

SPONTANEOUS PNEUMOTHORAX

Definitions:

- *Pneumothorax*:
 - 'the presence of free air in the intrapleural space'
- *Spontaneous pneumothorax*:
 - 'occurs in the absence of any external precipitating factor, either traumatic or iatrogenic'
- *Primary spontaneous PTX*:
 - 'occurs in individuals without clinically apparent lung disease'
- *Secondary spontaneous PTX*:
 - 'arises in the context of underlying pulmonary disease processes'.

Causes of Primary Pneumothorax:

- Healthy young men
- Taller than average height
- Cigarette smoking
- Change in ambient atmospheric pressure
- Mitral valve prolapse

BOX 75-1

CAUSES OF SECONDARY SPONTANEOUS PNEUMOTHORAX

Airway Disease

Chronic obstructive pulmonary disease
Asthma
Cystic fibrosis

Infections

Necrotizing bacterial pneumonia/lung abscess
Pneumocystis jiroveci pneumonia
Tuberculosis

Interstitial Lung Disease

Sarcoidosis
Idiopathic pulmonary fibrosis
Lymphangiomyomatosis
Tuberous sclerosis
Pneumoconioses

Neoplasms

Primary lung cancers
Pulmonary/pleural metastases

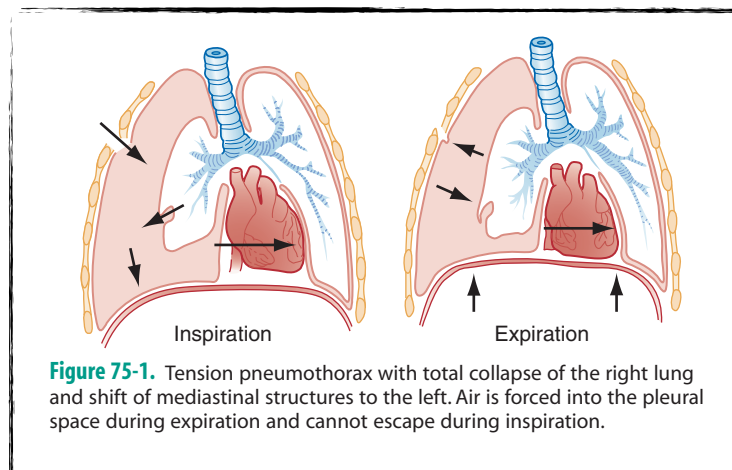
Miscellaneous

Connective tissue diseases
Pulmonary infarction
Endometriosis/catamenial pneumothorax

Pathophysiology:

- Normally, intrapleural pressure is *negative*. It fluctuates from -10 to -12 mmHg during inspiration to ~ -4 mmHg during expiration; whereas intrabronchial & intra-alveolar pressures are negative during inspiration (-1 to -3 mmHg), but *positive* during expiration (+1 to +3 mmHg).
- Alveolar walls & visceral pleural form a barrier that separates intrapleural and intra-alveolar spaces and maintains a pressure gradient between the two.
- If a defect occurs in this barrier; air enters the pleural space until either the pressures equalize or the communication seals.

- With the loss of negative intrapleural pressure in one hemithorax; the ipsilateral lung collapses.
- A large pneumothorax results in;
 - Restrictive ventilation impairment.
 - Reduced vital capacity, functional residual capacity & total lung capacity.
 - Hypoxia (from shunting blood through non-ventilated lung)
 - Compensated for by *hypoxic vasoconstriction* reflexes.
- In *tension pneumothorax*;
 - Alveolar-pleural defect acts as a one-way valve.
 - Progressive accumulation of intrapleural air and increasingly positive intrapleural pressure.
 - Leads to compression of contralateral lung with asphyxia & worsening hypoxia.
 - Impairment of venous return to the heart occurs when intrapleural pressures exceed 15-20 mmHg.
 - Final end point is cardiovascular collapse and death.



- In primary pneumothorax;
 - alveolar-pleural barrier is disrupted by rupture of *sub-pleural bulla (or bleb)*.
 - *Blebs* found in 90% of cases (in surgery or via CT imaging).
- In secondary pneumothorax;
 - underlying lung disease weakens the alveolar-pleural barrier.
 - eg. large, thin-walled bullae in COPD (increased risk of rupture) or nearby inflammation in patients with HIV-PCP.

Clinical Features:

Symptoms are related to the size of the pneumothorax, rate of development and underlying clinical status of the patient.

