Pneumothorax

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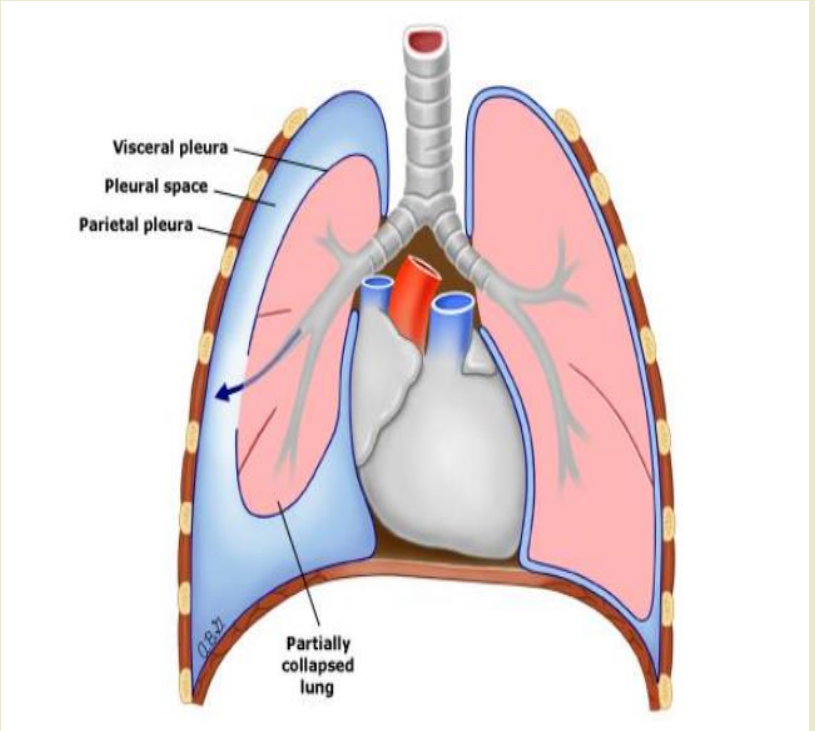
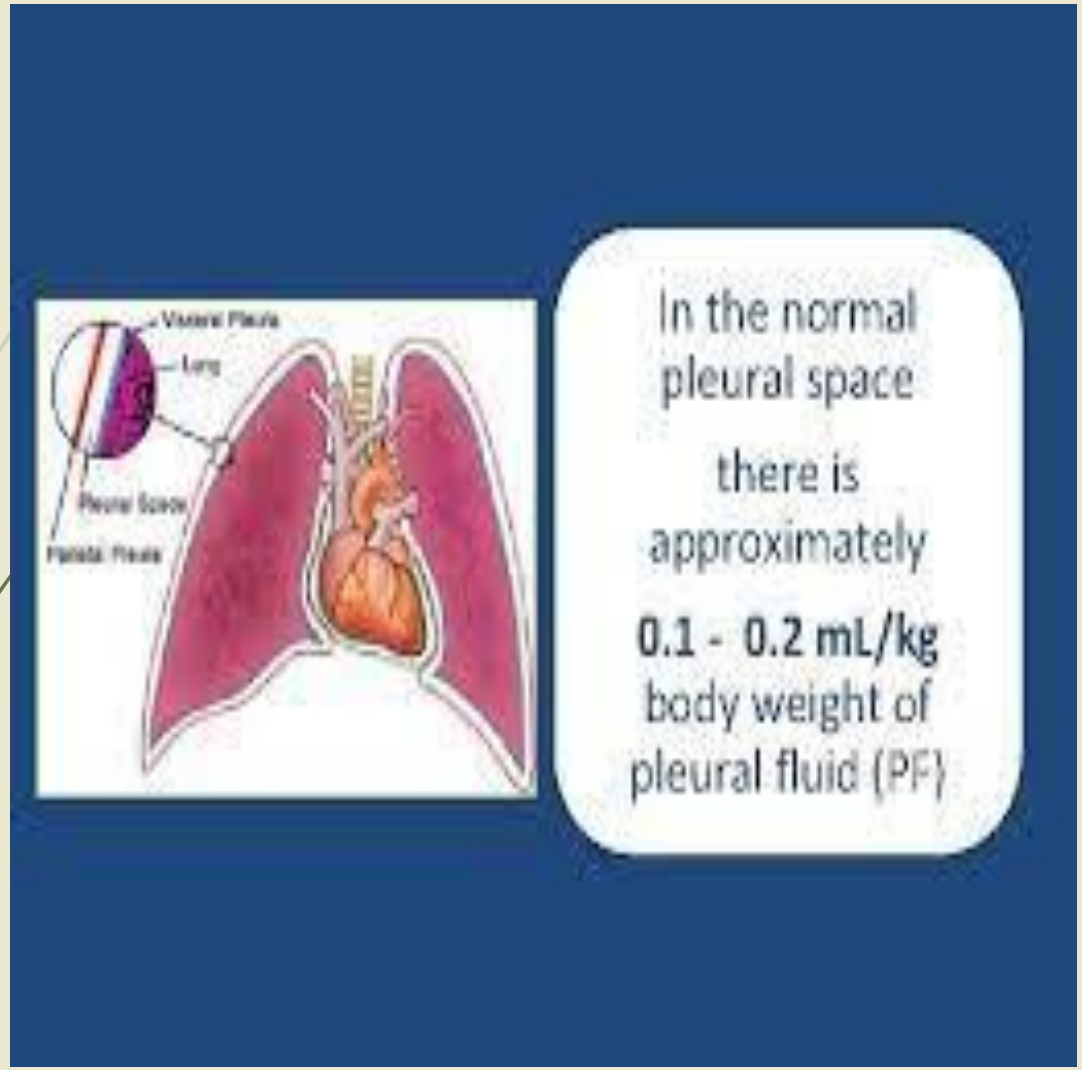
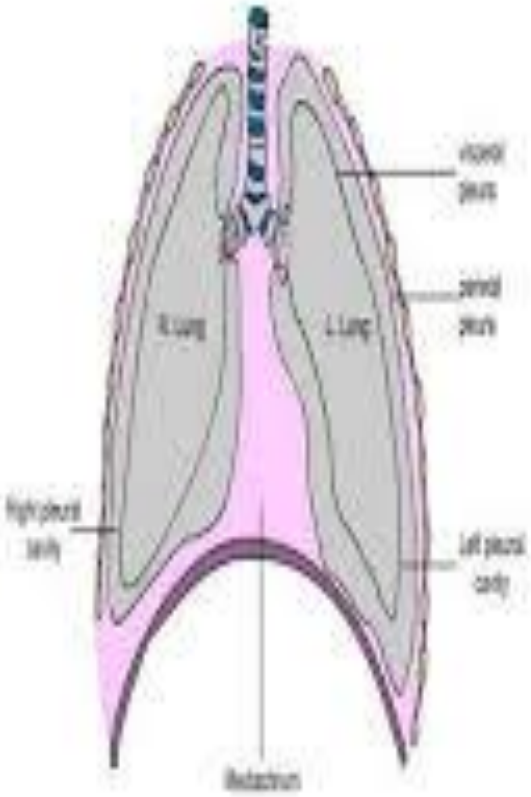




Pleura types

- There are two types of pleura :
  - * visceral pleura
  - * parietal pleura
- The parietal pleura is subdivided into
  - * mediastinal pleura
  - * costal pleura
  - * diaphragmatic pleura
  - * cervical pleura



DEFINITION

- Pneumothorax is defined as a collection of air that is located within the thoracic cage between the visceral and parietal pleura .

