Chest

SE 04 CH-01
The result of the study of determining the hiatal hernia and gastro-esophageal reflux disease (GERD) by endoscopy and roentgenography
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PURPOSE: To determine the association of endoscopic degree with GERD and to identify type of findings with roentgenography of hiatal hernia.

MATERIALS AND METHODS: We evaluated the 30 patients, who are diagnosed with hiatal hernia at Department of Radiology of Third Central Hospital, Ulaanbaatar, Mongolia between years of 2015 to 2016.

RESULTS: Our study included 17 female (57.7% ± 9.1) and 13 (43.3% ± 9.1) male overall 30 patients with hiatal hernia between age of 39-82. Paraesophageal hernia was no detected among patients under 54 years old whereas 1 (25%) out of 4 (13.3%) patients with paraesophageal hernia were 55-64 years old. Seven (26.9%) of 26 (86.7%) patients with axial type hiatal hernia were between age of 45-54. In 7 (23.3%) patients with GERD M who are diagnosed by endoscopic examination had 14.4% mild, 28.6% moderate and 57.1% severe types of hiatal hernia. The 66.7% of 3 (10.0%) GERD A degree patients had mild, 33.3% patients had moderate hiatal hernia. The 62.5% of 8 (26.7%) GERD B degree patients had mild, 37.6% patients had severe hiatal hernia. The 25.0% of 8 (26.7%) patients who are diagnosed GERD C degree had mild, 62.5% patients had moderate hiatal hernia and 12.5% had severe type of hiatal hernia. The 25.0% of 4 (13.3%) patients who are diagnosed GERD D degree had moderate, 75.0% patients had severe hiatal hernia and there was no mild type of hiatal hernia detected (p < 0.045).

CONCLUSION: 1. Under 54 years old there was no paraesophageal hernia detected and 26.9% of patients with axial hiatal hernia were 45-54 years old. 2. Among patients with GERD A who are diagnosed with flexible endoscopy, 66.7% has mild degree of hiatal hernia, 75% of GERD D patients had severe hiatal hernia reveals that GERD degree is direct association with degree of hiatal hernia.

SE 04 CH-02
A missed late presentation of congenital pulmonary airway malformation as pneumothorax
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Congenital pulmonary airway malformation (CPAM), accounts for 25% of congenital lung lesions. A vast majority of cases are diagnosed during immediate neonatal period, and antenatal diagnosis is made possible with ultrasound. When first diagnosed in adult, it is usually a result of infection or malignant transformation. We present a rare case of histologically - proven CPAM diagnosed in a young adult presenting with dyspnea secondary to an infected large bullae which was misinterpreted for a pneumothorax on chest radiograph.

SE 04 CH-03
Radiologic findings of postoperative complications after thoracic surgery
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A variety of surgical procedures are currently used in the treatment of lung diseases. All of these techniques can cause postoperative complications, which differ according to the type of surgery and the time elapsed since surgery was performed. Computed tomography (CT) scans obtained in patients who have undergone lung surgery show normal postoperative change resulting of the surgical procedure as well as various possible postoperative complications. The purpose of this exhibition is to recognize clinical and radiologic features of early and late complications after thoracic surgery. Familiarity with the clinical and imaging features of the expected alterations as well as the various possible complications after thoracic surgery is crucial in minimizing increased morbidity and mortality.
SE 04 CH-04
A rare case of pulmonary blastoma
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INTRODUCTION: Pulmonary blastoma (PB) is a rare lung tumor composed of immature mesenchyme and/or epithelium that morphologically mimics embryonal pulmonary structure. It has a poor prognosis with overall 5-year survival rate of 15%. Till date, there are not many cases reported in the literature. Radiologically, it usually presents as a well-defined mass lesion on chest radiography, which may be large enough to completely opacify the hemithorax and causes mediastinal shift. On Computer tomography (CT), it is seen as a mixed solid and cystic lesion with variable contrast enhancement and a necrotic center. Pleural effusion may be present but is not the predominant abnormality. The mainstay of treatment is surgical resection and chemotherapy. We report a rare case of pulmonary blastoma in a young patient who refused surgical resection and treated mainly with chemotherapy.

CASE PRESENTATION: A 26-year-old male with no known medical illness presented with left sided chest pain, occasional cough and shortness of breath for 2 months. Chest radiograph showed homogenous opacities of the left lung which was initially thought to be a massive pleural effusion. Pleural tapping done revealed blood stained pleural fluid which was exudative in nature. Contrast enhanced CT thorax showed a large heterogeneously enhancing lesion occupying entire upper lobe of left lung, with no calcification or fat component within. There was minimal left pleural effusion but no evidence of distant metastases. Ultrasound guided biopsy was performed and histopathological examination (HPE) confirmed the diagnosis of biphasic pulmonary blastoma. This patient has been started on combination chemotherapy including vinblastine, ifosfamide, cisplatin and a total of 4 cycles were given till date. Surgical resection was offered to the patient but was refused. Patient is currently showing response to the treatment as evidence by reduction of the tumor marker level.

SE 04 CH-05
Study of correlation between pulmonary circulation pressure level among patients with secondary atrial septal defect and Mure index
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PURPOSE: To study correlation of pulmonary circulation pressure level among patients with secondary atrial septal defect (ASD) and Mure index (MI).

MATERIALS AND METHODS: We involved 102 patients who diagnosed as secondary atrial septal defect in department of Radiology in State Third Central Hospital named after P.Kh. Shastin between 2013-2017 and concluded pulmonary circulation level and Mure index respectively. Mure index is evaluated as PA plain X-ray. Including: Measure from midline to outer edge of pulmonary artery (PA). Measure horizontal thoracic diameter from inner border of ribs at the level of right cardiophrenic angle (D).

$$\text{MI} = \frac{\text{PA} \times 100}{1/2D}$$

Mure index enlargement is classified into 3 grades. Including 1st grade 31-35%, 2nd grade 36-40%, 3rd grade > 41%. Diagnose of secondary atrial septal defect has approved with echocardiography, angiography and surgery.

RESULTS: From the structural signs of pulmonary circulation among patients with secondary atrial septal defects including pulmonary circulation insufficiency level IA of 23 patient’s (22.5%) 18 (78.3%) of had was normal/not-enlarged Mure index (p<0.001, 5 (21.7%) had 1st grade enlargement of Mure index; PCI/pulmonary circulation insufficiency level IB of 16 (15.8%) patient’s 2 (12.5%) had normal Mure index, 11 (68.8%) had 1st grade enlargement of Mure index (p<0.01) and 3 (18.7%) had 2nd grade enlargement of Mure index; PCI level II of 54 (52.9%) patient’s 19 (45.2%) had normal Mure index, 12 (22.2%) had 1st grade enlargement of Mure index, 13 (24.1%) had 2nd grade enlargement of Mure index and 10 (18.5%) had 3rd grade enlargement of Mure index; PCI level IIIA of 7 (6.9%) patient’s 2 (28.6%) had 1st grade enlargement of Mure index, 5 (71.4%) had 2nd grade enlargement of Mure index; PCI level IIIB of 2 (1.8%) patient’s 2 (100%) had 2nd grade enlargement of Mure index (p = 0.05) or total number of 102 (100%) patient’s 39 (38.2%) had any enlargement of Mure index respectively.

CONCLUSION: Study showed pulmonary circulation pressure level among patients with secondary atrial septal defect compared with Mure index is the key...
criteria for diagnosis of pulmonary circulation X-ray structure signs.

SE 04 CH-06
Healthcare-associated pneumonia in the elderly: difficulties in radiologic assessment
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LEARNING OBJECTIVES: Along with the rapid rise in the elderly population, the need for healthcare in the elderly population will rise quickly. The elderly are vulnerable to pneumonia because of functional disabilities and comorbidities. Healthcare-associated pneumonia (HCAP) is proposed by the American Thoracic Society/Infectious Diseases Society of America in 2005. This exhibit reviews the radiologic assessment of HCAP in the elderly.

SUMMARY OF CONTENTS: Elderly patients include aged ≥ 65 years. HCAP includes hospitalization for two days or more within the preceding 90 days, residence in a nursing home or extended care facility, the use of home infusion therapy, receipt of chronic dialysis within 30 days, home wound care and a history of infection with a multidrug-resistant pathogen in a family member. Elderly patients with HCAP show more severe pneumonia, higher rates of potentially drug-resistant pathogens, and worse clinical outcomes. Difficulties in radiologic assessment of elderly HCAP are mostly due to clinical overlapping pathology with multiple comorbidities and false negative findings on chest radiographs. Aspiration pneumonia is an important pathogenesis of elderly HCAP. Bronchopneumonia pattern is commonly observed with gravity dependent distribution in elderly HCAP. Early chest CT can provide more valuable information for the elderly patients with HCAP.

CONCLUSION: HCAP in the elderly is a challenge for radiologists as well as clinicians. More accurate radiologic assessment is needed to provide an appropriate diagnosis and treatment in elderly HCAP.

SE 04 CH-07
Radiologic overview of aspiration-induced lung diseases in adults
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LEARNING OBJECTIVES: Aspiration can cause a broad spectrum of lung diseases in adults. The type of aspiration-induced lung diseases depends on the quantity and nature of the aspired material, the chronicity, and the host responses. Despite its frequency, definitive diagnosis of aspiration-induced lung diseases is challenging to make. We provide an overview of the spectrum of aspiration-induced lung diseases with a focus on diagnostic aspect and radiologic manifestations.

