheter angiographic parameters.

SSM06-03 Correlation between the Degree of Systemic Collateral Supply and the Severity of Chronic Thromboembolic Pulmonary Hypertension: A CT Angiography Study Using Intra-Arterial Injection

Wednesday, Nov. 29 3:20PM - 3:30PM Room: S406B

Awards
Student Travel Stipend Award

Participants
Wenyu Sun, MD, Sendai, Japan (*Presenter*) Nothing to Disclose
Hideki Ota, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
Haruka Sato, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
Koichiro Sugimura, MD,PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
Kei Takase, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

sunwenyu910920@gmail.com

PURPOSE

It is known that systemic collateral supply develops in chronic thromboembolic hypertension (CTEPH). The aim of this study was to assess whether the degree of shunts from systemic artery to the pulmonary vascular system identified by CT angiography using intra-arterial injection was associated with clinical severity in patients with CTEPH.

METHOD AND MATERIALS

A total of 23 patients with inoperable CTEPH were referred to our cardiology department. During diagnostic right and left heart cardiac catheterization, CT angiography using intra-arterial injection from a catheter in the ascending aorta was performed. One-hundred-and-five ml of 1/3 diluted iodine contrast media (35 ml of 350mgI/ml contrast media and 70 ml of saline) was injected at a speed of 9 ml/sec. CT was imaged at scan delay of 9 sec with a 80-kVp tube voltage setting. Two radiologists evaluated CT images by consensus reading. We measured CT values of the pulmonary trunk (HUpt), sub-segmental pulmonary arteries (HUpa) and segmental pulmonary veins (HUpv).HUdiff was calculated as HUpa (or HUpv) - HUpt. The shunt level was zero of HUdiff < 50. For each additional 50 increase of HUdiff, the shunt level was increased by 1. Two shunt scores in each patient were defined separately as the sum of shunt levels in 42 sub-segmental arteries and 18 segmental veins. Mean pulmonary artery pressure (mPAP) and pulmonary vascular resistance (PVR) were measured by right heart catheterization. Correlations between the shunt scores and hemodynamics were evaluated by Pearson's correlation. A p value < 0.05 was considered to reflect statistical significance.

RESULTS

The mean ± standard deviation of mPAP in the 23 patients was 41.4 ± 8.9 mmHg [range, 25-58]. The mean arterial shunt score was 15.3 ± 16.4 [range, 0-60]; the venous shunt score was 11.7 ± 10.2 [range,1-41]. The shunt score of pulmonary vein was significantly correlated with the mean PAP ($r = 0.56$, $p < 0.01$), whereas the shunt score of pulmonary artery was not ($r = 0.13$, $p = 0.56$)

CONCLUSION

Localization of shunts from systemic artery to pulmonary vessels was possible. The degree systemic collateral supply as indicated by the shunt score may attribute to the clinical severity of inoperable CTEPH.

CLINICAL RELEVANCE/APPLICATION

Systemic collateral supply localized by CT angiography was correlated with the severity of inoperable CTEPH and may give information for stratifying balloon pulmonary angioplasty.

SSM06-04 Treatment Effect of Balloon Pulmonary Angioplasty in CTEPH Quantified by Automatic Comparative Imaging in CTPA

Wednesday, Nov. 29 3:30PM - 3:40PM Room: S406B

Participants
Zhiwei Zhai, Leiden, Netherlands (*Presenter*) Nothing to Disclose
Hideki Ota, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
Marius Staring, PhD, Leiden, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jan Stolk, Leiden, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Koichiro Sugimura, MD,PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
Kei Takase, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
Berend C. Stoel, PhD, Leiden, Netherlands (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

z.zhai@lumc.nl

PURPOSE

Balloon pulmonary angioplasty (BPA) in patients with inoperable chronic thromboembolic pulmonary hypertension (CTEPH) can have variable outcomes. To gain more insight into this variation, we aimed to visualize and quantify changes in lung perfusion using CT pulmonary angiography (CTPA). We validated these measurements of perfusional changes against hemodynamic changes measured during right-heart catheterization.

METHOD AND MATERIALS

We studied 14 consecutive CTEPH patients (12 female; age: 65±17), who underwent CTPA and right-heart catheterization, before and after BPA. Post-treatment images were registered to pre-treatment CT scans (using the Elastix toolbox) to obtain corresponding locations. Pulmonary vascular trees and their centerlines were detected using a graph-cuts method and distance transform. Areas distal from vessels were defined for measuring perfusional changes in the parenchyma. Subsequently, the density changes within the vascular and parenchymal areas were calculated and corrected for inspiration level differences, and displayed in color-coded overlays. For quantification, the median and inter-quartile range (IQR) of the density changes were calculated in the vascular and parenchymal areas (ΔVD and ΔPD, respectively). The recorded changes in hemodynamic parameters included changes in systolic, diastolic and mean pulmonary artery pressure (ΔsPAP, ΔdPAP and ΔmPAP, respectively) and in vascular resistance (ΔPVR). The Spearman's correlation coefficients between perfusional changes and hemodynamic changes were tested.

RESULTS

PAP and PVR were significantly improved after BPA. Comparative imaging maps showed distinct patterns in perfusional changes between patients. Within vessels, the IQR of ΔVD correlated with ΔsPAP (R=-0.58, p=0.03), ΔdPAP (R=-0.71, p=0.005), ΔmPAP (R=-0.71, p=0.005) and ΔPVR (R=-0.77, p=0.001, see Figure). In the parenchyma, the median of ΔPD correlated with ΔdPAP (R=-0.71, p=0.005) and ΔmPAP (R=-0.68, p =0.008).

CONCLUSION

Comparative imaging in CTEPH patients offers insight into differences in BPA treatment effect. Quantification of these perfusional changes provides non-invasive measures that reflect hemodynamic changes.

CLINICAL RELEVANCE/APPLICATION

CTPA studies before and after balloon pulmonary angioplasty in CTEPH can demonstrate density changes in the vascular and parenchymal areas and is recommended to monitor treatment effects.

SSM06-05 Radiologist Performance in the Detection of Pulmonary Embolism: Features That Favor Correct Interpretation and Risk Factors for Errors

Wednesday, Nov. 29 3:40PM - 3:50PM Room: S406B

Participants
Seth J. Kligerman, MD, Denver, CO (*Presenter*) Nothing to Disclose
Jason W. Mitchell, MD, Ellicott City, MD (*Abstract Co-Author*) Nothing to Disclose
Jacob W. Sechrist III, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Adam K. Meeks, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jeffrey R. Galvin, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Charles S. White, MD, Baltimore, MD (*Abstract Co-Author*) Consultant, Koninklijke Philips NV

For information about this presentation, contact:

skligerman@umm.edu

PURPOSE

To assess factors contributing to accurate detection and erroneous interpretation of PE

METHOD AND MATERIALS

Over 13 months, all CTPA studies were retrospectively re-read by a chest radiologist (rad) with 9 yrs experience. Any disagreement

Over 15 months, all CTPA studies were retrospectively re-read by a chest radiologist (rad) with 9 yrs experience. Any disagreement with the initial read was independently assessed by 2 additional chest rads. Studies with uniform disagreement from initial read were labeled false - (FN, miss) or false + (FP overcall). Studies concordant between initial and re-read were true + (TP) or true - (TN). Number (single vs. multiple), most proximal extent (central [C], lobar [L], segmental [S], and subsegmental [SS]), and specific location of PE were recorded. Also assessed were specialty training, experience, time of study, kV used, resident preliminary read, use of iterative recon (IR), signal to noise ratio (SNR), and reports describing study as 'limited'. Parametric and non-parametric statistical testing was performed (significance $p<0.05$)

RESULTS

Of 2555 CTPA cases assessed, there were 230 TP (170 multiple, 60 single PE), 2271 TN, 35 FN (15 multiple and 20 single PE), and 19 FP studies. Overall sensitivity, specificity, PPV, NPV and accuracy of rads was 86.8%, 99.2%, 92.4%, 98.5%, and 97.9%. Sensitivity for detection of multiple PE (92.4%) was significantly higher than single PE (74.1%, $p<0.01$). Sensitivity for C (100%) and L (97.8%) PE was significantly higher than S (85.9%) and SS (74%, $p<0.01$ for both). Sensitivity of thoracic rads (91.7%) was higher than non-thoracic (82.8%) but only reached significance for isolated PE (89.2% vs 61.4%, $P<0.02$). SNR of both TP (13.4) and TN (13.8) studies was significantly higher than FN (11) and FP(11.6). Other factors were not significant. Compared to other S and SS, there were significantly more FNs in the upper lobe posterior and lower lobe lateral S or SS. There were significantly more FP in the inferior lingula. FP studies were more likely to be described as 'limited' in the report.

CONCLUSION

Accuracy for PE detection is high but errors occur, especially in isolated S or SS PE in posterior S or SS of upper and lateral S or SS in lower lobes. Sensitivity was higher in studies with high SNR and if read by thoracic rads

CLINICAL RELEVANCE/APPLICATION

This study demonstrates that although radiologists are accurate in the detection of PE, errors occur most commonly due to location or PE in specific ' blind spots', especially in studies with poor SNR and when interpreted by a non-thoracic radiologist.

SSM06-06 The Power of Axial Scans with 16cm Wide-Detector Scanner: Dose Reduction in Triple-Rule-Out CT Angiography

Wednesday, Nov. 29 3:50PM - 4:00PM Room: S406B

Awards
Trainee Research Prize - Medical Student

Participants
Yuhuan Chen, MD, Xianyang, China (*Presenter*) Nothing to Disclose
Qi Yang, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Taiping He, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Yongjun Jia, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Xiujuan Zuo, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Tang Hui, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Chuangbo Yang, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Dong Han, MD, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Xinyang Zhu, MD,MD, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Zhen Tang Liu, xi`an, China (*Abstract Co-Author*) Nothing to Disclose
Shan Dang, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

754955678@qq.com

PURPOSE

To explore the value of using three consecutive axial scans in the triple-rule-out (TRO) examination for chest pain on a 16cm wide-detector CT system.

METHOD AND MATERIALS

Forty patients with acute chest pain underwent TRO scan and were assigned to study group (group A, n=20) and control group (group B, n=20). In both groups, 120kV tube voltage and automatic current modulation to obtain noise index of 21HU and contrast agent iopamidol (370 mg / ml) were used. For Group A, the time-density curves for pulmonary artery and aorta were monitored to calculate the scan delay time. Two-phasic contrast injection was used: 25mgI/kg/s for 12s in 1st phase and at 3.0ml/s injection rate for 20ml in 2nd phase. The pulmonary artery, coronary artery and aorta were scanned in succession in axial mode to cover the thoracic entrance to the top of the diaphragm. For Group B, scan was triggered by the threshold (100HU) for pulmonary artery to include the thoracic portal to the top of the diaphragm; the coronary artery was scanned after 7 seconds delay, followed immediately by scanning aorta in an helical mode. Contrast agent injection protocol: 25mgI/kg/s for 14s. Images were reconstructed with 80%ASIR-V. CT number and standard deviation (SD) of the thoracic aorta, pulmonary artery, coronary artery, fat and erector spinae muscle were measured to calculate SNR and CNR. Image quality was also assessed using a 5-point system (5: best, 1: worst). Measurements were statistically compared.

RESULTS

There was no difference in age, heart rate and body mass index between the two groups ($P> 0.05$); The CT number, SNR, CNR and subjective score of the two groups were statistically the same ($p>0.05$). However, There was a significant difference in total effective radiation dose between group A (3.3±1.2 mSv) and group B (5.56±0.67mSv) ($P<0.05$), resulting in40.3% effective dose reduction using the 3 consecutive axial scan mode.

CONCLUSION

Using 3 consecutive axial scans in in triple-rule-out (TRO) CTA on a 16cm wide-detector CT reduces both radiation dose and exposure times while maintaining image quality compared with the conventional TRO scanning protocol.

CLINICAL RELEVANCE/APPLICATION

Axial scans may be used on a 16cm wide-detector CT in triple-rule-out CTA to reduce radiation dose and maintain image quality.

RSNA 2017 Explore. Invent. Transform.
103rd Scientific Assembly and Annual Meeting
November 26 to December 1
McCormick Place, Chicago
Explore Invent Transform

SPSC45

Controversy Session: LUNG-RADS™ or Not: Which Nodule Management Protocol Should Be Used for Reporting Lung Cancer Screening CT?

Wednesday, Nov. 29 4:30PM - 6:00PM Room: N227B

CH CT OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
William C. Black, MD, Lebanon, NH (*Moderator*) Nothing to Disclose
Ella A. Kazerooni, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Marjolein A. Heuvelmans, MD,PhD, Groningen, Netherlands (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

william.c.black@hitchcock.org

ellakaz@umich.edu

LEARNING OBJECTIVES

1) Understand the rationale for using the ACR Lung CT Screening Reporting and Data System (Lung-RADS™). 2) Understand the advantages and limitations of using Lung-RADS™. 3) Be Aware of alternative nodule management protocols that can be used for reporting lung cancer screening CT.

ABSTRACT

The ACR Lung CT Screening Reporting and Data System (Lung-RADS™) was developed as a tool for the interpretation of lung cancer CT screening examinations as a way to standardizing reporting using a common nomenclature and structure, and track screening outcomes. Abnormalities are placed into categories 1-4 based on their risk of lung cancer as primarily defined by nodule size and stucture (solid, part solid and non solid) and their risk of lung cancer, each with a management recommendation. Lung-RADS™ is the reporting schema used in the American College of Radiology's Lung Cancer Screening Registry (ACR LSCR). As lung cancer CT screening is rolled out nationally in the United States, this reporting schema creates a mechanism by which to evaluate the performanc eof lung cancer screening in practice. The over 2200 facilities enrolled in the ACR LCSR receive reports with both facility and radiologist level data, which includes the use of Lung-RADS™ categories in their practice and comparative data for purpose of quality assurance and quality improvement. With nearly two years of screening data reported into the ACR LCSR, data on Lung-RADS™ category use and subsequent diagnostic testing/intervention and cancer detection rates can be used to refine Lung-RADS™ in the future. As technology progresses and volumetric tools become more available in practice, moving from nodule diameter measurements to nodule volume for measurement and growth rates is a future goal.

URL

www.acr.org/Quality-Safety/Resources/LungRADS www.acr.org/Quality-Safety/National-Radiology-Data-Registry/Lung-Cancer-Screening-Registry

Active Handout:William C. Black

http://abstract.rsna.org/uploads/2017/17001860/Active SPSC45.pdf

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

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103rd Scientific Assembly and Annual Meeting
November 26 to December 1
McCormick Place, Chicago
Explore Invent Transform

RC601

The Many Facets of Organizing Pneumonia: A Rad-Path Guide to Understanding and Diagnosis

Thursday, Nov. 30 8:30AM - 10:00AM Room: E451A

CH CT

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

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

Sub-Events

RC601A Introduction

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

Active Handout:Jeffrey R. Galvin

http://abstract.rsna.org/uploads/2017/17000288/Active RC601A.pdf

RC601B Pathology of Organizing Pneumonia

Participants
Teri J. Franks, MD, Silver Spring, MD (*Presenter*) Nothing to Disclose

RC601C Imaging of Organizing Pneumonia

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

RC601D Pathways to Fibrosis and Summary

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

LEARNING OBJECTIVES

1) Understand the microscopic anatomy of the lung that explains the high resolution CT findings associated with organizing pneumonia. 2) Improve their diagnostic skills related to the imaging recognition of organizing pneumonia. 3) Recognize the range of injuries and inhaled insults that lead to organizing pneumonia. 4) Apply a new knowledge of the pathways to fibrosis that allows for the differentiation of organizing pneumonia, IPF and diffuse alveolar damage. 5) Appreciate the importance of communication between the clinician, radiologist, and pathologist to improve diagnosis.

ABSTRACT

This presentation will review the histologic and radiologic findings of organization in lung injury due to diffuse alveolar damage, organizing pneumonia and acute fibrinous and organizing pneumonia. It will clarify the role of organizing pneumonia in the pathway to fibrosis that will sharpen the radiologist's ability to separate the various forms of fibrosis including: idiopathic pulmonary fibrosis, non-specific interstitial pneumonia and diffuse alveolar damage. Finally it will describe the multidisciplinary diagnostic process of which the radiologist is a key member.

Active Handout:Jeffrey R. Galvin

http://abstract.rsna.org/uploads/2017/17000294/Active RC601D.pdf

SSQ04

Chest (Interventional/Ablation)

Thursday, Nov. 30 10:30AM - 12:00PM Room: E351

CH CT IR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Matthew D. Cham, MD, New York, NY (*Moderator*) Nothing to Disclose
Steven Y. Huang, MD, Houston, TX (*Moderator*) Scientific Advisory Board, Adient Medical Inc

Sub-Events

SSQ04-01 Analysis of Risk Factors for Hemoptysis after Percutaneous Transthoracic Needle Biopsies in 4,172 Cases: Focusing on the Effects of Diametrical Enlargement of the Main Pulmonary Artery

Thursday, Nov. 30 10:30AM - 10:40AM Room: E351

Participants
Eui Jin Hwang, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Chang Min Park, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Soon Ho Yoon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun-Ju Lim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Samsung Electronics Co, Ltd; Research Grant, DRTECH Co, Ltd

For information about this presentation, contact:

ken921004@hotmail.com

PURPOSE

To evaluate risk factors for hemoptysis after cone-beam computed tomography (CBCT)-guided percutaneous transthoracic needle biopsy (PTNB) and, in particular, to determine whether the enlargement of main pulmonary artery diameter (mPAD) is a risk factor for PTNB-related hemoptysis.

METHOD AND MATERIALS

After approval from the Institutional Review Board, 4,172 cases of CBCT-guided PTNBs in 3,840 patients (2299 men and 1541 women; mean age, 63.64 years, ranging from 7-to-94 years) were retrospectively included in this study. Various clinical, radiological, and biopsy-related data including mPAD were evaluated using univariate and multivariate logistic regression analyses to figure out significant risk factors for both hemoptysis and severe hemoptysis. Severe hemoptysis was designated when blood transfusion, vascular embolization, or cardiopulmonary resuscitation were required to manage patients with the diagnosis.

RESULTS

Hemoptysis occurred in 5.78% (n=241) of all PTNB procedures, while severe hemoptysis occurred in 0.18% (n=7). Female sex (Odds ratio [OR]=2.703, P<0.001), history of anti-platelet or anti-coagulative drugs (OR=2.362, P=0.002), prolonged activated partial thromboplastin time (OR=1.951, P=0.042), subsolid nodules (OR=3.529, P<0.001), cavitary nodules (OR=3.205, P=0.038), and long pleura-to-target distance (P<0.001) were independent risk factors for hemoptysis, while mPAD enlargement was not a significant risk factor. Regarding severe hemoptysis, however, mPAD enlargement (OR=5.004, P=0.037) was a significant independent risk factor in combination with subsolid (OR=6.648, P=0.046) and cavitary target nodules (OR=20.284, P=0.008).

CONCLUSION

mPAD enlargement was not a significant risk factor for PTNB-related hemoptysis. However, it was a significant risk factor for severe PTNB-related hemoptysis.

CLINICAL RELEVANCE/APPLICATION

mPAD enlargement was a significant risk factor for severe PTNB-related hemoptysis, along with subsolid and cavitary nodule features.

SSQ04-02 Active Targeting Theranostic Iron Oxide Nanoparticles for MRI and Magnetic Resonance-Guided Focused Ultrasound Ablation of Lung Cancer

Thursday, Nov. 30 10:40AM - 10:50AM Room: E351

Participants
Na Tang, Shanghai, China (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

tnwaipodaren@126.com

PURPOSE

To evaluate an active targeting and nano-sized SPIO platform for the enhancement of imaging sensitivity and tumor-ablative efficacy in MRgFUS, and applications of a series of MRI approaches for non-invasive monitoring treatment response were demonstrated using nude rat lung tumor models.

