DECISIONS

A 44-year-old man with a parapneumonic effusion

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A 44-year-old man presents to his local emergency department with a 10-day history of fever, night sweats, productive cough and right-sided pleuritic chest pain. He has a history of alcohol abuse. Two weeks prior, he was assessed in the same emergency department after he was found obtunded on a park bench. He left the following day against medical advice. On examination, his temperature is 39.0°C, and his oxygen saturation is 87% on room air. He has poor dentition. Chest examination reveals dullness to percussion at the right base and bronchial breath sounds in the area of the right lower lobe. A chest radiograph shows right lower lobe consolidation and an associated parapneumonic effusion (example shown in Figure 1).

What are the clinical implications of a pleural effusion with pneumonia?

A parapneumonic effusion is defined as the presence of pleural fluid secondary to suspected pneumonia or a lung abscess. Parapneumonic effusions occur in 20%–57% of cases of pneumonia and have been associated with a higher risk of treatment failure for pneumonia.[1] A prospective cohort study of 1424 patients admitted to hospital with community-acquired pneumonia showed that the presence of a parapneumonic effusion was independently associated with treatment failure, defined as either persistent fever, hemodynamic instability, development of respiratory failure (Pao_2 < 60 mm Hg or saturation < 90% on an Fio_2 of 0.21), or radiographic

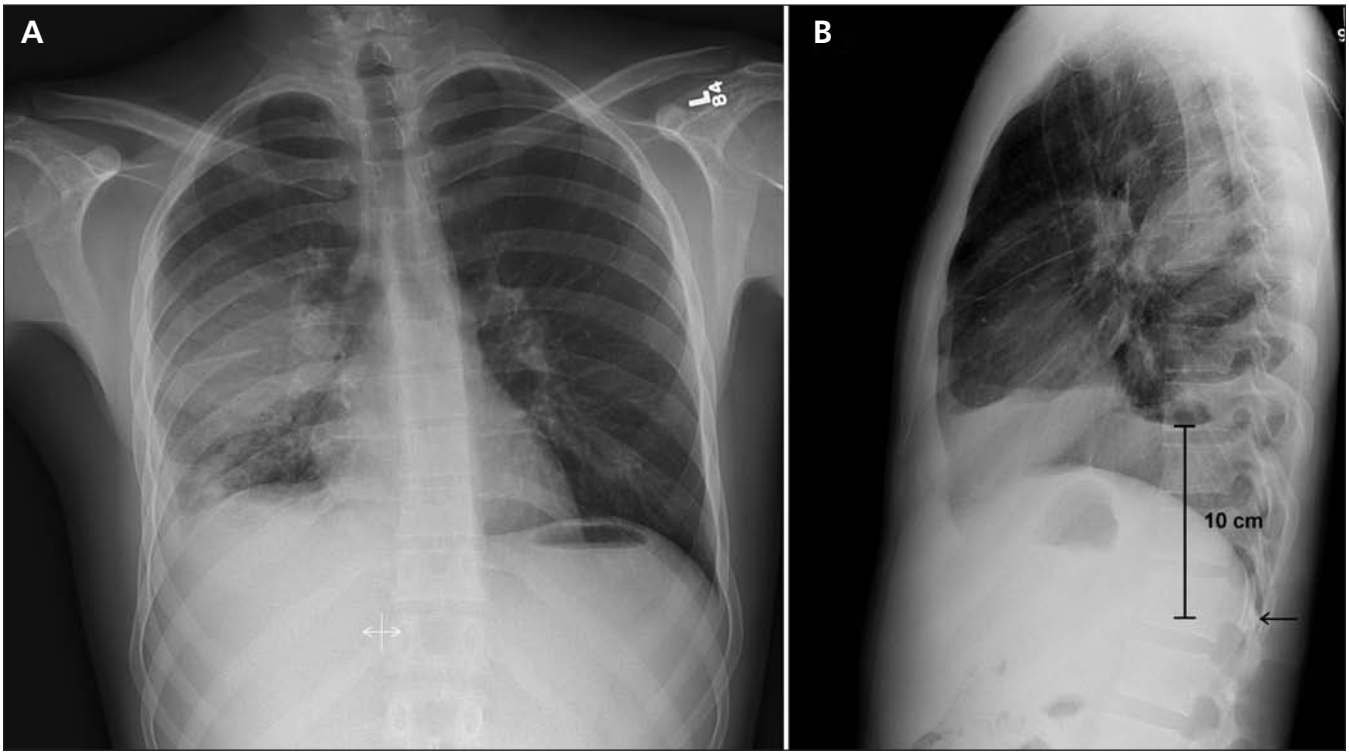

Figure 1: Chest radiographs showing a parapneumonic effusion requiring diagnostic thoracentesis. (A) Right lower lobe consolidation and a parapneumonic effusion (posterior anterior view). (B) Pleural effusion measuring 10 cm from the inferior costal sulcus (arrow) to the bottom of the meniscus of the effusion (lateral upright view).

progression despite empiric treatment according to guidelines (odds ratio 2.7 [95% confidence interval 1.8–4.2]).[2] Patients in whom treatment failed also had increased length of hospital stay and a higher death rate.[2] The presence of parapneumonic effusion in this patient is a marker of disease severity and should prompt urgent evaluation and management.

Does this patient require diagnostic thoracentesis?