SUMMARY: Aspiration is defined as accidental entrance of foreign matter into the lower respiratory tract, and is a common event and can occur in healthy individuals. Risk factors for aspiration are depressed consciousness, compromised airway defenses, dysphagia, gastroesophageal reflux disease, recurrent vomiting, and so on. Aspiration into the respiratory tract can cause pathologically bronchiolitis, pneumonitis, acute pneumonia, organizing pneumonia, abscess formation, and interstitial fibrosis. Aspiration represents a broad spectrum of diseases. Diseases with predominantly airway manifestation include foreign body aspiration and diffuse aspiration bronchiolitis. Diseases with predominantly lung parenchymal manifestation include acute diseases such as aspiration pneumonia, aspiration pneumonitis, and near drowning, and chronic diseases such as exogenous lipoid pneumonia and interstitial lung disease.

CONCLUSION: Aspiration into the airways and lungs can cause a wide spectrum of pulmonary diseases with various manifestations. Awareness of radiologic findings associated with these diseases is essential for accurate diagnosis and management of these diverse aspiration-related lung diseases.
SE 04 CH-08
Missed lung cancer: you can catch it in radiologic blind spots
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PURPOSE:
1. To review pitfalls in radiologic diagnosis of lung cancer
2. To be familiar with radiologic blind spots and uncommon manifestations of lung cancer

TABLE OF CONTENTS/OUTLINE:
1. Interpretation of chest radiograph
2. Review of the radiologic blind spots which can be easily overlooked on chest radiograph while interpretation
Lung apices
- Overlapping skeletal structures and vessels
  Apical pleural cap
  Paramediastinal region
- Normal contours and lines of the mediastinum
  Anatomic lines, stripes, and interfaces
  Assessment of central tracheobronchial tree
  Pulmonary hila
- Assessment of hilum
  Hilum convergence sign, hilum overlay sign
  Inferior hilar window
  Retrocardiac region
  Paravertebral regions
  Serious extrapulmonic pathology
3. Brief review of uncommon manifestations of lung cancer

SE 04 CH-09
Physical characteristics of novel steerable aspiration needle within explant porcine lung: preliminary investigation
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PURPOSE: We investigated the physical characteristics of Morrison Steerable Needle™ (MSN) within porcine lung explant during simulated transthoracic needle biopsy (TNB).

MATERIALS AND METHODS: We injected two artificial (paraffin) lung nodules into explant porcine lung and observed the course of MSN. If a needle approaches within 5mm of an artificial nodule with its tip pointing to the center third of the nodule, we considered the nodule as being hit by the needle. The lung was inflated after intubation, placed in the polystyrene box which acted as chest wall. MSN has a steerable stylet containing cables attached to a joystick hub. The following characteristics were tested: (1) maintaining a straight course with a neutral joystick position (2) durability of the curvature (3) lateral shifting of the needle tip after turning the joystick (4) maintaining the direction of the flexed distal tip when advanced (5) redirection capability of MSN (torque-free) and Chiba™ (torque and bevel steering used) needle which were advertently placed to point to a location 2 cm medial to the target center (1.0 x 0.5 cm-sized nodule 4 cm away from the needle tip in the vertical dimension).

RESULTS: (1) With neutral joystick, MSN traveled maintained a straight course (length of 2.7 cm) and hit a 0.8 x 0.5-cm nodule (2) Whenever the joystick was turned and hands were off the MSN, the distal portion of it maintained a sharp curvature within lung tissue (3) 1.2-cm and 2.5-cm advancements of MSN with 90-degree joystick turn resulted in a lateral redirection of 5 mm and 7 m, respectively; 4 cm-advancement with a full joystick turn a lateral redirection of 10 mm (4) When advanced, the tip deviated from the position expected from the direction of the flexed distal tip by 2, 0, and 3 mm toward the original needle direction (5) MSN was successfully redirected and hit the target. Chiba was off the target center by 1.8 cm.

CONCLUSION: An MSN can be steered toward a movable target much more effectively than a Chiba needle. However, there can be minor discrepancy between the direction of a flexed tip and the actual needle course after advancement.

SE 04 CH-10
Non-tumorous disease of the mediastinum: radiologic features
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PURPOSE: There are multiple causes of mediastinal masses, but the differential diagnosis can be narrowed based upon the compartment of presentation and the appearance of the disease on CT scan. When tissue diagnosis is required, selection from among the various biopsy procedures is based upon patient characteristics, the nature of the lesion, and its location. Proper diagnosis of non-tumorous diseases with radiologic findings is very important, because those mortality risk...
can be high with delayed diagnosis. This exhibit is to review and illustrate imaging manifestations of non-tumorous diseases, according to common pathologic entities. 

CONTENTS ORGANIZATION: To review the diagnostic entities to be considered and typical diagnostic approaches used in patients who present with mediastinal masses or widening. To review basic radiographic features associated with mediastinal lesions (mediastinal compartments, common imaging findings). 

SUMMARY: The most common non-tumorous lesions in this region include cysts and lymphadenopathies. The histologically most prevalent patterns of mediastinal lymphadenopathies are those accompanied by increased histiocytes and Castleman’s disease. Fibrosing mediastinitis is a non-specific reaction pattern of the mediastinum and can be associated with many processes; therefore, when establishing the diagnosis of sclerosing mediastinitis, several differential diagnoses have to be excluded. Simple thymic hyperplasia can be accompanied by considerable increase in organ size with severe local symptoms, while follicular thymic hyperplasia is often associated with myasthenia gravis and represents the most common findings in non-thymoma thymectomy specimens. Vascular lesions including aortic aneurysm, aortic dissection, hematoma can be occurred as well as esophageal lesions. For early and correct diagnosis, evaluation, and optimal patient management of mediastinal lesions in infants, children, or adults imaging plays an important role.

SE 04 CH-11
Evaluation and management of acquired esophageal fistula in adults
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Clinical presentation, detailed radiologic findings, and treatment methods of acquired esophageal fistula will be presented with many additional cases.

1. Predisposing conditions for esophageal fistulas
   - Postoperative or post-radiation status
   - Metastasis with invasion or necrosis
   - Pulmonary tuberculosis with lymph node involvement
   - Esophageal foreign body ingestion
   - Balloon procedure due to esophageal stricture
   - Aortic or esophageal stent graft infection
   - Esophagitis with perforation

2. Various types of esophageal fistulas
   - Tracheo-esophageal fistula
   - Broncho-esophageal fistula
   - Esophago-nodal fistula
   - Gastro-bronchial fistula after esophagectomy
   - Aorto-esophageal fistula
   - Perigraft-esophageal fistula
   - Esophago-pericardial fistula

A Dangerous Path: Various Types of Esophageal Fistulas

SE 04 CH-12
Come see the diverse non-neoplastic conditions in the mediastinum
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LEARNING OBJECTIVES:
To know clinical and imaging characteristics of mediastinal non-neoplastic conditions.
To learn the imaging findings of rare mediastinal non-neoplastic conditions with various cases.
To facilitates the accurate and prompt diagnosis of mediastinal non-neoplastic diseases.

1. Acute mediastinitis
   Perforation or rupture of esophagus
   Descending necrotizing mediastinitis
   Direct extension by adjacent infections
   Fibrosing mediastinitis
Perforation or rupture of airways
Post-surgical complication
2. Mesenchymal lesion
Thymolipoma
Hemangioma
Lymphangioma
3. Vascular lesion
Dilatation of mediastinal veins, pulmonary artery, and bronchial artery
Vascular injury
4. LN disease
Sarcoidosis
Tuberculosis
Castleman’s disease
5. Cystic lesion
Bronchogenic cyst
Thymic cyst
Pericardial cyst
Forogut duplication cyst
Thoracic duct cyst
Mediastinal pancreatic pseudocyst
6. Others
Intrathoracic goiter
Diverticulum
Thymic hyperplasia
Mediastinal lipomatosis
Extrademary hematopoiesis

SE 04 CH-13
A rare presentation of biopsied proven case of lymphocytic interstitial pneumonia
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Idiopathic lymphocytic interstitial pneumonia (LIP) is a rare form of benign interstitial lung disease or pulmonary lymphoproliferative disorders. It is characterized by infiltration of the interstitium and alveolar spaces of the lung by lymphocytes, plasma cells and other lymphoreticular elements. It is usually associated with other systemic diseases such as connective tissue disease or infections but idiopathic cases are being reported. LIP occurs commonly in Sjogren’s syndrome, SLE, patient with seropositive for HIV and Epstein-Barr virus. HRCT in patients with LIP may reveal ground glass opacities, centrilobular or subpleural nodules and randomly distributed thin-walled cysts. Immunohistochemistry reveals diffuse interstitial infiltrates composed of lymphocytes, plasma cells and histiocytes, which expand and widen the interlobular and alveolar septum. In this case report, we highlighted a rare biopsied proven case of LIP in an immunocompetent adult lady based on clinical and radiological findings and confirmed with lung biopsy and histological examination. She was now stable under steroids treatment. Lymphocytic interstitial pneumonia needs to be suspected as one of the causes of interstitial lung disease for better treatment response and in order to avoid disease progression to lung fibrosis, overwhelming infections or conversion to lymphoma.