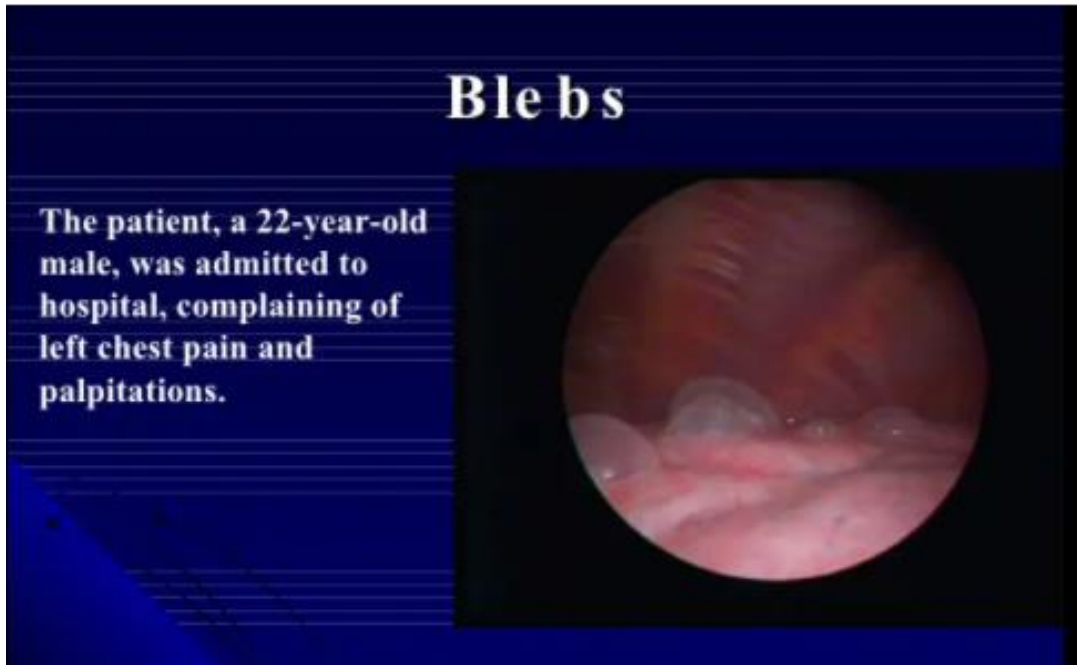
- Air can enter the pleural space through a leak in either pleural surface. It may flow freely within the chest or be loculated by fibrous bands or other tissues. Rarely, air accumulates due to infection with gas-producing bacteria.

Etiology

- Traumatic
  - *blunt, crush, or penetrating trauma to the chest*
  - *injury from a diagnostic or therapeutic procedure;*
  - *consequence of mechanical ventilation.*
- Spontaneous
  - *•Primary spontaneous pneumothorax*
  - *•Secondary spontaneous pneumothorax*

Causes of non-traumatic spontaneous pneumothorax

Primary pneumothorax
Asthenic body habitus/subpleural blebs
Drug use
Cigarette smoking
Snorting cocaine
Smoking marijuana
Increased transpulmonary pressure
Valsalva maneuver
Diving, military flying



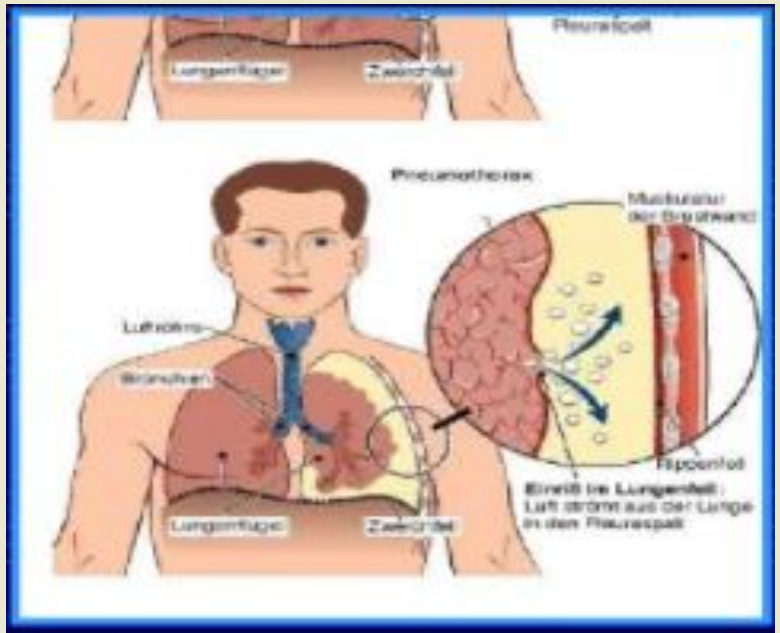
Secondary pneumothorax
Airway disease
Cystic fibrosis
Asthma
COPD
Infection
Pneumocystis jirovecii (*carinii*)
Tuberculosis
Necrotizing pneumonia
Congenital lung disease
Congenital pulmonary adenomatous malformation
Congenital lobar emphysema
Interstitial lung disease
Sarcoidosis
Langerhans cell granulomatosis
Other
Connective tissue/inflammatory disease
Marfan syndrome
Ehlers-Danlos syndrome
Juvenile idiopathic arthritis
Polymyositis or dermatomyositis
Birt-Hogg-DubÃ© syndrome
Other
Malignancy
Primary lung cancer
Metastatic disease
Airway obstruction
Foreign body aspiration
Thoracic endometriosis
Catamenial pneumothorax

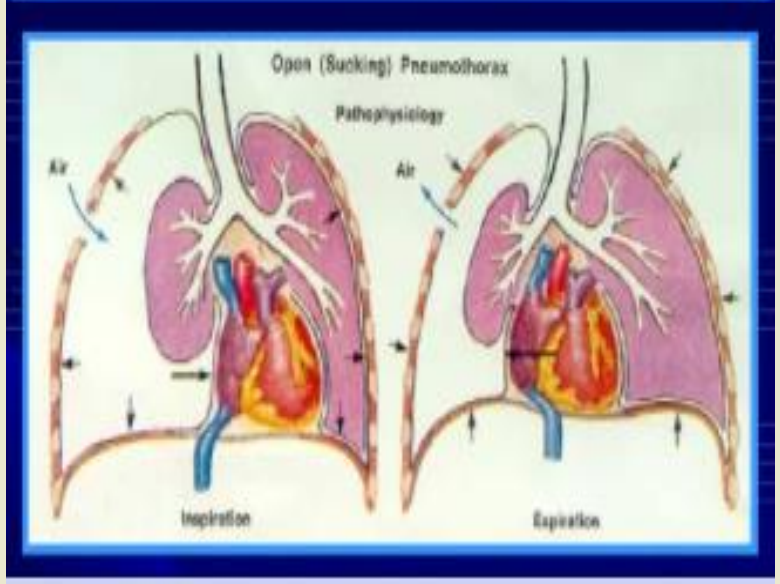
EPIDEMIOLOGY

- *The annual incidence of primary spontaneous pneumothorax (PSP) in the general population is estimated to be 5 to 10 per 100,000*
- *The incidence of pneumothorax is relatively high in the newborn period.*
- *Spontaneous pneumothorax is approximately three to six times more common in males than females.*