Among patients with parapneumonic effusion, diagnostic thoracentesis is recommended for those with clinical evidence of pneumonia and more than 10 mm of pleural fluid on a lateral decubitus radiograph or more than 5 cm on an upright lateral chest radiograph, as in the case of this patient and seen in the example in Figure 1.[3–5] Ideally, this procedure should be performed under image guidance. In instances of ongoing sepsis or increased effusion size despite antimicrobial therapy, diagnostic thoracentesis should be performed regardless of the initial size of the effusion.[1,3] Pleural fluid should be analyzed for lactate dehydrogenase, glucose and pH levels, and Gram staining and aerobic and anaerobic bacterial culture should be performed. For pH analysis, the specimen should be sent in a heparinized blood gas syringe on ice.[3] The results help to guide management decisions about antimicrobial therapy and drainage.

Does the effusion require definitive drainage?

Characteristics of pleural fluid analysis and imaging features that determine the need for definitive drainage appear in Table 1.[1,3] In this patient, the pleural fluid analysis indicated complicated parapneumonic effusion (cloudy appearance with low pH, high lactate dehydrogenase and low glucose levels, and gram-negative bacilli and gram-positive cocci seen on Gram staining). Whereas a simple (uncomplicated) parapneumonic effusion is likely to respond to antimicrobial therapy alone, a complicated effusion requires definitive drainage. Recent guidelines suggest that small-bore (10–14 F) catheters are an adequate means of drainage. However, unlike large-bore chest tubes, these tubes require frequent flushing to avoid blockage.[3]

What empiric antimicrobial therapy would you prescribe?

Early start of antimicrobial therapy for this patient can prevent progression of complicated parapneumonic effusion to empyema.[1,3] Most antimicrobials have adequate penetration into the pleural space, with the exception of aminoglycosides, which should be avoided if possible.[1] The choice of empiric antibiotic therapy should be directed by treatment guidelines for pneumonia, which highlight the need to include anaerobic coverage in instances of pneumonia associated with loss of consciousness (e.g., from alcohol abuse, drug overdose or seizure), poor dental hygiene or esophageal disorders, and in patients with prolonged duration of symptoms.[1,4] This patient meets several of these criteria. In addition, anaerobes have been isolated in up to 76% of pleural fluid samples by DNA amplification, although anaerobic cultures of pleural fluid may frequently be negative.[3] For this reason, the British Thoracic Society suggests that empiric

Table 1: Characteristics of pleural fluid to guide the need for drainage of the pleural space[1,3]

Characteristic	Uncomplicated parapneumonic effusion that may be managed with antibiotics alone	Complicated parapneumonic effusion requiring pleural space drainage*
Pleural fluid volume	≤ 50% of hemithorax	> 50% of hemithorax
Pleural fluid configuration†	Free-flowing	Loculated
Appearance on thoracentesis	Clear	Turbid or cloudy, or pus (empyema)
pH level‡	≥ 7.20	< 7.20
Lactate dehydrogenase level, U/L	≤ 1000	> 1000
Glucose level, mmol/L	≥ 3.4	< 3.4
Gram staining	Negative	Positive
Aerobic and anaerobic bacterial culture	Negative	Positive

*Drainage of the pleural space is indicated when 1 or more characteristics of complicated parapneumonic effusion are present.
†Computed tomography is often required to determine whether pleural fluid is loculated.
‡For pH analysis, the pleural fluid should be collected anaerobically in a heparinized blood gas syringe and transported on ice.

anaerobic coverage should be provided in all cases of parapneumonic effusion except in pneumonia caused by culture-proven *Streptococcus pneumoniae*.[3] Cultures from thoracentesis should be used to modify empiric therapy.

We are unaware of any prospective trials on the optimal duration of antimicrobial therapy for treatment of pleural space infections. Uncomplicated effusion can be treated for the same duration indicated for the management of community-acquired pneumonia, whereas complicated parapneumonic effusions usually require 3 weeks of therapy or longer depending on the adequacy of pleural space drainage and clinical response.[3]

When should referral to a surgeon or chest physician be considered?

All patients requiring definitive chest tube drainage should have early involvement of a chest physician or thoracic surgeon to ensure adequate pleural space drainage and chest tube management.[3] Ongoing signs of sepsis, including fever lasting longer than 5–7 days despite pleural drainage and appropriate antimicrobial therapy, are an indication for surgery. Options include video-assisted thoracoscopic surgery and standard thoracotomy.[1,3]

If a patient is not a candidate for surgery, what other options can be considered?

The use of fibrinolytics in the management of complicated parapneumonic effusion remains controversial and is not recommended by current guidelines.[3] A recent randomized controlled trial of 210 patients with complicated pleural infection showed that early intrapleural administration of tissue plasminogen activator plus deoxyribonuclease compared with placebo increased pleural fluid drainage and reduced the need for surgical referral at 3 months (4% v. 16%; odds ratio for surgical referral 0.17, 95% confidence interval 0.03–0.87; $p = 0.03$), with no significant reduction in the rate of surgery.[6] The investigators also found a reduced length of hospital stay.[6] This approach may be an option for patients who require surgery but are not surgical candidates. Larger studies are required to accurately determine the treatment effects of thrombolytic therapy, including death outcomes, before this practice is incorporated into routine care.

The case revisited

Because the results of this patient's pleural fluid analysis indicated a complicated parapneumonic effusion requiring definitive drainage, a small-bore chest tube was inserted under ultrasound guidance. Empiric antimicrobial therapy with intravenous ceftriaxone and oral metronidazole was started following the results of Gram staining of the pleural fluid. Culture of the pleural fluid grew viridans-group streptococci, *Fusobacterium nucleatum* and a species of *Peptostreptococcus*, compatible with oropharyngeal aspiration. A repeat chest radiograph on day 10 showed complete resolution of the effusion, and the chest tube was removed. The patient's antimicrobial therapy was changed to oral amoxicillin and clavulanate to complete a total of 3 weeks of treatment. At 1-month follow-up, he remained well. The patient's willingness to stop drinking was explored, and he was referred to a support organization.

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