SE 04 CH-14
X-ray examination results for active tuberculosis using additional vitamin “D” with standard treatment
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BACKGROUND: From the 37 countries of the World Health Organizations Pacific Ocean Western Region, Mongolia is one of the 7 countries with a high outbreak and death rate of tuberculosis (TB). There are few researches concerning D-vitamin treatment in TB patients so by using X-ray changes in PA position we researched the correlation of D vitamin additional treatment in positive smear test active pulmonary TB patients.

AIMS: Comparing X-ray visual symptoms on standard verses standard plus high dosage of vitamin D treatment for active pulmonary tuberculosis infection.

MATERIALS AND METHODS: A retrospective investigation study method was used for the 100 occurrences during the year 2012-2014 at National Center for Communicable Disease. The materials were selected randomly from the archive but with the criteria of positive smear test of tuberculosis (200 chest-X-ray) and processed the data with SPSS-20 statistical program.

RESULTS: In all 100 occurrences 64% was male, 36% was female and regarding age half of the participants were teenagers, 1/3 were 21-29 (37%), 30-39 (19%). The average life expectancy was 36.4 ± 14 (SD). The mean of BMI of the participants were 19.7 ± 5, 36% were underweight and 60% (18.6-24.9) were normal. The types of TB infection were consolidation 37%, consolidation and cavity type 48%, cavity type 6%, dissemination 4%, and pleuritis occurred 16% in total.
patients. In all 100 occurrences bilateral lung infection were 65%, unilateral lung infection were 35% and in both group lymphadenopathy occurred in 49% of total patients. The X-ray changes in before and after treatment were evaluated by dividing the field of each lung and counting the changes as high effective (< 4), mid effective (2-3), low effective (1), no change (0), not very effective (< 0). The results were the experimental group had high effective 4%, medium effective 40%, low effective 42% and it is 30% higher than the before treatment X-ray changes, 10% higher than the control group (p = 0.003). But the pleuritis X-ray changes in the experimental group had 33% decrease compared to the before treatment X-ray changes (0.0001) and 10% lower than the control group. In both groups the mean of complication occurrence had 20-25% decrease compared to the before treatment (p = 0.0001).

CONCLUSION: D vitamin may have improved the TB treatment because using D vitamin as additional treatment for active pulmonary TB has shown positive dynamic results in the X-ray exam.

SE 04 CH-15
Defining location of coronary artery stenosis by studying with coronary CT angiography
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PURPOSE: To define the location of coronary artery stenosis of Mongolian people by studying with coronary computed tomography (CT) angiography.

MATERIALS AND METHODS: We made this research based on the materials of totally 101 analyzed people, who were involved in the coronary artery test of the heart with contrast dye with assistance of tomography (64 MD-CT) in “Philips Ingenuity” computer with 64 cuts in CT of the state III and Central Hospital of Mongolia from November of 2015 to February of 2017. Coronary artery stenosis has been detected in 33 people from 101 people involved in the examination.

RESULTS: When considering coronary artery stenosis of 33 people by locations, left anterior descending coronary artery stenosis was detected 10 (30.3% ± 7.9), right coronary artery stenosis was 16 (48.5% ± 8.7) and left circumflex coronary artery stenosis was 7 (21.2% ± 7.1) both solely and combined. Cases of right coronary artery stenosis prevailed from coronary artery stenosis as covering 48.5% are showing statistical fact probability (p < 0.05). Case of left anterior descending coronary artery stenosis was detected from totally 10 cases 1 (10.0% ± 10.0) in the 1st segment, 3 (30.0% ± 15.3) in the 2nd segment and 6 (60.0% ± 16.3) in the 3rd segment. It shows that left anterior descending coronary artery stenosis cases are found predominantly in the 3rd segment (p < 0.01). From 16 cases of right coronary artery stenosis, it was found 3 (18.75% ± 10.1) in the 1st segment, 4 (25.0% ± 11.2) in the 2nd segment and 9 (56.25% ± 12.8) in the 3rd segment. It shows that right coronary artery stenosis cases are found predominantly in the 3rd segment (p < 0.05). From 7 cases of left circumflex coronary artery stenosis, it was found 2 (28.57% ± 18.44) in the 1st segment and 5 (71.43% ± 18.44) in the 2nd segment. Therefore left circumflex coronary artery stenosis has statistical fact probability (p < 0.05), because these cases were prevailed in the 2nd segment. It has been combined with 2 of LAD + 2 of RCA, 2 of LAD + 3 of RCA, 1-3 of LAD + 2-3 of RCA, 2-3 of RCA + 1-2 of LCX.

CONCLUSION: 1. It is defined that right coronary artery stenosis was prevailed in 48.5% as solely and combined from all coronary artery stenosis cases. 2. Right coronary artery and left anterior descending coronary artery stenosis cases were prevailed in 60% in the 3rd segment and left circumflex coronary artery stenosis cases were prevailed in 71.43% in the 2nd segment.

SE 04 CH-16
Clinical and radiologic manifestations of combined pulmonary fibrosis and emphysema (CPFE)
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BACKGROUND: Combined pulmonary fibrosis and emphysema (CPFE) is a clinical syndrome characterized by the coexistence of upper lobe emphysema and lower lobe fibrosis. Patients with this syndrome may have severe dyspnea and impaired gas exchange with preserved lung volumes. CPFE shows different natural history and prognosis than IPF or emphysema alone. Correct and early recognition of this syndrome and early diagnosis of its complications are important for providing the patients with the best treatment. In this educational exhibition, we are going to review and describe various clinical and radiologic manifestation of CPFE.

PURPOSE:
1. To review various important clinical and radiologic manifestations of combined pulmonary fibrosis and emphysema (CPFE)
2. To improve the awareness of this syndrome and help effective therapeutic strategies in clinical practice

SUMMARY OF CONTENT:
1. Definition: diagnostic criteria and exclusion criteria
2. Etiology and prevalence
1) Risk factors
   - Cigarette smoking, male sex, occupational exposures, others

3. Pathogenesis
4. Clinical characteristics
   1) Symptoms
   2) Pulmonary function test findings
      - Preserved lung volume, marked reduction in diffusing capacity for carbon monoxide (DLco)

5. Radiologic manifestations on CT
   1) Emphysema
      - Centrilobular emphysema, paraseptal emphysema, bullae
   2) Fibrosis
      - Honeycombing, reticulation, traction bronchiectasis
      - UIP pattern, NSIP pattern, other patterns of fibrosis
   3) Thick-walled cystic lesions (TWCLs): unique feature of CPFE
   4) Ground glass opacity (GGO)

6. Complications
   1) Pulmonary hypertension
   2) Lung cancer
   3) Acute lung injury
7. Prognosis and mortality

SE 04 CH-17
Imaging spectrum of allergic lung disease: hypersensitivity reactions on the lung parenchyma
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BACKGROUND: Allergic lung diseases include various disease entities with overlapping radiologic manifestations and a wide range of clinical presentations. Integration of laboratory, imaging, and clinical findings is essential in making the correct diagnosis of this complex group of disorders. In this educational exhibition, we are going to review and describe various imaging findings of allergic lung disease and correlate them with clinical information.

PURPOSE:
1. To describe the imaging findings of allergic lung disease and correlate them with clinical information
2. To discuss features that are helpful in differential diagnosis of allergic lung diseases
3. To discuss lung involvement of other uncommon systemic allergic diseases

SUMMARY OF CONTENT:
1. Types and pathogenesis of hypersensitivity reactions
2. Hypersensitivity pneumonitis
3. Eosinophilic lung diseases
   1) Idiopathic eosinophilic lung diseases
   2) Eosinophilic lung diseases with known causes
4. Asthma
5. Pulmonary manifestations of other allergic diseases

SE 04 CH-18
CT-guided localization of pulmonary nodules for thoracoscopic resection using barium, Lipiodol, and hook-wire: various post-procedural findings
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The purpose of this exhibit is to present possible post-procedural findings that may or may not affect the outcome of procedures, based on our experience using different materials, including barium, Lipiodol, and hook-wire in CT-guided localization of pulmonary nodules.

TABLE OF CONTENTS/OUTLINE:
1. Different types of marking materials
   - Barium
   - Lipiodol
   - Hook-wire
   - Others
2. Common post-procedural CT findings
   - Pneumothorax
   - Parenchymal hemorrhage
3. Possible post-procedural CT findings among different materials
   - Leakage into the pleural cavity (barium, Lipiodol)
   - Aspiration to the bronchus (Lipiodol)
   - Deeper insertion of the hook-wire to penetrate pulmonary vessel
4. Intraoperative findings
   - Radiopaque spot on fluoroscopy
   - Wire tagging
   - Marking at puncture site on pleural surface

1. Pneumothorax
2. Parenchymal hemorrhage
Pulmonary tuberculosis in the immunocompromised hosts: radiologic and clinical findings

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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 immunocompromised hosts
   1) Primary and recurrent (post-primary) infection
   2) Traditional and new concept of radiologic finding of PTB
   3) PTB and TNF-α antagonist
2. Clinical and radiologic findings of PTB in the immunocompromised hosts
   1) PTB in HIV infection
   2) TB-Associated Immune Reconstitution Inflammatory Syndrome (TB-IRIS)
   3) PTB in Diabetes Mellitus
   4) PTB in Chronic Interstitial Pneumonia
   5) PTB in Systemic lupus Erythematosus
   6) PTB in Elderly
   7) PTB in Solid Organ Transplantation
   8) PTB in Patients with Cancer
   9) 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.
SE 04 CH-20  
Imaging evaluation of cystic mediastinal masses: correlation with clinic-pathologic findings
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Cystic masses of the mediastinum have a wide spectrum of disease. We evaluated clinically or pathologically-proven various cystic mediastinal masses, including congenital mediastinal cystic masses (i.e., bronchogenic cyst [n = 28], enteric cyst [n = 2], pericardial cyst [n = 4], thymic cyst [n = 37], meningocele [n = 2]), cystic mediastinal neoplasm (i.e., mature cystic teratoma [n = 29], lymphangiomma [n = 3], germ cell tumor [n = 3], infectious or post-inflammatory cystic masses [n = 5], pancreatic pseudocyst [n = 2]), cystic degeneration of tumors and lymphatic tissues (i.e., thymoma [n = 1], Hodgkin disease [n = 1], germ cell tumor [n = 1], mediastinal carcinomas [n = 1], metastases [n = 1], neurogenic tumors [n = 1]).

