Pleural Infections

Irina M. Murray Casanova, MD and Philip A. Efron, MD

Editorial Review: Joseph Galante, MD
Clay Cothren Burlew, MD

Injury/Disease Demographics

- Pleural infection has an annual incidence of up to 80,000 cases in the United Kingdom and United States combined.
- Pleural infection occurs most commonly in the pediatric and elderly populations.
- Risk factors for pleural infections are similar to those for pneumonia. Independent risk factors for development of empyema include, but are not limited to, diabetes mellitus, immunosuppression including steroids, gastro-esophageal reflux, alcohol abuse and intravenous drug abuse.
- Anaerobic infections are usually preceded by a history of aspiration or poor oral hygiene.
- Iatrogenic pleural infections may occur following pleural interventions, as well as thoracic or esophageal surgery, or esophageal perforation.
- Often patients have no apparent risk factors.

Clinical Presentation

- A high index of suspicion is required for the diagnosis of pleural infection.
- Patients may present with fever, pleuritic pain, cough, dyspnea and sputum production.
- A patient's failure to respond to the initial management of pneumonia (ongoing symptoms or signs of sepsis) may indicate the presence of a parapneumonic effusion or empyema.
- No specific clinical features have been identified that accurately predict the need for pleural drainage.
- Sampling is often required to assess whether the patient's pleural fluid is infected.

Evaluation/Diagnostics/Imaging

- Increasingly, thoracic ultrasound is being performed alongside chest radiographs in patients with suspected pleural infection to diagnose/visualize fluid collections.
- Contrast-enhanced CT scanning may be of value in patients when the diagnosis is in doubt or there is a suspected underlying cause such as a mass or injury. It is also helpful in formulating management decisions about drainage and/or surgical interventions based on the radiographic findings of pleural thickening or loculations.
- On imaging, an empyema (defined as pus in the pleural cavity) is usually lenticular in shape and compresses the lung parenchyma. A lung abscess (defined as liquefaction necrosis of lung parenchyma tissue) usually has an indistinct boundary between the lung parenchyma and the collection.
- Determining the characteristics of the patient's pleural fluid remains the most reliable diagnostic test to guide management.
- Imaging guidance (e.g. ultrasound) should be used when sampling this fluid since

it can minimize the risks of organ perforation and improve the recovery rate of pleural fluid/success of the procedure.

- The pH and the protein concentration of the pleural fluid should be determined, and a microbiological culture analysis should be requested. Pleural fluid cytology (e.g. for cancer) and acid/alcohol fast bacilli analysis for mycobacteria should be performed if clinically indicated.
- The characteristic biochemical features of a complicated pleural collection sample include elevated number of neutrophils, pleural fluid acidosis (ph<7.2) and decreased levels of glucose (glucose < 2.2 mmol/L or glucose <60 mg/dL) which are all as a result of anaerobic utilization of glucose by neutrophils and bacteria. Lysis of neutrophils results in elevated lactate dehydrogenase levels (LDH>1000 IU/L.
- Proper sampling technique is imperative to avoid false positive samples. Exposure of the fluid to air, delay in measurement and use of pH meters instead of a blood gas machine lead to inaccuracies.

Role of Nonoperative Management and Associated Considerations

- All patients should receive antibiotics targeted to treat the bacterial profile of complicated pleural collection and should also take into consideration local antibiogram and resistance patterns.
- Antibiotic narrowing should be guided by bacterial culture results.
- Empirical antibiotic treatment for hospital-acquired empyema should include treatment for Methicillin-resistant Staphylococcus aureus (MRSA) and anaerobic bacteria. Intravenous antibiotics should be changed to oral therapy once there is clinical and objective evidence of improvement in the infection/sepsis. Intrapleural antibiotics are not recommended.
- Prolonged courses of antibiotics may be necessary and can often be administered as an outpatient after discharge.
- There is no indication for the routine use of intrapleural fibrinolytics in patients for pleural infection.

Indications for Operative Intervention

- Patients with frankly purulent or turbid/cloudy pleural fluid on sampling should receive prompt pleural space chest tube drainage.
- Large non-purulent effusions can be drained by aspiration and/or chest tube if required for symptomatic benefit.
- A small-bore catheter 10-14French can be adequate for most cases of pleural infection. However, there is no consensus on the size of the optimal chest tube for drainage.
- If a small-bore flexible catheter is used, regular flushing is recommended to avoid catheter blockage.
- Chest tube insertion should be performed under imaging guidance when possible

to ensure proper placement and drainage. Repeat imaging 36-48 hrs should confirm evacuation. Consider more invasive procedures such as early VATS or thoracotomy if collection undrained with properly placed chest tubes.

- Chest tubes are typically left in place until the drainage rate has fallen below 50 mL/day and there is radiographic evidence that the empyema cavity has closed
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Pre-operative Preparation

- Poor nutrition and hypoalbuminemia have been associated with adverse outcomes with a pleural empyema. Often these factors are overlooked and can be hard to correct prior to the identification of the infection. Clinicians should provide adequate nutritional support and consider supplemental enteral feeding from the time of diagnosis.
- Patients with pleural infections suffer catabolic consequences which may lead to further immunodeficiency and a slow recovery.
- Acutely ill patients with pleural infections who have been admitted to the hospital should receive deep vein thrombosis (DVT) prophylaxis unless contraindicated. The type of medical DVT prophylaxis therapy should be determined based on the conditions of the patient (e.g. renal impairment).
- Mechanical prophylaxis and thromboembolic deterrent stockings should be used in those patients with contraindications to anticoagulant treatment.

Operative Techniques/ Intraoperative Considerations

-Video-assisted thoracoscopic surgery (VATS) is increasingly being used as a first-line therapy, although open thoracic drainage or thoracotomy and decortication remain alternative techniques.

-The type of procedure performed whether it be video assisted thoracoscopy vs open thoracotomy and decortication will depend on many factors including the patient's age and comorbidities, as well as the surgeon's preferences and equipment availability.

-Less radical surgical interventions such as open thoracostomy that entail a vertical incision through the chest wall with rib resection to permit open drainage of the empyema with placement of a large-bore drain may be considered in frail patients depending on the surgeon's expertise and the location of the infection. This can be performed in some cases under local or epidural anesthesia.

-In patients with ineffective effusion drainage and persistent sepsis/infection who are unable to tolerate general anaesthesia, re-imaging of the thorax and placement of a further image-guided small-bore catheters, a large-bore chest tubes or intrapleural fibrinolytic (eg, streptokinase, urokinase, and tissue plasminogen activator [TPA]) /DNAse therapy could be considered.

- The combination of intrapleural thrombolysis and DNase (10 mg intrapleural TPA/5 mg intrapleural DNase) administered twice daily for three days is appropriate for patients with ongoing signs of infection incompletely drained collections due to loculations
- For some patients, palliative treatment and active symptom control measures will be appropriate.

Postoperative Management/ Complications

- Removal of the chest drain is appropriate after radiological confirmation of successful pleural drainage and objective evidence of sepsis/infectious resolution.
- Pain control, antibiotic course completion and pulmonary toilet are essential for patient recovery.
- Complications include failure of adequate drainage, re-accumulation of the fluid collection, lung-entrapment, ongoing sepsis and death.

Suggested Readings

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