METHOD AND MATERIALS

PEGylated SPIO nanoparticles was further decorated with high affinity anti-EGFR monoclonal antibody to form a nanocomposite (anti-EGFR-PEG-SPIO) , and in vitro and vivo MRI was preformed. 24 rats were then randomly divided into positive control group (n=6), negative control group (n=6), PEGylated SPIO group (n=6), and anti-EPS group (n=6). The nude rats tumors were sonicated after injection of the PEGylated SPIO and anti-EPS solution (1ml) via tail vein at 4.0 h. Prior to sonication, T2W SE were acquired. For each nude rat, two to five sonications were planned. The treated areas were about 0.5 cm2 according to the pretreatment plan. Each dynamic temperature was monitored by real-time MRI temperature mapping of the treated area.

RESULTS

The T2 values for the anti-EGFR-PEG-SPIO and PEGylated SPIO contrast agents at 3.0 T MRI were 10.3ms and 11.2ms, respectively. T2 relativity values were 97.1 s-1mM-1 and 89.3 s-1mM-1, respectively.The T2 SI in targeting group decreased significantly compared with non-targeting group. The rate of SI change was -58.2%, -82.7%, -94.4%, and 98.3% respectively, at the iron concentrations. Thirty minutes after the injection of anti-EPS, the T2 SNR in the lung tumor started to decrease. The T2 SNR at the tumor region decreased more significantly at 4 hours post-injection of anti-EPS compared with the nontargeting group ($p<0.01$). The energy of the targeting group was even lower than that of the control (low enegy) group (32W vs 54 W, $P<0.01$) ,Peak temperature significantly higher than control group. T2W SI and ADC significantly after ablation higher than before ablation in targeting, and nontargeting, control group

CONCLUSION

We have successfully developed anti-EGFR modified PEGyloated SPIO nanoparticles as targeted MR imaging contrast agents and the synergistic agents for MRgFUS lung carcinoma thermotherapy. After tumor ablation, tumor therapeutic efficiency monitored by the clinical MRI equipment can be applied as an attractive potential noninvasive strategy.

CLINICAL RELEVANCE/APPLICATION

Applications of a series of MRI approaches can be applied as an attractive potential noninvasive strategy.

SSQ04-03 Non-Diagnostic CT-Guided Percutaneous Needle Biopsy (PTNB): Predictive Factors and Final Diagnoses

Thursday, Nov. 30 10:50AM - 11:00AM Room: E351

Participants
Thanisa Tongbai, MD, Bangkok, Thailand (*Presenter*) Nothing to Disclose
Shaunagh McDermott, FFR(RCSI), 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
Jo-Anne O. Shepard, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Matthew D. Gilman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the final diagnosis of pulmonary lesions with an initial non-diagnostic result on CT-guided percutaneous transthoracic needle biopsy (PTNB) and the predictive factors for a non-diagnostic result.

METHOD AND MATERIALS

All PTNB performed over a 4-year period were retrospectively reviewed. The initial pathological results were classified into 3 categories as malignant or suspicious for malignant, benign specific, and non-diagnostic. The demographic data of patients, lesion characteristics, technique, complications, initial pathological results and final diagnosis were reviewed. Statistical analysis was performed using Pearson's X2 test or Fisher's exact test.

RESULTS

Out of a total of 894 consecutive biopsies, 690 (77.2%) were positive or suspicious for malignancy, 55 (6.2%) were specific benign, and 149 (16.7%) were non-diagnostic. Significantly higher non-diagnostic rates were found in cases where the lesion was less than 15mm, the needle tract traversed emphysema, the introducer needle was outside the lesion, total time was greater than 60 minutes and when alveolar hemorrhage was present during the procedure. 122 of 149 non-diagnostic cases had a subsequent diagnosis made by repeat biopsy, surgery or follow-up; and malignancy was confirmed in 44 cases (44/122, 36%). There were statistically significant differences in non-diagnostic biopsy rates for patients with malignant lesions (44/734, 6%) and benign lesions (78/133, 59%) ($p=0.001$). In the non-diagnostic group, patients with history of prior malignancy and patients with atypical cells present in the initial pathological report were more likely to have a final diagnosis of malignancy ($p=0.043$ and $p=0.001$, respectively)..

CONCLUSION

The predictive factors for non-diagnostic results were lesion size less than 15mm, needle tract traversing emphysema, introducer needle outside the lesion, procedure time greater than 60 minutes, presence of alveolar hemorrhage, and a final benign diagnosis. Although the majority of the non-diagnostic cases yielded a benign diagnosis, 36% were malignant. In cases with a history of malignancy or the presence of atypical cells in the biopsy sample repeat biopsy or surgical resection should be considered.

CLINICAL RELEVANCE/APPLICATION

The management of a non-diagnostic PTNB result is difficult, however, the 36% rate of malignancy in this group underscores the need for further diagnostic evaluation in these patients.

SSQ04-04 Evaluation of Rabbit Lung VX2 Tumor after Radiofrequency Ablation by Multi-B Value Based MR Diffusion Weighted Imaging

Thursday, Nov. 30 11:00AM - 11:10AM Room: E351

Participants
Fei Shan, Shanghai, China (*Presenter*) Nothing to Disclose
Zenghui Cheng, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Zhiyong Zhang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Yuxin Shi, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

shanfeiqz@aliyun.com

PURPOSE

To explore the multi-b value based diffusion weighted imaging (DWI) on evaluation of lung VX2 tumor after radiofrequency ablation (RFA).

METHOD AND MATERIALS

Fifty-three lung VX2 tumor models were examined by multi-b value DWI (b=0,10,20,50,100,150,200,500,800, 1000,2000 s/mm2) at 1 day before RFA, and 1, 3, 7, 14 days after RFA. Both mono-exponential and bi-exponential model (including intravoxel incoherent motion imaging, diffusion kurtosis imaging (DKI) and stretched exponential model (SEM)) were used to calculate corresponding parameters (ADC, D, D*, f, Dk, K, DDC and A) based on ROIs of the maximal cross-sectional tumor before and after RFA by two thoracic radiologists, blindly. The parameters were compared between pre-RFA and post-RFA groups; the complete and incomplete RFA groups based on H&E and TUNEL staining, and correlated with MVD. The t test, Wilcoxon test, or Mann-Whitney U test was used in two-group comparisons. The area under curve (AUC) was used to assess the diagnostic performance. The Spearman correlation was used to analyze the correlation. Bland-Altman method was used to assess the intraobserver repeatability, and the coefficient of variation (CV) <5% was in good repeatability.

RESULTS

ADC, D, Dk, DDC and a values increased after RFA (all p<0.02), while K values decreased at day 3 and day 7, postoperatively (p=0.03; 0.01). ΔADC, ΔD, ΔDk, ΔDDC, Δa and ΔK of the complete RFA group was higher than that of the incomplete RFA group (all p<0.03) at day3; day7; day1-14; day7; day7 and day3, postoperatively, respectively, and the AUC of ΔADC>=0.44×10-3mm2/s; ΔD>=0.18×10-3mm2/s; ΔDk>=0.50, 0.37, 0.19 and 0.19×10-3mm2/s; ΔDDC>=0.16 × 10-3mm2/s; Δa>=0.05; ΔK>=0.23 in determination of tumor with complete ablation, was 0.93; 1.00; 1.00, 0.98, 1.00 and 0.96; 0.88; 0.88; 0.95, respectively. No difference of D*and f value changes was noticed, postoperatively (all P value>0.09). No difference of AUC and no correlation of parameters with MVD (all P values > 0.05). The CV of ADC, DDC, a, Dk, K and D at baseline was 2.18%, 3.33%, 3.45%, 7.18%, 8.65% and 18.62 %, respectively.

CONCLUSION

DKI could be used to evaluate the efficacy of RFA at day 1, postoperatively; ADC (b = 0, 500s/mm2) and DKI could be utilized to evaluate it at day 3, postoperatively; both the DKI and SEM-DWI could evaluate it at day 7 and day 14, postoperatively.

CLINICAL RELEVANCE/APPLICATION

DKI and ADC could be used to early assess the lung tumor after RFA.

SSQ04-05 Risk of Pleural Recurrence after Percutaneous Transthoracic Needle Biopsy in Stage I Non-Small Cell Lung Cancer: A Large Center Experience

Thursday, Nov. 30 11:10AM - 11:20AM Room: E351

Participants
Su Yeon Ahn, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Soon Ho Yoon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Tae Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chang Hyun Kang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
In Kyu Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chang Min Park, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Samsung Electronics Co, Ltd; Research Grant, DRTECH Co, Ltd

PURPOSE

To determine whether percutaneous transthoracic needle biopsy (PTNB) increase the risk of (a) isolated pleural recurrence and (b) concomitant pleural seeding and metastasis in stage I non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS

In this institutional review board-approved retrospective study, medical records of total of 830 consecutive patients with stage I NSCLC who underwent curative resection between 2004 and 2010 were reviewed. Median duration of follow-up was 1843 days (interquartile range, 1006-2734). Multiple logistic regression analyses were performed to identify risk factors of pleural recurrence.

RESULTS

Of 830 patients, 540 patients (65.1%) underwent PTNB before surgery, while 290 patients (34.9%) underwent non-PTNB procedures including bronchoscopic biopsy or exploratory thoracotomy. An isolated pleural recurrence was found in 26 patients (3.1%, [95%CI, 2.1-4.6%]) (20 in PTNB group, 6 in non-PTNB group). There was no significant association between PTNB and isolated pleural recurrence (P=0.197). Concomitant pleural recurrence occurred in 42 patients (5.1%, [95%CI, 3.8-6.8%]) (34 in PTNB group, and 8 in non-PTNB group). Subpleural location (p=0.007), tumor consistency (solid, part-solid, nonsolid) (p=0.046), PTNB (p=0.027), pathologic T stage (p<0.001), microscopic pleural invasion (p<0.001) and microscopic lymphatic invasion

(p=0.019) were associated with concomitant pleural recurrence. The most significant factor of pleural recurrence was only microscopic pleural invasion (Odds Ratio, 4.28; 95% CI, 2.20 to 8.29) (P<0.001) on multiple logistic analysis. Among 540 patients undergoing PTNB, transfissural approach did not have significant association with pleural recurrence (P=0.220), while the most sole significant factor was microscopic pleural invasion (Odds Ratio, 3.40; 95% CI, 1.54 to 7.51) (P=0.002).

CONCLUSION

PTNB did not increase the risk of isolated or concomitant pleural recurrence in early stage NSCLC. Higher incidence of concomitant pleural seeding in PTNB group was presumably attributed to peripheral lung cancer, potentially accompanying microscopic pleural invasion.

CLINICAL RELEVANCE/APPLICATION

PTNB can be performed for confirmatory diagnosis of early stage lung cancer without raising the risk of isolated or concomitant pleural recurrence.

SSQ04-06 Genomic Profiling of Non-Small Cell Lung Cancer (NSCLC) for Personalized Therapy

Thursday, Nov. 30 11:20AM - 11:30AM Room: E351

Participants
David J. Murphy, MBBCh,FFR(RCSI), Boston, MA (*Presenter*) Nothing to Disclose
Pasi A. Janne, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Lynette M. Sholl, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Bruce E. Johnson, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ritu R. Gill, MBBS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

murphy.84@gmail.com

PURPOSE

Genomic profiling for personalized targeted therapy is emerging for NSCLC. Systematic testing for mutations in BRAF, ERBB2, PIK3CA and ALK translocations, in addition to EGFR and KRAS was introduced in our institution in July 2009. We report the utility, efficacy and safety of CT guided trans-thoracic needle biopsy (TTNB) in this cohort.

METHOD AND MATERIALS

Patients with stage IV/relapsed NSCLC who underwent CT guided TTNB to identify driver mutations prior to therapy were reviewed. Pathology specimens were evaluated for tumor adequacy, then manually dissected and analyzed by a variety of methods, including next generation sequencing for mutations in selected exons of EGFR, KRAS, BRAF, PIK3CA and ERBB2. ALK rearrangements were detected with fluorescence in-situ hybridization (FISH) and/or immunohistochemistry. Complications (pneumothorax, hemorrhage and admission) were recorded.

RESULTS

Between 6/12/2009 and 12/30/2016, 764 patients with NSCLC underwent TTNB. The median age was 67 years. 454(59%) were female, 426(56%) were former/current smokers and 580(75%) had stage IIIB/IV disease. 492(64%) of all TTNB performed were profiled for genomic analysis, of which 426(87%) had sufficient tissue on core biopsies for genomic profiling; 75(10%) of the 492 patients failed analysis for ALK rearrangements due to less than 50 tumor cells on the hybridized slide. The number of samples obtained ranged from 1-10 (2 cm 18-20G). Lesions biopsied ranged in size from 0.6-9.9 cm. PET guidance was used in 323(42%) patients. Targetable alterations were identified in 172/426(40%) patients (EGFR:139(18%); KRAS:101(13%);ALK:10(1%);BRAF:9(1%)). 216(28%) had pneumothoraces:137(<10% in size), 42 (10-30%) and 37(>30%). 79(10%) were admitted post procedure. 85(11%) had pulmonary hemorrhage. There was no statistically significant difference in pneumothorax rate by needle size (p=0.8). Pneumothorax rate significantly correlated with distance from the pleura and emphysema. Treatment strategy was changed in 183(24%) patients based on the biopsy result.

CONCLUSION

CT guided TTNB is a feasible, safe and efficacious technique for genomic profiling for targeted therapy, enabling the acquisition of sufficient tissue for gene mutation analyses.

CLINICAL RELEVANCE/APPLICATION

Personalized medicine has increased the need for rebiopsy in NSCLC; the ability to acquire sufficient tissue with minimal morbidity will help design clinical trials and inform management decisions.

SSQ04-07 Repeat Biopsy for the Patients with Acquired Resistance to EGFR TKIs: Implication of Biopsy-related Factors on Detection of T790M Mutation

Thursday, Nov. 30 11:30AM - 11:40AM Room: E351

Participants
Hyungjin Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Kum Ju Chae, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Soon Ho Yoon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Miso Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Bhumsuk Keam, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Tae Min Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Samsung Electronics Co, Ltd; Research Grant, DRTECH Co, Ltd
Dong-Wan Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chang Min Park, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

khj.snuh@gmail.com

PURPOSE

Identification of T790M resistance mutation through repeat biopsy is essential to determine eligibility of the potential candidate patients for the third-generation epidermal growth factor receptor (EGFR) tyrosine kinase inhibitors (TKIs). We aimed to investigate predictors for the successful repeat biopsy specimen acquisition for mutational analysis and T790M mutation detection.

METHOD AND MATERIALS

We retrospectively reviewed 90 advanced non-small cell lung cancer patients harboring EGFR mutation who underwent repeat cone-beam CT-guided transthoracic needle biopsy. Clinical characteristics as well as repeat biopsy-related factors were compared between the patients with and without adequate biopsy specimen acquisition and between the patients with and without T790M mutation. After univariate analysis, multivariate logistic regression analysis was performed to reveal independent predictors.

RESULTS

Appropriate biopsy specimen was obtained in 90% (81/90) and T790M mutation was found in 61.7% (50/81) of the study population. None of the analyzed variables was significantly associated with successful biopsy specimen acquisition. For the T790M mutation detection, duration of EGFR TKI treatment (P=0.066), duration of total chemotherapy treatment (P=0.026), tumor size (P=0.066), and metastatic lesion as a biopsy target (P=0.029) showed P values less than 0.10. Multivariate analysis revealed that smaller target tumor size (odds ratio, 0.765; 95% confidence interval: 0.600, 0.975; P=0.031) and metastatic lesion as a biopsy target (odds ratio, 4.194; 95% confidence interval: 0.997, 17.637; P=0.050) were significant independent predictors of T790M mutation detection.

CONCLUSION

Detection of T790M mutation at repeat biopsy was associated with smaller target tumor size and selection of metastatic lesion as a biopsy target.

CLINICAL RELEVANCE/APPLICATION

Selection of biopsy target can affect detection of T790M mutation in in patients undergoing repeat biopsy (PTNB) as candidates of third-generation EGFR TKIs.

SSQ04-08 Single Institution Experience in Pre-Operative Pulmonary Lesion Marking Using Fiducial Markers and Micro-Coils in Preparation for Fluoroscopic Wedge Resection: Rates of Success, Complications, and Comparison of Two Labeling Devices

Thursday, Nov. 30 11:40AM - 11:50AM Room: E351

Participants
William C. Small, MD, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose
Babatunde Olaiya, MD , Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Charles A. Gilliland IV, MD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose
Seth Force, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Felix Fernandez, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Manu Sancheti, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

wsmall@emory.edu

PURPOSE

Evaluate the use of either Fiducial Marker (FM) or Microcoils (MC) to aid image-assisted wedge surgical resection of small pulmonary nodules and explore associations between patient/nodule characteristics and development of complications.

METHOD AND MATERIALS

IRB approved , HIPAA compliant database search identified patients who had CT-guided FM or MC implantation for wedge resection of pulmonary nodules from 01/01/95 - 01/22/2016. EMR was searched to extract patient's demographics including age, gender and body mass index. CT images prior to FM/MC insertion were reviewed by a single radiologist for nodule characteristics including size, location and depth. Post procedure CT images were read to measure distance of FM/MC to the nodule and to assess for complications including hemorrhage, pneumothorax and marker migration. Chi squared analysis at <0.05 was used to explore asssociations between patient/nodule characteristics and the development of complications.

RESULTS

We identified 136 nodules in 127 patients (67M:60F). Preoperatively, 130 FMs and 33 MCs were inserted to aid wedge resection in 112 and 15 patients respectively. 97% [124/127] of patients had successful same day resection as planned, two were delayed due to complications and a single patient needed a lobectomy due to lesion location. 68% of patiebnts [88/127] had complications following FM/MC insertion including hemorrhage [32%], pneumothorax [24%], a combination of hemmorhage and pneumothorax [9%] and marker moigration/emolization [3%]. Depth of lesion from skin was significantly associated with developing a complication. No other patient of nodular characteristic was associated with developing a complication. We observed a smaller percentage of patient complications in MC as compared to FM placement and these were of less severity, although statistical significance was not reached (p=0.06)

CONCLUSION

CT-guided pulmonary marking of pulmonary lesions is effective at aiding wedge resection. Complications are relatively common but mild with no significant effect on patient clinical management. Use of MC rather than FM may improve the saftey profile of lesion marking.

CLINICAL RELEVANCE/APPLICATION

Mild complications are relatively frequent but shoiuld not deter FM or MC placement for wedge resection of pulmonary nodules. Our

data suggests MC may have a better safety profile as compared to FM.

SSQ04-09 Rebiopsy of Non-Small Cell Lung Cancer with Acquired Resistance to EGFR Tyrosine Kinase Inhibitor: Clinical and CT Characteristics of Patients with T790M Mutation

Thursday, Nov. 30 11:50AM - 12:00PM Room: E351

Awards
Student Travel Stipend Award

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

For information about this presentation, contact:

mimowdr@gmail.com

PURPOSE

Re-biopsy for T790M mutation analysis of non-small cell lung cancer (NSCLC) after EGFR-tyrosine kinase inhibitor (TKI) treatment failure is important to determine further chemotherapy regimen. However, little is known regarding the clinical and radiologic differences among patients with or without T790 mutation.