In this exhibit, we would like to demonstrate protean radiologic findings of various cystic masses in the mediastinum with clinic-pathologic correlations, also to help differentiating mediastinal cystic masses by radiologic studies.

SE 04 CH-21  
Cases of tumor involving both mediastinum and lung: what is your expected origin?
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PURPOSE: In daily practice of chest radiology, radiologists encounter various cases of tumor involving both mediastinum and lung parenchyma, and often undergo difficulty determining the origin of tumor. We retrospectively collected 10 cases of tumor and the determinants of 15 radiologists’ decisions to inquire about the origin of tumor. There have been certain agreeable findings to the expected origin. Through the review of published articles, we re-estimated the findings that may be the factors providing appropriate diagnostic approach to the origin of tumor involving mediastinum and lung.

CONTENTS ORGANIZATION:
1. The careers of 15 radiologists
2. Case 1~10
   1) Case information and Chest CT images
   2) Case review
      - Pathology
      - Origin (lung vs. mediastinum)
      - Results of inquiry
      - Helpful findings for the correct origin
   3) Related published articles
3. Factors to be considered in determining the origin of tumor involving mediastinum and lung

SUMMARY: Findings helped to make the correct origins were open bronchus sign, involvement of middle mediastinum, and mediolateral displacement of mediastinum. On the other hand, findings such as epicenter of mass, irregular margin, angle of the mass with mediastinal contour, and pleural metastasis were not contributable.

Understanding the CT findings of tumor mass involving mediastinum and lung may be helpful to diagnosis.

SE 04 CH-22  
Percutaneous cryoablation of lung tumors: procedural features and follow-up CT appearance
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Percutaneous image-guided pulmonary ablation is a minimally invasive treatment, especially for patients with medically inoperable condition. RF ablation has been used with increasing frequency for lung tumors. Cryoablation has several advantages, including good visualization under computed tomography (CT), its less destructive nature to collagenous architecture and its analgesic character. Although the experience is limited, cryoablation of lung tumors has been reported to be safe and feasible. CT is the most widely used imaging modality for post ablation assessment. Follow-up CT imaging shows the ablated area can evolve in several different patterns. An understanding of the evolution of ablated tumors on CT is important for differentiation of normal post cryoablation change from incomplete tumor necrosis and local recurrence. In this presentation, we present our experience with percutaneous cryoablation of lung tumors and review the literature.
Paragonimiasis is endemic in certain areas of East and Southeast Asia. Ingested metacercaria penetrates the small intestine and enters the abdominal cavity. After 3-8 weeks, the larva penetrates through the pleura and together with its non-specific clinical symptoms it can be difficult to make diagnosis radiologically.

CONTENTS: We analyzed total 20 patients who had been diagnosed with PW. The results same as follow:
- Hydrothorax: 9 patients including 2 bilaterality.
- Hydropneumothorax: 2 patients
- Consolidation: 6 patients
- Consolidation with air bubble: 3 patients
- Nodule: 6 patients
- Linear or tubular densities: 5 patients
- Mass: 2 patients
- Cavitary nodule: 1 patient

TEACHING POINTS:
1. Pathophysiology of paragonimiasis
2. Radiologic findings of paragonimiasis
3. Differential diagnoses of paragonimiasis

Predictors of conversion to thoracotomy during video-assisted thoracoscopic lobectomy in patients with lung cancer: additional predictive value of FDG PET/CT to chest CT

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PURPOSE: To evaluate the added clinical value of ¹⁸F-fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET/CT) scans to chest CT imaging in predicting the conversion to thoracotomy during video-assisted thoracoscopic surgery (VATS) lobectomy in patients with lung cancer.

MATERIALS AND METHODS: We included 235 patients who underwent planned VATS lobectomy for primary lung cancer between 2011 and 2015. CT images were interpreted in terms of the presence and the attenuation of peribronchial lymph nodes (PLN) and peribronchial cuffs of soft tissue (PCS), pleural calcification, and parenchymal calcified nodule. On FDG PET/CT images, anthracofibrotic lymph node was considered present when high FDG uptake (SUVmax > 3.5) was observed on PET/CT images corresponded to PLN or PCS on chest CT.

RESULTS: Among the 235 patients undergoing attempted VATS lobectomy, 55 (23.4%) underwent conversion to thoracotomy. Multivariate logistic regression analysis revealed that the attenuation of PLN or PCS on chest CT (OR, 2.57; 95% CI, 1.328 to 4.380, 0.005) was only independent predictor of conversion. The ROC curve showed that combined FDG PET/CT and chest CT reading (areas under curve [AUC], 0.847 [95% CI, 0.795-0.891]) was significantly better than that of chest CT scans alone (AUC, 0.655 [95% CI, 0.50-0.751]) in predicting conversion (p = 0.024).

CONCLUSION: The addition of FDG PET/CT scanning to chest CT imaging provides better performance for predicting conversion to thoracotomy during VATS lobectomy in lung cancer patients. Therefore, in lung cancer patients undergoing surgical resection, FDG PET/CT can provide additional reliable information in selecting the appropriate surgical approach for a lobectomy.

Evaluation of pneumonia findings on the chest X-ray

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PURPOSE: To evaluate radiographic signs of pneumonia.

MATERIALS AND METHODS: This single institute (which is Department of Radiology of Reference center on Diagnostic Imaging named after R. Purev State laureate, People’s physician and Honorary professor of the State III and Central Hospital) based retrospective study enrolled 774 patients has diagnosed pneumonia between January 2012 to January 2015. We evaluated chest AP, PA and lateral films and has done roentgenoscopy used digital radiography. The research designed to collect data on SPSS 23 analysis software.
**RESULTS:** Age ranged from 18 to 87 and 154 (19.8% ± 1.4), 126 (16.2% ± 1.3), 129 (16.6% ± 1.3), 133 (17.1% ± 1.4), 102 (13.1% ± 1.2), 94 (12.1% ± 1.2) and 36 (4.6% ± 0.8) patients were included in 10-99 age decades respectively. A total of 774 patients, 378 (48.8% ± 1.8) were male and 396 (51.2% ± 1.8) were female and the male to female ratio is 1.05:1. The major clinical features of pneumonia were cough (699 (90.3% ± 1.1)), fever-597 (77.1% ± 1.5), chest pain-456 (58.9% ± 1.8), dyspnea-504 (65.4% ± 1.7) and phlegm-520 (67.2% ± 1.7). The most common sign was cough and there has a statistical significance (p < 0.001). In radiographic findings, increased lung markings noted in 300 (38.8%) patients, out of 558 patients has detected consolidation 158 (28.3%) cases occurred in RLL mostly, from 28 patients has focal changes 23 (82.1%) cases appeared in both lungs, there out 178 patients has revealed pleural effusion, 24 (13.5%) cases located in RLL and from 25 cavitation 7 cases 28,0% were positioned in RLL and both lungs dominantly. Pneumonia incidences from 2012 until 2015 occurred 278 (35.9% ± 1.7), 231 (29.9% ± 1.7) and 265 (34.2% ± 1.7) correspondingly, shows respiratory disease first placed in a non-communicable disease in Mongolia but the number of in-patient admissions decreased a little in the State 3rd Central Hospital.

**CONCLUSION:** 1. Age ranged from 18 to 87 and the male to female ratio was 1.05:1. 2. Predominant clinical manifestations were cough (90.3%), fever (77.1%), phlegm (67.2%), dyspnea (65.4%) and chest pain (58.9%). 3. The most popular radiographic findings were increased lung markings, consolidation and focal changes during the pneumonia.

**SE 04 CH-26**
**Similar but not the Same: Differentiating Pulmonary Mucormycosis from Aspergillosis**
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**PURPOSE:** To illustrate CT imaging features of pulmonary mucormycosis and invasive pulmonary aspergillosis (IPA).

**TABLE OF CONTENTS:**
1. Background
   Chest 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 invasive pulmonary aspergillosis and pulmonary mucormycosis
   1) Angioinvasive form
      - Macroanodeule (≥ 1 cm in diameter)
      - Mass-shaped consolidation
   2) Airway-invasive form
      - Clusters of centrilobular nodules (< 1 cm in diameter)
      - Peribronchial consolidation
      - Ground-glass opacity
      - Smooth bronchial wall thickening
   3) Necrotizing bronchial wall thickening
      - Air-crescent sign
      - Cavitory lesion with consolidation
      - Internal low attenuation within consolidation
      - Reverse halo sign (Typical reverse halo sign, Bird’s nest sign)
   4) Solitary lesion
   5) Air bronchogram

**CLINICAL RELEVANCE/APPLICATION:** No available laboratory markers and low culture sensitivity of pulmonary mucormycosis & insufficient sensitivity and specificity of galactomannan assay to diagnosis invasive pulmonary aspergillosis. The reverse halo sign is a more frequent feature of mucormycosis than of IPA; conversely, the airway-invasive form is a less common feature of mucormycosis 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.
PURPOSE: To determine clinical significance and predictors of acute and delayed pneumothorax after CT-guided transthoracic lung biopsy.