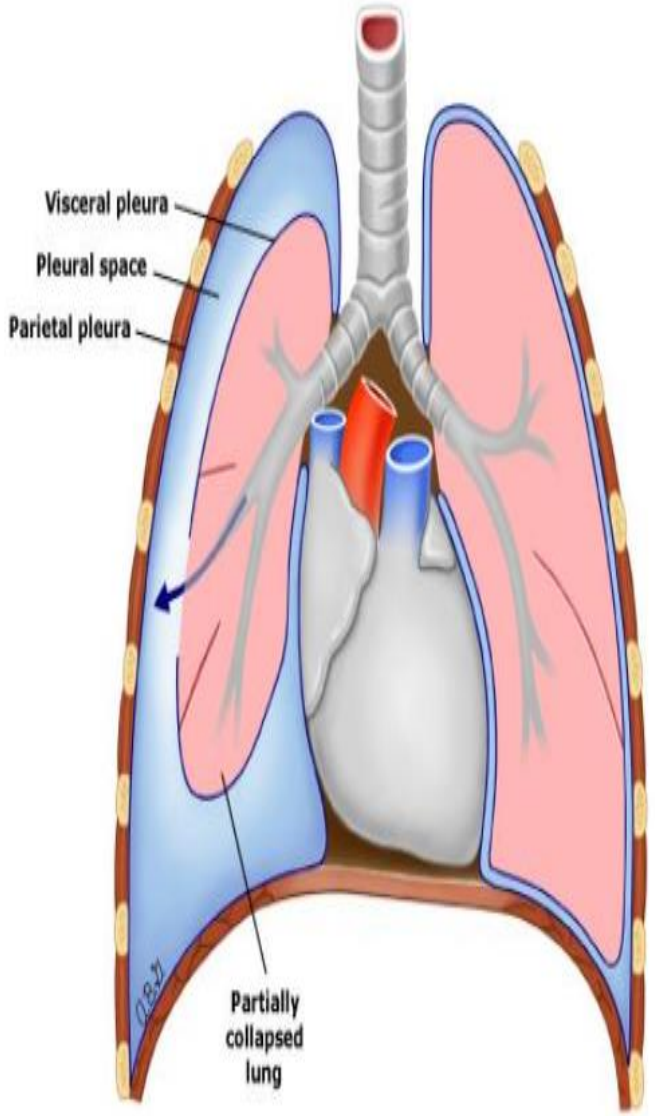
MECHANISMS OF PNEUMOTHORAX

- ●Acute increase in transpulmonary pressure
- ●Defects in visceral pleura
- ●Catamenial pneumothorax

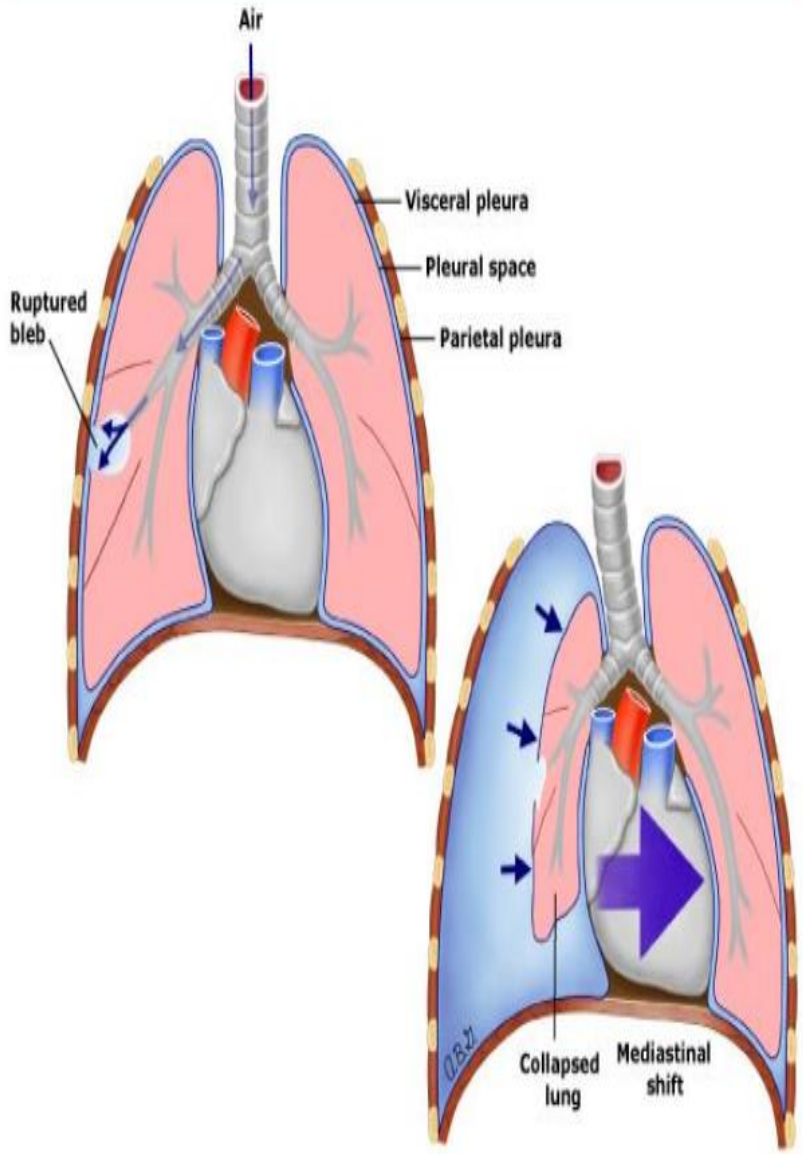




Simple pneumothorax



Tension pneumothorax



CLINICAL FEATURES

History

- *A small pneumothorax may be asymptomatic.*
- *sudden onset of dyspnea and pleuritic chest pain*
- *The pain often resolves spontaneously during the first 24 hours, even if the pneumothorax persists*
- *A dry or nonproductive cough*
- *The history should investigate potential causes of secondary pneumothorax*
- *The presence of apical blebs supports the diagnosis of primary spontaneous pneumothorax (PSP). Otherwise, PSP is largely a diagnosis of exclusion.*

Physical Examination

- *decreased chest excursion, diminished breath sounds, hyper resonant percussion, and decreased vocal fremitus on the affected side. Other signs of respiratory compromise may include tachypnea, increased work of breathing, and cyanosis.*