- *Ipsilateral chest pain & dyspnoea* are the most common symptoms.
- Pain is typically *sharp & pleuritic*; but can evolve into a dull, steady ache.
- Cough can be present.

Physical findings include;

- Sinus tachycardia (most common finding).
- Tachypnoea.
- Decreased or absent breath sounds
- Hyperresonance to percussion
- Dyspnoea (esp. in those w/ poor pulmonary reserve).

Clinical Hallmarks of Tension PTx:

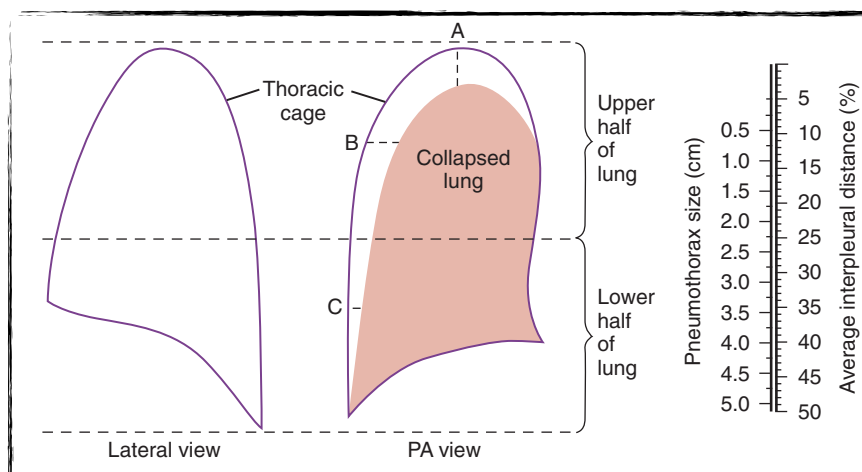
- Tracheal deviation
- Ipsilateral hyperresonance
- Tachycardia (often >120 bpm)
- Hypoxia
- Hypotension (a late & ominous finding)
- Jugular venous distention

Diagnostic Strategies:

Whilst history & examination may be suggestive, the diagnosis of pneumothorax is generally made with CXR. **** Remember: Tension pneumothorax is a clinical diagnosis !! ****

CXR:

- Thin visceral pleural line lying parallel to the chest wall, separated by a radiolucent band which is devoid of lung markings (*Sensitivity = 83%*).
- The width of this band can be used to determine pneumothorax size.
- (Generally characterised as *small, moderate, large or total*).



- Difficult to recognise in *supine CXR* - look for *deep sulcus sign* !
- *Pseudo-pneumothorax* results from skin-folds, large bullae, scapula borders or external tubing.

Radiologic signs of tension include:

- Complete lung collapse
- Gross distention of ipsilateral thoracic cavity
- Mediastinal shift across the midline.

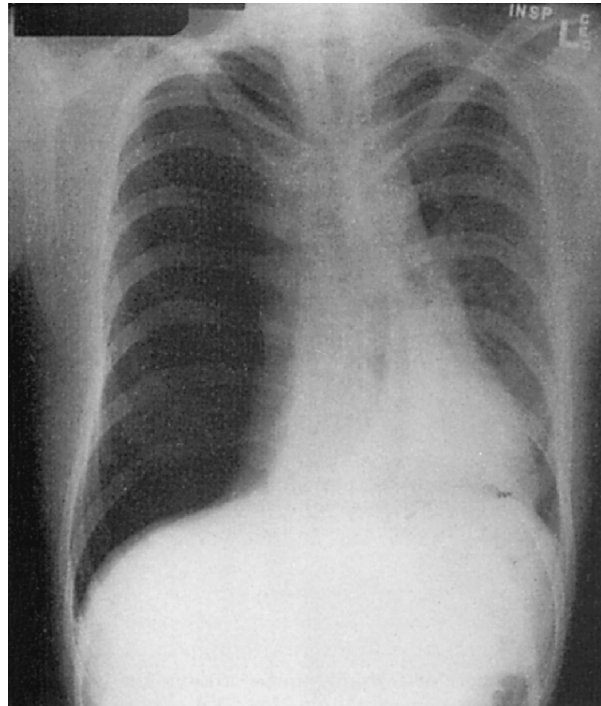
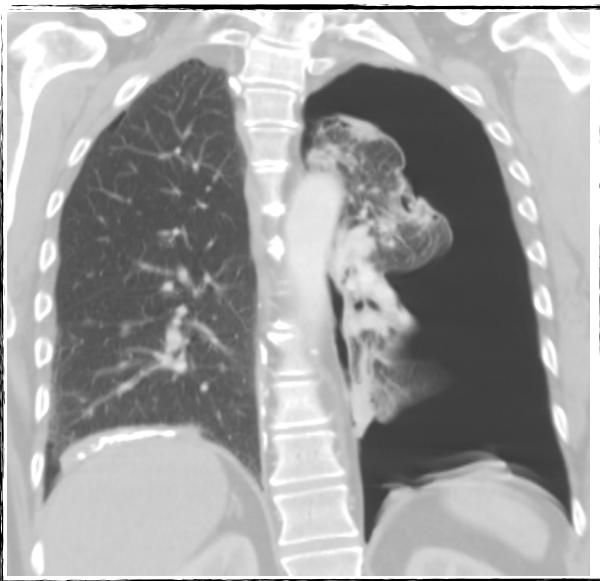