MATERIALS AND METHODS: Medical and imaging records of 536 patients who underwent CT-guided transthoracic lung biopsy between March 2010 to September, 2015 were reviewed. The incidence and risk factors of overall pneumothorax, early pneumothorax (visualized on CT scan at the time of biopsy), and delayed pneumothorax (discovered on the follow-up chest X-ray) were evaluated by using variables such as age, gender, lesion size, type, depth from pleural surface, lobar location, presence of emphysema, number of pleural puncture, the needle insertion angle, and needle indwelling time. The rate of chest tube insertion between early and delayed pneumothorax was compared.

RESULTS: Overall pneumothorax developed in 161 patients (30.1%). Early pneumothorax developed in 135 patients (25.2%) and delayed pneumothorax developed in 26 patients (4.9%). The presence of
emphysema, lesion depth, lesion size, number of pleural puncture, and lower lobar location were risk factors of early pneumothorax (OR = 2.07, 1.30, 0.82, and 3.10, respectively). Among overall risk factors, lesion size and number of pleural puncture were significantly related with development of delayed pneumothorax (OR = 0.66, and 8.75, respectively). The incidence of chest tube insertion was higher in delayed pneumothorax than early pneumothorax (p < 0.05).

**CONCLUSION:** In patients with small lesion and multiple pleural puncture during CT-guided transthoracic lung biopsy, follow-up chest X-ray is required to monitor development of delayed pneumothorax.

**SE 04 CH-28**

**Advantages of dynamic imaging for characterization of suspicious lung masses on contrast enhanced multi detector CT along with its histopathological correlation**

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**PURPOSE:** To assess the utility of dynamic imaging viz. wash-in and wash-out characteristics via Multi detector CECT in differentiating benign and malignant pulmonary masses.

**MATERIALS AND METHODS:** 73 patients who were suspected to have malignant pulmonary mass on the basis of clinical symptoms and chest radiograph were included in the study. All the patients underwent MDCT scanning and three series of images were obtained for each patient- non-contrast, early enhanced and 15 minutes delayed enhanced scans. CT findings were assessed in terms of wash-in, absolute and relative percentage washout of contrast. Biopsy of the mass was done and sent for histopathological evaluation. Sensitivity, specificity and area under curve for diagnosing malignancy in the lung masses were calculated by considering both the wash-in and washout characteristics at dynamic CT and plotting the Receiver operating curve after the final diagnosis which was obtained by histopathological evaluation.

**RESULTS:** Threshold net enhancement (wash-in) value of > 22.5 HU had sensitivity, specificity and diagnostic accuracy of 88.5% and 57.1% and 82% respectively in predicting malignancy. Threshold relative percentage wash-out of < 16.235% had 98.1%, 85.7% and 94% sensitivity, specificity and diagnostic accuracy respectively and threshold absolute percentage washout of < 42.72% had 98.1%, 95.2% and 95% sensitivity, specificity and diagnostic accuracy respectively in predicting malignancy.

**CONCLUSION:** Threshold net enhancement (wash-in), absolute and relative washout percentages can be used to predict malignancy with very high diagnostic yield and possibly obviate the need of invasive procedures for the diagnosis of bronchogenic carcinoma.

**SE 04 CH-29**

**Using a simple scoring system to quantify multi detector CT characteristics and demographic parameters to get high diagnostic high diagnostic yield in patients of suspected bronchogenic carcinoma**

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**PURPOSE:** Lung cancer is the leading cause amongst the cancer death in the world. Detection of malignancy at an early stage and with precision is the utmost objective of Radiological evaluation. The final diagnosis of lung cancer is histopathological evaluation of the mass. The authors hereby have tried to convert the multidetector CT (MDCT) characteristics and patient demographics into quantitative data to formulate a scoring system that can predict lung malignancy as close to histopathology as possible.

**MATERIALS AND METHODS:** After obtaining ethical clearance 104 cases of suspected Lung cancer by history, clinical and radiographic evaluation were enrolled in the study. These patients were underwent CT thorax (noncontrast and contrast) on 384 slice Siemens somatom force. After undergoing the radiological evaluation biopsy of the mass was done either by CT guided or bronchoscopy guided. Radiological and histopathological findings were correlated. Patients age > 50, lymphadenopathy, tumor volume > 50 cc, enhancement > 15 HU after contrast injection were given a score of 15 each. History of smoking, bronchus cut off, spiculated/lobulated margins, mediastinal/pleural involvement and angiogram sign positive were given a score of 20 each. So a maximum score of 160 can be achieved by history and MDCT evaluation.

**RESULTS:** Sensitivity, Specificity, PPV, NPV and diagnostic accuracy of MDCT by using conventional parameters against histopathology was 97.5%, 85%, 96.29%, 89.47%, and 95.0%. The sensitivity and specificity calculated through ROC for predicting malignancy were found to be 98.8% and 90.0% for a cut off score of > 97.5 out of maximum of 160.

**CONCLUSION:** MDCT serves as an excellent tool for early diagnosis of Lung cancer and it is the utmost important tool for cases where biopsy or FNAC is not possible. By creating a quantitative criteria to diagnose lung malignancy the subjective nature of MDCT
diagnosis can be converted into an objective based evaluation.

SE 04 CH-30
Rare primary tumor of air way and lung parenchyma - imaging feature and clue to diagnosis
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PURPOSE: To illustrate computed tomographic (CT) features of rare tumors of lung parenchyma and air way of thorax. To discuss the clues to radiologic differential diagnosis.
TABLE OF CONTENTS:
1. Lung parenchyma
   1) Benign tumor
      (1) Papillary adenoma
      (2) Inflammatory myofibroblastic tumor
      (3) Paraganglioma
      (4) Meningioma
      (5) Myxoma
      (6) MMPH (Multifocal micronodular pneumocyte hyperplasia)
   2) Malignant tumor
      (1) Sarcoma
         - Synovial sarcoma
         - Pulmonary intimal sarcoma
         - Fibromyxoid sarcoma
         - Kaposi sarcoma
         - Ewing sarcoma
      (2) Others
         - Epithelioid hemangioendothelioma
         - Primary malignant melanoma in neurofibromatosis type1
         - Lymphoepithelioma-like carcinoma
         - Carcinosarcoma
         - Sarcomatoid carcinoma

2. Air way
   1. Benign tumor
      (1) Endobronchial lipoma
      (2) Hamartoma
      (3) Endobronchial papilloma/papillomatosis
      (4) Schwannoma
   2. Malignant tumor
      (1) Adenoid cystic carcinoma
      (2) Mucoepidermoid carcinoma
      (3) Granular cell tumor
   3. Summary: clues to the differential diagnosis on CT imaging.
CONCLUSION/SUMMARY:
Various uncommon benign and malignant tumors of the lung are usually difficult to distinguish radiologically, but some tumors may show characteristic CT findings.

To narrow the range of differential diagnosis and to increase the chance of an accurate radiological diagnosis of such lesions, it is essential for radiologists to be acquainted themselves with radiologic findings of various, uncommon benign and malignant tumors of the lung.

SE 04 CH-31
CT findings of esophageal perforation: review of 10 cases
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BACKGROUND: Esophageal perforation is a rare medical emergency condition that can be life-threatening requiring early management. Hence, early clinical decision and imaging is vital to perform prompt management ultimately reducing patient’s mortality and morbidity. CT is a non-invasive investigation method that can rapidly identify the perforation, extent and its complications. Although many cases are due to endoscopic instrument induced iatrogenic perforation, other causes such as foreign body, tumor, or spontaneous perforation can be further evaluated via CT imaging. Understanding various causes and CT imaging features of esophageal perforation is important for radiologist to make fast diagnosis of this life threatening condition. This study retrospectively reviewed ten cases of CT scans which were confirmed to be esophageal perforation by esophageal-gastro-duodenoscopy.

CONTENTS:
1. Etiology of esophageal perforation: Iatrogenic / Foreign body ingestion / Spontaneous / Tumorous condition.
2. CT Patterns of esophageal perforation: Pneumomediastinum / Perforation to the pleural space / Perforation to the lung parenchyma / Esophagobronchial fistula / Abscess formation.

TEACHING POINTS: To review CT findings of esophageal perforations due to various causes and its complications.
SE 04 CH-32

ATLAS of lung nodules proposed by lung-RADS

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BACKGROUND: Quantitative and qualitative growth of imaging surveillance is now approaching new challenges not only for radiologists but also for clinicians. In recent years, we are face to the quantitative increase in CT scans, due to the preparation of national cancer screening projects for lung cancer and screening tests at smoking cessation camps.

PURPOSE: To present the form of ATLAS for lung cancer screening, according to the lung RADS categories.

MATERIALS AND METHODS: The subjects of lung cancer screening and various lesions that can be seen in CT scan were described along with imaging findings, and the interpretation of Lung-RADS original ACR and lung cancer imaging study group (KISLC) and case examples by category were posted in ATLAS format.