METHOD AND MATERIALS

Between Jan 2011 and Jan 2017, 370 lung cancer patients underwent re-biopsy after TKI failure, and among them, 362 were assessed with adequate specimen. Clinical course, serial CT scans and pathologic reports were retrospectively reviewed. Re-biopsy methods are varied: CT or fluoroscopy-guided lung biopsy (n=130), EBUS or BFS-guided (n=71) biopsies, US-guided lymph node (n=40) or liver (n=20) biopsy, pleura biopsy (n=9), other sites (n=48) biopsies including surgical lung resection and pleural fluid analysis (n=44). CT scans obtained at the time of initial diagnosis and re-biopsy were compared between patients with and without T790M mutation.

RESULTS

Among 362 patients, 150 (41.4%) presented T790M mutation on re-biopsy. Two patients who were negative T790M mutation on pleural fluid analysis finally diagnosed as positive T790M mutation by following CT-guided biopsy or surgical lung resection. Mean interval between initial TKI failure and rebiopsy was longer in T790M positive group than negative group (p=0.01). On initial CT, the presence of pleural metastasis was significantly higher in T790M positive group (p=0.006). On CT obtained at the time of rebiopsy, pleural retraction adjacent to primary lung cancer and pleural metastasis were significantly noted, and number of metastatic sites is also higher in patients with positive T790M mutation ($p < 0.01$).

CONCLUSION

T790M mutation may be related to the interval between initial TKI failure and rebiopsy. Pleural retraction adjacent to primary lung cancer and pleural metastasis on CT at the time of rebiopsy were significantly associated factors to positive T790M mutation in NSCLC patients with TKI failure.

CLINICAL RELEVANCE/APPLICATION

On CT at the time of rebiopsy, pleural retraction and pleural metastasis were significantly noted in patients with positive T790M mutation after TKI failure. Negative T790M on pleural fluid analysis could not give a guarantee for true negative, and further core biopsy might be recommended.

SSQ05

Chest (Lung Cancer Screening)

Thursday, Nov. 30 10:30AM - 12:00PM Room: S402AB

CH CT OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Girish S. Shroff, MD, Houston, TX (*Moderator*) Nothing to Disclose
Sudhakar N. Pipavath, MD, Mercer Island, WA (*Moderator*) Consultant, Boehringer Ingelheim GmbH; Advisor, Boehringer Ingelheim GmbH; Adjudicator, Gilead Sciences, Inc

Sub-Events

SSQ05-01 Performance of Deep Learning Model in Detecting T1 Lung Cancer with Chest Radiographs

Thursday, Nov. 30 10:30AM - 10:40AM Room: S402AB

Participants
Jeong Hyun Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Myung Jin Chung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, General Electronic Company; Research Grant, Samsung Electronics Co, Ltd; Research Grant, Lunit Inc
Min Jae Cha, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyung S. Lee, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kangeui Lee, PhD, Yongin-Si, Korea, Republic Of (*Abstract Co-Author*) Employee, Samsung Electronics Co, Ltd
Hyun-Hwa Oh, PhD, Yongin-Si, Korea, Republic Of (*Abstract Co-Author*) Employee, Samsung Electronics Co Ltd
Dong-Jae Lee, Suwon, Korea, Republic Of (*Abstract Co-Author*) Employee, Samsung Electronics Co, Ltd

For information about this presentation, contact:

mjchung@skku.edu

PURPOSE

The conventional chest radiograph (CXR) is one of the most widely available modality, but detecting small nodules on CXR remains a demanding task for radiologists. The purpose of this study was to evaluate diagnostic performance of deep convolutional neural network model (Deep learning model, DLM) for detecting a T1 lung cancer.

METHOD AND MATERIALS

For the training set, we collected CXRs from 19,927 individuals at our hospital (M:F = 11,082:8,845; mean age, 55 yrs) including 14,579 normal subjects and 5,348 patients with CT proven lung nodules. We adopted an augmented training method to create a training set of 280,000 images, then developed and trained DLM using a 50-layer deep residual network. For the test set, we collected 2,509 consecutive patients with a surgically-proven T1 lung cancer (M:F = 1,167:1,347; mean age, 60 yrs) between years 2010 and 2015. Inadequate cases (e.g., missing presurgical CXR, long interval between CT and CXR, nodules < 10 mm) were excluded. Two expert radiologists, who reached decisions by consensus, marked and scored nodule visibility on CXR on four levels: 1 (invisible) ~ 4 (obvious). The final test set included 1,483 patients with a lung nodule >= 10 mm. For human observer study, we selected 200 patients from the test set (100 with a nodule of subtlety 3 and 100 with subtlety 4) and 300 matching normal images. Six radiologists (experience of CXR reading ranging from 4 to 21 years) participated as observers. The radiologists marked lesion candidates and scored the confidence of nodule presence from 1 to 10. The detection performance of DLM and observers were evaluated using FROC analysis.

RESULTS

DLM showed sensitivities of 75% for all T1 lung cancers and 88% for subtlety levels 3 and 4, respectively at FPPI 0.3. When compared with human observers, DLM showed sensitivity 82.5% at FPPI 0.1 and 88% at FPPI 0.3. Observers showed mean sensitivity 78% (68 ~ 83%) at FPPI 0.1 and 85% (80 ~ 89%) at FPPI 0.3. Observers showed mean AUC 0.819 (0.754 ~ 0.862) in the FPPI range from 0.03 to 0.44, while DLM showed AUC of 0.858 in the same FPPI range.

CONCLUSION

A DLM developed for the detection of lung nodules on CXR yields high diagnostic performance in detecting T1 lung cancers.

CLINICAL RELEVANCE/APPLICATION

A diagnostic system based on a deep learning model shows promise for the future development of a CR-based, mass screening device for lung cancer identification.

SSQ05-02 Extrapulmonary Malignancy as a Cause of Death in the CT Arm of the National Lung Screening Trial: A Retrospective Analysis of CT Evidence of Disease

Thursday, Nov. 30 10:40AM - 10:50AM Room: S402AB

Participants

Myrna C. Godoy, MD, PhD, Houston, TX (*Abstract Co-Author*) Research Grant, Siemens AG
Caroline Chiles, MD, Winston-Salem, NC (*Abstract Co-Author*) Advisory Board, ImBio, LLC
Charles S. White, MD, Baltimore, MD (*Presenter*) Consultant, Koninklijke Philips NV

For information about this presentation, contact:

mgodoy@mdanderson.org

PURPOSE

To explore CT findings associated with "other neoplasms", which were the cause of death (COD) in 22% of deaths in the National Lung Screening Trial (NLST).

METHOD AND MATERIALS

Three board-certified cardiopulmonary radiologists retrospectively reviewed low-dose screening CTs of the 263 NLST participants whose CODs were one of the 10 most common extrapulmonary malignancies (EPM), either on the death certificate or in the endpoint verification process, and in whom CT images were available. Two readers each reviewed ½ the cases, and a 3rd reader reviewed all 263 cases. The readers were aware of COD in each case. The scans were classified as negative, indeterminate or positive for findings that could be correlated with the EPM listed as the COD. For discrepant reads, the case was reviewed by all three readers to develop a consensus opinion.

RESULTS

The most common EPMs to cause death in the CT arm of the NLST population were pancreas (N = 76), esophagus (N = 35), colorectal (N = 34), brain (N = 21), leukemia (N = 21), bladder (N=19), liver (N = 18), breast (N=14), multiple myeloma (N=13) and lymphoma (N = 12). Of these, the CT scans were positive for EPMs with visualization of the primary tumor or metastatic disease in 15.6% (41/263) of cases. The EPMs that were most likely to be detected on the CT were esophageal (37.1%, 13/35), breast (35.7%, 5/14) and pancreatic (13.1%, 10/76) cancers. In all three tumors, the primary tumor was visible as a solid mass. In colorectal cancer, however, the disease was detected as metastatic to the liver in 11.8% (4/34) cases. The CT scans were classified as indeterminate for detection of the primary malignancy or metastasis in an additional 9.9% (26/263) of cases, but the findings could potentially have prompted additional work-up ultimately leading to the detection of the EPM.

CONCLUSION

Extrapulmonary malignancy is the third most common cause of death in the lung cancer screening population. Findings related to the primary tumor or metastatic disease are present in 15.6% of the most common tumors. The primary tumor was most likely to be seen in esophageal, breast and pancreatic cancers, and appeared as a solid mass.

CLINICAL RELEVANCE/APPLICATION

Detection of an EPM on lung cancer screening CT may help reduce mortality in this high risk population. Esophageal, breast and pancreatic cancers may be visible as solid masses.

SSQ05-03 Outcome of Lung-RADS Category 3 and 4 on Initial Lung Cancer Screening Exams

Thursday, Nov. 30 10:50AM - 11:00AM Room: S402AB

Participants
Milena Petranovic, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Alexi Otrakji, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Amita Sharma, MBBS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ashok Muniappan, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jo-Anne O. Shepard, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Shaunagh McDermott, FFR(RCSI), Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

mpetranovic@partners.org

PURPOSE

To determine the follow-up course and clinical outcome of lung cancer screening exams for patients whose studies were designated as Lung-RADS category 3 and 4 on the initial screening exam.

METHOD AND MATERIALS

The reports of all initial lung cancer screening chest CT exams performed at a major tertiary center between 2/1/2013 and 12/31/2016 were reviewed. Detailed chart review was performed for all patients assigned as category 3 and 4, including reports of any subsequent imaging, diagnostic procedures and complications, pathology and microbiology. We compared our findings with those estimated and predicted by ACR Lung-RADS version 1.0.

RESULTS

Our IRB approved study included 1567 adult patients (M:F 826:741, Age:64±6) and identified 20% (317/1567) exams as Lung-RADS category 3 or 4. 18% (58/317) of category 3 and 4 patients underwent some type of invasive procedure (CT-guided biopsy (7), bronchoscopy (6), surgery (43), other (2)). 4% (7/181) of category 3 and 32% (43/136) of category 4 patients were diagnosed with malignancy. Median time from initial screening exam to tissue diagnosis for malignancy was 11 weeks (range 2-154weeks). Majority of patients who underwent an invasive procedure went directly to either wedge resection or lobectomy without prior tissue diagnosis. Complications were seen in 7% (4/58) of patients, all related to surgery and included air leak (3) and chyle leak (1). 2% (8/317) of patients who underwent an invasive procedure yielded benign pathology. 8% (26/317) patients did not have any imaging follow-up, including 6% (20/181) of category 3 and 2% (6/136) of category 4. 51% (93/181) of category 3 and 41% (56/146) of category 4 patients were downgraded to category 2. The average number of CT exams performed prior to downgrading was 1.3.

CONCLUSION

We found our patient population had greater percentage of category 3 and 4 patients than the estimated population prevalence. A

higher percentage of category 3 and 4 patients ultimately had a malignant diagnosis than predicted. A small proportion of patients had procedures performed for benign diagnosis. Complications among all groups were low.

CLINICAL RELEVANCE/APPLICATION

The high percentage of malignancy diagnosed in Lung-RADS category 4 and, to a lesser extent, category 3 patients emphasizes the importance of adhering to the guidelines in the management of these patients.

SSQ05-04 Assessment of the Vancouver Risk Calculator Compared to ACR Lung Rads Applied to National Lung Screening Trial Nodules

Thursday, Nov. 30 11:00AM - 11:10AM Room: S402AB

Participants
Charles S. White, MD, Baltimore, MD (*Presenter*) Consultant, Koninklijke Philips NV
Ekta D. Dharaiya, MS, Highland Heights, OH (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Sandeep Dalal, Cambridge, MA (*Abstract Co-Author*) Employee, Koninklijke Philips NV

For information about this presentation, contact:

cwhite@umm.edu

PURPOSE

To compare the efficacy of the Vancouver Risk Calculator (VRC) with ACR LungRADs in determining malignancy among solid nodules identified in the National Lung Screening Trial (NLST).

METHOD AND MATERIALS

The study received approval from the IRB and NCI CDAS system to use NLST data. All nodules detected in the CT arm of the NLST were considered for inclusion. After exclusions due to inability to determine malignant vs benign nodule status (no gold standard), incomplete data sheets preventing the use of the risk calculator, and subsolid nodule type, 4078 nodules were available for evaluation. The 4078 solid nodules were scored using the VRC consisting of 9 nodule and patient parameters (output = % likelihood of malignancy, malignancy threshold tested at >5% likelihood) and LungRADS (output = Category 2-4B, malignancy defined as 4A or 4B, malignancy defined as >5% likelihood as noted in LungRADS table on ACR website). Comparison was performed between LungRADS and the VRC to determine their respective sensitivity, specificity and accuracy to distinguish between benign and malignant solid nodules.

RESULTS

For ACR LungRADS category 2 (non-malignant), there were 2,141 nodules of which 3 were malignant. The VRC designated 0 malignant with 0 False Positives (FP) for the 5% threshold. For LungRADS category 3 (non-malignant) there were 1,136 nodules of which 7 were malignant. The VRC designated 3 malignant, with 31 false positives. For LungRADS category 4A (malignant), there were 630 nodules of which 26 were malignant. The VRC designated 25 malignant with 244 FP. For LungRADS category 4B (malignant), there were 171 nodules of which 64 were malignant. VRC designated 64 malignant with 107 FP. Overall sensitivity, specificity and accuracy for LungRADS was 90.0%, 82.1% and 82.3%, respectively and for VRC 5% threshold, it was 92.0%, 90.4% and 90.4%, respectively.

CONCLUSION

In comparison with ACR LungRads, the Vancouver risk model demonstrated higher sensitivity, specificity and accuracy in determining malignancy among solid nodules in the NLST.

CLINICAL RELEVANCE/APPLICATION

For solid nodules, risk models such as the Vancouver risk calculator may provide a superior assessment of the likelihood of malignancy than the ACR LungRads categories.

SSQ05-05 Management of New Solid Nodules at First Follow-Up after Detection in Incidence Screening Rounds of Low-Dose CT Lung Cancer Screening

Thursday, Nov. 30 11:10AM - 11:20AM Room: S402AB

Participants
Joan E. Walter, BSc, Groningen, Netherlands (*Presenter*) Nothing to Disclose
Marjolein A. Heuvelmans, MD,PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Rozemarijn Vliegenthart, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Instutional Research Grant, Siemens Healthineers
Peter M. Van Ooijen, MSc, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Harry De Koning, Rotterdam, Netherlands (*Abstract Co-Author*) Research Grant, F. Hoffmann-La Roche Ltd Equipment support, Siemens AG Medical Advisory Board, F. Hoffmann-La Roche Ltd
Matthijs Oudkerk, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

m.oudkerk@umcg.nl

PURPOSE

Low-dose CT (LDCT) lung cancer screening is recommended by US guidelines for high-risk individuals. New solid nodules detected after baseline screening have a high lung cancer probability and their management is crucial for the success of a screening program. Currently, there is no evidence for the management of nonresolving new solid nodules at first follow-up after detection.

METHOD AND MATERIALS

In this ongoing, multicenter, randomized controlled trial, 15,822 participants were randomly assigned to screening with LDCT (n=7,915) or no screening (n=7,907). In total, 7,557 individuals underwent baseline screening and 7,295 participants underwent subsequent screening rounds. We included all participants with solid non-calcified nodules, registered by the radiologists as new or

<15mm³ (study detection limit, ca. 3mm) at previous screens, that received a follow-up scan after detection. High-risk nodules (>500mm3) which led to immediate referral at first detection were excluded. Nodule volume was generated semiautomatically by software.

RESULTS

Overall, 680 participants with 1,020 low-intermediate risk new solid nodules were included. A total of 562 (55%) new solid nodules were resolving and in 321 (47%) participants all detected new solid nodules were resolving nodules. In 356 (52%) participants a new solid nodule persisted as solid nodule, with 25 (7%) participants being diagnosed with lung cancer in such a nodule. At follow-up, volume doubling time (VDT) (area under the curve [AUC]: 0.913, 95%CI 0.861-0.965), volume (AUC: 0.875, 95%CI 0.822-0.928), and VDT combined with a previously established >=200mm3 volume cutoff (AUC: 0.939, 95%CI 0.904-0.974) had high discriminatory power for lung cancer. The combination of <=590days VDT or >=200mm3 volume at follow-up provided 100% (95%CI 84-100%) sensitivity, 84% (95%CI 80-87%) specificity, and 27% (95%CI 19-37%) positive predictive value for lung cancer.

CONCLUSION

More than half of new solid nodules identified in LDCT lung cancer screening are resolving nodules. At first follow-up, a cutoff combination of <=590days VDT or >=200mm3 volume can be used for risk stratification.

CLINICAL RELEVANCE/APPLICATION

Management of new nodules detected after baseline determines the success of a screening program. Appropriate risk stratification by VDT and volume at follow-up could prevent delayed cancer diagnosis.

SSQ05-06 Use of a Risk Model Combining Clinical Information and CT Findings to Customize Follow-Up Intervals in Lung Cancer Screening

Thursday, Nov. 30 11:20AM - 11:30AM Room: S402AB

Awards
Trainee Research Prize - Fellow

Participants
Anton Schreuder, MD, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Cornelia M. Schaefer-Prokop, MD, Nijmegen, Netherlands (*Abstract Co-Author*) Advisory Board, Riverain Technologies, LLC
Ernst T. Scholten, MD, Haarlemmerliede, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Colin Jacobs, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Research Grant, Varian Medical Systems, Inc
Mathias Prokop, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG; Speakers Bureau, Bracco Group; Speakers Bureau, Toshiba Medical Systems Corporation; Research Grant, Toshiba Medical Systems Corporation;
Bram Van Ginneken, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Stockholder, Thirona BV Co-founder, Thirona BV Research Grant, MeVis Medical Solutions AG Research Grant, Delft Imaging Systems Research Grant, Toshiba Corporation

For information about this presentation, contact:

antoniusschreuder@gmail.com

PURPOSE

The U.S. has launched an annual CT lung cancer screening program, irrespective of individual participants' malignancy risk. We developed a risk model based on information from the baseline CT and clinical information to calculate the trade-off between cost savings by omitting one year follow-up scans in low risk individuals and the number of delayed cancer diagnoses.

METHOD AND MATERIALS

We used data from the National Lung Screening Trial. We selected all subjects who underwent a baseline scan and a one year follow up scan, those diagnosed with lung cancer after the baseline scan were excluded. Using baseline clinical data and baseline scan variables, various models were developed to estimate the risk of developing lung cancer after the one year follow-up scan, using backward stepwise regression. The full model included both clinical and scan variables. Additionally we tested a clinical-only model and a nodule-only model, the latter including the largest nodule diameter as the only variable. Furthermore, the published Brock and Patz models were validated on the same data set.

RESULTS

174 of 24,542 participants were diagnosed with lung cancer in the year after the first annual follow up. Best predictors included in the full model were older age, higher smoking duration and intensity, shorter smoking quit time, previous COPD and cancer diagnosis, emphysema, longest and perpendicular diameter of the largest nodule, presence of subsolid nodules, presence of an upper lobe nodule, and presence of a spiculated nodule. Using our full model, 9,972, 16,298, 19,726, and 21,158 of the cancer-free persons could have safely avoided the one year follow-up scan, at the expense of delaying the diagnosis of 17, 44, 70, and 88 of the lung cancer patients, respectively. The area under the ROC curve ranged from 0.79 with our full model to 0.73 with the Brock model to 0.67 in the Patz model.

CONCLUSION

Predictive models based on clinical and baseline scan information can be used to personalize follow up intervals in lung cancer screening, saving radiation and costs. Results differed substantially depending on the risk model used.

CLINICAL RELEVANCE/APPLICATION

Our model can be used to improve lung cancer screening efficiency by selecting a substantial proportion of participants for a two year follow-up interval, while delaying lung cancer diagnosis in only very few cases. This can greatly reduce costs, radiation burden and radiologist's work-load.