Figure 75-3. Radiograph of tension pneumothorax with mediastinal shift to left.

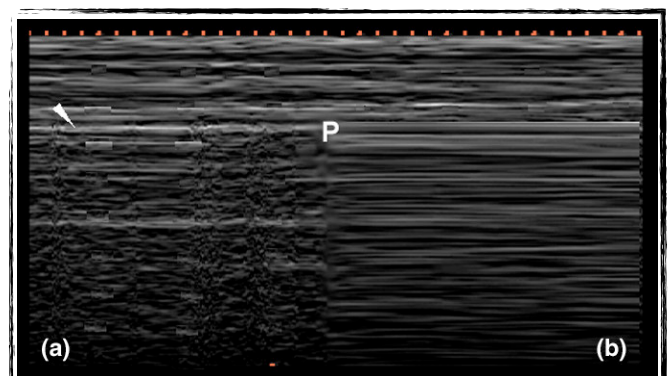


CHEST CT:

- Often considered the *gold-standard* for diagnosis of pneumothorax.
- Patients must be stable enough to both lie down & be transported.

USS:

- A rapid and accurate diagnostic aid.
- Sensitivity approaches 100% in the right hands.
- Abnormal findings include:
 - Loss of lung-sliding or comet-tail artifacts (real-time)
 - Demonstration of a 'lung-point'
 - Loss of "sandy beach" sign on M-mode.



Differential Diagnosis:

- Pulmonary embolism
- Pleural effusion / Haemothorax
- Pneumonia
- Pneumomediastinum
- Pericarditis
- Boerhaave syndrome
- Aortic dissection

Management:

**** THE PATIENTS CLINICAL STATUS DETERMINES TREATMENT OPTIONS ****

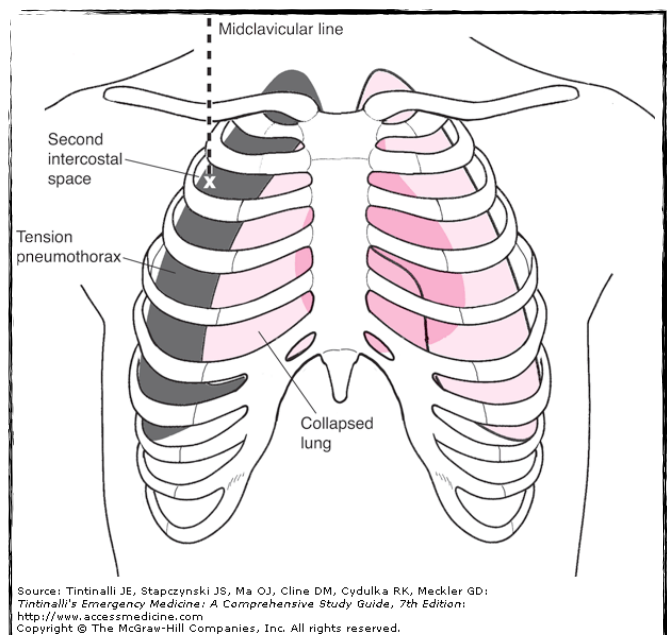
If clinical judgement suggests tension pneumothorax the pleural space should be decompressed.

