



Pneumothorax

Objectives

- Consider pneumothorax as part of the differential diagnosis of chest pain and shortness of breath
- Recognize the common exam findings in patients with a pneumothorax
- Recognize both the obvious and more subtle radiographic findings associated with pneumothorax
- Understand the emergent treatment of a pneumothorax

A pneumothorax occurs when the potential space between the parietal and visceral pleura of the lung fills with air and collapses the lung. It can occur spontaneously or following trauma, and is a common iatrogenic complication of multiple procedures. If left untreated, it can be fatal when tension builds and pressure is placed on the vascular structures within the mediastinum. Prompt diagnosis and treatment of a pneumothorax is essential.

Classic Presentation

A spontaneous pneumothorax can either be primary or secondary, and is frequently caused by a ruptured bleb. A primary pneumothorax occurs in patients that have no underlying pulmonary disease. It is most common in thin, young males with a history of tobacco use. A secondary pneumothorax occurs in patients with an underlying medical disease, such as COPD, cystic fibrosis, lung cancer and Marfan's disease.

Patients with both primary and secondary pneumothoraces will most commonly present with a history of sudden onset of sharp chest pain, often unilateral, and shortness of breath. The shortness of breath often increases over time as the pneumothorax increases in size. Patients may also complain of a cough. Occasionally the pain is more prominent in the back and shoulder. Vital signs frequently demonstrate tachycardia, tachypnea and, depending on the severity, hypoxia and hypotension.

Iatrogenic and traumatic pneumothoraces will present in a clinically similar manner, but in close time proximity to a traumatic event or an invasive procedure. A pneumothorax can be seen both with penetrating and blunt trauma. The most common procedures to cause a pneumothorax include a central line, thoracentesis, pacemaker, tracheostomy or biopsy. Other causes include CPR and positive-pressure ventilation.

A tension pneumothorax is a true emergency that needs immediate correction. The classic presentation will be a patient in distress with tachycardia, tachypnea, hypotension and hypoxia. A traumatic tension pneumothorax may develop rather quickly, but other causes, such as positive pressure ventilation, occur gradually.

Initial Actions and Primary Survey

Before a lengthy history and physical examination can be recorded, the clinician must first consider, diagnose, and treat a tension pneumothorax. The classic exam findings are hypotension, tracheal deviation away from the side of the injury, distended neck veins, and respiratory distress/arrest. If the patient is intubated, there will be extreme difficulty in bagging or high airway pressures.

If the patient is stable, ask about the onset and duration of their symptoms. Establish if there are any chronic diseases that could produce a secondary pneumothorax or if they have a history of prior pneumothorax. Assess if they have had any recent procedures, putting them at risk for an iatrogenic pneumothorax. If the patient has a traumatic injury, establish the mechanism and quickly assess for penetrating injuries to the chest.

Physical exam findings for a pneumothorax are unequal breath sounds, hyperresonance with percussion over the chest wall, and decreased wall movement on the affected side of the chest. The chest wall should be palpated and any crepitance or signs of trauma should be noted. As mentioned previously, vital sign abnormalities may include tachycardia, tachypnea, hypoxia and hypotension, depending on the severity of the pneumothorax.

A chest x-ray should be ordered early in the evaluation of a patient with a suspected pneumothorax. If the patient is unstable, however, and a tension pneumothorax is suspected, proceed directly to treatment without waiting for the radiograph. Any delays in the treatment of a tension pneumothorax should be avoided.

Diagnostic Testing

Chest x-ray: An upright CXR is the optimal study for demonstrating a collapsed lung. A pneumothorax will be evident when there is a linear delineation of the edge of the collapsed lung, with no further lung markings beyond this line. This line may be confused with the scapula or ribs if the clinician does not look closely. A large bleb is also occasionally confused with a pneumothorax.

A tension pneumothorax is a large pneumothorax with shifting of the mediastinal structures away from the side of the pneumothorax.

Subcutaneous air in a patient with a pneumothorax, click to enlarge picture

The deep sulcus sign is suggestive of an anterior pneumothorax (From <http://www.trauma.org> (<http://www.trauma.org/>))

Other findings that suggest the possibility of a pneumothorax include subcutaneous air or a deep sulcus sign on the side of the injury.

Chest CT: In a stable patient, a CT scan may be useful to accurately quantify the size of the pneumothorax and any underlying pathology or other injuries. A CT is absolutely not indicated in the unstable patient or those with obvious tension physiology.

Ultrasound: A probe placed in the 3-4th intercostal space on the anterior chest can demonstrate the classic signs of a pneumothorax including a lack of sliding movement of the pleura on the ribs and an absence of the comet tail artifact that is normally seen in this location. A “lung point” can also be seen at the location of the pneumothorax, where the lung sliding (or lack thereof) are seen within the same view. Ultrasound can be very useful in patients when an upright chest x-ray cannot be obtained (eg, intubated patients and those in spinal precautions)

How Do I Make the Diagnosis

The diagnosis of pneumothorax is made by the combination of history, physical exam and radiography. Again, a tension pneumothorax should be diagnosed and treated based on your history and physical exam, without waiting for radiographic imaging.

Treatment

Specific treatment depends on the severity of a pneumothorax, but all patients should be put on oxygen and placed on a cardiac monitor.

Tension pneumothorax: Immediate correction can be accomplished with needle decompression. Place a 14-gauge angiocatheter into the 2nd intercostal space at the midclavicular line. This should convert a tension pneumothorax to a simple pneumothorax. In some obese patients, the length of the angiocatheter is not long enough to enter the thoracic space. In these patients, a longer catheter should be sought or the chest tube should be placed immediately, whichever is faster. If needle decompression is successful, a chest tube should be placed immediately thereafter as needle decompression is only temporizing.

Large pneumothorax: A large pneumothorax is usually defined as greater than 20%. In this situation, a chest tube is usually indicated. The size of the chest tube and its ideal location will be determined by the mechanism and if there is an associated hemothorax.

Small pneumothorax: A small pneumothorax may be relieved by needle aspiration, a small pigtail catheter, or simple observation with repeat CXR to assess for spontaneous resolution.

Disposition

While there is the option of observing otherwise healthy patients with a small pneumothorax in the ED for 4 hours with a repeat CXR, the majority of patients with a pneumothorax will be admitted for further observation and management.

Pearls and Pitfalls

- A pneumothorax can be missed or not diagnosed in a timely manner. Remember that not all collapsed lungs are from trauma!
- Don't wait for a CXR to decompress a pneumothorax in an unstable patient
- Needle decompression may be very difficult in obese patients. Prepare quickly, if not simultaneously, for immediate chest tube placement.
- Consider a tension pneumothorax in the post-CPR patient on positive pressure ventilation that again begins to decompensate.
- When performing an invasive procedure that may result in an iatrogenic pneumothorax, make sure the patient is aware of the risk and has signed a consent
- Remember that ultrasound can be a useful tool to diagnose a pneumothorax, especially in a patient that must remain supine.

Selected References

- Baumann MH, Strange C, Heffner JE, et al. and the AACP Pneumothorax Consensus Group: Management of Spontaneous Pneumothorax: An American College of Chest Physicians Delphi Consensus Statement. Chest 2001;119:590.

- Wilkerson, R. Gentry. Sensitivity of Bedside Ultrasound and Supine Anteroposterior Chest Radiographs for the Identification of Pneumothorax After Blunt Trauma. *Academic Emergency Medicine* Jan. 2010; 17, 11-17.