Surgical Intervention for Thoracic Infections

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KEYWORDS

• Infection • Parapneumonic effusion • Empyema • Pulmonary abscess • Tuberculosis • Aspergilloma • Sternoclavicular joint infection

KEY POINTS

- Multidisciplinary management of thoracic infection, including experts in thoracic surgery, pulmonology, infectious disease, and radiology, is ideal for optimal outcomes.
- Initial assessment of parapneumonic effusion and empyema requires computed tomographic evaluation and consideration for fluid sampling or drainage.
- Goals for the treatment of parapneumonic effusion and empyema include drainage of the pleural space and complete lung reexpansion.
- Pulmonary abscess is often successfully treated with antibiotics and observation.
- Surgical intervention for the treatment of fungal or tuberculous lung disease should be undertaken by experienced surgeons following multidisciplinary assessment.
- Sternoclavicular joint infection often requires joint resection.

PARAPNEUMONIC EFFUSION AND EMPYEMA

Historically, open surgical drainage of the pleural space was the only available treatment for pleural infection from the time of Hippocrates until the early twentieth century.[1] In response to a rash of streptococcal respiratory infections, likely related to the influenza epidemic, the US Army established an empyema commission with mortality rates reaching 70%.[2] Evarts Graham subsequently published the results of this effort, outlining several key principles (**Box 1**), which remain the cornerstone of contemporary management of pleural space infection. The application of these principles led to a remarkable reduction in mortality, to 3.4%[2] in the military population. Despite many subsequent advances, including the introduction of antibiotics, ventilator technology, minimally invasive surgical techniques, and the many advances in critical care, mortality remains as high as 20% in modern series.[3]

Pathophysiology

Pleural fluid normally measures less than 15 mL (in a standard 70-kg individual) and serves to lubricate the pleural space. Lacunas in the pleural surface connect it with

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Box 1
Essential principles of empyema management reported by Evarts Graham in 1925

1. Careful avoidance of pneumothorax in the acute stage including the utilization of closed drainage systems
2. Prevention of chronic empyema by the rapid sterilization and obliteration of the infected cavity
3. Careful attention to the nutrition of the patient

lymphatics that ultimately drain into the thoracic duct.[4] Pleural effusions are due to either an increase in the production of pleural fluid or a decrease in drainage, and are a precursor to empyema. Parapneumonic effusions occur in response to a suppurative pulmonary process; up to 60% of pneumonias are associated with pleural effusion,[1] although less than 5% progress to empyema (Table 1).[4] Parapneumonic effusions begin as simple, free-flowing collections as the increased interstitial fluid from the pulmonary parenchyma traverses the pleura and enters the pleural space. Early on this is known as the exudative stage, in which the fluid analysis is characterized by glucose greater than 60 mg/dL, pH greater than 7.2, and negative Gram stain/cultures. Without intervention, this can progress to the fibrinopurulent stage, in which loculations caused by fibrinous septations occur. Fluid analysis at this point reveals glucose less than 60, pH less than 7.2, and positive bacterial studies. Subsequently fibroblasts may migrate into the pleural fluid, resulting the in the third stage, the organizing stage. At this point a fibrinous peel entraps the lung and prevents expansion (Table 2). Infection may progress at any point from the early fibrinopurulent stage, resulting in frank pus in the pleural space or empyema.

Diagnosis

The diagnosis of a parapneumonic effusion or empyema begins with a careful history and physical examination. Clinical features of pneumonia include productive cough, fever, dyspnea, and pleuritic chest pain. In general, history alone is not useful for differentiating patients with pneumonia from those with pneumonia and a parapneumonic process. The same is also true for physical examination, whereby diminished breath sounds, dullness to percussion, fremitus, and egophony can all be explained by consolidated lung parenchyma or a pleural fluid collection. Generally speaking, imaging is essential to making the correct diagnosis.

Imaging

Imaging generally begins with a simple chest radiograph. Fig. 1A and B display the typical radiographic appearance of a parapneumonic effusion/empyema including basilar consolidation, lateral meniscus sign, and opacification of the costophrenic sulcus on lateral images. Separate densities at the base suggest a loculated process. Decubitus views are helpful for identifying layering fluid collections implying a

Table 1
Etiology of empyema

Pneumonia	60%
Postoperative	20%
Trauma	5%
Other	15%

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