SSQ05-07 A Novel DeepWise CAD System for Detection of Pulmonary Nodules

Thursday, Nov. 30 11:30AM - 11:40AM Room: S402AB

Participants

Linlin Qi, Beijing, China (*Presenter*) Nothing to Disclose
Jianwei Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhen Zhou, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Ning Wu, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Shichao Feng, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaojuan Xu, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Wei Tang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Ming Lei, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

qdqilinlin@163.com

PURPOSE

To validate a novel DeepWise computer-aided detection (CAD) system for automated detection of pulmonary nodules.

METHOD AND MATERIALS

The DeepWise CAD system designed by means of a specialized deep neural network is a novel and more intelligent CAD system to detect pulmonary nodules automatically. A public data set LIDC-IDRI and an in-house data set (a total of about 7,000 nodules) were used as the development data set. One hundred consecutive low-dose CT (LDCT) scans in a screening program and 100 specified and matched nodules in another 60 LDCT scans were independently evaluated by two radiologists (Radiologist *1, 2*) and the DeepWise CAD system to identify nodules larger than or equal to 2 mm in average diameter. All the nodules detected by both the radiologists and the system were reviewed jointly by another two chest radiologists, who were experienced in LDCT lung cancer screening, and a "true" nodule count was determined. The performance of the two radiologists and the DeepWise CAD system were compared.

RESULTS

Radiologist *1, 2* and the DeepWise CAD system detected 193, 115 and 271 nodules, respectively. Of the 325 separate nodules detected by the three techniques, 282 were classified as true nodules on consensus review. Of the true nodules present, the detection date of the Radiologist 1, 2 and the DeepWise CAD system were 66.3% (187/282), 40.8% (115/282) and 83.0% (234/282), respectively. And the 48 nodules missed by the DeepWise CAD included 41 solid nodules with an average diameter of less than 5 mm and 7 ground glass nodules. 187 (96.9%) of 193 Radiologist 1-detected nodules were true nodules, all 115 Radiologist 2-detected nodules were true nodules, and 234 (86.3%) of 271 of the DeepWise CAD-detected nodules were true nodules. The DeepWise CAD system identified 37 lesions that on consensus review were false-positive nodules, a rate of 0.23 (37/160) per patient.

CONCLUSION

The novel DeepWise CAD system detected 83.0% of true nodules, which was significantly superior to radiologists. And its false positive rate, 0.23 per patient, was significantly cut down.

CLINICAL RELEVANCE/APPLICATION

With the popularity of MDCT, the detection rate of lung nodules was significantly improved, which brought great pressure to radiologists. And the false positive nodules detected by traditional CAD software were so much that the clinical application was limited. So we need a more intelligent CAD system to detect pulmonary nodules accurately.

SSQ05-08 Lung-RADS Performs Well in a Diverse and Underserved Lung Cancer Screening Population

Thursday, Nov. 30 11:40AM - 11:50AM Room: S402AB

Awards
Student Travel Stipend Award

Participants
Hannah Milch, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Mark Kaminetzky, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Anna Shmukler, MD, Brooklyn, NY (*Abstract Co-Author*) Nothing to Disclose
Robert Peng, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Edward Mardakhaev, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Abraham Kessler, BA, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Eran Bellin, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Jeffrey M. Levsky, MD, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Linda B. Haramati, MD, MS, Bronx, NY (*Presenter*) Spouse, Board Member, Kryon Systems Ltd

For information about this presentation, contact:

milchh@mskcc.org

PURPOSE

To evaluate the performance of Lung-RADS in a clinical setting that markedly differs from the Lung-RADS score derivation populations.

METHOD AND MATERIALS

Our low dose CT (LDCT) lung cancer screening program is referral based and relies on a bilingual coordinator. LDCTs were interpreted by subspecialized chest radiologists using Lung-RADS. 30% (356/1181) were interpreted prior to Lung-RADS release and assigned an internally derived 1-5 score that was later converted to Lung-RADS as follows: scores of 1 and 2 to Lung-RADS 1 and 2, scores 3 and 4 to Lung-RADS 3, scores 5a and 5b to Lung-RADS 4a and 4b. Data were obtained by patient interview and electronic medical records.

RESULTS

1181 patients were referred from December 2013 - December 2016, median age 63 [IQR 58-67], 40% (560) were 75%

1181 patients were screened from December 2012- December 2016, median age was 63 [IQR 59-67], 49% (569) men, 75% non-white (31% black, 31% Hispanic, 13% other), 55% (651) Medicaid/Medicare insured, 71% current smokers (median pack-years 45), median socioeconomic status -2.26. Comorbidities: 69% overweight/obese (32%/37%), 68% hypertension, 67% chronic lung disease, 35% diabetes, 17% heart disease, 2.1% HIV positive. Lung-RADS performance: 87% (1030/1181) of baseline LDCTs were negative (Lung-RADS 1 or 2)- lung cancer rate 0.2%(2/1030); 10% (119) Lung-RADS 3- cancer rate 3.4%(4/119); 1.2% (14) Lung-RADS 4a- cancer rate 43% (6/14); 1.5% (18) Lung-RADS 4b- cancer rate 83% (15/18). The overall positive rate (Lung-RADS 3, 4a, and 4b) was 12.8% (151/1181), false positive rate 10.9%, and positive predictive value (PPV) 16.6% (CI 14.0-19.5). Sensitivity was 92.6%. Mortality in lung cancer patients was 27% vs 0.6% in non-lung cancer patients.

CONCLUSION

Although Lung-RADS was derived and retrospectively validated primarily via the NLST and I-ELCAP screening cohorts, it performs well clinically in a predominantly poor, ethnically diverse population, meeting or exceeding benchmarks.

CLINICAL RELEVANCE/APPLICATION

In clinical practice Lung-RADS increased the PPV of the LDCT exam to 16.6% versus 3.8% in the NLST and significantly exceeded ACR cancer diagnosis benchmarks for Lung-RADS 4a-43% and 4b-83% (benchmarks: 4a- 10-15%, 4b- >15%). .

SSQ05-09 Access to Lung Cancer Screening Services: Preliminary Analysis of Geographic Service Distribution Using the ACR Lung Cancer Screening Registry

Thursday, Nov. 30 11:50AM - 12:00PM Room: S402AB

Awards
Student Travel Stipend Award

Participants
Paniz Charkhchi, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Ruth C. Carlos, MD, MS, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

panizcharkhchi@yahoo.com

PURPOSE

Lung cancer has the highest mortality rate among all types of cancer in the United States. NLST demonstrated low dose CT (LDCT) for lung cancer screening decreases both lung cancer related mortality and all-cause mortality. Currently, the only CMS approved lung cancer screening registry is the Lung Cancer Screening Registry (LCSR) administered by the American College of Radiology (ACR). We aim to show the availability of facilities, participated in the LCSR, in the each state to provide lung cancer screening services to those who are screen-eligible and to assess if facility availability is proportionate to state-level demographic and lung cancer related outcome.

METHOD AND MATERIALS

The ACR LCSR list of participating lung cancer screening facilities was used as a proxy for the availability of lung cancer screening facilities in each state. Additionally, we normalized the number of facilities by state by the number of screening-eligible individuals using BRFSS data. State-level demographics were obtained from the 2015 BRFSS: poverty level, insured population, unemployed, Black and Latino. We obtained data on lung cancer incidence and death, number of active physician per 100,000 and Medicare expenditure. We performed linear regression models to examine the influence of the covariates on state-level screening facility number by state using Stata 11.

RESULTS

As of 11/18/2016, 2,423 facilities participated in the LCSR, with a median number of 32 facilities per state (interquartile range 63) with highest number in the Florida (n=198) and the lowest number in the District of Colombia and Montana (n=3). Figure 1 graphically represents the location and distribution of lung cancer screening facilities by proportion of screen-eligible individuals. There was a positive independent effect (OR=12.90, 95% CI =11.01- 14.79) between state-level number of screening facility and rate of screen-eligible individuals rate per 100,000. There were no significant correlations between numbers of facility and lung cancer outcomes, state demographic characteristics, or physician supply and Medicare expenditure.

CONCLUSION

Although there was a positive relation between facility number and screening eligible rate, there is a further need to evaluate the geographic access of these facilities.

CLINICAL RELEVANCE/APPLICATION

Screen eligible by state remains additional work define if other access barriers exist.

CHS-THA

Chest Thursday Poster Discussions

Thursday, Nov. 30 12:15PM - 12:45PM Room: CH Community, Learning Center

CH

AMA PRA Category 1 Credit ™: .50

Participants
Girish S. Shroff, MD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

CH262-SD-THA1 Prediction of Pathological Classification in Thymic Epithelial Tumors by Diffusion-Weighted MR Imaging

Station #1

Participants
Gang-Feng Li, Xian, China (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ligangfeng919@163.com

PURPOSE

To determine whether diffusion-weighted imaging could be used to predict the pathological subtypes of TETs.

METHOD AND MATERIALS

Seventy-five patients of TETs were enrolled in Tangdu Hospital (42 men and 33 women; mean age, 49 years), whose diseases were further confirmed by surgical pathology or needle biopsy. Conventional MR sequences and DWI scan (b value=0, 1000 sec/mm2) was performed in all patients preoperatively on a 3.0-T MRI system. Parameters of ADC and eADC were generated by two readers. They were tested for differences between low-risk (types A, AB and B1), high-risk thymoma (types B2 and B3) and thymic carcinomas based on one-way ANOVA. ICC was used to estimate the agreement for both readings.

RESULTS

Twenty one (28.0%) patients had low-risk thymoma, 32 (42.7%) had high-risk thymoma and 22 (29.3%) had thymic carcinoma. There were significant differences between low risk ((2.11 ± 0.95)×10-3 mm2/sec, 0.18 ± 0.12), high-risk thymoma((1.79 ± 0.69)×10-3 mm2/sec, 0.21 ± 0.12) and thymic carcinoma ((1.40 ± 0.59)×10-3 mm2 /sec, 0.29 ± 0.14) for mean ADC and eADC value, respectively (P<0.05).There were good intraobserver agreement of both readings with no significant difference(P>0.05) (ICC= 0.909 [95% confidence interval: 0.859, 0.941]) and (ICC= 0.875 [95% confidence interval: 0.810, 0.919]) for ADC and eADC value, respectively.

CONCLUSION

The ADC or eADC value derived from DWI is a noninvasive, reliable, and reproducible imaging parameter that may help predict the pathological subtype of TETs preoperatively.

CLINICAL RELEVANCE/APPLICATION

The ADC or eADC value derived from DWI is a noninvasive, reliable, and reproducible imaging parameter that may help predict the pathological subtype of TETs preoperatively.

CH263-SD-THA2 Bronchiolocentric Pattern of Interstitial Pneumonia: CT-Pathologic Correlation in 15 Cases

Station #2

Participants
Takeshi Johkoh, MD, PhD, Itami, Japan (*Presenter*) Nothing to Disclose
Kiminori Fujimoto, MD, PhD, Kurume, Japan (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Fumikazu Sakai, MD,PhD, Hidaka, Japan (*Abstract Co-Author*) Research Consultant, AstraZeneca PLC; Research Consultant, Otsuka Holdings Co, Ltd; Research Consultant, Boehringer Ingelheim GmbH; Research Consultant, Ono Pharmaceutical Co, Ltd; Research Consultant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Fuji Pharma Co, Ltd
Mikiko Hashisako, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Junya Fukuoka, Nagasaki City, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Although bronchiolocentric pattern of interstitial pneumonia (BPIP) is introduced as a rare histologic variation of idiopathic interstitial pneumonias (IIPs) by 2013 ATS/ERS IIPs classification, corresponding CT findings are still unknown. The objective of this study was to describe CT findings of BPIP and precisely correlate them with the pathologic findings.

METHOD AND MATERIALS

Based on the definition of 2013 ATS/ERS classification, 15 cases diagnosed as BPIP (9 male, 6 females, mean age; 62 years old)

with surgical lung biopsy were enrolled in the study. 1 to 3 specimens in each case were obtained and total 32 specimens were collected. CT findings corresponding to the 32 specimens were precisely correlated with pathologic ones

RESULTS

CT showed centrilobular opacities in all cases (Fig1), cysts in 9 (Fig. 2) peribronchial opacities in 7, intralobular reticular opacities in 2. CT findings were categorized into the following 5 patterns; 1. diffuse centrilobular opacities (n=3) (Fig). 2. diffuse peribronchial opacities (n=2), 3. lower peripheral predominant centrilobular and peribronchial opacities (n=5), 4. lower predominant peribronchial opacities with surrounding cysts (n=4) and 5 lower peripheral predominant reticular opacities (n=1) Pathologically, centrilobular faint opacities correlated with either alveolitis or alveolar septal fibrosis surrounding terminal bronchioles (Fig 1), or peribronchial metaplasia there. Peribrochial opacities correspond to alveolitis or alveolar septal fibrosis surrounding bronchus or bronchioles which are proximal to terminal bronchioles. Cysts were derived from elastolysis of alveolar septa surrounding bronchus or bronhcioles (Fig 2). Intralobular reticular opacities correlated with distorted centrilobular fibrosis.

CONCLUSION

The common CT findings of BPIP are centrilobular or peribronchial opacities due to alveolitis or fibrosis surrounding bronchus or bronchioles. Cysts are related to elastolysis of peribronco-bronchial alveolar septa.

CLINICAL RELEVANCE/APPLICATION

The common CT findings of centrilobular or peribronchial opacities. Centrilobular or perilobular opacities are derived from alveolitis or fibrosis surrounding bronchus or bronchioles. Cysts are related to elastolysis of peribronco-bronchial alveolar septa.

CH264-SD-THA3 Antebrachial IV Placement Significantly Increases Incidence of Suboptimal Pulmonary Arterial Enhancement on CT Pulmonary Angiograms: A Single Center Review of Over 700 Cases

Station #3

Participants
Junjian Huang, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Vivek Pandey, Saint Louis, MO (*Presenter*) Nothing to Disclose
Parinda Shah, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Rohit S. Loomba, MD, Wauwatosa, WI (*Abstract Co-Author*) Nothing to Disclose
Rohan Shah, MD, Glenview, IL (*Abstract Co-Author*) Nothing to Disclose
Vivek Yedavalli, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Derek Lee, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Mai Britt Campbell, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

vivek.pandey@advocatehealth.com

PURPOSE

The purpose of this study is to retrospectively analyze the effect of IV placement as an independent risk factor for suboptimal pulmonary arterial enhancement in CT pulmonary angiograms (CTPA).

METHOD AND MATERIALS

Between July 1, 2015 and March 31, 2016, all patients who underwent CT pulmonary angiograms at a single institution were evaluated for quality of pulmonary arterial enhancement as defined by descrete statements embedded within the dictation. The attending radiologist, CT technician, injection protocol utilized, IV gauge, and IV site were also recorded from each of these cases. All statistical analyses were performed utilizing SPSS (IBM).

RESULTS

A total of 712 CTPA studies were performed during this time period with 83 studies deemed suboptimal including 2 studies which had to be repeated entirely. 133 IV site placements were documented (114 antecubital and 19 antebrachial). Univariate analysis demonstrated that the attending radiologist (p=0.299), CT technician (p=0.352), protocol (p=0.951), and IV gauge (p=0.068) were nonsignificant factors for suboptimal pulmonary arterial enhancement; however, IV site placement was found to be highly significant (0.001). Regression analysis demonstrated that IV's placed in the antebrachium yielded an odds ratio of 7.8 (1.8-33.8, p=0.006) of having suboptimal pulmonary arterial enhancement compared to those placed at the antecubital fossa.

CONCLUSION

Utilization of an 18-20g IV placed distal to the antecubital fossa is associated with a markedly increased likelihood of suboptimal pulmonary arterial enhancement in CT pulmonary angiogram studies when compared to those placed at the antecubital fossa. IV placement in the antebrachium should be discouraged if the patient is anticipated to have this exam performed.

CLINICAL RELEVANCE/APPLICATION

Antebrachial IV placement is a known risk factor for contrast extravasation however its role in compromising diagnostic quality of CTPA exams is less well documented. This study clearly shows that IV placement distal to the antecubital fossa is a risk factor for suboptimal studies and presents a simple fix in the effort for better quality exams. This small study is a good start and further investigation is encouraged.

CH265-SD-THA4 Diagnostic Rate and Complications of CT-Guided Percutaneous Transthoracic Needle Biopsy in Elderly Patients

Station #4

Participants
Thanisa Tongbai, MD, Bangkok, Thailand (*Presenter*) Nothing to Disclose
Shaunagh McDermott, FFR(RCSI), Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Florian J. Fintelmann, MD, Boston, MA (*Abstract Co-Author*) Consultant, McKesson Corporation; Royalties, Reed Elsevier
Melissa Price, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Amita Sharma, MBBS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Matthew D. Gilman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic rate and complications of CT-guided percutaneous transthoracic needle biopsy (PTNB) in elderly patients (age > 80).

METHOD AND MATERIALS

All PTNB performed in a single dedicated thoracic academic institution over a 4-year period were reviewed. The CT-guided PTNB (fine needle aspirate with or without core needle biopsy) were uniformly performed according to the standard department protocol under conscious sedation with rapid on-site evaluation (ROSE). Elderly patients were routinely admitted for overnight observation if they lived alone or had co-morbidities, as were any patient who required overnight observation for management of a complication. The demographic data of patients, lesion characteristics, technique, diagnosis, complications and treatment were reviewed. The data of elderly and younger patient groups were compared using Pearson's X2 test.

RESULTS

Out of a total 894 biopsies, 141 cases were performed on elderly patients (16%). There was no significant difference in the size and morphology of the nodules between the two groups (p=0.5 and p=0.8, respectively). Compared to younger patients, there was a trend towards increased diagnostic accuracy in the elderly (87% vs. 83%, p=0.268), as well as a higher rate of malignancy (88% and 84%, respectively, p=0.267). Complication rates did not differ significantly between the groups: pneumothorax 23% vs. 24%, p=0.682; chest tube insertion 2% in both groups, p=0.9; hemoptysis 3% vs. 2%, p=0.434. Post procedure admission rate was significantly higher for the elderly (59% vs. 23%, p=0.001), however there was no significant difference in need for intervention (chest tube insertion or blood transfusion) during hospitalization (p=0.850). The length of hospitalization was 1 day in 87% of cases (221/253).

CONCLUSION

PTNB is a safe and accurate procedure in patients 80 years and older. The diagnostic accuracy and complication rate is similar to that observed in younger patients.

CLINICAL RELEVANCE/APPLICATION

As the population ages, PTNB in elderly patients will become increasingly common; this study confirms that it is a safe and accurate procedure.

CH266-SD-THA5 Submillisievert CT Bronchoscopy Using Spectral Shaping in Third-generation Dual-source CT

Station #5

Participants
Amirhossein Mozafarykhamseh, MD, Chicago, IL (*Presenter*) Grant, Siemens AG
Rishi Agrawal, MD, Chicago, IL (*Abstract Co-Author*) Speakers Bureau, Boehringer Ingelheim GmbH
Hatice Savas, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Faezeh Sodagari, MD, Chicago, IL (*Abstract Co-Author*) Grant, Siemens AG
Eric M. Hart, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Vahid Yaghmai, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

v-yaghmai@northwestern.edu

PURPOSE

To evaluate the image quality and lesion conspicuity at virtual CT bronchoscopy using low dose CT scans with spectral shaping with a tin filter.

METHOD AND MATERIALS

An anthropomorphic chest phantom containing a 1.2 cm bronchial polyp was scanned with a third-generation dual-source CT scanner with a 0.6 mm tin filter over the X-ray tubes to shape the output of Sn100 kV and Sn150 kV. Phantom was scanned with tube currents ranging from 25 to 500 mAs for Sn100, and from 5 to 250 mAs for Sn150. Images were reconstructed with two strengths of advanced modeled iterative reconstruction (ADMIRE 3 and 5). Axial CT images were evaluated for subjective and objective image quality. Volume-rendered images depicting the polyp were used for assessment of the polyp conspicuity by two chest radiologists who were blinded to the acquisition parameters. The subjective image quality and the polyp conspicuity were evaluated on five-point scales (5=excellent; 1=poor). Paired t-test, Wilcoxon signed-rank test, and kappa statistic were used for analysis.