Needle decompression:

- IV cannula / angiocath
- 2nd intercostal space
- Mid-clavicular line
- Tempourising procedure

Immediate tube thoracostomy:

- 4th-5th intercostal space.
- Triangle of safety
 - Anterior latissimus dorsi
 - Posterior pectoralis major
 - Mid to anterior axillary line.
- Definitive treatment.



“ The diagnosis of tension pneumothorax is confirmed by ‘hiss of air’ escaping under positive pressure. “

Two goals of therapy for managing spontaneous pneumothorax:

1. to evacuate air from pleural space
2. to prevent recurrence.

Therapeutic options for treatment include:

- simple observation
- aspiration via catheter
- insertion of intercostal catheter
- video-assisted thoracoscopic surgery (VATS)
- thoracotomy.

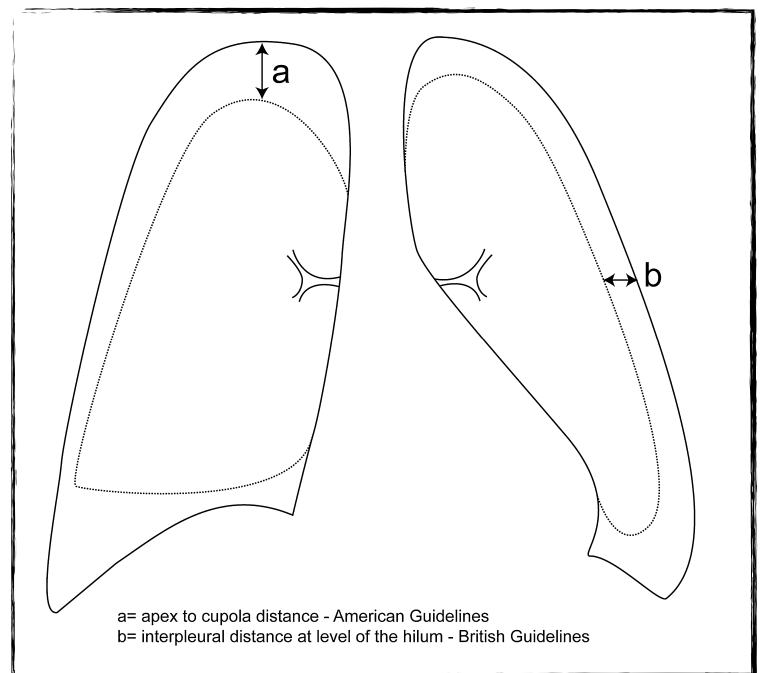
Individualising decision based on:

- Size of PTx
- Severity of signs
- Underlying pulmonary disease
- Other comorbidities
- Previous Hx of PTx's
- Degree & persistence of air leak
- Available follow-up.

Intrinsic reabsorption of pneumothoraces occurs at a rate of 1-2% per day; accelerated up to 4% per day with the administration of 100% oxygen.

Size does matter:

The British Thoracic Society classifies pneumothorax size as small if the distance from the thoracic apex to lung cupola is <2 cm, or large if ≥ 2 cm