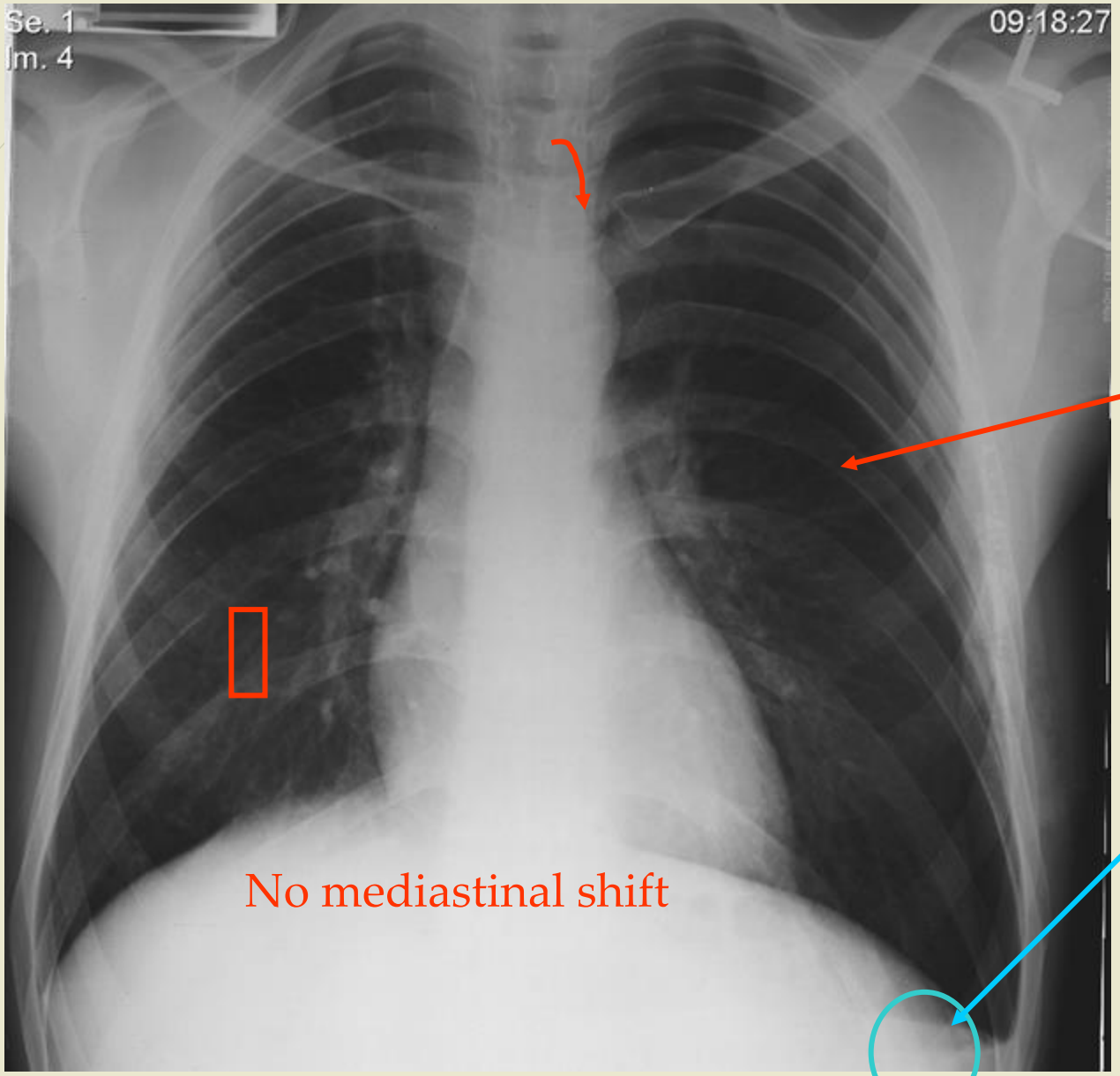
- *Signs suggestive of* tension pneumothorax *include deviation of the trachea towards the contralateral side. Other signs of tension pneumothorax include tachycardia, hypotension, and cyanosis .*

- *Heart sounds may be diminished and the apical impulse shifted to the contralateral side.*

DIAGNOSIS

- **CXR**
- AP and lateral
- Lat Decobitus
- **Computed tomography**
- Computed tomography (CT) scanning is not necessary unless abnormalities are noted on the conventional chest radiograph that require further assessment.
- conditions that complicate interpretation of the conventional radiograph
- detection of small apical blebs
- in assessing chest tube placement when needed

