Pictorial Review of Tuberculosis involving the Pleura.

Poster No.: C-0207
Congress: ECR 2011
Type: Educational Exhibit
Authors: S. H. Hwang; Mokpo/KR
Keywords: Thorax, Thoracic wall, CT, Ultrasound, Conventional radiography, Diagnostic procedure, Education, Infection, Fistula, Cavitation
DOI: 10.1594/ecr2011/C-0207

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method ist strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Learning objectives

To illustrate the various imaging features of tuberculosis involving the pleura.

Background

Tuberculosis (TB) is caused by *Mycobacterium tuberculosis*. Pleura is the mesothelial lining of each hemithorax and consisted of visceral and parietal pleurae. Pleural space surrounding the lung is a potential thin space between visceral and pareital pleura. The various manifestations of TB through pleura or pleural space occur depending the disease process.

Imaging findings OR Procedure details

**TB pleural effusion**

TB pleural effusion results from the combination of the increased pleural fluid formation by the hypersensitive reactions for tuberculous protein and the decreased pleural fluid removal by obstruction of lymphatic pores in the parietal pleura. In analysis of TB pleural effusion, pleural fluid is invariably as protein-rich exudate and occasionally demonstrates an elevated level of adenosine deaminase (ADA), a sensitive marker of TB pleural effusion. Ultrasonography (US) can help characterize TB pleural effusion as exudate with complex septated, complex nonseptated, or homogeneously echogenic patterns (Fig. 2). A reasonable management strategy for TB pleural effusion would be to initiate antituberculous chemotherapy and perform a therapeutic thoracentesis in patients with large or symptomatic effusions.

A transient worsening like newly developed subpleural tuberculoma or increase in amount of pleural effusion (Fig. 3 and 4) is defined as paradoxical response of treatment for TB pleural effusion. Paradoxical response during the treatment period for TB pleural effusion can usually resolve with only continuation of antituberculous chemotherapy.

**Pneumothorax with TB**

Pneumothorax secondary to TB often heralds severe pulmonary involvement by the infectious process and the onset of bronchopleural fistula and empyema. Pleural
caseous infiltrates from TB result in pleural necrosis and rupture causing pneumothorax. Computed tomography (CT) can be useful to detect the pneumothorax and evaluate its cause in a patient with extensive pulmonary TB (Fig. 5). Tube drainage is the treatment of choice.

**TB Empyema**

TB empyema is defined as persistent grossly purulent pleural fluid containing numerous tubercle bacilli. Empyema develops commonly in three distinct phases (Fig. 6). In the fibrinopurulent phase, CT typically shows thickened visceral and parietal pleurae separated by fluid, the "split pleura" sign. In the organizing phase, CT reveals a loculated pleural fluid collection with thickened pleural peel and variable degree of calcification with or without proliferation of extrapleural fat (Fig. 7). TB empyema may either decompress through the chest wall (empyema necessitatis) or communicate with bronchial tree (bronchopleural fistula).

**Bronchopleural fistula from TB**

Bronchopleural fistula (BPF) can occur due to an open pathway between bronchus or lung parenchyme and pleura established by TB. The diagnosis is based on an increasing amount of sputum production, air in the pleural space, a changing air-fluid level, and contralateral spread of pneumonic infiltrations. CT with thin section thickness can demonstrate the sites of communication between the pleural space and airways or lung parenchyme in patients with BPF (Fig. 8). BPF can be classified as central and peripheral types. TB is the major cause of peripheral BPF. Successful management of BPF is timely repair of fistula following the control of active infection and adequate drainage of the hemithorax.

**Empyema necessitatis from TB**

Empyema necessitatis from TB is formed by breakage of the TB empyema through the parietal pleura for spontaneous discharge of its contents. The most common site of empyema necessitatis is subcutaneous tissue of the chest wall. CT scan and US study can lead to a diagnosis of empyema ncessitatis by allowing visualization of intra/extrathroacic lesions or their fistulous track (Fig.9 and 10).

**Bronchocutaneous fistula from TB**
Pneumatocele or subcutaneous emphysema is a very rare manifestation of rupture of a pulmonary cavity into subcutaneous tissue resulting from bronchocutaneous fistula (BCF) in a patient with TB (Fig. 11). Drainage of a cold abscess from TB may be responsible for a potential weakness in the pleura and chest wall leading to the development of BCF.

**Pleural thickening and fibrothorax from TB**

Pleural TB often leaves sequelae as pleural thickening with or without calcification. Severe pleural thickening with fibrous tissue and calcification encompassing the lung is defined as fibrothorax (Fig. 12). Fibrothorax may be associated with extensive volume loss of lung and even with ventilatory impairment.

**Chest wall destruction from TB**

Chest wall involvement from TB consisting of osseous destructing and abscess formation may occur by direct extension from a pleuropulmonary TB lesion or by hematogeneous spread from a distant focus. Chest wall TB is characterized by bone or costal cartilage destruction and soft tissue masses with or without evidence of underlying lung or pleural disease (Fig. 12). Malignancy as a relatively rare complication should be also watched for in a patient with pleural TB and chest wall destruction.