RESULTS

All acquisitions provided satisfactory bronchial polyp conspicuity. The lowest radiation parameters at which both image quality and bronchial polyp conspicuity were satisfactory were Sn100kV/100 mAs (0.19 mSv). At similar radiation dose levels, using Sn100 with higher mA provided better image quality than using Sn150 with lower mAs settings (P<0.05). ADMIRE 5 compared with ADMIRE 3 provided significantly improved image noise, CNR and SNR (P<0.01), without a significant change in subjective image quality or conspicuity (P > 0.05). Inter-observer agreement was moderate for lesion conspicuity (κ= 0.54) and good for subjective image quality (κ= 0.79).

CONCLUSION

Virtual CT bronchoscopy can be performed using spectral shaping at doses below 0.2 mSv. Higher strength of iterative reconstruction provides better image quality. Virtual CT bronchoscopy using spectral shaping with Sn100 kV and 100 mAs is the most dose-efficient setting that provides good image quality and lesion conspicuity at low radiation dose.

CLINICAL RELEVANCE/APPLICATION

Virtual CT bronchoscopy can be performed using spectral shaping at doses below 0.2 mSv. Higher strength of iterative reconstruction provides better image quality.

CH184-ED-THA7 Thoracic Imaging in PET-CT: When CT Makes the Difference (Case-Based)

Station #7

Awards

Certificate of Merit

Participants
Leonela E. Lepore, MD, Caba, Argentina (*Presenter*) Nothing to Disclose
Maria V. Ramos, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Mariano Volpacchio, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Veronica Rubio, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Santiago E. Rossi, MD, Capital Federal, Argentina (*Abstract Co-Author*) Advisory Board, Koninklijke Philips NV; Advisory Board, Boehringer Ingelheim GmbH; Speaker, Boehringer Ingelheim GmbH; Royalties, Springer Science+Business Media Deutschland GmbH

For information about this presentation, contact:

llepore@cdrossi.com

TEACHING POINTS

• Review sites of physiological FDG- uptake due to false positive results • Review metabolic processes mimicking malignant lesions • Review therapeutic procedures producing false positive results • Review false negative findings where CT is useful for accurate diagnosis This exhibit reviews how CT can be useful for accurate diagnosis in the interpretation of PET/CT in the thorax.

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RSNA 2017 Explore. Invent. Transform.
103rd Scientific Assembly and Annual Meeting
November 26 to December 1
McCormick Place, Chicago
Explore Invent Transform

CHS-THB

Chest Thursday Poster Discussions

Thursday, Nov. 30 12:45PM - 1:15PM Room: CH Community, Learning Center

CH

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Patricia M. de Groot, MD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

CH268-SD-THB1 Benign and Malignant Pure Ground Glass Nodule Diagnosed By High Resolution Computer Tomography (HRCT)

Station #1

Participants
YUAN GANG QI, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Jing Yan, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Yun Li, MD, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Wenwu Li, MD, Shandong, China (*Abstract Co-Author*) Nothing to Disclose
Liheng Liu, MD, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Yong Huang, MD, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Han Lei, Jinan, China (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

13631697@qq.com

PURPOSE

To analyze the correlation between the invasion ability and the high resolution computer tomography (HRCT) performance of the persistence of pure ground glass nodule (pGGN).

METHOD AND MATERIALS

A total of 59 patients (59 pGGNs) were enrolled in this study. Three radiologists reviewed the characteristics of these HRCTs of pGGN.According to histopathological results, pGGN invasion was divided into pre-invasive lesions (including atypical adenomatous hyperplasia and carcinoma in situ) and invasive lesions (including micro-invasive adenocarcinoma and invasive adenocarcinoma). The diagnostic efficacy of pGGN diameter was analyzed by receiver operating characteristic (ROC) curve.

RESULTS

The pGGN diameter, burr sign, margin lobulation, thickening of blood vessels, vascular traction sign, density and pleural depressions between the pre-invasive lesions and invasive lesions had significant differences ($P<0.05$), while the pneumatic bronchus had no significant differences. Logistic multivariate regression analysis showed that margin lobulation, vascular traction and thickening of blood vessels were the independent influencing factors of lung lesions and invasive lesions ($P<0.05$). ROC curve analysis showed that the best cutoff value of pre-invasive lesion and invasive lesions was 0.945cm, the area under the curve was 0.688, the sensitivity of diagnosis was 95.10% and the specificity was 44.40%.

CONCLUSION

CT features can be used to predict the benign and malignant pGGN. Margin lobulation, vascular trauma, thickening of blood vessels and diameter greater than 0.945cm were important in predicting the invasiveness of pGGN.

CLINICAL RELEVANCE/APPLICATION

no exampie

CH269-SD-THB2 Multi Detector CT Evaluation of Suspicious Malignant Lung Masses with Its Combined Wash-In & Wash-Out Features and Their Histopathological Correlation

Station #2

Awards
Student Travel Stipend Award

Participants
Saurav Bhagat, MBBS, Lucknow, India (*Presenter*) Nothing to Disclose
Sachin Khanduri I, MBBS,MD, Lucknow, India (*Abstract Co-Author*) Nothing to Disclose
Girjesh Kumar, MBBS , Lucknow, India (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

saurav310@gmail.com

PURPOSE

Detection of malignancy at an early stage with precision is the utmost objective of Radiological evaluation. MDCT serves as an excellent purpose for early diagnosis and characterization of lung masses although the final confirmation is done by histopathological analysis obtained by biopsy or FNAC only.This study was undertaken with a purpose of evaluationg the Multi detector CT characteristics of a suspicious lung mass along with its contrast wash in & wash out features and correlate them with its histopathological findings.

METHOD AND MATERIALS

After obtaining ethical clearance 50 cases of suspected Lung cancer by clinical and radiography evaluation were enrolled in the study. These patients underwent CT Thorax (non contrast, contrast & delayed scans) on 384 slice CT scanner. After undergoing the Radiological evaluation biopsy of the mass was done (either CT or Bronchoscopy guided). Radiological and histopathological findings were correlated.

RESULTS

Sensitivity, Specificity, PPV, NPV and diagnostic accuracy of MDCT using conventional features against histopathology was 97.3%,76.9% , 92.3% , 90.9%, and 92.0% in correctly predicting malignancy. Sensitivity and specificity calculated through Receiver operator curve for wash-in (Net early enhancement) for >17.00 HU were found to be 97.3% and 76.9%. While that of wash out characterization of lung mass- Relative wash-out at <18.83% were 97.3% and 93.3% and Absolute washout at <65.48% were 97.3% and 93.3% in predicting malignancy.

CONCLUSION

MDCT serves as an excellent tool for early diagnosis of Lung cancer and it is utmost important tool for cases where biopsy or FNAC is not possible. Faster and newer CT techniques like contrast wash-in and wash out are having more diagnostic accuracy than the conventional diagnostic techniques. So a combination of conventional and newer techniques can further increase the diagnostic accuracy of MDCT in diagnosing lung cancers.

CLINICAL RELEVANCE/APPLICATION

Conventionally wash in or contrast enhancement has been used as a predictior of malignancy.It has good sensitivity but poor specificity in prediciting bronchogenic carcinoma.As the results of this study show that wash out characteristics that includes relative and absolute wash out percentages have better sensitivity and specificity in predicting malignancy in suspicious masses.So they can be used as a predictor for malignancy and invasive methods can be avoided for biopsy/FNAC.

CH270-SD-THB3 Outcomes of Multi-Detector Computed Tomography Pulmonary Angiography (CTPA) in Pregnant Women with Suspected Pulmonary Embolism

Station #3

Awards
Student Travel Stipend Award

Participants
Simon Sun, MD, Montreal, QC (*Presenter*) Nothing to Disclose
Marius I. Diaconescu, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Tian Zhe, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Benoit D. Mesurolle, MD, Clermont-Ferrand, France (*Abstract Co-Author*) Nothing to Disclose
Alexandre Semionov, MD, PhD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

simon.sun@mail.mcgill.ca

PURPOSE

To compare the outcomes of computed tomography pulmonary angiography (CTPA) in pregnant, early postpartum and non-pregnant women of reproductive age, with clinically suspected diagnosis of pulmonary embolism (PE).

METHOD AND MATERIALS

We carried out a retrospective review of all the CTPA studies for suspicion of PE in female patients aged 18 to 40 years from two tertiary-care academic hospitals, between October 2006 and September 2015. The patients were classified as pregnant, early postpartum (up to 8 weeks after delivery) and non-pregnant. The primary outcome was diagnosis of PE on imaging, which we modeled as a categorical variable by logistical regression. Secondary variables included method of delivery, technical adequacy of the study, and PE extent (i.e. central, segmental). Subgroup analysis was performed for patients with additional independent risk factors for PE (i.e. active malignancy, known thrombophilia).

RESULTS

A total of 1465 patients were identified (111 pregnant and 132 early postpartum [67 vaginal births and 65 caesarean sections]). 16 studies were technically nondiagnostic and excluded, while 126 showed some motion artifact, but remained diagnostic. The PE prevalence rate was found to be 2.8%(3/109) for the pregnant, 11.5%(15/131) for the early postpartum and 10%(121/1088) for the non-pregnant groups. Positive pregnancy status was associated with statistically significant lower risk of PE with an odds ratio (OR) of 0.26 (95% CI [0.06-0.72], p=0.025). After excluding pregnant patients with an additional independent risk factor for PE, the OR was 0.38 (95% CI [0.09-1], p=0.11). Patient age, technical adequacy of the study and PE extent did not demonstrate a statistically significant correlation with the rate of PE.

CONCLUSION

In our patient population, the prevalence of a positive CTPA in pregnant patients was relatively low, and lower than in the postpartum and non-pregnant groups. Pregnancy was shown to be associated with statistically significant lower risk of PE on CTPA. After excluding patients with additional independent factors for PE, the central tendency towards decreased risk of PE remained despite loss of statistical significance.

CLINICAL RELEVANCE/APPLICATION

In our population, the lower risk of positive CTPA in pregnant women suggests that there is a low clinical threshold for ordering CTPA in this patient group, potentially exposing them to unnecessary radiation and intravenous contrast.

CH271-SD-THB4 Early Evaluation of Rabbit Lung VX2 Tumor after Radiofrequency Ablation by CT Perfusion

Station #4

Awards

Student Travel Stipend Award

Participants
Zenghui Cheng, MD, Shanghai, China (*Presenter*) Nothing to Disclose
Fei Shan, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Zhiyong Zhang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Yuxin Shi, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

zhcheng14@fudan.edu.cn

PURPOSE

To assess CT perfusion (CTP) on early evaluation of lung VX2 tumor after CT guided percutaneous radiofrequency ablation (RFA).

METHOD AND MATERIALS

CTP was proceeded in 24 lung VX2 tumor models 1 day before and after RFA. CTP pseudo-color maps with dual-input model (CT value: -80 HU ~ 150 HU) were generated using the maximal slope method. Regions of interest (ROIs) were placed on the maximal cross-sectional tumor before and after RFA by two thoracic radiologists, blindly. The mean bronchial flow (BF), Pulmonary flow (PF) and perfusion index (PI) were compared between pre-RFA and post-RFA groups. The parameters of complete and incomplete RFA groups were compared based on H&E and TUNEL staining, and were correlated with microvascular density (MVD). 13 models with predominant "ground-glass opacity (GGO)"after RFA were also calculated for lung parenchymal CTP pseudo-color maps with single-input model (CT value: -400 HU ~ -50 HU) and the same mathematical method . ROIs of "GGO" were made by two thoracic radiologists, blindly, according to different color scales. PF was compared between complete and incomplete RFA areas based on H&E and NADH staining. The paired or unpaired t test was used for comparisons.The receiver operating characteristic curve (ROC) was used to assess the diagnostic performance. The Pearson correlation was used for correlation between parameters and MVD.

RESULTS

BF and PF after RFA were all lower than those before RFA (all p values<0.03). The decrease of BF and PF values (ΔBF and ΔPF) in the complete RFA group were higher than those in the incomplete RFA group (p = 0.01; 0.02), and the area under curve (AUC) of ΔBF, ΔPF at=14.85ml/min/100ml; 17.25 ml/min/100ml, in determination of tumor with complete ablation, was 0.80, 0.78 (sensitivity: 75.00%, 75.00%; specificity: 66.67%, 66.67%), respectively. ΔBF was positively correlated with MVD (p = 0.046, r = 0.468). PF of "GGO" with incomplete RFA was higher than that of complete RFA and normal lung after RFA, respectively (P = 0.00; 0.01), and there was no difference of PF between the latter two groups (p = 0.84). The AUC of PF <= 29.4 ml/min/100ml in determination of tumor with complete ablation was 0.99 (sensitivity:100.00%; specificity: 91.67%).

CONCLUSION

CTP could early assess the lung VX2 tumor after RFA.

CLINICAL RELEVANCE/APPLICATION

CTP could early assess the lung tumor after RFA

CH272-SD-THB5 Prevalence, Reporting, and Management of Interstitial Lung Disease Present on Low-Dose Lung Cancer Screening CT Studies

Station #5

Participants
Satinderpal S. Khera, MD, Sacramento, CA (*Presenter*) Nothing to Disclose
Justin Oldham, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Elyse Lafond, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
Shehabaldin Alqalyoobi, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
Aleksandar Kitich, MD, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
Michael A. Kadoch, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mkadoch@ucdavis.edu

PURPOSE

To identify the prevalence and patterns of interstitial lung disease (ILD) present on low-dose CT (LDCT) studies performed for lung cancer screening (LCS) and to assess current rates of reporting and management of incidental ILD.

METHOD AND MATERIALS

Following IRB approval, a database search was performed to identify all LDCT scans performed for LCS from 2013-2017. All LDCT scans and radiology reports were reviewed by a thoracic radiologist to assess for evidence of ILD and for rates of reporting. Clinical data was obtained from the electronic medical record.

RESULTS

364 patients underwent LDCT for LCS during the 4-year period. Evidence of overt ILD or nonspecific interstitial lung abnormalities (ILA) were present in 29 patients (8.0%). A definite or possible usual interstitial pneumonia pattern was the most common overt ILD and was present in 9 patients (31.0%). ILA was present in 12 patients (41.4%). ILD/ILA findings were reported for 13 patients (46.4%). These findings were subsequently noted in the referring primary care physician (PCP) progress notes for 6 patients

(20.7%), prompting a referral to pulmonary medicine in 5 patients (17.2%).

CONCLUSION

Evidence of ILD/ILA is common among patients undergoing LDCT for LCS. These findings may presently be underreported by radiologists and undermanaged by PCPs.

CLINICAL RELEVANCE/APPLICATION

ILD is an important co-morbidity among high-risk smokers who undergo LDCT for LCS. Recent advancements in ILD treatment demand improved reporting and management of ILD findings from LCS studies.

CH273-SD-THB6 Potential of Grid-Like Software on Bedside Chest Radiography in Improving Image Quality and Dose Reduction: An Observer Preference Study between Non-Grid, Grid-Like, and Grid Images

Station #6

Participants
Su Yeon Ahn, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Kum Ju Chae, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Samsung Electronics Co, Ltd; Research Grant, DRTECH Co, Ltd

PURPOSE

Applying an anti-scatter grid improves image quality of bedside chest radiography but impedes workflow in installing and aligning the grid. This study aimed to compare the observer preference of image quality and radiation dose between non-grid, grid-like, and grid images

METHOD AND MATERIALS

After IRB approval and obtaining informed consent, 38 patients were enrolled in this study. Each patient underwent two bedside chest radiography examinations with and without grid. A grid-like image was generated from a non-grid image by applying SimGrid software (Samsung Electronics Co. Ltd.) which uses de-scattering image processing technology. Two readers recorded the preference for 10 anatomic landmarks and overall appearance on a five point scale for a pair of non-grid and grid-like images and then a pair of grid-like and grid images respectively which were presented in a randomized order. Dose area product (DAP) was also recorded. Wilcoxon's rank sum test was used to assess the significance of preference.

RESULTS

As for overall image quality, both readers preferred grid-like images to non-grid images significantly ($p<0.001$); there was discrepancy in preference of grid images to grid-like images between two readers ($p=0.317$, 0.034, respectively). As for anatomic landmarks, both readers preferred grid-like images to non-grid images ($p<0.005$) in all landmarks; significant preference of grid-images to grid-like images was observed in proximal airways by two readers and in retrocardiac lung and thoracic spine by one reader. DAP was 1.53 ± 0.16 dGy*cm2 in images with grid and 1.24 ± 0.13 dGy*cm2 in images without grid.

CONCLUSION

SimGrid software improved image quality of non-grid images significantly to an almost similar level of grid images with relatively lower level of radiation exposure.

CLINICAL RELEVANCE/APPLICATION

SimGrid software can be employed for grid-less bedside chest radiography through enhancing workflow and radiation dose reduction

CH187-ED-THB7 Dual-energy CT Pulmonary Angiography: Scanning techniques, Contrast Reduction, and Postprocessing

Station #7

Participants
Nikkole Weber, Rochester, MN (*Presenter*) Nothing to Disclose
Lori Peterson, ARRT, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
David L. Levin, MD, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Ronald S. Kuzo, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
Ahmed Halaweish, PhD, Rochester, MN (*Abstract Co-Author*) Employee, Siemens AG
Joel G. Fletcher, MD, Rochester, MN (*Abstract Co-Author*) Grant, Siemens AG; ;
Cynthia Walfoort, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG

For information about this presentation, contact:

weber.nikkole@mayo.edu

TEACHING POINTS

Beam-hardening and streaking artifacts caused by high concentration of iodine in the subclavian vein and aorta may significantly degrade the DE postprocessing. Techniques exist to reduce the artifacts. Dual Energy (DE) kV pairs should be optimized based on patient size to improve DE image quality in CT pulmonary angiography. DE virtual monochromatic images at low keV (e.g. 40 or 50 keV) has improved contrast than regular 120 kV and other low kV options, thus allowing substantial iodine contrast reduction.

TABLE OF CONTENTS/OUTLINE

Introduce basic principles of DE techniques for CT pulmonary angiography. Describe optimized scanning and reconstruction techniques for CT pulmonary angiography, including kV pair selection, helical pitch, radiation dose, iterative reconstruction, and iodine beam hardening correction. Describe basic steps of post processing to perform lung vessel analysis and lung perfused blood volume (PBV) calculation. Compare contrast and contrast to noise ratio of DE virtual monochromatic images at low keV with regular polychromatic 120 kV and other low kV options and quantitatively determine the amount of iodine contrast reduction using DE

virtual monochromatic imaging. Discuss benefits and pitfalls of DE techniques for CT pulmonary angiography.

RC701

Practical Issues in Thoracic Imaging

Thursday, Nov. 30 4:30PM - 6:00PM Room: E353C

CH CT SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Sub-Events

RC701A Practical Guide to Radiation Dose Reduction

Participants
John R. Mayo, MD, Vancouver, BC (*Presenter*) Speaker, Siemens AG

For information about this presentation, contact:

john.mayo@vch.ca

LEARNING OBJECTIVES

1) To review patient factors determining radiation sensitivity. 2) Outline thoracic CT dose reduction strategies. 3) Illustrate information systems that improve radiation dose awareness.

RC701B 'No Touch' Thoracic Interventional Lesions

Participants
Joseph G. Mammarappallil, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

joseph.mammarappallil@duke.edu

LEARNING OBJECTIVES

1) Identify lesions in thorax that should not undergo percutaneous biopsy by utilizing imaging findings and patient history.