RESULTS: Typical examples of pulmonary nodules shown in chest CT for lung cancer screening. It is possible to compare the findings of the low-dose chest CT with previous findings or share and manage the data with other medical institutions, transmit the imaging findings, prepare the readings in standardized form.

CONCLUSION: We suggest that it can contribute to the improvement of workflow by reducing false positives and avoiding unnecessary additional tests including invasive procedures such as biopsy, thus increasing the cost effectiveness of lung cancer screening CT and reducing unnecessary radiation exposure.
Revisit metastasis of air way and lung parenchyma - pattern approach and clue to diagnosis

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PURPOSE: To illustrate computed tomographic (CT) features of variable metastasis of lung parenchyma and air way of thorax depending on histologic types of primary tumors by the pattern approach. To discuss the clues to radiologic differential diagnosis.

TABLE OF CONTENTS:

Benign
Benign metastasizing leiomyomatosis

Malignant
1. Endobronchial metastasis
   - Renal cell carcinoma
   - Breast cancer
   - Colon cancer
   - Hepatocellular carcinoma
   - Malignant melanoma
2. Aerogenous metastasis
   - Lung cancer (mucinous adenocarcinoma)
3. Military metastasis
   - Lung cancer (adenocarcinoma)
   - Thyroid cancer
4. Hemorrhagic metastasis
   - Choriocarcinoma
   - Angiosarcoma
   - Renal cell carcinoma
5. Cavitory metastasis
   - Squamous cell carcinoma of head and neck
   - Angiosarcoma
6. Multicentric ground glass nodule (GGN)
   - Malignant melanoma
7. Pulmonary thrombotic microangiopathy
   - Hepatocellular carcinoma
   - Gastric cancer
8. Transvascular metastasis
   - Lymphoma
9. Calcified metastasis
   - Osteosarcoma
   - Chondrosarcoma
10. Nodular metastasis but unusual primary site
    - Epithelioid hemangioendothelioma
    - Paraganglioma

SUMMARY: Various primary tumors metastasize to lung parenchyma and airway, and occasionally they show specific CT findings according to the histological characteristics and location of the primary tumor. Knowing the CT findings according to the types of primary tumors will be helpful in differential diagnosis of radiological findings, therefore it is essential for radiologists to be acquainted themselves with radiologic findings of various metastasis of the lung.

Congenital systemic artery to pulmonary vessel fistulas: CT features

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PURPOSE: Congenital fistulas between the systemic and pulmonary vascular systems are rare conditions, except for those associated with patent ductus arteriosus, congenital heart disease, and pulmonary sequestration. The aim of this study was to describe the CT features of congenital systemic artery to pulmonary vessel fistula in seven patients.

MATERIALS AND METHODS: The study group consisted of seven patients (M:F = 3:4; mean age, 59 years) with congenital systemic artery to pulmonary vascular fistula who were seen during a 10-year period at our institution. No patients had a history of prior surgery or trauma. All patients were imaged with contrast-enhanced chest CT at 1 mm to 5 mm slice thickness. Three patients also underwent angiography for transcatheter embolization.

RESULTS: One patient presented with dyspnea related to multiple fistulas. In other six patients showed no symptoms related to anomalous fistulas. In our patients, the involved systemic arteries were as follows: inferior phrenic artery (n = 3), bronchial artery (n = 2), internal mammary artery (n = 2), coronary artery (n = 1). In one patients with multiple fistulas, both bronchial artery and inferior phrenic artery were seen as separate feeders in upper lobe and lower lobe, respectively. Draining vessels were pulmonary arteries (n = 6) and/or veins (n = 2). In one patient, both pulmonary artery and vein were simultaneously seen as draining vessels. Anomalous vascular connections were manifested as tortuous and tangled vessels with hypertrophied systemic artery on CT and angiography.

CONCLUSION: The CT features of congenital systemic artery to pulmonary vessel fistula includes hypertrophied systemic artery, tortuous and tangled vessels with draining pulmonary vessels. MDCT is useful for detection of congenital fistulas between systemic artery and pulmonary vessel even if patients are asymptomatic.
SE 04 CH-35
Prediction of prognosis for idiopathic pulmonary fibrosis with thin-section CT findings including simple quantitative assessment
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PURPOSE: To retrospectively evaluate whether the thin-section computed tomographic (CT) appearance and automated quantification of abnormal density area in lungs have prognostic value for prediction of disease severity and mortality in patients with idiopathic pulmonary fibrosis (IPF).

MATERIALS AND METHODS: We enrolled 41 patients with a multidisciplinary diagnosis of IPF who were followed clinically for at least two years and were hospitalized due to acute pulmonary symptoms. We retrospectively evaluated the thin-section CT scans obtained within 7 days after hospitalization in 21 survivors (mean age ± standard deviation: 73.8 years ± 8.1) and 20 nonsurvivors (mean age ± standard deviation: 75.9 years ± 6.0). Visual assessment of five radiological abnormalities as follows; extent of ground glass opacities (GGO), consolidation, reticulation, honeycombing and emphysema was performed. Automated quantification of abnormal opacity; sum of increased density extent (thresholds -600 to -100: selected values from our experience) and emphysema extent (thresholds -920 to -1024) was obtained. Chi-square, Fisher’s exact, and Student’s t tests were used for comparing survivors with nonsurvivors.

RESULTS: Significant differences were noted in the automatically quantified extent of abnormal opacity (p < 0.001), visually assessed extent of GGO (p < 0.001), honeycombing (p = 0.009) between the survivor and nonsurvivor groups. There were no significant differences in extent of reticulation, consolidation, and emphysema. Visually assessed GGO extent and automatically quantified abnormal opacity were the most powerful predictors for mortality on ROC curve analysis. Automatic segmentation and quantification of abnormal opacities were well correlated with visually assessed extent of radiologically abnormal areas (p < 0.001).

CONCLUSION: Extensive GGO and honeycombing on thin-section CT were independently predictive of poor prognosis in patients with IPF. Automatic quantification of abnormal opacity also could be used as fatal prognostic indicators in acute pulmonary symptomatic patients with IPF.

SE 04 CH-36
The clinical and imaging overview of the lung cancer patients, diagnosed as breast cancer related with hormone receptor status
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BACKGROUND: Over 10 years, the incidence of lung cancer is dramatically increased, especially adenocarcinoma. Women are more likely than men to be diagnosed with adenocarcinoma and small-cell carcinoma of the lung compared to squamous cell carcinoma, and never smokers diagnosed with lung cancer are almost three times more likely to be female than male.

PURPOSE: To review the clinical and imaging pattern of lung cancer, diagnosed and treated with breast cancer within 10 years. To evaluate the clinical stage and prognosis and treatment response of lung cancer, depending on the hormone receptor of breast cancers.

MATERIALS AND METHODS: Retrospectively reviewed the medical records of breast cancer patients, since 2007. Total 17 patients were included and 19 breast cancers were detected. The age range was between 43 to 78 years old. We reviewed the histopathology, tumor stage, and hormone receptor. One patient had bilateral breast cancers, the histopathology were mucinous carcinoma (left), and invasive ductal carcinoma (right). Two nodules were proved as invasive ductal carcinoma and one is ductal carcinoma in situ.

RESULTS: The histopathology of the breast cancer was invasive ductal carcinoma (14), ductal carcinoma in situ (2) mucinous carcinoma (1), papillary carcinoma (1), invasive lobular carcinoma (1). The pathologic stage was T1 (17), T2 (2). Lymph nodes metastases were shown in only three patients (N1). Distant metastases were not found. In 6/19 breast cancers, ER (-), PR (-) and triple receptor negative tumors were found in three cases. In lung cancers, the histopathology were mostly adenocarcinoma, except two cases. One is adenoid cystic carcinoma and the other is mucoepidermoid carcinoma. The T stage of lung cancer is T1 (14) among them one is adenocarcinoma in situ and T3 (1), T4 (2). No evidence of lymph nodes metastases, and 2/17 cases showed distant metastases. The primary tumor dimension is ranging from 8 mm to 29 mm. The interval between two tumors were ranging from 11 days to 14 years since breast cancer diagnosis

CONCLUSION: The hormone receptor and stage of lung cancer is relatively higher lung cancer stage and lymph nodes metastases were more common. The hormone receptor analysis in breast cancer and
immunohistochemistry of lung cancer might explain lung cancer growth pattern and predict treatment response and prognosis.

SE 04 CH-37

Case-based review of benign and malignant pathologies of the bony thorax
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PURPOSE: To present a variety of interesting and challenging cases involving the bony thorax on chest CT. To discuss clinical and imaging manifestations of disease entities presented. To highlight key imaging findings that narrow the differential diagnosis.

SUMMARY: It is common to encounter pathologic processes of bony thorax in the course of routine CT of the chest. The incidental discovery of these entities at chest CT may be the first opportunity to provide diagnostic value during patient evaluation. Knowledge of the musculoskeletal pathologic conditions commonly encountered at chest CT will allow the radiologist to provide a confident diagnosis or structured differential diagnosis and guide additional work-up and management decisions. We described variety of interesting and challenging cases involving the bony thorax identified on chest CT.

