

PNEUMOTHORAX (PTX)

(Last updated 08/07/2016; Reviewers: Marcus J. Schultz, MD; Yuliya Pinevich)

PRESENTING COMPLAINT: Shortness of breath, chest pain, signs of anxiety

FINDINGS

- **A** Check airway
- **B** ↑RR, shortness of breath, increased work of breath
- **C** ↑HR; ↓HR, pulsus paradoxus (late signs/tension PTX)
- **D** P (chest pain), variable altered (V,U,D)* (late signs)
- **E** Reduced breath sounds, reduced chest expansion, hyperresonant percussion on the affected side; tracheal deviation to contralateral sign, distension of neck veins, evidence of chest trauma, cyanosis in severe cases (late findings)
- **L_{PC}** ↓PaO₂, ↑PCO₂, respiratory acidosis
- **U_{PC}** Absence of lung sliding, ‘sea-shore sign’ in M-mode, presence of a ‘lung point’

***V** (verbal), **P** (pain), **U** (unconsciousness), **D** (delirious)

U_{PC} (point of care ultrasound) **L_{PC}** (point of care labs)

OTHER HISTORY

- Non-traumatic: Primary PTX: associated with smoking; Secondary PTX: (frequent) COPD, lung malignancy, and pneumonia; (rare) thoracic endometriosis and cystic fibrosis
- Traumatic: Open (penetrating trauma) or closed (e.g., rib fractures)
- Iatrogenic: Most often a needle puncture (e.g., during instrumentation for central venous catheter), intrathoracic (and sometimes upper abdominal) surgery

OTHER INVESTIGATIONS

- Labs: Consider ABG
- Continuous monitoring of vital signs: Blood pressure, heart rate, respiratory rate, SpO₂; ECG
- Imaging:
 - Lung US (absence of lung sliding, absence of sea-shore sign in M-mode, identification of ‘lung point’)
 - Chest X-ray (consider lateral or lateral-decubitus XR when unable to get upright lateral; look for a “deep sulcus sign” in supine CXR, although this sign is more seen with ‘sick’ lungs that do not completely collapse around the lung hilum and in patients that are bed-ridden, but more to the back causing the typical “deep sulcus sign”)

- CT scan in selected stable patients (those undergoing chest CT for another indication) and when it is impossible to rule out pneumothorax with Lung US or chest X-ray (loculated pneumothorax or tethered lung). Clinically unstable patients (e.g., hemodynamic compromise, life-threatening hypoxia, tension pneumothorax), should undergo immediate chest tube or needle decompression.

THERAPEUTIC INTERVENTIONS

Initial Treatment:

- Tension PTX: Immediate aspiration by prompt insertion of cannula (2nd intercostal space, midclavicular line); leave in place until functioning chest tube positioned
- Non-tension PTX:
 - Primary PTX: Rim of air < 2 cm and without dyspnea: may be managed conservatively as outpatient if observation and early follow-up possible; Rim of air > 2 cm and/or dyspnea: chest tube
 - Secondary PTX: Oxygen (by nasal cannula in case of SpO₂ < 92%; use caution in chronic hypercapnic respiratory failure: too much oxygen may cause a depression in the respiratory drive) and close follow-up (i.e., admission); Dyspnea and rim of air > 2cm => aspiration by catheter and one way valve
 - Penetrating pneumothorax: Sucking wounds should be closed by an occlusive (plastic) dressing; securing 3 sides only may allow air evacuation via one-way-valve effect while awaiting a chest tube. If intubated, special attention is needed due to high likelihood of a tension PTX

Subsequent Treatment: chest tube:

- Indicated for tension, secondary, traumatic and iatrogenic PTX, age >50 years, rim of air > 2 cm
- Analgesia, sterile procedure, +/- prophylactic antibiotics (usually not needed but consider if prolonged period of chest tube)
- Preferably a small bore Seldinger technique chest drain under US guidance for PXT. A larger bore drain inserted via cut down and finger sweep may be considered for large persistent leaks, especially in ventilated patients
- Use the “safe triangle” between the anterior border of the latissimus dorsi, the lateral border of the pectoralis major muscle, above the line at the height of the nipple, and an apex below the axilla for insertion of a chest tube
- Underwater seal
- Control the correct chest tube position by CXR, or CT scan (only for complicated PXT)
- No suction (high volume, low pressure -10 to -20 cmH₂O) initially; Don't clamp if bubbling

ONGOING TREATMENT

- Observe air leak:
 - Chest tube is left in place till no air leak is seen. The presence of air leak should be assessed periodically to determine whether the tube can be removed. The integrity of the tubing and drainage device should be inspected to ensure that any air leak that is present is from the lung.
 - Use negative pressure suction \ if air leak persists A persistent air leak is arbitrarily defined as the continued bubbling of air through a chest drain after 2-3 days. It has been suggested that optimal suction should entail pressures of -10 to -20 cm H₂O (compared with normal intrapleural pressures of between -3.4 and -8 cm H₂O, according to the respiratory cycle), with the capacity to increase the air flow volume to 15–20 l/min.
 - Don't clamp if bubbling.
 - Once the air leak has sealed and the lung is fully expanded, clamp the chest tube/catheter for an additional 4 to 12 hours. Clamping the chest prevents inapparent drainage of small amounts of air through the water seal and thus allows recognition of small leaks that would otherwise be missed.
 - Confirm re-expansion of the lung by X-ray especially before removing the tube
 - Consider pleurodesis or surgical options if pneumothorax cannot be handled by chest tube
 - Be very careful when considering removal of a chest tube in a mechanically ventilated patient: an ongoing air leak can cause a tension pneumothorax (if the wound is tightly dressed)

CAUTIONS

- Positive pressure ventilation and PEEP can worsen pneumothorax and precipitate tension
- Complications: Hemothorax, Reexpansion pulmonary edema (uncommon complication after rapid reexpansion of a lung that has been collapsed, due to either pneumothorax or effusion, for at least three days)

REFERENCES & ACKNOWLEDGMENTS

Acknowledgement: *Benjamin Bonneton, MD; Jakobus Preller, MD*

-Henry M., Arnold T., Harvey J. Pleural Diseases Group, Standards of Care Committee, British Thoracic Society. BTS guidelines for the management of spontaneous pneumothorax. *Thorax*. 2003 ; 58 Suppl 2 : ii39-52.

-Andrew MacDuff,¹ Anthony Arnold,² John Harvey,³ on behalf of the BTS Pleural

-Disease Guideline Group. Management of spontaneous pneumothorax: British Thoracic Society pleural disease guideline 2010. *Thorax* 2010;65 (Suppl 2):ii18-ii31. doi:10.1136/thx.2010.136986

-Sharma A, Jindal P. Principles of diagnosis and management of traumatic pneumothorax. *J Emerg Trauma Shock*. 2008 Jan-Jun; 1(1): 34–41.

-<http://www.brit-thoracic.org.uk/clinical-information/pleural-disease.aspx>