RC701C Managing the Indeterminate Lung Nodule

Participants
Claudio Silva, MD , Santiago, Chile (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

csilvafa@alemana.cl

LEARNING OBJECTIVES

1) Present a systematic approach to the incidental indeterminate lung nodule. 2) Provide insight on the incremental value of the classic features that suggest malignancy/benignity. 3) Provide evidence-based information on the strengths and weakness of the available diagnostic procedures following detection. 4) Review current follow-up recommendations for solid and subsolid incidental nodules.

RC701D Incidental Findings at Thoracic Imaging

Participants
Carol C. Wu, MD, Houston, TX (*Presenter*) Author, Reed Elsevier

For information about this presentation, contact:

carolcwu@gmail.com

LEARNING OBJECTIVES

1) Understand the definition and prevalence of incidental findings on chest CT. 2) Learn and apply available evidence and recommendations for appropriate evaluation and management of incidentalomas encountered on chest CT.

RC708

Imaging of Thoracic/Cardiovascular Emergencies

Thursday, Nov. 30 4:30PM - 6:00PM Room: N230B

CA CH CT ER VA

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Douglas S. Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose

Sub-Events

RC708A Emergency CT of Aortic Aneurysms

Participants
Douglas S. Katz, MD, Mineola, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

dkatz@winthrop.org

LEARNING OBJECTIVES

1) To review the current status of MDCT for imaging known or suspected acute presentations/complications of thoracic and/or abdominal aortic aneurysms, including rupture, dissection, fistula formation to the thorax/bowel, superinfection/primary infection, and the 'draped aorta sign'. 2) To review technical issues, and to demonstrate examples of these entities/complications on MDCT, with an emphasis on potential pitfalls, such as the crescent sign. 3) To review the current literature on the use of MDCT for imaging acute presentations/complications of thoracic and/or abdominal aortic aneurysms.

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/ Douglas S. Katz, MD - 2013 Honored EducatorDouglas S. Katz, MD - 2015 Honored Educator

RC708B Understanding the Role of CT in the Imaging of Pulmonary Infections

Participants
Constantine A. Raptis, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand important indications for CT in the setting of pneumonia. 2) Recognize important imaging findings which can affect differential diagnosis. 3) Appreciate imaging findings that have the potential to change management in patients with pulmonary infections.

RC708C CT Pulmonary Angiography for Pulmonary Embolism

Participants
Sanjeev Bhalla, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the role of CT for Pulmonary Embolism in the modern era. 2) To highlight tips for radiation dose reduction and artifact minimization. 3) To emphasize tips on correctly diagnosing embolic disease.

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/ Sanjeev Bhalla, MD - 2014 Honored EducatorSanjeev Bhalla, MD - 2016 Honored EducatorSanjeev Bhalla, MD - 2017 Honored Educator

RC708D Emergency Coronary CT Angiography

Participants
Jeffrey M. Levsky, MD, PhD, Bronx, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jlevsky@montefiore.org

LEARNING OBJECTIVES

1) Assess the evidence base for coronary CTA in the Emergency Department, including this modality's impact on outcomes, downstream interventions and length of stay. 2) Understand the appropriate use criteria for patient selection for coronary CTA in the emergent setting. 3) Identify important unanswered questions regarding the use of emergency coronary CTA.

RC801

Imaging of Cardiothoracic Emergencies

Friday, Dec. 1 8:30AM - 10:00AM Room: E353C

CA CH ER

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

LEARNING OBJECTIVES

1) To review imaging manifestations of common life-threatening complications of thoracic trauma. 2) To highlight common difficulties radiologists encounter when interpreting imaging studies in patients with thoracic trauma. 3) Overview current imaging strategies and key facts in Pulmonary Embolism imaging. 4) Provide an update on current issues and challenges in Pulmonary Embolism imaging. 5) Improve their recognition of the appearances of different thoracic aortic repair techniques. 6) Understand normal post operative findings which can be confused for pathology. 7) Be able to recognize frequently seen complications and understand their importance. 8) Overview current imaging strategies and key facts in pulmonary embolism imaging. 9) Provide an update on current issues and challenges in pulmonary embolism imaging. 10) Describe current appropriateness criteria for imaging of patients with suspected acute coronary syndrome. 11) Identify the findings of acute coronary syndrome on imaging studies.

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events

RC801A Thoracic Trauma

Participants
Santiago Martinez-Jimenez, MD, Kansas City, MO (*Presenter*) Author, Reed Elsevier; Author, Oxford University Press

LEARNING OBJECTIVES

1) To review imaging manifestations of common life-threatening complications of thoracic trauma. 2) To highlight common difficulties radiologists encounter when interpreting imaging studies in patients with thoracic trauma. 3) Overview current imaging strategies and key facts in Pulmonary Embolism imaging. 4) Provide an update on current issues and challenges in Pulmonary Embolism imaging.

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/ Santiago Martinez-Jimenez, MD - 2014 Honored EducatorSantiago Martinez-Jimenez, MD - 2015 Honored EducatorSantiago Martinez-Jimenez, MD - 2017 Honored Educator

RC801B Imaging of the Repaired Thoracic Aorta: Normal Appearances and Complications

Participants
Constantine A. Raptis, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Improve their recognition of the appearances of different thoracic aortic repair techniques. 2) Understand normal post operative findings which can be confused for pathology. 3) Be able to recognize frequently seen complications and understand their importance.

RC801C Pulmonary Embolism

Participants
Ioannis Vlahos, MRCP, FRCR, London, United Kingdom (*Presenter*) Research Consultant, Siemens AG; Research Consultant, General Electric Company;

For information about this presentation, contact:

johnny.vlahos@stgeorges.nhs.uk

LEARNING OBJECTIVES

1) Overview current imaging strategies and key facts in pulmonary embolism imaging. 2) Provide an update on current issues and challenges in pulmonary embolism imaging.

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

RC801D Acute Coronary Syndrome

Participants
Harold I. Litt, MD, PhD, Philadelphia, PA (*Presenter*) Research Grant, Siemens AG ; Research Grant, Heartflow, LLC; ;

LEARNING OBJECTIVES

1) Describe current appropriateness criteria for imaging of patients with suspected acute coronary syndrome. 2) Identify the findings of acute coronary syndrome on imaging studies.

RSNA 2017 Explore. Invent. Transform.
103rd Scientific Assembly and Annual Meeting
November 26 to December 1
McCormick Place, Chicago
Explore Invent Transform

SST03

Chest (Functional Lung Imaging/Radiation Dose Reduction)

Friday, Dec. 1 10:30AM - 12:00PM Room: E451B

CH CT MR SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Brett W. Carter, MD, Houston, TX (*Moderator*) Editor, Reed Elsevier
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Moderator*) Research Grant, Toshiba Medical Systems Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Fuji Pharma Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;

Sub-Events

SST03-01 Measuring Specific Ventilation using Four-dimensional Magnetic Resonance Ventilation Imaging: A Novel Physiological Biomarker of Asthma

Friday, Dec. 1 10:30AM - 10:40AM Room: E451B

Awards
Trainee Research Prize - Resident

Participants
Dante Capaldi, BS, London, ON (*Presenter*) Nothing to Disclose
John S. Baxter, London, ON (*Abstract Co-Author*) Nothing to Disclose
A J. McLeod, London, ON (*Abstract Co-Author*) Nothing to Disclose
Fumin Guo, London, ON (*Abstract Co-Author*) Nothing to Disclose
Rachel L. Eddy, London, ON (*Abstract Co-Author*) Nothing to Disclose
Sarah Svenningsen, BSC, London, ON (*Abstract Co-Author*) Nothing to Disclose
David McCormack, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
Grace Parraga, PhD, London, ON (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

gparraga@robarts.ca

PURPOSE

Specific ventilation (SV) is defined as a dimensionless quantity of inhaled gas ventilation that occurs during tidal breathing and is calculated as tidal volume divided by functional residual capacity (Lewis *et al*, 1978). 1H MRI was previously proposed to regionally quantify SV, using inhaled O2 as a contrast agent (Sa *et al*, 2010). Our objective was to develop a novel and rapid way to measure whole lung and regional SV using free-breathing 1H MRI without exogenous contrast agents and over a short tidal breathing scan using conventional equipment. We also aimed to directly compare 1H MRI SV with hyperpolarized inhaled noble gas MRI ventilation and ventilation percent (VP).

METHOD AND MATERIALS

We evaluated 10 asthmatics (50±12yrs) and two healthy volunteers (27±6yrs) who provided written informed consent to MRI, spirometry and whole body plethysmography. Pulmonary hyperpolarized noble gas MRI (Kirby *et al*, 2012) and dynamic 2D multi-slice, whole lung coverage, free tidal-breathing 1H MRI using a bSSFP sequence (Capaldi *et al*, 2015) were acquired on a 3T system (GEHC). Free-breathing 1H MRI was retrospectively gated to generate tidal inspiration/expiration lung volumes that were co-registered using optical flow deformable registration (Lucas *et al*, 1981). 4DMRI SV maps were generated on a voxel-by-voxel basis using the co-registered volumes to generate local SV distribution maps. MRI ventilation percent (VP=ventilation volume normalized to thoracic cavity volume) and whole lung mean 4DMRI specific ventilation were determined and compared using Pearson correlation coefficients (r).

RESULTS

In Figure 1, 4DMRI SV and 3He MRI for an asthmatic (27yr female FEV1=74%pred, SV=0.08, VP=97.4%) shows qualitative agreement in the right-upper-lobe. For all subjects, there was a significant relationship for MRI specific ventilation and inhaled noble gas MRI ventilation percent (r=.67, p=.02), FEV1/FVC (r=.74, p=.007) and plethysmography SV (r=.77, p=.003).

CONCLUSION

In asthmatics, 4DMRI ventilation defects were spatially related with hyperpolarized inhaled noble gas MRI ventilation defects; 4DMRI SV also strongly correlated with experimentally measured SV and inhaled gas MRI ventilation percent.

CLINICAL RELEVANCE/APPLICATION

Free-breathing 4DMRI was exploited to generate specific ventilation maps that strongly correlated with experimentally acquired specific ventilation and inhaled noble gas MRI ventilation percent.

SST03-02 Preoperative Assessment of Localized Pleural Adhesion: Utility of Software-Assisted Analysis on 4-Dimensional Ultra-Low-Dose CT (4D-ULDCT)

Friday, Dec. 1 10:40AM - 10:50AM Room: E451B

Participants
Masayuki Hashimoto, Otsu, Japan (*Presenter*) Nothing to Disclose
Yukihiro Nagatani, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuhiko Oshio, MD,PhD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Norihisa Nitta, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Shigetaka Sato, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Ryo Uemura, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Yuka Itsuno, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Makoto Yoshigoe, RT, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Kiyoshi Murata, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Jun Hanaoka, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mhashi@belle.shiga-med.ac.jp

PURPOSE

To assess the usefulness of software analysis using 4-dimensional ultra-low-dose CT (4D-ULDCT) for localized pleural adhesion (LPA).

METHOD AND MATERIALS

Twenty-four consecutive patients scheduled to undergo surgery underwent both 4D-ULDCT during a single respiration and conventional high-resolution chest CT as preoperative assessments. Four radiologists, who were blinded to patient status, independently evaluated the presence and severity of LPA in 3 grading-scale (non-LPA, mild LPA and severe LPA) for 6 measurement points (MPs) (upper and lower area on ventral, lateral and dorsal aspects) on the chest CT by 2 different methods: (i) observing conventional high-resolution CT images (static), reconstructed in the axial, coronal, and sagittal directions; (ii) observing 4D-ULDCT images (movie), while another radiologist similarly evaluated the presence and severity of LPA by the other method: (iii) observing adhesion map (A-map), which is colored gradient map created by research software using 4D-ULDCT that suggested the absence/presence of LPA based on the difference in the movements between the lung surface and chest wall. The presence and severity of LPA was confirmed in an identical fusion by their intraoperative thoracoscopic findings. Diagnostic accuracy in 3 grade scaling and the LPA presence were conducted between (i) and (iii), between (ii) and (iii) using t-test for a single sample, and between (ii) and (iii) using Wilcoxon signed-rank test.

RESULTS

The presence of LPA was surgically confirmed on 23MPs in 8 patients: 20MPs with mild LPA, 3MPs with severe LPA. For the LPA assessment, A-map method (iii) achieved significant better diagnostic performance with higher accuracy in 3-grade scaling of 78.5%, and higher sensitivity of 73.9%, PPV of 44.7% and NPV of 94.3%, comparable specificity of 82.6% for the LPA presence, in comparison with the other methods ((i), (ii)) ($p<0.05$). No significant difference in diagnostic performance were showed between conventional CT (i) and 4D-ULDCT (ii) ($p >0.05$)

CONCLUSION

Four-D ULDCT in combination with A-map method could be useful as a novel imaging approach for accurate preoperative analysis of LPA.

CLINICAL RELEVANCE/APPLICATION

This is the first study to demonstrate the clinical usefulness of software-aided, 4D-ULDCT images for the preoperative diagnosis of the presence and severity of LPA.

SST03-03 Quantification of Lung Perfusion and Ventilation in Patients with Chronic Thromboembolic Pulmonary Hypertension (CTEPH) Before and After Pulmonary Endarterectomy Using Phase Resolved Fourier Decomposition MRI

Friday, Dec. 1 10:50AM - 11:00AM Room: E451B

Participants
Gesa H. Hauck, MD , Hannover, Germany (*Presenter*) Nothing to Disclose
Andreas Voskrebenzev, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian O. Schoenfeld, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Till F. Kaireit, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Filip Klimes, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Serghei Cebotari, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank K. Wacker, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Jens Vogel-Claussen, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate Fourier decomposition (FD) imaging of the lung as a radiation free, non-contrast-enhanced method for detection of perfusion and ventilation changes in CTEPH patients before and after pulmonary endarterectomy (PEA).

METHOD AND MATERIALS

We investigated 27 patients with diagnosed CTEPH before and 2 weeks after PEA. All patients underwent DCE time-resolved angiography with stochastic trajectories (TWIST) in one breathhold and a 2D fast low-angle shot (FLASH) sequence in free breathing in supine position, on a 1.5 T MRI. Coronal acquisition of FD imaging of the lung was performed. After nonrigid image registration (ANTS), and manual segmentation, perfusion and ventilation maps were generated using a image-sorting algorithm.

Histograms were calculated to visualize the distribution of ventilation and perfusion. Ventilated, but not perfused lung voxels were defined as perfusion defect, perfused, but not ventilated lung voxels were classified as ventilation defect.

RESULTS

Using DCE MRI as reference, the median PBF increased from 30,1ml/min/100ml (25-75% quartile range: 26-50) to 54,5ml/min/100ml (25-75 quartile range: 49-71, p<0,0001). Using FD MRI, the median perfusion defect percentage of the whole lung decreased from 46% (25-75% quartile range: 39-50%) to 33% (25%-75% quartile range: 27 -39%) after PEA (p<0.0001). The ventilation defect percentage of the whole lung was minimal and did not change (pre and post procedural median: 1% (25-75% quartile range: 0-3%). There was a significant difference of the perfusion defect percentage in the right lower lobe (median: pre 42%, median post: 17%, p<0,0001), the right upper lobe (median: pre 53%, median post: 28%, p=0.0005) and in the middle lobe (median: pre 46%, median post: 25%, p=0.0002). No significant difference of perfusion defect percentage was observed in the left lower (median: pre 48%, median post: 52%, p=0.48) and upper (median: pre 35%, median post: 41%, p=0.13) lobes.

CONCLUSION

Phase resolved Fourier Decomposition MRI is a feasible method to monitor regional ventilation and perfusion in CTEPH patients pre and post PEA. Especially left lower lobe results may be influenced by cardiac motion, which could interfere with the phase measurements of the parenchymal blood flow.

CLINICAL RELEVANCE/APPLICATION

These promising results may enable a proton-based, radiation and contrast free monitoring option of therapeutic effects after PEA in CTEPH patients in the future.

SST03-04 Blood Volume-Based MR Imaging with Ultra-Short TE vs Quantitatively and Qualitatively Assessed CT vs Perfusion SPECT: Capability for Prediction of Postoperative Lung Function in Non-Small Cell Lung Cancer Patients

Friday, Dec. 1 11:00AM - 11:10AM Room: E451B

Participants
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Toshiba Medical Systems Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Fuji Pharma Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
Masao Yui, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation
Yu Chen, MENG, Beijing, China (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation
Shigeharu Ohyu, MEng, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation
Yuji Kishida, MD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation
Shinichiro Seki, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation
Katsusuke Kyotani, RT,MSc, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Hisashi Tachizaki, Tustin, CA (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation

For information about this presentation, contact:

yosirad@kobe-u.ac.jp

PURPOSE

To directly compare the capability of contrast-enhanced (CE-) pulmonary thin-section MR imaging with ultra-short TE (UTE) as semi-quantitatively assessed blood-volume based MR imaging (BV-MRI with UTE) for prediction of postoperative lung function in non-small cell lung cancer (NSCLC) patients as compared with quantitatively and qualitatively assessed CT and perfusion SPECT.

METHOD AND MATERIALS

29 NSCLC patients (16 men and 13 women) underwent unenhanced and contrast-enhanced pulmonary thin-section MR imaging with UTE at a 3T system, thin-section CT, perfusion SPECT, and measurements of FEV1% before and after lung resection. In each patient, BV MRI was generated as percent signal change between unenhanced and CE-pulmonary thin-section MR imaging by pixel-by-pixel analyses after non-rigid registration. On BV-MRI with UTE, postoperative FEV1% (poFEV1%) was predicted from semi-quantitatively assessed blood volumes within total and resected lungs. Quantitatively predicted poFEV1% using CT was determined from the functional lung volumes within total and resected lungs by commercially available software. Qualitatively predicted poFEV1% using CT was determined from the number of segments of total and resected lungs. On perfusion SPECT, poFEV1% was predicted from uptakes within total and resected lungs. Then, each predicted poFEV1% was correlated with actual poFEV1%, and the limits of agreement between actual and each predicted poFEV1% were also evaluated by Bland-Altman analysis.

RESULTS

poFEV1%s predicted by BV-MRI with UTE (r=0.82, p<0.0001) and quantitative CT (r=0.86, p<0.0001) had better correlation with actual poFEV1%, when compared with qualitatively assessed CT (r=0.79, p<0.0001) and SPECT (r=0.78, p<0.0001). The limits of agreement between predicted and actual poFEV1% by BV-MRI with UTE (4.3±12.7 %) and quantitatively assessed CT (3.5±10.8 %) were smaller than those by qualitatively assessed CT (5.1±13.9 %) and SPECT (4.2±14.5 %).

CONCLUSION

BV-MRI with UTE can more accurately predict postoperative lung function than qualitatively assessed CT and perfusion SPECT, and is at least as valuable as quantitatively assessed CT in NSCLC patients.

CLINICAL RELEVANCE/APPLICATION

Blood volume-based MRI with UTE can more accurately predict postoperative lung function than qualitatively assessed CT and perfusion SPECT, and is at least as valuable as quantitatively assessed CT in NSCLC patients.

SST03-05 Correlation between Diaphragmatic Excursion and Decrease in Lung Volume on Expiratory Phase Imaging in Asthma Patients

Friday, Dec. 1 11:10AM - 11:20AM Room: E451B

Awards
Student Travel Stipend Award

Participants
Lea Azour, MD, New York, NY (*Presenter*) Nothing to Disclose
David S. Mendelson, MD, Larchmont, NY (*Abstract Co-Author*) Spouse, Employee, Novartis AG Advisory Board, Nuance Communications, Inc Advisory Board, General Electric Company Advisory Board, Toshiba Medical Systems Corporation Advisory Board, Bayer AG
Michael Chung, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Adam Jacobi, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Matthew D. Cham, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Mary M. Salvatore, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

Lea.azour@nyumc.org

PURPOSE

Inspiratory and expiratory phase imaging is often requested in asthma patients to evaluate air trapping, however, there is no radiographic measure of optimal expiration. Diaphragmatic excursion may be a reliable surrogate for lung volume assessment to gauge adequacy of expiration, particularly as the trachea may not change in configuration despite decrease in tracheal and/or lung volume.