**Trapped lung from pleural TB**

Trapped lung is the end stage of dysfunctional healing of pleural injury like a pleural TB that results in a restrictive visceral pleural peel. The visceral pleural peel, pleural air, and unexpandable lung can suggest the trapped lung (Fig. 13). Surgical decortication is the only available therapy.

**Images for this section:**
Fig. 1: The various manifestations of pleural TB

Fig. 2: TB pleural effusion in 35-year-old man. a. Chest radiography shows nodular opacities in left upper lung zone and pleural abnormality obliterating the left costophrenic
angle. b. Chest ultrasonography shows multiple linear echogenic structures in the pleural cavity representing the septa.

**Fig. 3:** Paradoxical response of TB pleural effusion in 25-year-old woman during the antituberculous treatment. a. Initial chest radiography shows right pleural effusion. b. Two-month follow-up chest radiography shows that right pleural effusion has aggravated. c. Follow-up chest radiography, obtained 3 days after b, shows right hydropneumothorax (arrows).

**Fig. 4:** Paradoxical response of TB pleural effusion in 17-year-old woman during the antituberculous treatment. a. Initial chest radiography shows right pleural effusion. b. Two-month follow-up chest radiography shows an ill-defined mass (arrow) above the right side of the diaphragm. c. Transverse chest CT scan as b shows an inhomogeneously enhancing pulmonary lesion (arrow) abutting the pleura. d. Eight-month follow-up chest radiography shows that the right lung mass seen in b and c has disappeared.
Fig. 5: Pneumothorax in 25-year-old woman with pulmonary tuberculosis. a. Chest radiography shows consolidations and nodules throughout right lung. No evidence of pneumothorax is seen on this chest radiography. b. Transverse chest CT scan, obtained at lung window setting, reveals pneumothorax in the right hemithorax.

Fig. 6: Empyema develops commonly in three distinct phases.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Pathology</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exudative</td>
<td>Inflammation of visceral pleura</td>
<td>Fluid aspiration</td>
</tr>
<tr>
<td></td>
<td>High-protein fluid into pleural space</td>
<td>Tube drainage</td>
</tr>
<tr>
<td>Fibrinopurulent</td>
<td>Deposition of fibrin on the inflamed pleural surfaces</td>
<td>Tube drainage</td>
</tr>
<tr>
<td>Organizing</td>
<td>Recruitment of fibroblasts</td>
<td>Tube drainage + streptokinase</td>
</tr>
<tr>
<td></td>
<td>Deposition of collage and granulation tissue in pleural space</td>
<td>Decortication</td>
</tr>
</tbody>
</table>
**Fig. 7:** Chronic TB empyema in 40-year-old man. Coronal image of contrast-enhanced chest CT scan shows thickened visceral and parietal pleurae (arrows) separated by fluid with the proliferation of extrapleural fat (arrowheads).
Fig. 8: Bronchopleural fistula in 42-year-old man with pulmonary TB. Coronal view of chest CT scan, obtained at lung window setting, reveals a small defect (arrow) at thickened pleural surface, which has continuity with the ectatic peripheral airway in the left upper lobe.
**Fig. 9:** TB empyema necessitatis in 51-year-old woman. a. Transverse chest CT scan shows oval-shaped fluid collection (black arrow) along pleura and another unilocular fluid collection (white arrow) along adjacent chest wall in right hemithorax. b. Direct communication between pleural and chest wall fluid collection (arrow) is shown on coronal image of chest CT scan. c. Right lateral view of chest and abdomen shows a large swelling mass (arrow).

**Fig. 10:** TB empyema necessitats in 46-year-old man. a. Transverse chest CT scan reveals thick-walled fluid collection involving both pleural cavity (arrow) and adjacent chest wall (arrowheads). Direct communication between pleural and chest wall fluid collection is also demonstrated on this CT scan. b. Chest ultrasonography shows fistula track (arrow) between pleural (P) and chest wall (C) fluid collection.
Fig. 11: Bronchocutaneous fistula in 47-year-old man with pulmonary TB. a. Chest radiography shows volume loss in the left lung with a large cavity and radiolucent lesion (arrow) in left extrathoracic area. b. Coronal view of chest CT scan, obtained at lung window setting, reveals extrathoracic air filled compartment (arrow) in communication (arrowhead) with the destroyed left lung.
**Fig. 12:** Fibrothorax and chest wall destruction in 46-year-old man with TB empyema. a. Transverse chest CT scan shows diffuse pleural wall thickening with interrupted calcifications (arrowheads) in right hemithorax and a large cavity (arrow) leading to rib destruction in left hemithorax. b. Coronal image of chest CT scan reveals multiple rib destructions (arrows) with soft tissue densities in left hemithorax.

**Fig. 13:** Trapped lung in 48-year-old man with TB pleuritis. a. Transverse chest CT scan, obtained at lung window setting, shows left-sided hydropneumothorax causing the decrease in the volume of left upper lobe with subpleural consolidations and nodules. b. Six-month follow-up transverse chest CT scan reveals abnormal diffuse visceral pleural peel (arrows) in left lung and left-sided hydropneumothorax.
Conclusion

The manifestations of pleural TB are as varied as those of pulmonary TB. According to the disease process or combined complication of pleural TB, management plan should be changed. Understanding the various radiologic findings for pleural TB can be valuable for correct diagnosis and appropriate management plan.

Personal Information

References