CONTENTS:
1. Sternum and clavicle
   1) Sternoclavicular joint disease
      - Osteoarthritis
      - Rheumatoid arthritis
      - Synovitis acne pustulosis hyperostosis osteitis syndrome (SAPHO)
   2) Osteomyelitis (Tuberculosis)
   3) Chondrosarcoma
   4) Metastasis
2. Scapula
   1) Glenohumeral joint: Osteoarthritis, Rheumatoid arthritis, Infectious arthritis
   2) Elastofibroma
   3) Gorham's disease
3. Rib
   1) Congenital anomalies
      - Cervical rib
      - Fused rib/bifid rib
   2) Neoplasms
      - Fibrous dysplasia
      - Osteochondroma, Enchondroma
      - Aneurysmal bone cyst
      - Desmoid tumor
      - Metastasis
      - Chondrosarcoma
   - Intercostal neurogenic tumor
4. Spine
   1) Incidental findings
      - Ligamentum flavum calcification
      - Dural calcification
   2) Infection
      - Pyogenic osteomyelitis
      - Tuberculous spondylitis
   3) Neoplasms
      - Hemangioma, ependymoma, meningioma, schwannoma
      - Multiple myeloma, lymphoma
      - Metastasis
   4) Miscellaneous
      - Hyperparathyroidism
      - Ankylosing spondylitis
      - Diffuse idiopathic skeletal hyperostosis

SE 04 CH-38

Predictive value of perfusion defect volume using dual-energy CT in acute pulmonary embolism: a retrospective cohort study
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PURPOSE: To investigate dual-energy computed tomography (CT) findings predictive of clinical outcome and determine the incremental risk stratification benefit of dual-energy CT findings compared with the CT ventricular diameter ratio in patients with acute pulmonary embolism.

MATERIALS AND METHODS: We retrospectively evaluated 172 acute pulmonary embolism patients who underwent dual-energy CT. We measured the ventricular diameter ratio and relative perfusion defect volume. The primary endpoints were death within 30 days and pulmonary embolism-related death.

RESULTS: The ventricular diameter ratio (≥ 1) was associated with an increased risk of death within 30 days (Hazard ratio: 3.822, p = 0.002) and pulmonary embolism-related death (Hazard ratio: 18.051, p < 0.001). Relative perfusion defect volume was also associated with an increased risk of death within 30 days from any cause (Hazard ratio: 1.044, p = 0.014) and pulmonary embolism-related death (Hazard ratio: 1.052, p = 0.005). However, the addition of relative perfusion defect volume to the ventricular diameter ratio had no added benefit for the prediction of death within 30 days from any cause (Concordance statistics: 0.833 vs. 0.815, p = 0.187) or pulmonary embolism-related
death (Concordance statistics: 0.873 vs. 0.874, p = 0.866).

CONCLUSION: The lung perfusion defect volume had no significant added benefit for the prediction of death within 30 days or pulmonary embolism-related death in comparison to ventricular diameter ratio alone.

SE 04 CH-39
Toxic lung injury from A to Z: review of clinical, radiologic and physiologic effects of various toxic agents
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kyunghyundo@gmail.com

PURPOSE:
1. To describe the various toxic agents and their pathophysiology causing toxic lung injury.
2. To describe the most common clinical manifestation of toxic lung injury and their important complication of each causative toxic agents.
3. To present the broad spectrum of imaging patterns from toxic lung injury at the different time points.

CONTENT OF ORGANIZATION:
1. Mechanisms of toxicity
   1) Variable pathophysiology of toxic lung injury
   2) General categories of representative toxicants and type of injury
2. Inhalation injury
   1) Simple asphyxiants: methane, carbon dioxide, helium, neon and xenon
   2) Respiratory irritants, water soluble: ammonia, chlorine, cocaine, and humidifier disinfectant
   3) Respiratory irritants, water insoluble: oxides of nitrogen, phosgene (pesticides, fluorocarbone), metal (cadmium, mercury, nickel)
3. Aspiration and ingestion injury
   1) Gastric acid aspiration
   2) Near drowning
   3) Lipoid pneumonia
   4) Paraquat
4. Hypersensitive reaction
5. Summary

CONCLUSION/SUMMARY: Various toxic agents can cause toxic lung injury via inhalation, aspiration or ingestion which covers a wide spectrum of diseases. With the relatively low diagnostic accuracy of chest radiography, CT can improve the detection of initial abnormalities following exposure and detection of complication. Being familiar with the common clinical manifestation and broad spectrum of imaging findings and their temporal changes of various toxic substances is imperative for prompt diagnosis and appropriate management, resulting in decreased mortality and morbidity rates.

SE 04 CH-40
Impact of the new International Association for the Study of Lung Cancer staging system in non-small cell lung cancer: with comparison to 7th edition
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PURPOSE: To investigate the impact of the proposed 8th edition of International Association for the Study of Lung Cancer (IASLC) tumor, node, metastasis (TNM) system on staging and outcome of non-small cell lung cancer (NSCLC).

MATERIALS AND METHODS: With a total of 418 NSCLC patients with staging according to 7th edition of IASLC TNM staging (TNM-7) were reclassified according to the IASLC proposed 8th edition of TNM staging (TNM-8). The impact of TNM-8 in comparison with TNM-7 was evaluated at three levels: change in substage, staging, and outcome. The outcome measure was to compare the stage-specific overall survival of NSCLC between the two groups of patients.

RESULTS: A total of 134 (32.1%) patients had changed TNM staging, and 65 (15.6%) patients had changed stage groupings in TNM-8 compared to TNM-7. Among 65 patients showing changed stage grouping, 51 (12.2%) showed upstage and 14 (3.3%) demonstrated downstage. The TNM-8 system resulted in better separation of survival curves among stage-specific NSCLC than TNM-7 system, especially in separation of stage IIB versus IIIA (p = 0.018) and stage IIIB versus IVA (p < 0.001).

CONCLUSION: TNM-8 for lung cancer appears to be superior in defining stage-specific survival groups than TNM-7, especially between stage IIB versus stage IIIA and stage IIIB versus stage IVA.
SE 04 CH-41

Easy to go - “chest X-ray interpretation"

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1. Imaging acquisition techniques - PA vs. AP
2. Image quality assessment - position, inspiration, penetration, and FOV
3. Normal anatomy - including lines and stripes
4. Imaging interpretation methods
   1) lesion detection
   2) pattern of the lesions

SE 04 CH-42

Evaluation of non-traumatic acute chest pain with chest CT at the Emergency Department: a pictorial review

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Chest pain is one of the most common and the initial presenting symptoms among non-traumatic patients at the emergency department. We, radiologists, encounter an increasing amount of chest and cardiac CT to exclude life-threatening causes from the vast differential diagnoses of diseases. We retrospectively reviewed chest CT of 476 patients with non-traumatic acute chest pain for recent one year. They were 269 men and 207 women (15-101 years old, mean 52.3 years), who presented with non-traumatic acute chest pain in the emergency department, including acute ischemic symptom (31%), non-specific (29%), cardiomyopathy (7%), aortic dissection or aneurysm (7%), pulmonary thromboembolism (7%), pleural effusion (5%), pericarditis (4%), pneumonia (4%), arrhythmia or heart failure (4%), myocarditis (2%), others (2%).

In this exhibit, we would like to demonstrate educative cases from patients, and to help the radiologist to suggest alternative diagnoses in the diagnostic challenge of acute chest pain.

SE 04 CH-43

Quantitative image quality and histogram-assisted evaluations of an iterative reconstruction algorithm at low-to-ultralow radiation dose levels: a phantom study in chest CT

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ghw68@hanmail.net

PURPOSE: To evaluate the effect of an iterative reconstruction (IR) algorithm in chest CT using quantitative image quality parameters at low-to-ultralow CT radiation dose levels.

MATERIALS AND METHODS: In an adult anthropomorphic phantom, chest CT was performed with 128-section dual-source CT at 70, 80, 100, 120, and 140 kVp, and the reference (3.4 mGy in volume CT Dose Index), 30%-., 60%-., and 90%-reduced radiation dose levels. CT images were reconstructed by using filtered back projection (FBP) algorithms and IR algorithm with strengths 1, 3, and 5. We compared image noise, signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), and histogram-based analysis of subtraction images among FBP and IR algorithms.

RESULTS: Compared with FBP images, IR images with strengths 1, 3, and 5 demonstrated image noise reduction up to 49.1%, SNR increase up to 100.7%, and CNR increase up to 67.3%. Noteworthy image quality degradations on IR images, including 184.9% increase in image noise, 63.0% decrease in SNR, and 51.3% decrease in CNR, were shown between 60% and 90% reduced levels of radiation dose (p < 0.0001). Subtraction histograms between FBP and IR images showed progressively increased dispersion with increased IR strength and increased dose reduction. After standardization, the histograms appeared deviated and ragged between FBP images and IR images with strength 3 or 5, but almost normally-distributed between FBP images and IR images with strength 1.

CONCLUSION: The IR algorithm may be used to save radiation dose without substantial image quality worsening of chest CT in the adult anthropomorphic phantom down to approximately 1.4 mGy in volume CT Dose Index.
PURPOSE: Pneumonia is one of the most common infectious cause of mortality in ICU setup. The objective of this study is to introduce basic techniques of lung ultrasonography, and ultrasound findings in pneumonia in ICU setup and to compare it with X-ray.

MATERIALS AND METHODS: The study was performed for six months duration from August 2016 to January 2017. Total of 224 patients were studied with pneumonia in ICU patients and ultrasound findings were correlated with chest X-ray. A complete chest ultrasound examination were performed with a high frequency linear-array probes of 7 and 12 MHz. The pleural line, A-lines, B lines were studied. The pleural line slides with respiration. The sliding movement seen on ultrasound is the lung moving on respiration. The movement of lung is displayed in M-mode.