METHOD AND MATERIALS

Between January 1, 2016 and December 31, 2016, a total of 226 CT exams with inspiratory and expiratory phase imaging were performed, 63 in individuals with asthma. Patients with supine imaging acquired with the same parameters in each phase were included (n= 33, mean age = 62, M=15, F=15). Diaphragmatic excursion was calculated as the difference between axial slices through the lungs on inspiration and expiration, using the lung apex and the cranial bound and diaphragm caudally. Lung and tracheal volumes were measured for each patient at inspiration and expiration.

RESULTS

Average inspiratory (I) and expiratory (E) lung volume was greater for men (I=5007 mL, E=3122 mL) than women (I=3122mL, E=1503mL). Similarly, average tracheal volumes were higher in men (I=61mL, E=45) than women (I=44, E=30). Average change in lung volume was 1500mL (range -564mL to 4109mL). Diaphragmatic excursion was found to range from -0.6cm to 6.8cm, with an average change in diaphragmatic excursion of 2.5 cm between inspiratory and expiratory scans (2.3 cm in women, and 2.7 cm in men). There was a very strong positive correlation between diaphragmatic excursion and change in lung volume between inspiratory and expiratory scans (r=0.83), and strong positive correlation with change in tracheal volume (r=0.79). A strong correlation was also found between change in tracheal volume and change in lung volume (r=0.67).

CONCLUSION

Diaphragmatic excursion is a strong quantitative measure of actual expiratory effort as validated by both lung and tracheal volumes, and may be more reliable than qualitative features such as tracheal morphology.

CLINICAL RELEVANCE/APPLICATION

Diaphragmatic excursion is a reliable quantitative surrogate for lung volume, and is an easily applicable clinical tool to assess the adequacy of expiratory phase image acquisition.

SST03-06 Pulmonary Function Diagnosis Based On Temporal Changes in Lung Density with Dynamic Flat-Panel Detector (FPD) Imaging: An Animal-Based Study

Friday, Dec. 1 11:20AM - 11:30AM Room: E451B

Participants
Rie Tanaka, PhD, Kanazawa, Japan (*Presenter*) Nothing to Disclose
Toru Tani, MD, PHD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Norihisa Nitta, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Takahisa Tabata, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Noritsugu Matsutani, Hachioji, Japan (*Abstract Co-Author*) Employee of Konica Minolta, Inc.
Shintaro Muraoka, Hachioji, Japan (*Abstract Co-Author*) Employee, Employee, Konica Minolta Group
Shikou Kaneko, Hachioji, Japan (*Abstract Co-Author*) Employee, Konica Minolta Group
Sho Noji, Hachioji, Japan (*Abstract Co-Author*) Employee of Konica Minolta, Inc.
Tsutomu Yoneyama, Hachioji, Japan (*Abstract Co-Author*) Employee of Konica Minolta, Inc.
Shigeru Sanada, PhD, Kanazawa, Japan (*Abstract Co-Author*) Stockholder, Hologic, Inc Research Grant, EIZO Corporation

For information about this presentation, contact:

rie44@mhs.mp.kanazawa-u.ac.jp

PURPOSE

X-ray translucency of the lungs changes with respiration. This is caused by relative increases and decreases in the volume of the lung vessels and bronchi per unit lung volume; pulmonary function can be evaluated based on temporal changes in the image density of the lung regions. The aim of the present study was to investigate the diagnostic performance of dynamic chest radiography for pulmonary function diagnosis based on respiratory changes in lung density.

METHOD AND MATERIALS

Sequential chest radiographs of six domestic pigs (body weight ca. 20-30 kg) were obtained during respiration using a dynamic flat-panel detector system (100 kV; 0.25 mAs/pulse; 15 frames/s; Test model, Konica Minolta). The pigs were intubated under

anesthesia, and respiratory control was ensured with a ventilator (100, 200, 300, 400, and 500 mL). We created porcine models of atelectasis using a catheter procedure, and analyzed the correlation between the inspired volume and changes in the pixel value measured in the lungs. To facilitate visual evaluation, differences in pixel values between an image taken at maximum expiration and those during respiration were sequentially calculated and then superimposed on the original images as a color display, employing a color table in which higher X-ray translucency (increased air) is shown in cold colors, creating functionally colored images.

RESULTS

Average pixel values in the lung regions changed according to forced respiration. High linearity was seen between changes in pixel value and inspired volume ($r = 0.9$). Changes in pixel value related to the inspired volume were successfully visualized as changes in color intensity on the functional colored images. In addition, areas of atelectasis were revealed as decreased changes in pixel values. Trapped air and airflow restriction were detected as higher and lower color intensity on functionally colored images, respectively (Fig. 1).

CONCLUSION

Dynamic chest radiography allowed for the evaluation of pulmonary function based on temporal changes in lung tissue image density. Inspired volume is quantified as changes in pixel value, and ventilation defects are detected as reduced changes in pixel value even without the use of contrast media.

CLINICAL RELEVANCE/APPLICATION

The method presented here is a simple and cost-effective functional imaging technique that can be performed as an adjunctive examination for conventional chest radiography.

SST03-07 CT Measurement of Atrioesophageal Adipose Tissue and Correlation with Metabolic Syndrome: Preliminary Results

Friday, Dec. 1 11:30AM - 11:40AM Room: E451B

Participants
Dennis P. Gilroy, DO, Rochester, NY (*Presenter*) Nothing to Disclose
Hakan Sahin, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Epicardial adipose tissue measurements on cardiac imaging planes have demonstrated association with atrial fibrillation and coronary artery disease. We wanted to investigate the utility of adipose measurements between the left atrium and esophagus on conventional axial and sagittal planes of routine chest CTs performed with ECG-gating in predicting the presence/complications of metabolic syndrome.

METHOD AND MATERIALS

The study protocol has been approved by the IRB. In this preliminary analysis, 50 patients with cardiac-gated CT performed for cardiac morphology or suspected aortic dissection were included, prospectively recorded, and retrospectively analyzed. The size of the atrioesophageal adipose tissue was measured on axial and sagittal images. Clinical conditions associated with metabolic syndrome were also recorded (hypertension, diabetes mellitus, BMI, dyslipidemia and atrial fibrillation). The association between the size of the adipose tissue and the clinical conditions was investigated.

RESULTS

Preliminary analysis reveals statistically significantly larger atrioesophageal fat in patients with dyslipidemia, compared with those who did not (p value 0.006). Additionally, this relationship extends to those with elevated systolic blood pressure (p value 0.05). The optimal threshold within the atrioesophageal fat measurement was determined to be greater than 4.1 mm in the sagittal plane (72.7% sensitivity and 62.5% specificity for the presence of dyslipidemia). Additional correlation exists between the axial measurement of atrioesophageal fat and BMI, albeit not statistically significant with the current data.

CONCLUSION

CT based epicardial fat quantification, using conventional imaging planes, is a simple tool that can be applied in everyday practice to identify patients with components of metabolic syndrome and possibly predict complications. While these results are preliminary, it is felt that the correlation between atrioesophageal fat measurement and additional various clinical parameters of metabolic syndrome will exist at statistically significant levels with a larger population.

CLINICAL RELEVANCE/APPLICATION

CT-based identification of patients with metabolic syndrome during routine CT evaluation using conventional imaging planes can serve as a value-added service leading to prediction of complications such as atrial fibrillation and alter therapeutic management due to known subsequent recurrence.

SST03-08 Effect of New Model-Based Iterative Reconstruction on Computer-Aided Detection for Quantitative Analysis of Airway Tree in Low-Dose Chest CT: Comparison with Adaptive Statistical Iterative Reconstruction in Routine Dose

Friday, Dec. 1 11:40AM - 11:50AM Room: E451B

Participants
Yongjun Jia, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Yun Shen, PhD, Beijing, China (*Presenter*) Employee, General Electric Company Researcher, General Electric Company
Yong Yu, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Nan Yu, MD, Xian Yang, China (*Abstract Co-Author*) Nothing to Disclose
Haifeng Duan, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Chuangbo Yang, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Xirong Zhang, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoxia Chen, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Taiping He, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the new model-based iterative reconstruction (MBIRn) with balanced setting (MBIRSTND) and spatial resolution preference (MBIRRP20) and adaptive statistical iterative reconstruction (ASIR) in low-dose and ASIR in routine dose on the performance of computer-aided detection (CAD) for quantitative airway analysis.

METHOD AND MATERIALS

30 patients had follow up scan for pulmonary disease on a GE Discovery CT750 HD system. Image acquisition was performed at routine dose and reduced dose level by increasing noise index (NI) from 14HU to 28HU using automatic tube current modulation. Tube voltage was fixed at 120kVp. Data of routine dose were reconstructed with ASIR, while low-dose were reconstructed with ASIR, MBIRSTND and MBIRRP20. Airway dimensions measured from the four reconstructions using an automated, quantitative software that was designed to segment and quantify the bronchial tree, and a skeletonization algorithm to extract the center-line of airway trees automatically (Figure 1). For each patients and reconstruction algorithm chose the right middle lobe bronchus with the least tortuous and bifurcation to measure the bronchial length of the matched airways. Two radiologists used a semi-quantitative 5-point scale (-2: inferior; 0, equal to ASIR in routine dose; 2: superior) to rate subjective image quality of airway trees on the low-dose images reconstructed with ASIR and MBIRn. Using paired t and Wilcoxon signed-rank tests for comparison.

RESULTS

Median effective dose was 3.01±1.89mSv at routine dose and 0.88±0.83mSv at 71% dose reduction. Algorithm impacts the measurement variability of the length of bronchus in low-dose chest CT, and MBIRSTND and MBIRRP20 were better than ASIR for the airway trees, while MBIRSTND displayed longer bronchus than ASIR in routine dose ($P<0.05$) (Table 1,Figure 2). MBIRSTND for the low dose chest CT also had higher subjective scores for the airway trees than ASIR in routine dose (Table 2,Figure 2).

CONCLUSION

The quantification accuracy of airway is strongly influenced by reconstructions. MBIRSTND and MBIRRP20 algorithms allow the desired airway quantification accuracy of CAD for chest to be achieved for 71% radiation dose reduction.

CLINICAL RELEVANCE/APPLICATION

Compare ASIR,MBIRSTND and MBIRRP20 from MBIRn algorithm potentially allows the desired airway quantification accuracy to be achieved on the performance of CAD with low-dose chest CT, especially for MBIRSTND.

SST03-09 Modified CT Fluoroscopy-Guided Lung Nodule Biopsy versus Conventional CT-Guided Biopsy: A Prospective Controlled Study to Assess Radiation Doses and Complication Rate

Friday, Dec. 1 11:50AM - 12:00PM Room: E451B

Participants
Ting Liang, Xian, China (*Presenter*) Nothing to Disclose
Gang Niu, MD, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Jin Shang, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Jian Yang, MD, PhD, Xian, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

liangting31500@126.com

PURPOSE

The aim of the study was to evaluate complication rate and radiation doses of lung nodule biopsy by the CT modified fluoroscopy-guided and conventional CT-guided methods.

METHOD AND MATERIALS

A total of 100 patients in single radiology unit were prospectively enrolled to receive CT-guided lung biopsy. 50 patients were undergoing modified CT fluoroscopy-guided (CTF) biopsy (Group 1), and other half was checked by traditional CT-guided methods (Group 2). The modified biopsy plan referred to the method of using axial scan with step by step for the nodule. 2 experienced chest radiologists performing thoracic biopsies performed CT-guided biopsy. 64 slice spiral CT (Toshiba) were performed with CT-guided pulmonary biopsy with the Japan 16G cutting biopsy needle. Radiation dose and diagnostic accuracy of patient were outcome measurements. Differences between proportions were analyzed with the chi-square test. Dose-length product (DLP) was compared between 2 groups. Sensitivity, specificity and accuracy were calculated based on 80 patient's results.

RESULTS

There were no significant between the two groups for the pulmonary nodules characteristics : size, group 1: 34±18mm (mean±standard deviation) vs. group 2: 38±20 mm ($p=0.845$); depth from pleura, 13±12 mm vs. 12±9 mm ($p=0.595$) (Table 1). The total DLP of the study group (median 3.8 mSv) was significantly reduced compared to that of the comparison group (median 11.1 mSv, p?0.05).

CONCLUSION

CT modified fluoroscopy-guided lung nodule biopsy provides high diagnostic accuracy and more lower radiation doses compared to conventional methods, and may be alternatively used for appropriate lung nodule.

CLINICAL RELEVANCE/APPLICATION

The CT modified fluoroscopy-guided pulmonary biopsy which can significant reduce the radiation dose and complication rate should be selected in clinical practice.

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SST07

Nuclear Medicine (Chest Imaging)

Friday, Dec. 1 10:30AM - 12:00PM Room: E353C

CH CT MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Ephraim E. Parent, MD, PhD, Atlanta, GA (*Moderator*) Nothing to Disclose
Andrew C. Homb, MD, Rochester, MN (*Moderator*) Nothing to Disclose

Sub-Events

SST07-01 Whole-Body FDG-PET/MRI: Comparison of its Capability for TNM Staging with that of Whole-Body MRI, Integrated FDG-PET/CT and Conventional Radiological Examination in Patients with Malignant Pleural Mesotheliom

Friday, Dec. 1 10:30AM - 10:40AM Room: E353C

Participants
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Toshiba Medical Systems Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Fuji Pharma Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
Yuji Kishida, MD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinichiro Seki, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation
Masao Yui, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation
Kota Aoyagi, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation
Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation
Katsusuke Kyotani, RT,MSc, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Shigeo Kaminaga, Otawara-shi, Japan (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation
Yoshimori Kassai, MS, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation
Hisashi Tachizaki, Tustin, CA (*Abstract Co-Author*) Employee, Toshiba Medical Systems Corporation

For information about this presentation, contact:

yosirad@kobe-u.ac.jp

PURPOSE

To directly and prospectively compare the TNM staging capability among whole-body co-registered FDG-PET/MRI, MRI with diffusion-weighted imaging (DWI), integrated FDG-PET/CT and conventional radiological examination in patients with malignant pleural mesothelioma.

METHOD AND MATERIALS

23 consecutive pathologically diagnosed malignant mesothelioma patients (14 men, 9 women, mean age 69.2 years old) underwent whole-body MRI including DWI, integrated PET/CTs, conventional radiological examinations, pathological examinations and surgical reports as well as follow-up examinations. TNM staging was evaluated by three different reader groups including radiologists with more than three year experiences of whole-body MRI and PET/CT and nuclear medicine physicians. Kappa statistics were determined for evaluations of agreements of each factor and the clinical stage between each of the methods and final diagnosis. Finally, the diagnostic accuracy of each factor and of determination of the clinical stage was statistically compared with each other by using McNemar's test.

RESULTS

T factor agreements were determined as substantial (PET/CT and conventional examination: kappa value=0.61) or almost perfect (PET/MRI and MRI: kappa value=0.86). N factor agreements were also determined as substantial (PET/CT: kappa value=0.73, conventional examination: kappa value=0.61) or almost perfect (PET/MRI and MRI: kappa value=1.00). M factor assessment, agreements were also determined as moderate (conventional examination: kappa value=0.47), substantial (MRI: kappa value=0.78) or almost perfect (PET/MRI and PET/CT: kappa value=1.00). In addition, clinical stage agreements were determined as substantial (PET/CT and conventional examination: kappa value=0.70) or almost perfect (PET/MRI and MRI: kappa value=0.87). Finally, accuracies of N factor evaluation on PET/MRI and MRI (100 [23/23] %) were significantly higher than that of conventional examination (73.9 [17/23] %, p=0.03).

CONCLUSION

Whole-body PET/MRI and MRI with DWI are potentially more useful for TNM stage assessment than conventional radiological examination, and can be considered at least as effective as PET/CT.

CLINICAL RELEVANCE/APPLICATION

Whole-body PET/MRI and MRI with DWI are potentially more useful for TNM stage assessment than conventional radiological

examination, and can be considered at least as effective as PET/CT.

SST07-02 Prognostic Value of Metabolic Variables of [18F]FDG PET/CT in Surgically Resected Stage I Lung Adenocarcinoma

Friday, Dec. 1 10:40AM - 10:50AM Room: E353C

Participants
Xiaoyi Wang, MD, Beijing, China (*Presenter*) Nothing to Disclose

PURPOSE

The objective of this study was to assess the prognostic value of metabolic tumor burden measured by positron emission tomography/computed tomography (PET/CT) in patients with stage I lung adenocarcinoma.

METHOD AND MATERIALS

We reviewed 127 consecutive patients with pathologically proven stage I lung adenocarcinoma who underwent pre-treatment [18F]FDG PET/CT scans in our hospital from 2005 June to 2012 June. The maximum, mean and peak standardized uptake value (SUVmax, SUVmean and SUVpeak), metabolic tumor volume (MTV), total lesion glycolysis (TLG) and computed tomography volume (CTV) were measured. The Kaplan-Meier and Cox proportional hazards model were used with age, gender, TNM stage, clinical stage, histological grade, nodule type, tumor size and metabolic parameters to predict progression-free survival (PFS). The cut-off point was determined through ROC curve.

RESULTS

In univariate analysis, the histological grade, nodule type, diameter (cut-off value of 2.0cm), CTV (6.56cm3), SUVmax (3.25g/ml), SUVmean (1.58g/ml), SUVpeak (1.84g/ml), MTV (4.80cm3) and TLG (10.40) were significantly associated with PFS (all P value <0.05). Patients with poorly differentiated adenocarcinoma, solid nodule type, large size, high metabolic tumor burden were associated with poor prognosis. In multivariate analysis, only histological grade was independent prognostic factors for progression with a P value of 0.005 (RR, 0.355; 95 % CI, 0.173-0.728). Among five PET/CT metabolic parameters, only MTV was independent prognostic factors for progression with a P value of 0.031 (RR, 1.118; 95 % CI, 1.010-1.237).

CONCLUSION

Histological grade was an independent predictor for progression in patients with stage I lung adenocarcinoma. Among five PET/CT metabolic parameters, only MTV was an independent predictor for progression.

CLINICAL RELEVANCE/APPLICATION

Owing to the high heterogeneity, there is quite a limitation in treatment planning and prognosis predicting only based upon TNM stage and pathological type. Recently, several researches have already proved that SUVmax, MTV and TLG had prognostic and predictive value in NSCLC patients. Howerer, previous studies focused primarily on advanced stage disease, few studies have reported the role of those parameters in early stage adenocarcinoma. This study was conducted to document the prognostic role of metabolic tumor burden parameters in patients with stage I lung adenocarcinoma.

SST07-03 Comparison of Different Automated Lesion Delineation Methods for Metabolic Tumor Volume of 18F-FDG PET/CT in Patients with Stage I Lung Adenocarcinoma

Friday, Dec. 1 10:50AM - 11:00AM Room: E353C

Participants
Xiaoyi Wang, MD, Beijing, China (*Presenter*) Nothing to Disclose

PURPOSE

Defining metabolic tumor volume (MTV) of small and/or low uptake lesions using positron emission tomography/ computed tomography (PET/CT) is usually challenging since the variation is generally high. The aim of this paper is to investigate the suitable segmentation method in small, low uptake and heterogeneous stage I lung adenocarcinoma.