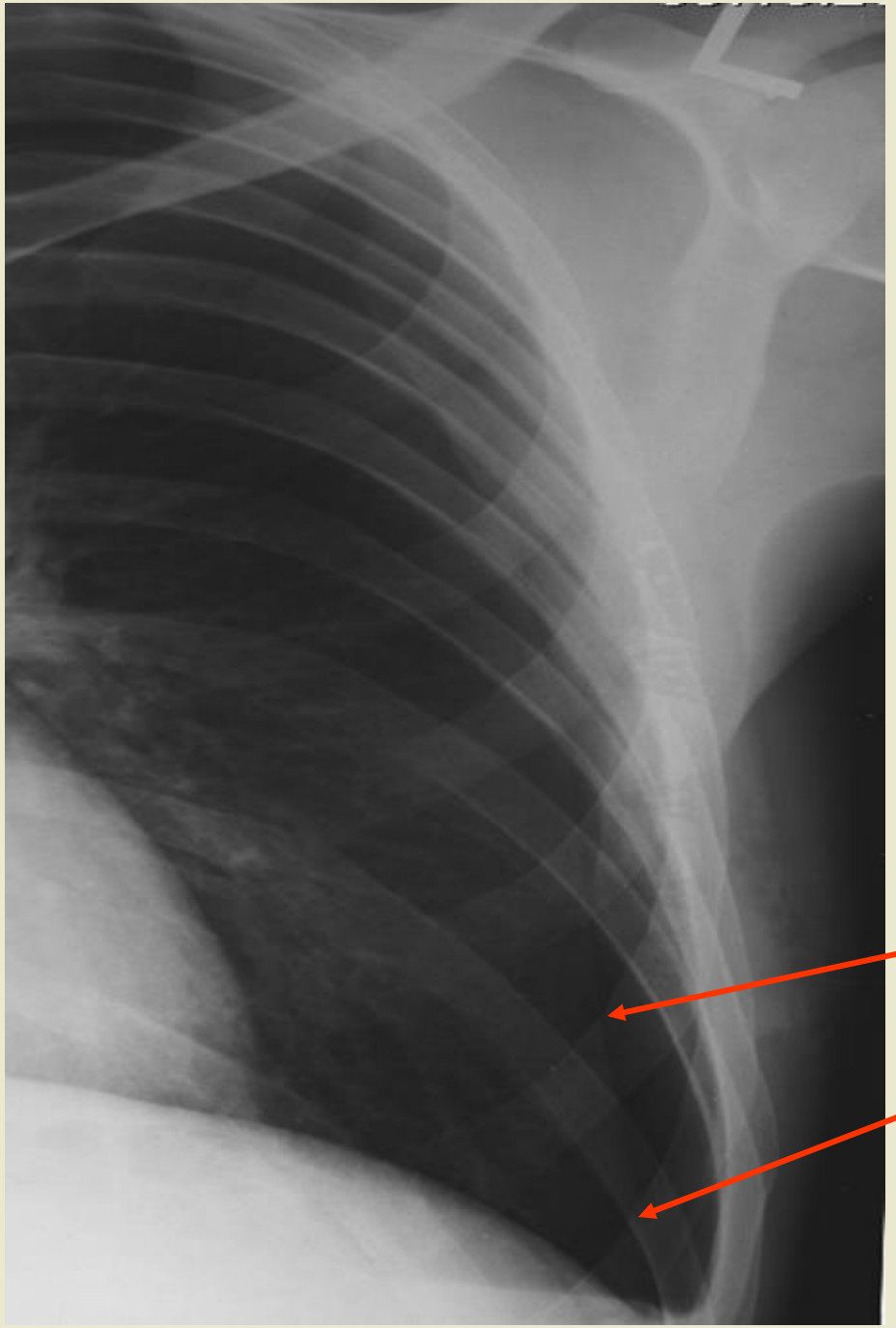
Simple Left Pneumothorax

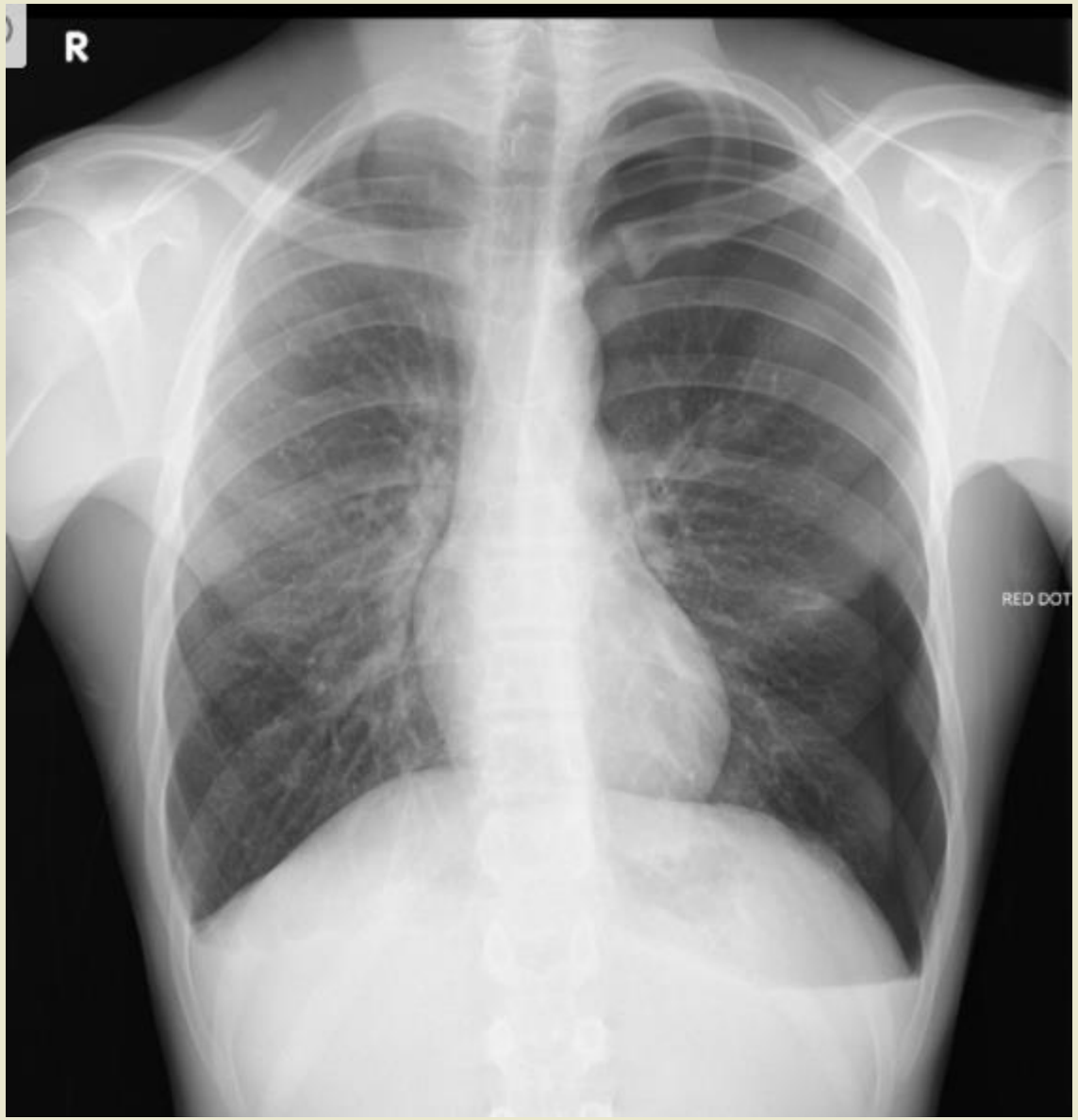


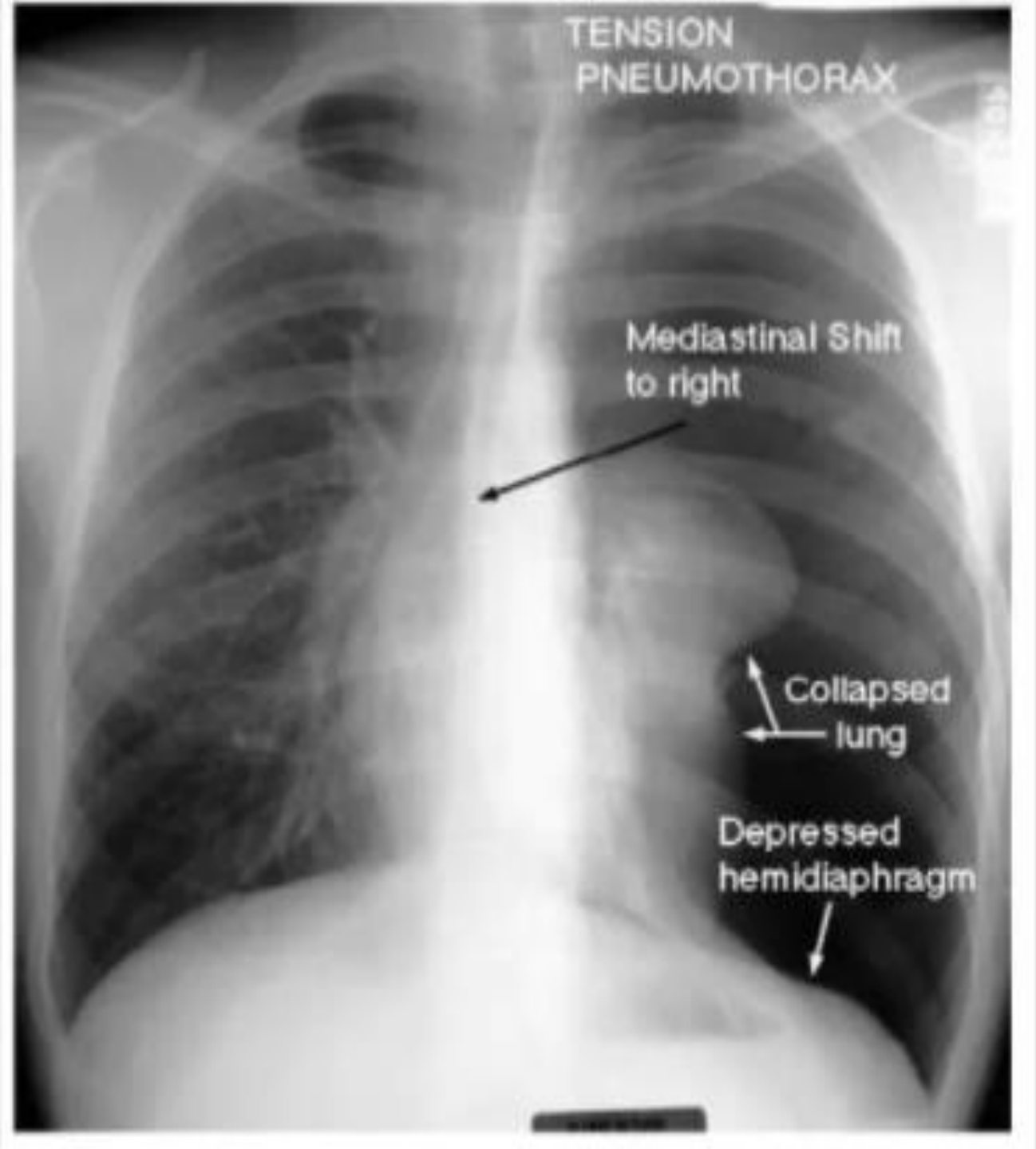
Visceral pleural line (zoomed view on next slide)