RESULTS: In the study of 224 patients, there were 110 women and 114 men. Mean age of patients was 55.6 years. Pneumonia was confirmed in 218 patients. In six patients tuberculous infections was diagnosed clinically, but on ultrasound examination, consolidations of lung parenchyma have not been specific enough, so for statistical analysis these patients were considered as false positive. On ultrasound we found pathological findings presented with B-lines, consolidation of lung parenchyma, pleural effusion, empyema, parenchymal cavitary necrosis and abnormalities of pleural line. Sensitivity of ultrasound was 100% with positive predictive value of 97.32%. Sensitivity of chest X-ray was 68.89% with specificity 83.30%, positive predictive value of 99.33% and negative predictive value of 6.85%.

CONCLUSION: Lung ultrasound is a reliable diagnostic tool for pneumonia in ICU setup. Lung consolidation with air bronchogram is one of the most important ultrasound findings in pneumonia, pleural line abnormalities and interstitial syndrome are common, but nonspecific and are related to both inflammatory reaction and the degree of inflammatory exudate. Our study shows high sensitivity of ultrasound in diagnosing pneumonia in ICU setup superior to chest X-ray.
SE 04 CH-46
CT findings and lesion score change of subclinical pulmonary tuberculosis progressing into active disease according to risk factors: implication for contact investigation
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yshoka@gmail.com

PURPOSE: To evaluate subclinical tuberculosis progressing into active disease without a radiologic evidence of previous tuberculosis in terms of CT findings, change of lesion score according to risk factors for progression.

MATERIALS AND METHODS: A prospective cohort of 309 adult patients with bacteriologically confirmed pulmonary tuberculosis from 2012 to 2014 were retrospectively reviewed for the following inclusion criteria: (a) chest CT scan was obtained at the time of diagnosis; (b) incidental pre-diagnostic CT scan available at least one month apart; (c) absence of symptoms or signs at the time of incidental CT scan. Patients with tuberculous pleurisy or those with a radiological evidence of previous tuberculosis were excluded. Two radiologists evaluated CT scans for parenchymal abnormalities per segment using a scoring system encompassing CT findings of typical and atypical patterns. Risk factors for progression of tuberculosis such as immunocompromised state were assessed. Baseline CT patterns and incidence of progression according to risk factors was analyzed using the χ2 test, while multivariate logistic regression analysis was done for identifying predictor for a rapid progression (score increase higher than 0.5 per month).

RESULTS: A total of 66 patients (mean age, 52.8 years old; M:F = 45:21; median interval between CT scans, 7 months) were included. The most prevalent CT finding of subclinical tuberculosis was a centrilobular micronodule (72.7%) in upper lobes (median lesion score, 1; IQR: 2). The proportion of typical pattern on baseline CT scan was statistically similar regardless of risk factor (91.6% vs. 90.4%, p = 0.71). The incidence of progression was higher in patients with risk factors (91.9%) than in those without (58.6%) (OR 7.06, [95% CI, 1.99-32.21], p = 0.001). Multivariate analysis revealed that the presence of risk factor (OR 4.37, [95% CI, 1.37-13.90], p = 0.013) and atypical CT pattern on diagnostic CT (OR 5.53, [95% CI, 1.60-19.17], p = 0.007) were significantly associated with rapid progression.

CONCLUSION: Subclinical tuberculosis show similar baseline radiologic features regardless of risk factor. But the progression prevalence and progression rates significantly differed depending on a risk factor and CT pattern.

CLINICAL RELEVANCE: A follow-up interval for contact investigation might be adjusted based on the patient's risk factor.

SE 04 CH-47
Diagnostic criteria for detection of thrombus involving pulmonary trunk, right and left pulmonary arteries on plain CT chest images: a retrospective study
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PURPOSE: To define possible diagnostic criteria for the diagnosis of pulmonary thromboembolism on plain CT chest imaging.

MATERIALS AND METHODS: All the proven cases of pulmonary thromboembolism cases were studied which were done from January 2011 to January 2017 in S S Institute of Medical Sciences, Davangere, India. From them, cases with thrombosis involving pulmonary trunk, its right and left branches were included in the study. A total of 39 cases were taken into the study. Thrombosis involving rest of the pulmonary arterial tree was excluded to avoid the complexity. After knowing the exact location of the thrombus on the CT pulmonary angiography (CTPA) images, the same location is retrospectively reviewed on plain images to define the possible diagnostic criteria. The Hounsfield’s unit (HU) value of the thrombus location was compared with that of surrounding normal blood flow areas. The HU values were measured all along the length of the main pulmonary trunk and its main branches using an uniform ROI (Region of interest) of 0.48 sq cm. The HU values at the thrombosed and non thrombosed areas were compared for any significant difference. Also, diameter of the pulmonary trunk is taken as the indirect sign of thrombosis though pulmonary arterial hypertension is not the specific sign for pulmonary thromboembolism.

RESULTS: There was a significant difference minimum of 20 HU was noted between the thrombosed area and the surrounding flowing blood in the pulmonary arteries in about 24 cases of the 39 cases taken into the study. In the remaining cases the difference in HU values was less than 15 HU. There was no significant difference in the HU values when the thrombus is streak, irregular, incomplete and extending along the length of the involved artery. Pulmonary hypertension was seen in 19 cases of the 39 cases.
CONCLUSION: Significant number of cases can be diagnosed on plain CT chest images itself using the HU value difference and pulmonary artery diameter. The pulmonary thromboembolism can be ruled out in all the cases with plain images itself using these criteria. The criteria can be used in cases in which CT contrast is contraindicated like in renal failure cases. The study can open research in future prospects.

SE 04 CH-48
Structured reporting for carcinoma of esophagus - a simplified new approach to improve the quality of reporting
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PURPOSE: To assess the impact of implementing a structured report template on the quality of computed tomography reports for esophageal cancer cases.

MATERIALS AND METHODS: A prospective study with 30 biopsy proven cases of carcinoma of esophagus, who were referred to department of Radio diagnosis, SSIMS & RC, Davangere from January 2016 to January 2017 was carried out. Two separate qualified radiologists have reported each case, one in descriptive format and other in structured report format. TNM staging used for reporting was latest “Seventh Edition of TNM Staging System for Esophageal Cancer (AJCC)”.

structured reporting template

<table>
<thead>
<tr>
<th>Distance of superior tumor margin from carina.</th>
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<tr>
<td>Circumferential tumor location.</td>
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<tr>
<td>Completely encircling lumen.</td>
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<tr>
<td>Partially encircling: to o’clock in clockwise manner</td>
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<tr>
<td>Longitudinal length of tumor.</td>
</tr>
<tr>
<td>Distance of lowest tumor margin from GE junction.</td>
</tr>
<tr>
<td>Arc of contact with thoracic aorta</td>
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<tr>
<td>Triangle of fat</td>
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<tr>
<td>Preserved/infiltrative</td>
</tr>
<tr>
<td>For ≥T3 lesion, maximum extramural depth of tumor invasion.</td>
</tr>
<tr>
<td>For T4b lesion-invasion of adjacent structures, involved structures are.</td>
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<tr>
<td>T4a: resectable (pleura, pericardium, or diaphragm).</td>
</tr>
<tr>
<td>T4b: unresectable (aorta, vertebral body, or trachea).</td>
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<tr>
<td>Mediastinal lymph node spread.</td>
</tr>
<tr>
<td>N1: 1-2 regional LNs</td>
</tr>
<tr>
<td>N2: 3-6 regional LNs</td>
</tr>
<tr>
<td>N3: ≥7 regional LNs</td>
</tr>
<tr>
<td>Metastasis</td>
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<tr>
<td>M1a: cervical LN (in upper esophageal cancer) or celiac LN (in lower esophageal cancer).</td>
</tr>
<tr>
<td>M1b: all other distant metastases.</td>
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</table>

RESULTS: Both old descriptive and structured reports were given to the surgeons for feedback. Structured reports gave better understanding of each case scenario rather than descriptive report.

CONCLUSION: Management of esophageal cancer is increasingly depends on MDCT chest. A lot of evidence
has been accumulated indicating that MDCT chest can provide multiple prognostic findings and imaging features to guide proper management of esophageal cancer patients. Quality reporting is critical for accurate and effective communication of the information among multiple disciplines, for which a systematic structured approach is beneficial. Structured reporting of carcinoma of esophagus in patients with esophageal cancer facilitates surgical planning and leads to a higher satisfaction level of referring surgeons in comparison to full text descriptive reports.

SE 04 CH-49
Reduced lung elasticity in female patients with interstitial lung disease: histogram analysis and comparison with age, sex-matched normal controls
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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.

MATERIALS AND METHODS: 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. The paired segmented CT images were aligned using surface-based affine registration, and landmark-based registration was sequentially performed using bronchial and pulmonary vascular landmarks 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 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 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 = 0.017), as well as percentile values of 3D distance of movement from 10th to 95th percentile (p < 0.05). Standard deviation (SD) and Entropy of 3D distance of movement were also significant lower in patient group (p = 0.017). 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 < 0.05). 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 = 0.271; p = 0.039) with mean 3D distance of movement.

CONCLUSION: Lung elasticity was significantly decreased in absolute value and in heterogeneity at the level of vital capacity in ILD patients.
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