METHOD AND MATERIALS

One-hundred and thirty-three stage I lung adenocarcinoma patients with 2-deoxy-2-[18F]fluoro-D-glucose PET/CT scans were enrolled in this retrospective study. All lesions were divided into different groups according to nodule density (16 non-solid, 30 part-solid and 87 solid), nodule size (53 small lesions with longest diameter <= 20 mm; 80 large lesions with longest diameter >20 mm) and the maximum standard uptake value (SUVmax) level (57 low uptake lesions with SUVmax <= 2; 76 high uptake lesions with SUVmax > 2). The MTVs of the four different PET segmentation methods were evaluated and compared with CT volume (CTV). Percentage volume error (%VE) compared to CTV was calculated and the correlations between MTVs and CTV were analyzed.

RESULTS

The adaptive iterative algorithm (AT-AIA) had the highest accuracy in large, high uptake and solid nodules (72.5%, 72.4% and 65.6%, respectively). The method of adaptive thresholding at 40% SUVmax (AT40%) had the highest accuracy in small, low uptake and non-solid nodules (56.6%, 56.1% and 62.6%, respectively). In part-solid nodules, the accuracy of AT-AIA (60.0%) and AT40% (56.7%) were higher than that of the other two methods. The MTV of AT-AIA was in excellent consistent with the CTV in solid nodules (R=0.831, P=0.000) and in high uptake nodules (R=0.830, P=0.000). The MTV of AT40% was in good consistent with the CTV in non-solid nodules (R=0.686, P=0.003) and in part-solid nodules (R=0.731, P=0.000).

CONCLUSION

AT40% showed best performance in small, low uptake, non-solid and part-solid lesions. AT-AIA was suitable for large, high uptake and solid lesions.

CLINICAL RELEVANCE/APPLICATION

Up to now, defining metabolic tumour volume of small and/or low uptake lesions is still challenging since the variation is generally high. The aim of this study is to investigate the suitable segmentation method in small, low uptake and heterogeneous stage I lung

adenocarcinoma.

SST07-04 Decrease in SUV Max of a Solitary Pulmonary Nodule (SPN) in Dual-Time FDG-PET/CT Imaging: Does it Reliably Exclude Malignancy?

Friday, Dec. 1 11:00AM - 11:10AM Room: E353C

Participants
Charles M. Intenzo, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Sung M. Kim, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Donna D. Carstens, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Paras Lakhani, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Gregory Kane, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Michael Unger, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Achala Donuru, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

Charles.intenzo@jefferson.edu

PURPOSE

FDG-PET/CT is a well established modality for evaluating indeterminate solitary pulmonary nodules (SPN). Although the sensitivity for detecting malignancy is considered quite high, the specificity is lower. By adding delayed imaging (Dual-Time PET/CT), the specificity for malignancy improves, since malignant SPN increase glucose utilization over time, i.e. an increase by > 10% in the maximum standardized uptake value (SUV Max). By contrast, a decrease or no significant change in SUV Max suggests benign etiology. We observed, however, that it was not uncommon for biopsy-proven malignant nodules to show either no significant change or a decrease in SUV Max on delayed imaging. Our aim was to (1) determine the frequency of this pattern and (2) to correlate with histopathology.

METHOD AND MATERIALS

From 2007 through 2016, we collected all cases of FDG-PET/CT scans used for SPN evaluation in which the final diagnosis was lung malignancy, yet the SUV Max either did not significantly change, or decreased by 10% or more on delayed imaging.

RESULTS

A total of 86 patients met the above criteria, 50 men and 36 women. In 40 of the patients (Group A), the SUV Max decreased by $\geq$ 10%, which was considered a significant decrease. Of these, 23 patients had adenocarcinoma, 4 had squamous cell, 4 had small cell, and 13 had bronchoalveolar (BAC). The remaining 46 patients (Group B) demonstrated either no significant change in SUV Max, or a decrease less than 10%; 15 had adenocarcinoma, 13 had small cell, 7 had BAC, and 11 had squamous cell cancer.

CONCLUSION

(1) Although a significant increase in SUV Max in dual-point FDG PET/CT imaging generally indicates SPN malignancy, a decrease or lack of change in SUV does not necessarily mean a benign etiology. (2) Adenocarcinoma is the most common cell type in which SUV Max decreases or does not significantly change, likely a reflection of tumor differentiation.

CLINICAL RELEVANCE/APPLICATION

A lack of change or a significant decrease in SUV Max over time of an SPN does not exclude malignancy and this pattern is unreliable in SPN evaluation.

SST07-05 18FDG Uptake Patterns by Mediastinal Lymph Nodes and EBUS in the Nodal Staging of Patients with Non-Pulmonary Malignancies

Friday, Dec. 1 11:10AM - 11:20AM Room: E353C

Participants
Socrates Angelides, MBBS, Westmead, Australia (*Presenter*) Nothing to Disclose
Andrew Markewycz, BMedSc, Westmead, Australia (*Abstract Co-Author*) Nothing to Disclose
Josh Escabach, BMedSc, Westmead, Australia (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively compare 18FDG-PET scans and EBUS findings in patients with documented mediastinal lymphadenopathy and non-pulmonary primary malignancies.

METHOD AND MATERIALS

25 patients with documented mediastinal lymphadenopathy and non-pulmonary primary malignancies underwent 18FDG-PET scintigraphy followed by EBUS within the ensuing 3 weeks. One-two nodes (n = 29) were assessed in each patient, determined by 18FDG-PET findings and accessibility of the 18FDG-positive nodes. The mediastinal nodal status from each procedure was compared.

RESULTS

EBUS resulted in mediastinal nodal status downgrading in 60% patients. No upgrading was noted. Downgrading most likely occurred when there several non-enlarged lymph nodes of similar 18FDG-avidity distributed randomly and bilaterally in the mediastinum, often with bilateral hilar uptake (~80% of patients). 100% patients with positive EBUS findings for malignant disease demonstrated discrete 18FDG-avid lymph nodes ipsilaterally, with minimal-to-no 18FDG-avid nodes contralaterally. EBUS findings in 20% of patients were inconclusive, despite multiple sampling. Enlarged, rounded lymph nodes with avid FDG uptake (SUV>4) were also more likely to harbour metastatic disease.

CONCLUSION

The pattern of mediastinal 18FDG uptake was highly predictive of metastatic disease, and may circumvent the need for EBUS

evaluation. Prospective analysis of these parameters will be undertaken.

CLINICAL RELEVANCE/APPLICATION

Patterns of 18FDG uptake in mediastinal lymph nodes may circumvent the need for EBUS assessment.

SST07-06 Short TE and Low Flip Angle VIBE Sequence for Lung Evaluation in PET-MRI

Friday, Dec. 1 11:20AM - 11:30AM Room: E353C

Participants
Alessia Varotto, MD, Padova, Italy (*Presenter*) Nothing to Disclose
Roberto Stramare, MD, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Giovanna Orsatti, MD, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Diego Cecchin, MD, Padova, Italy (*Abstract Co-Author*) Research Grant, The Piramal Group
Filippo Crimi, MD, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Pietro Zucchetta, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Franco Bui, MD, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Fabio Pomerri, MD, Padua, Italy (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

ale.varotto86@gmail.com

PURPOSE

Low-dose CT in standard PET/CT offers a better morphological lung characterization when compared with Dixon sequences in PET/MRI. Our aim is to improve diagnostic accuracy for lung lesions detection with PET/MRI avoiding a significant increase in the acquisition time, adding a short TE (Echo Time) and low FA (Flip Angle) T1-weighted sequence (gradient-echo volumetric interpolated breath-hold examination [VIBE]) to the standard acquisition protocol.

METHOD AND MATERIALS

We enrolled 21 oncological patients (11 M and 10 F) who underwent both thoracic CT scan and 3T PET-MRI (Siemens Biograph mMR) including lung dedicated short TE and low FA VIBE (inspiration, 3 mm slice thickness, axial plane). Time interval between the two examinations was < 2 weeks. VIBE sequences were retrospectively and independently evaluated by two radiologists for the detection of pulmonary nodules, parenchymal consolidations and dense bands; to assess inter-observer agreement Cohen's kappa coefficient (κ) was calculated. Results were then compared with CT scans findings, considered as the gold standard. Sensitivity and specificity were calculated.

RESULTS

VIBE sensitivity in lung nodules evaluation was 80% (8/10 patients) for nodules >5 mm and 57,1 % (4/7 patients) for nodules <= 5 mm, compared to CT imaging. In both cases specificity was 100%. All dense bands and parenchymal consolidation were found both with CT scan and VIBE. Inter-observer agreement was 95 % for nodules >5 mm (κ =0.90, $p<0.001$), 85% for nodules <= 5 mm (κ=0.44 $p<0.005$), 90% for dense bands (κ =0.56, $p<0.001$) and 100% for parenchymal consolidations.

CONCLUSION

VIBE showed high sensitivity in the evaluation of lung nodules > 5 mm; sensitivity was less satisfactory for smaller nodules. This sequence obtained also a very good inter-observer agreement, resulting a very reproducible imaging technique in pulmonary lesion investigation. Considering also the short acquisition time (15-18 s), it seems be reasonable to integrate PET/MRI protocols with a short TE and low FA VIBE, improving its diagnostic performance in lung evaluation.

CLINICAL RELEVANCE/APPLICATION

Short TE and low FA VIBE sequence can improve PET-MRI diagnostic performance in pulmonary lesions detection, without a significant increase in the acquisition time.

SST07-07 Relative Effect Size of Different Clinical & PET Variables on NSCLC Patient's Survival Estimated with Random Survival Forest Model

Friday, Dec. 1 11:30AM - 11:40AM Room: E353C

Participants
Jiangping He, PhD, Lanzhou, China (*Abstract Co-Author*) Nothing to Disclose
Chin-Tu Chen, PhD, Chicago, IL (*Abstract Co-Author*) Stockholder, EVO Worldwide , Inc; Stockholder, Medical Simulation Corporation ; Stockholder, EDDA Technology, Inc; Stockholder, EnDepth Vision Systems, LLC; Research Consultant, DxRay, Inc ; Advisor, RefleXion Medical Inc
James X. Zhang, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Tianming Wu, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Lili Liu, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Yonglin Pu, MD, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

PURPOSE

To assess relative effect size of the different clinical & PET variables on the overall survival (OS) in patients with non-small cell lung cancer (NSCLC), using permutation Variable Importance (VIMP) measure with a Random Survival Forest (RSF) model.

METHOD AND MATERIALS

A RSF model, which can address right censored data problem, was constructed based on 952 Consecutive NSCLC patients with baseline PET/CT studies, but no brain metastasis or other type of primary cancer (separated into 604 for training and 348 for testing, according to their PET/CT study acquisition scanners). The RSF model included gender, age, race, smoking status, TNM stage (according to the 8th edition of the clinical TNM staging system), histology type, treatment types (with surgery, without surgery and no treatment), and maximum standard uptake value of whole-body tumor (SUVmaxWB) and whole-body metabolic

tumor volume (MTVWB) measured on the PET/CT studies. The overall survival (OS) time served as independent variable. The VIMP, which is a measure of relative importance of parameters on survival (the higher value indicates higher importance), was calculated using permutation method included in the RSF R package (randomForestSRC). The trained RSF model was used to predict the survival rate for the patients in the test dataset and the results were compared to the standard Cox model.

RESULTS

The top 3 highest VIMP coefficients of 0.047, 0.036 and 0.032, were from treatment type, clinical TNM stage and MTVWB, respectively. The coefficient of SUVmaxWB was 0.011. The histology type, race, smoking status and gender had similar coefficients of about 0.003, while age had the smallest VIMP of 0.001. When predicting the test patients' survival rate with the identical variables, our RSF model achieved moderate performance with C-index (a measure of predictive ability of a model) of 0.73, compared to 0.71 by the Cox model.

CONCLUSION

Our model suggests that treatment types, TNM stage and MTVWB are relatively important variables on NSCLC patient's survival, among the commonly used clinical prognostic and PET tumor variables. SUVmaxWB has a moderate effect, while the histology type, race, smoking status, gender and age have small effect on patients overall survival.

CLINICAL RELEVANCE/APPLICATION

This work suggests that treatment type, TNM stage, MTVWB and SUVmaxWB are important prognostic factors useful for the treatment decision making and prognosis of NSCLC patients.

SST07-08 Active Contour-Based Segmentation for 18F-FDG PET Thoracic Oncology: A Powerful Alternative to the Clinical State-of-the-Art Expert-Based Segmentation

Friday, Dec. 1 11:40AM - 11:50AM Room: E353C

Participants
Florent L. Besson, MD,MSc, Le Kremlin Bicetre, France (*Presenter*) Nothing to Disclose
Theophraste Henry, MD, Le Kremlin-Bicetre, France (*Abstract Co-Author*) Nothing to Disclose
Celine Meyer, MD, Le Kremlin Bicetre, France (*Abstract Co-Author*) Nothing to Disclose
Virgile Chevance, Creteil, France (*Abstract Co-Author*) Nothing to Disclose
Victoire Roblot, MD, Le Kremlin-Bicetre, France (*Abstract Co-Author*) Nothing to Disclose
Elise Blanchet, Rockville, MD (*Abstract Co-Author*) Nothing to Disclose
Victor Arnoud, MD, Orsay, France (*Abstract Co-Author*) Nothing to Disclose
Gilles Grimon, MD, Le Kremlin Bicetre, France (*Abstract Co-Author*) Nothing to Disclose
Malika Chekroun, MD, Le Kremlin-Bicetre, France (*Abstract Co-Author*) Nothing to Disclose
Laurence Mabille, MD, NEUILLY sur SEINE, France (*Abstract Co-Author*) Nothing to Disclose
Florence Parent, Le Kremlin-Bicetre, France (*Abstract Co-Author*) Nothing to Disclose
Andrei Seferian, MD,MSc, Le Kremlin-Bicetre, France (*Abstract Co-Author*) Nothing to Disclose
Sophie Bulifon, Le Kremlin-Bicetre, France (*Abstract Co-Author*) Nothing to Disclose
David Montani, MD,PhD, Le Kremlin-Bicetre, France (*Abstract Co-Author*) Nothing to Disclose
Marc Humbert, Clamart, France (*Abstract Co-Author*) Nothing to Disclose
Philippe Chaumet-Riffaud, MD,PhD, Le Kremlin-Bicetre, France (*Abstract Co-Author*) Nothing to Disclose
Vincent Lebon, MD,PhD, Orsay, France (*Abstract Co-Author*) Nothing to Disclose
Emmanuel Durand, MD,PhD, Le Kremlin-Bicetre, France (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

florent.besson@aphp.fr

PURPOSE

The aim of this study was to assess the performances of an active contour-based user GUI approach for the PET segmentation of complex-shaped lung tumours, in comparison to an optimized expert-based manual reference standard.

METHOD AND MATERIALS

In this retrospective study, 75 complex-shaped lung tumours were blindly segmented using the same graphical user interface (GUI) ITK snap software. For each tumour, four independent raters semi-automatically segmented the 75 tumours twice (sessions 1 and 2) using the active contour based-procedure of the GUI software. A probabilistic estimate of each tumour ground truth was also computed from the set of six independent expert-based manual segmentation results using the Simultaneous Truth And Performance Level Estimate (STAPLE) algorithm. Accuracy of the semi-automatic procedure was assessed by measuring the spatial overlap between the raters segmentation outputs and the corresponding expert probabilistic reference standards, using the DICE similarity coefficient (DSC). Interrater and intrarater reliability analyses were also performed using the intra class correlation coefficients (ICC) estimates of the output volumes,(two-way mixed-model, individual-rating, absolute-agreement). For all tumours segmentation procedures, average time per procedure was also estimated.

RESULTS

Overall accuracy of the user GUI active contour-based procedure was excellent with a DSC of 0.835 (95%CI = 0.775-0.895). Interrater reliabilities provided the following results: ICC = 0.941 (95%CI = 0.913-0.961) for the first session and ICC = 0.935 (95%CI = 0.906-0.956) for the second session. Intrarater reliabilities provided the following results: ICC = 0.993 (95%CI = 0.990-0.996) for the rater 1; ICC = 0.987 (95%CI = 0.976-0.993) for the rater 2; ICC = 0.972 (95%CI = 0.956-0.982) for the rater 3; and ICC = 0.977 (95%CI = 0.964-0.985) for the rater 4. Average time was 631 seconds for manual segmentation procedure, and 130 seconds for active contour-based procedure.

CONCLUSION

Compared to the state of the art expert-based manual segmentation, the GUI-based active contour procedure provided excellent accuracy and reliability, with a mean procedure duration almost five-times faster than the manual reference standard.

CLINICAL RELEVANCE/APPLICATION

Active contour-based segmentation from ITK-snap software is robust, fast, and easy enough to be routinely applied to segment

Active contour based-segmentation from ITK snap software is robust, fast, and easy enough to be routinely applied to segment heterogeneous and complex-shaped lung tumours.

SST07-09 FDG-PET/CT Predicts Development of Thyroiditis due to Immunotherapy for Lung Cancer

Friday, Dec. 1 11:50AM - 12:00PM Room: E353C

Participants
Naghmehossadat Eshghi, MD, PhD, Tucson, AZ (*Presenter*) Nothing to Disclose
Linda Garland, MD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Emily S. Nia, MD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Robert A. Betancourt, MD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Krupinski, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Phillip Kuo, MD,PhD, Tucson, AZ (*Abstract Co-Author*) Author, MD Training at Home; Research Grant, Astellas Group; Consultant, Endocyte, Inc; Consultant, General Electric Company; Education Grant, General Electric Company; Speakers bureau, Eli Lilly and Company; Consultant, inviCRO, LLC; Consultant, Imaging Endpoints; Consultant, Progenics Pharmaceuticals, Inc;

PURPOSE

Determine if PET/CT parameters of FDG uptake in the thyroid gland pre-and post-immunotherapy with nivolumab for advanced lung cancer could predict the development of the immune-related adverse event, thyroiditis.

METHOD AND MATERIALS

An IRB-approved retrospective chart review over 2 years found 18 patients with advanced lung cancer treated with nivolumab and with FDG-PET/CT scans pre and post therapy. The post-treatment FDG-PET/CT was performed approximately 6-9 weeks after the first dose of nivolumab. The standardized uptake value (mean and max) and total lesion glycolysis (TLG) of the thyroid gland were measured. Patients obtained monthly thyroid function testing as standard of care while receiving nivolumab. Results of the thyroid testing separated the patients into two groups, patients who developed new hypothyroidism (thyroiditis) and those who did not. Statistical t-test analysis used the FDG-PET/CT parameters to compare the two groups.

RESULTS

In the hypothyroid group, 7 patients developed hypothyroidism after immunotherapy. In the euthyroid group, 9 patients remained euthyroid and 2 patients had a pre-existing history of hypothyroidism (including these 2 did not significantly affect statistics). T-test analysis demonstrated statistically significant higher post-therapy SUVs in the hypothyroid versus euthyroid group. The differences in average values between the two groups were SUV mean 0.77 ($p<0.04$), SUV max 0.96 ($p<0.04$) and TLG 0.96 ($p<0.02$). Pre-therapy SUVs showed no statistical difference. 4 out of 7 patients in the hypothyroid group were euthyroid at the time of the post-therapy PET scan and developed hypothyroidism months later.

CONCLUSION

Nivolumab is an immune checkpoint inhibitor which works by activation of T cells against tumors and is associated with immune-related adverse events like thyroiditis. Increases in FDG uptake in the thyroid gland after immunotherapy indicate inflammation from thyroiditis and therefore predict the development of immunotherapy-induced hypothyroidism, potentially before laboratory testing or development of symptoms.

CLINICAL RELEVANCE/APPLICATION

FDG-PET/CT can predict the development of immunotherapy-induced hypothyroidism and therefore the necessity for thyroid hormone replacement.

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