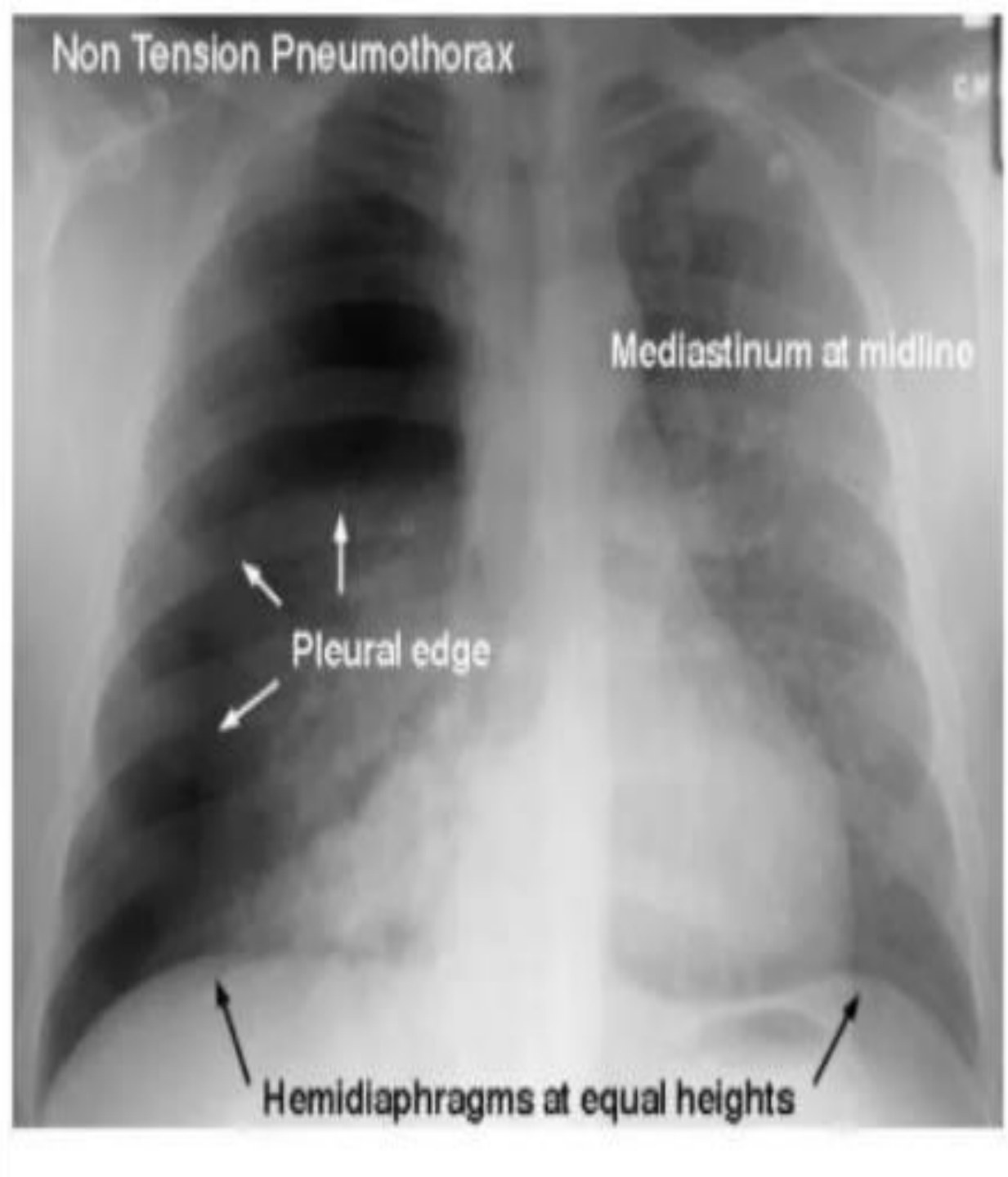
No mediastinal shift

Small pleural effusion (common finding)


Note absence of lung markings lateral to this line


R
RED DOT

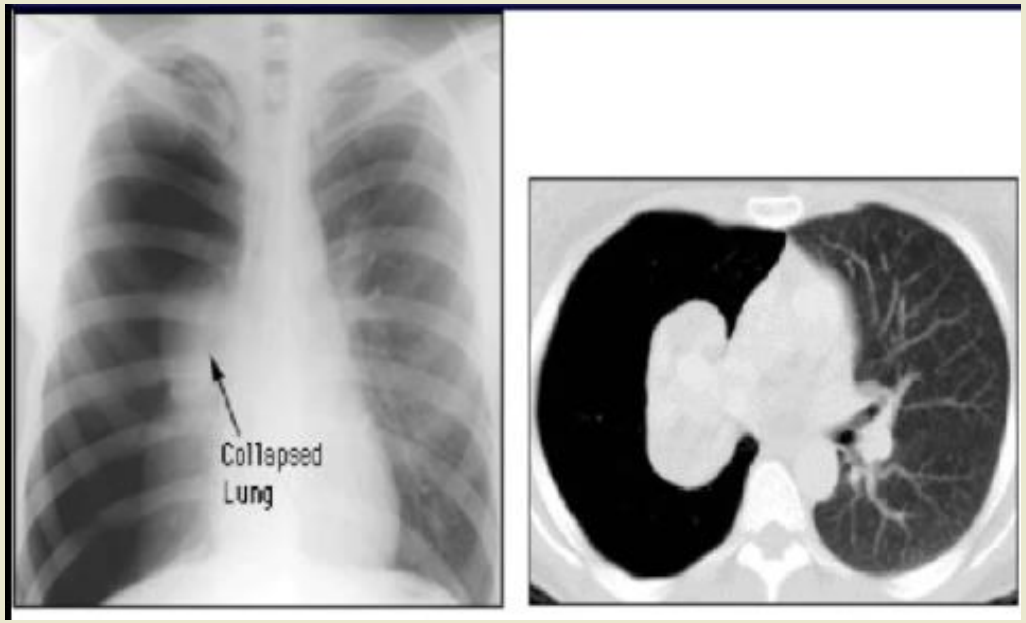

TENSION
PNEUMOTHORAX
Mediastinal Shift
to right
Collapsed
lung
Depressed
hemidiaphragm

