

The EM Educator Series

The EM Educator Series: Empyema – Does this “pneumonia” need source control?

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Case 1: A 33-year-old female with a recent admission for large hemothorax after an MVC returns with shortness of breath and fever.

Case 2: A 45-year-old male presents with fatigue, fever, chills, chest pain, and shortness of breath. He was diagnosed with pneumonia several weeks ago and treated with antibiotics, but he states his symptoms have worsened. He is hypotensive and febrile on exam, and chest x-ray reveals a moderate pleural effusion on the left.

Questions for Learners:

1. What is an empyema?
2. What are the risk factors for empyema?
3. How can patients present?
4. What tests should we perform in the ED?
5. What is the recommended treatment?

Suggested Resources:

- Articles
 - [emDOCs – Empyema](#)
 - [emDOCs – Pleural Effusion](#)
- Journal Articles
 - <https://pubmed.ncbi.nlm.nih.gov/31525811/>
 - <https://pubmed.ncbi.nlm.nih.gov/28274565/>

Answers for Learners:

1. What is an empyema?

Put simply, an empyema refers to a collection of pus within the pleural space. This can be caused by bacteria, fungi, parasites, or mycobacteria because of adjacent pneumonia, direct inoculation (blunt trauma/prior chest tube), or other source.

2. What are the risk factors for empyema?

As one would expect, pneumonia is a large risk factor for developing an empyema. Therefore, there is much overlap between the risk factors for developing pneumonia and empyema. Commonly cited risk factors are listed below:

- Aspiration
- Poor dental hygiene
- Malnutrition
- Alcohol/Intravenous drug use (IVDU)
- Immunosuppression
- Partially treated pneumonia
- Gastroesophageal reflux disease (GERD)
- Pre-existing pleural fluid (i.e. heart/liver failure, cancer)
- Intraabdominal infection leading to translocation of bacteria across diaphragm

3. How can patients present?

Patients with empyema usually present with symptoms similar to that of pneumonia. These include **fever, dyspnea, cough, increased sputum production, and pleuritic chest pain**. If symptoms have been ongoing despite appropriate antibiotic administration, this should raise suspicion for development of a parapneumonic effusion or empyema. In addition, when compared to pneumonia, empyema can lead to prolongation of symptoms, such as fever and malaise, for up to two weeks. In those patients at risk for anaerobic infections (i.e. aspiration, poor dental hygiene) symptoms may be more insidious and delayed with loss of appetite and weight loss lasting over weeks to months.

4. What tests should we perform in the ED?

Maintain a low threshold for ordering **CT Chest with IV contrast**, as this is the most sensitive imaging modality for diagnosing and characterizing empyemas

The diagnosis of empyema primarily relies on imaging. Thoracentesis is usually indicated for fluid analysis, which can guide further management. US can be utilized to help locate the largest area of fluid collection within the empyema and guide needle/tube placement for the thoracentesis. If frank pus is observed when sampling the pleural fluid collection, the diagnosis of empyema is confirmed.

Fluid obtained by thoracentesis should be sent for the following:

- Cell Count with Differential
- Total Protein
- Lactate Dehydrogenase
- Aerobic Culture

- Anaerobic Culture
- Fungal Culture
- Mycobacterial Culture
- Cytology

Blood cultures should be obtained, although many patients with empyema have negative blood cultures.

5. What is the recommended treatment?

After initial stabilization of airway, breathing, and circulation, early antibiotic coverage and source control by way of drainage are the next steps.

- **Antibiotics:** Generally, empiric intravenous (IV) antibiotics are started when the diagnosis of empyema is known or expected. Antibiotic therapy should not be delayed for any diagnostic procedure including thoracentesis as delay in antibiotic initiation has been shown to increase in mortality.²¹ Antibiotic coverage of empyema is subdivided into community acquired and hospital acquired in order to appropriately treat the most common offending organisms.
 - **Community-acquired:** An IV regimen targeting *Streptococcus pneumoniae*, oropharyngeal flora, and anaerobic bacteria. This regimen will generally include a third generation cephalosporin plus an agent with anaerobic coverage. Some treatment options can be seen below:
 - **Ceftriaxone 2 g IV once daily + Metronidazole 500 mg TID**
 - **Cefotaxime 2 g IV q 8 hrs + Metronidazole 500 mg TID**
 - **Hospital-acquired:** Hospital acquired empyema is defined as being derived from a Hospital Acquired Pneumonia (HAP) or post-procedural (Video-Assisted Thoracic Surgery (VATS), prior chest tube insertion etc.). IV antibiotics that target MRSA, gram negative bacteria (including *Pseudomonas* spp), and anaerobic bacteria. Several treatment options can be seen below:
 - **Vancomycin + Metronidazole 500 mg TID + Cefepime 2 g q 8 hrs**
 - **Vancomycin + Metronidazole 500 mg TID + Ceftazidime 2 g q 8 hrs**
 - **Vancomycin + Piperacillin/Tazobactam 4.5 g q 6 hrs**
 - Penicillin allergy options:
 - **Vancomycin + Metronidazole 500 mg TID + Ciprofloxacin 400 mg q 8 hrs**
 - **Vancomycin + Meropenem 1 g q 8 hrs**
- **Drainage:** In addition to antibiotic coverage, source control via drainage of the empyema is required. This is done by chest tube insertion with the guidance of ultrasound if available. There is no definitive recommendation on the exact size of chest tube to use as guidelines vary. Traditionally, larger bore (>24 Fr) chest tubes were recommended for empyema due to the viscous quality of the pus and pleural fluid. However, more recent literature to suggest that smaller bore tubes may be as efficacious as larger bore tubes. In a prospective, nonrandomized trial involving 454 patients who underwent chest tube drainage for empyema, no significant difference was found between mortality and need for thoracic surgery between large (15 to 20 Fr), medium (10 to 14 Fr) or small (<10 Fr “pigtail catheter”) chest tubes. As expected, patients reported markedly less pain with smaller size tube placement. It should be noted however that smaller tubes up to 14 Fr have a higher propensity for blockage due to viscus empyema drainage, blood, or proteinaceous debris with one study stating an occlusion rate of 11-30%.

Therefore, if a small bore chest tube is placed, periodic flushing with 30 mL sterile saline every 6 hours via 3 way stopcock attached to the tube may be required in order to preserve chest tube patency. Suction is typically not needed unless there is an air leak or the pleural fluid fails to drain.

- Click here for a walk-through video of small bore “pigtail catheter” placement: <https://www.youtube.com/watch?v=FDxZyR9abAs>
- **Disposition:** After antibiotic administration and chest tube placement, the patient should be admitted to the hospital for continued antibiotic therapy, monitoring of chest tube output and patient’s symptoms. If symptoms continue to worsen (increasing/relapsing fever, worsening leukocytosis, sepsis, etc.) this may be evidence of treatment failure and the patient may require VATS. However, many patients (50-80%) may respond to antibiotic adjustment, additional chest tube placement, and/or application of tPA/DNase through the tube in order to facilitate drainage.