

## Treatment of Pneumothorax and Airleaks

Treatment of pneumothorax depends primarily on the presence of symptoms and size as well as the patient's priority of avoidance of a procedure as compared with rapid symptoms relief.

Because better safety profile and noninferiority regarding resolution of pneumothorax, current tendency favors:

- Conservative management rather than interventional management.
- Percutaneous small  $\leq 14F$  pigtail chest tube placement rather than larger tubes.

### Size pneumothorax definition:

- Small pneumothorax is defined as below otherwise is considered large.
  - $< 2$  cm from chest wall at the hilum.
  - $< 3$  cm from chest wall at the apex.

### Primary spontaneous pneumothorax (PSP)

#### First small PSP

- Clinically stable.
  - O<sub>2</sub> and observation for 6 hr with CXR.
    - If stable, discharge.
    - If worse, percutaneous small  $\leq 14F$  pigtail chest tube placement or needle aspiration (1).
- Clinically unstable
  - Percutaneous small  $\leq 14F$  pigtail chest tube placement.

#### First large PSP

- Percutaneous small  $\leq 14F$  pigtail chest tube placement.
- Consider aspiration or no intervention if asymptomatic and adequate oxygenation on room air\*\*.
  - Place on O<sub>2</sub> and observation for 6 hr with CXR follow up.
    - If stable, discharge.
    - If worse, percutaneous small  $\leq 14F$  pigtail chest tube placement or needle aspiration.

There is modest evidence suggesting that needle aspiration is as safe and effective as tube thoracostomy in patients with both PSP and SSP (1).

The British Thoracic Society guideline for pleural disease recommend conservative management for patient with asymptomatic PSP regardless of size (2):

- There is modest evidence that conservative management of large PSP was noninferior to interventional management, with a lower risk of serious adverse events (3, 4).
- Conservative management in this group is associated with successful pneumothorax resolution and lower recurrence.
  - The hypothesis is that although the chest tubes allow for rapid re-expansion of the lung, they create a conduit for negative pressure and exacerbate the pressure gradient,

whereas slower re-expansion as occur with conservative management may allow for more effective healing of the visceral pleura.

- The caveat is that the applicability of conservative management is limited to a select group of patient (asymptomatic with adequate oxygenation).

### **Secondary spontaneous pneumothorax (SSP)**

#### **Initial intervention**

- Percutaneous small  $\leq 14F$  pigtail chest tube placement.
- If small pneumothorax:
  - Consider aspiration or no intervention if asymptomatic and adequate oxygenation on room air.

#### **Definitive intervention for first episode**

- It should be performed during the same hospitalization (e.g., within three to five days) to prevent recurrence rather than waiting for a second event in most patients.
  - VATS is preferred.
  - Nonsurgical chemical pleurodesis or prolonged thoracostomy drainage
    - Patients who are not good candidates for or are unwilling to undergo surgery.

#### **Traumatic pneumothorax**

- Iatrogenic
  - Treated as if they had PSP.
- Non-iatrogenic.
  - Traditionally, chest tube placement has been recommended.
  - Current tendency:
    - If small and clinically stable, no intervention.
    - If large or clinically unstable:
      - Most pneumothoraces, including those with concomitant hemothorax can be treated with percutaneous small  $\leq 14F$  pigtail chest tube (5).
      - Very large pneumothoraces or those with concomitant hemothorax may require percutaneous 20F or large bore 28-32F chest tubes.

#### **Pneumothorax in patients on positive pressure ventilation**

- Percutaneous small  $\leq 14F$  pigtail chest tube.
- Cautious observation in stable patients with small pneumothoraces if availability for immediate chest tube placement can be provided if needed (6).

#### **Persistent airway leak (PAL)**

PAL with  $>90\%$  lung re-expansion

- Ambulatory drainage or continued chest tube in those not suitable for an ambulatory device
- For pts not suitable for ambulatory drainage or continued chest tube
  - Non-surgical pleurodesis, or
  - VATS with pleurodesis
    - Choosing among these is at the discretion of the surgeon and patient preference

PAL with  $<90$  re-expansion

- VATS with pleurodesis

- For pts not candidates or unwilling to undergo surgery
  - Non-surgical pleurodesis, or ambulatory drainage or continued chest tube

### Chest tube-Air leak

- Causes
  - Leak in the collection system
    - Clamping the chest tube as it connects to the pleural drainage unit will terminate the air leak seen in the suction chamber
  - Large bronchopleural fistula
  - Intraparenchymal placement
  - Outward migration of the chest tube such that one or more of its side holes sit outside the patient and can entrain air from the atmosphere
- Placement of an additional chest tube
  - If the patient is clinically unstable owing to incompletely evacuated pleural air
  - Large bronchopleural fistula that is insufficiently treated by a single chest tube
- PEEP is frequently reduced in the presence of a bronchopleural fistula to try to decrease mean alveolar pressure, reduce the magnitude of air leaking through a bronchopleural fistula, and promote closure of the fistula

### Unexpandable lung

- Persistent pneumothorax despite a functional chest tube and is without an air leak
- Most common causes
  - Diseases affecting the visceral pleura all preventing the lung from normal expansion
  - Trapped and entrapped lung
  - Endobronchial obstruction with lobar collapse
  - Chronic atelectasis
  - Large lung parenchymal tumors

### References:

1. Thelle A, et al. Randomized comparison of needle aspiration and chest tube drainage in spontaneous pneumothorax. *Eur Respir J* 2017; 49: 1-9.
2. Roberts ME, et al. British Thoracic Society guideline for pleural disease. *Thorax* 2023;78: suppl 3: s1-s42.
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5. Kulvatunyou N, et al. Small caliber 14-Fr PCs are equally as effective as 28- to 32-Fr chest tubes in their ability to drain traumatic hemothorax with no difference in complications. *J Trauma Acute Care Surg.* 2021;91: 809–813.
6. Clements TW. OPTICC: A multicenter trial of Occult Pneumothoraces subjected to mechanical ventilation: The final report. *Am J Surg* 2021: 221:1252-58.