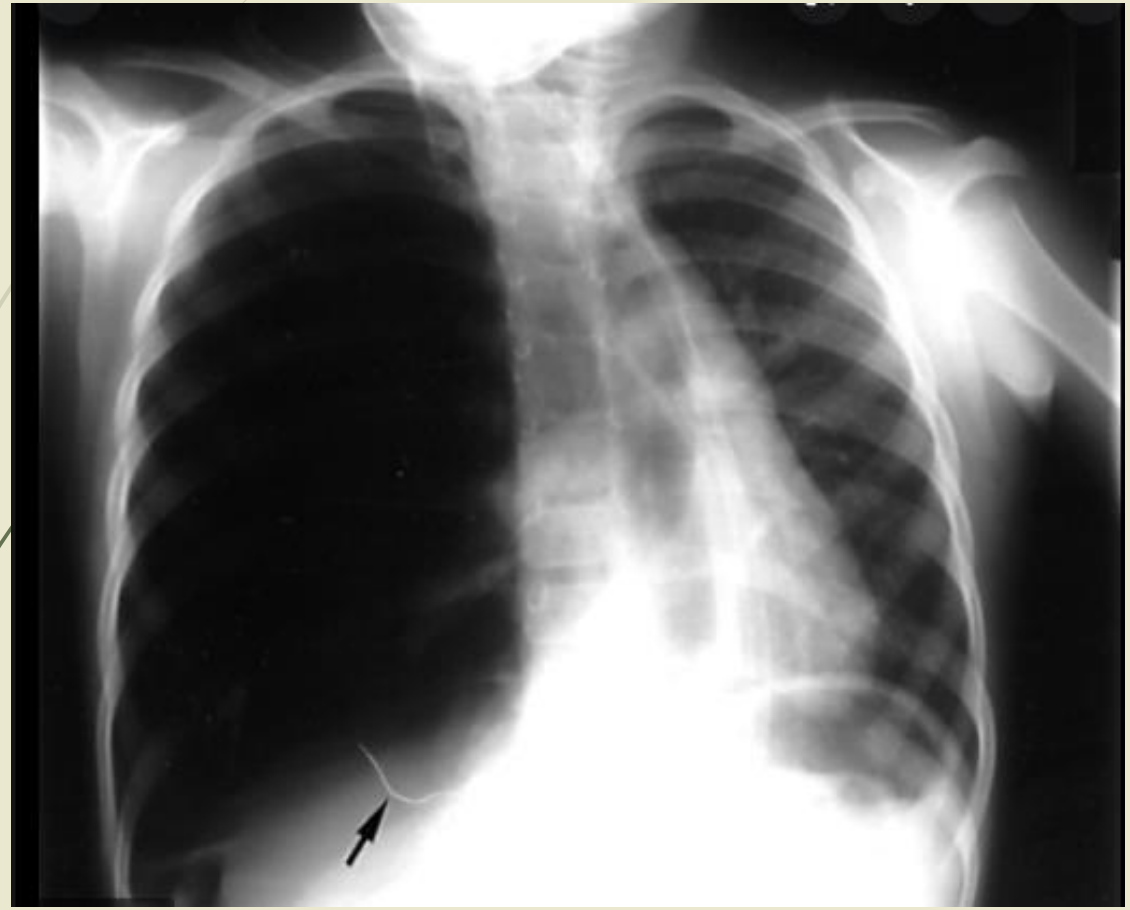

Non Tension Pneumothorax
Mediastinum at midline
Pleural edge
Hemidiaphragms at equal heights