MANAGEMENT OF SPONTANEOUS PNEUMOTHORAX

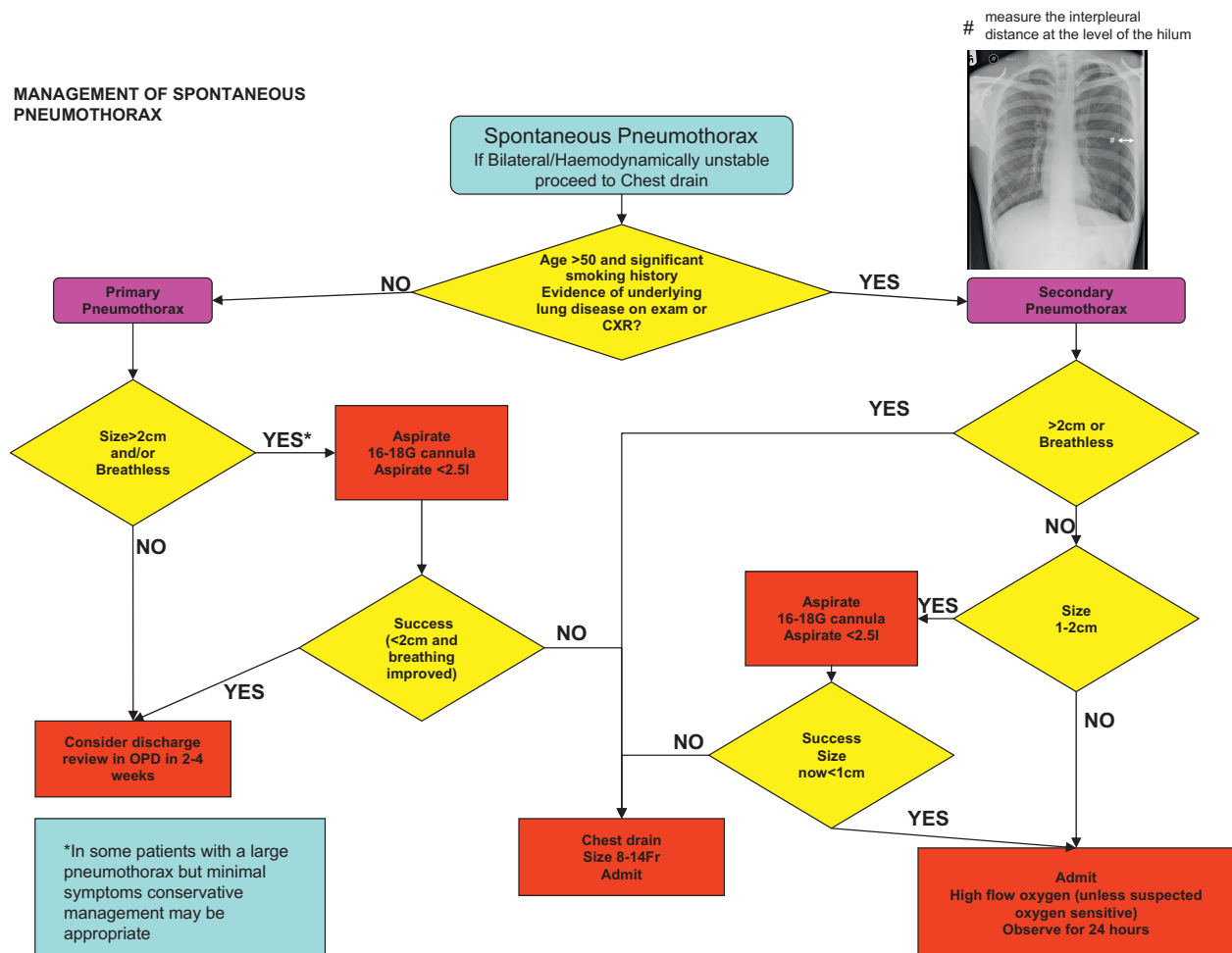


Figure 2 Flowchart of management of spontaneous pneumothorax.

Table 71-3 Treatment of Pneumothorax

Condition	Treatment Options
Small primary pneumothorax	Observation for 6 h, discharge if no symptoms and return for check if symptoms reoccur or in 24 h
	or
	Small-size catheter aspiration with immediate catheter removal, then observe for 6 h, discharge if no symptoms and return for check if symptoms reoccur or in 24 h
	or
	Small-size catheter or small-size chest tube insertion, Heimlich valve or water-seal drainage, and admission
Small secondary pneumothorax	Small-size catheter or small-size chest tube insertion, Heimlich valve or water-seal drainage, and admission
Large pneumothorax, either primary or secondary, or bilateral pneumothoraces	Moderate-size chest tube and admission; large-size chest tube if fluid or hemothorax present; water-seal drainage and admission
Tension pneumothorax	Immediate needle decompression followed by moderate or large-size chest tube insertion, water-seal drainage, and admission

The routine application of *suction* neither increases the rate at which the lung re-expands nor improves patient outcome and is no longer recommended after standard tube thoracostomy.

Common complications of chest tube insertion include incorrect placement, pleural infection and prolonged pain.

Re-expansion pulmonary oedema and hypotension are rare occurrences after rapid evacuation of large pneumothoraces, especially if present for >72 hours. Treatment of this is supportive, with aggressive volume resuscitation.

Patients with *unresolved pneumothorax* should not fly or dive unless definitive prevention has taken place.

Outcome:

Recurrence is very common. Approximately 1 in 3 for primary spontaneous pneumothorax.

- May be life threatening in those with underlying lung disease.
- Intervention is advocated to prevent further recurrence
 - After 1st presentation of secondary pneumothorax OR
 - After 2nd presentation (of ipsilateral lung) in primary pneumothorax.
- This may involve pleurodesis or wedge resection of areas with large bullae.