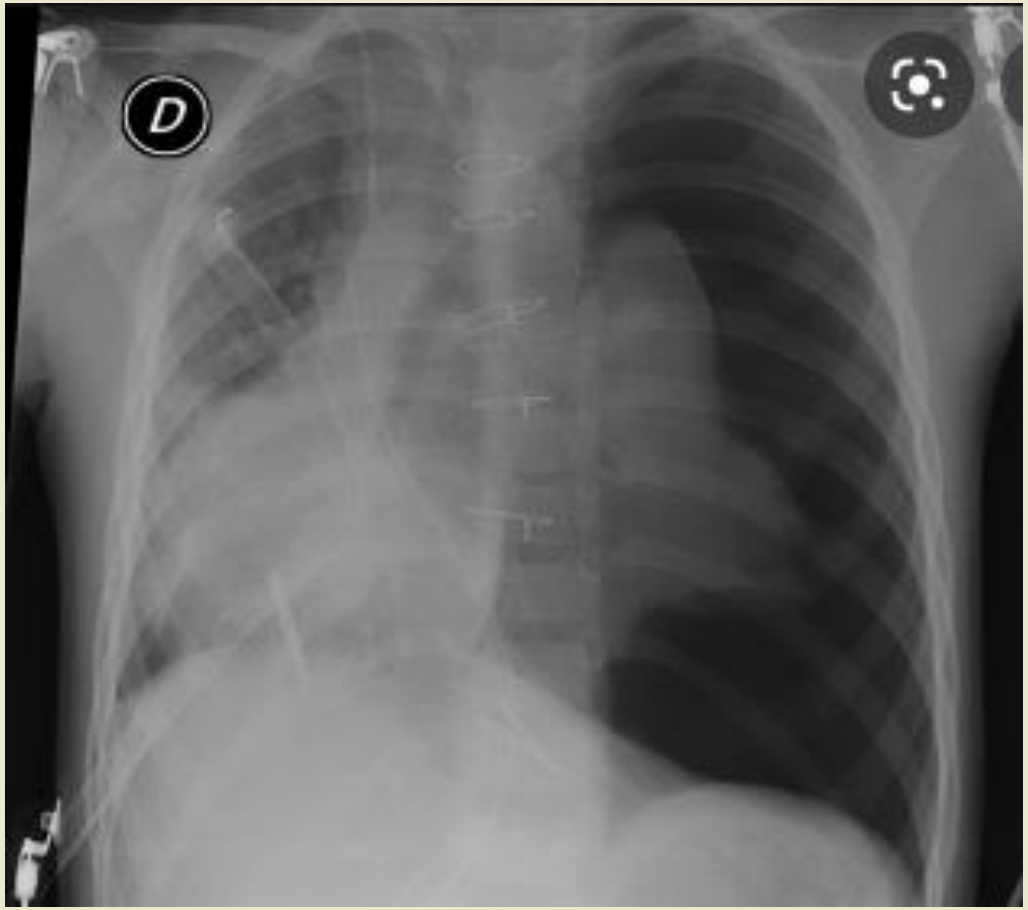
Imaging- Plane chest X-ray film

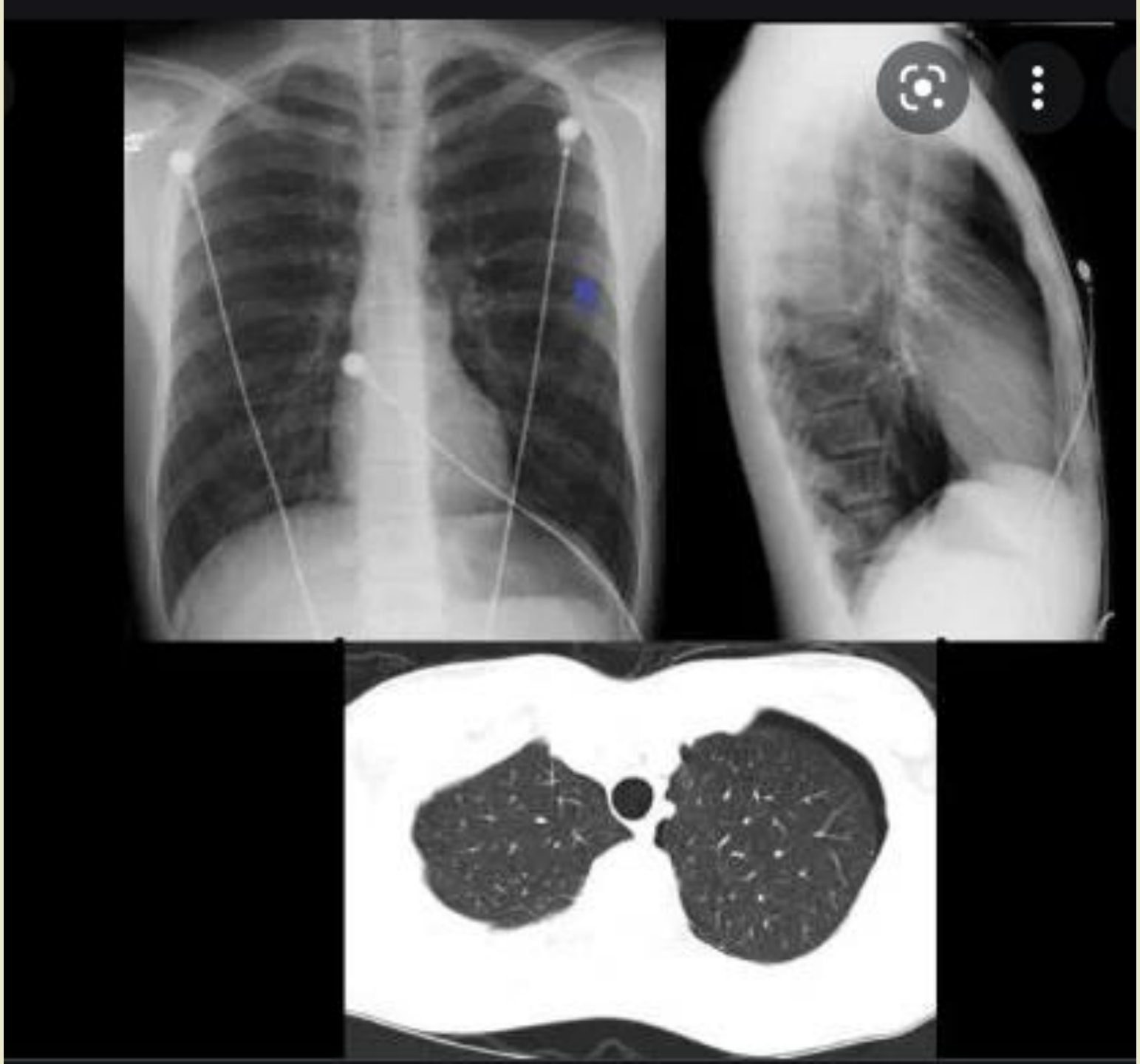
- Establishing the diagnosis
- The characteristics of pneumothorax
  - Pleural line
  - No lung markings in pneumothorax
- The outer margin of visceral pleura separated from the parietal pleura by a lucent gas space devoid of pulmonary vessels

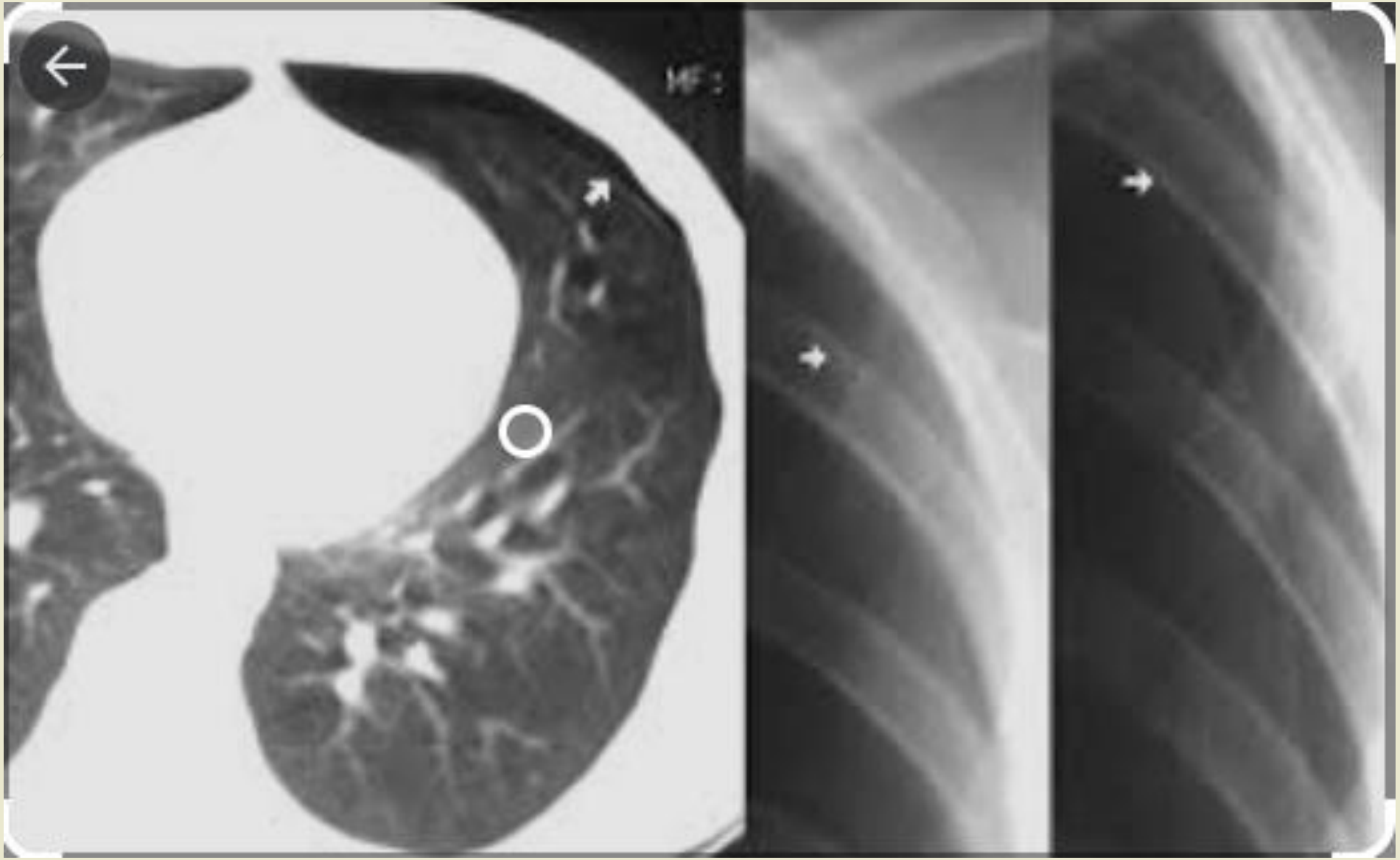
CT scanning






D





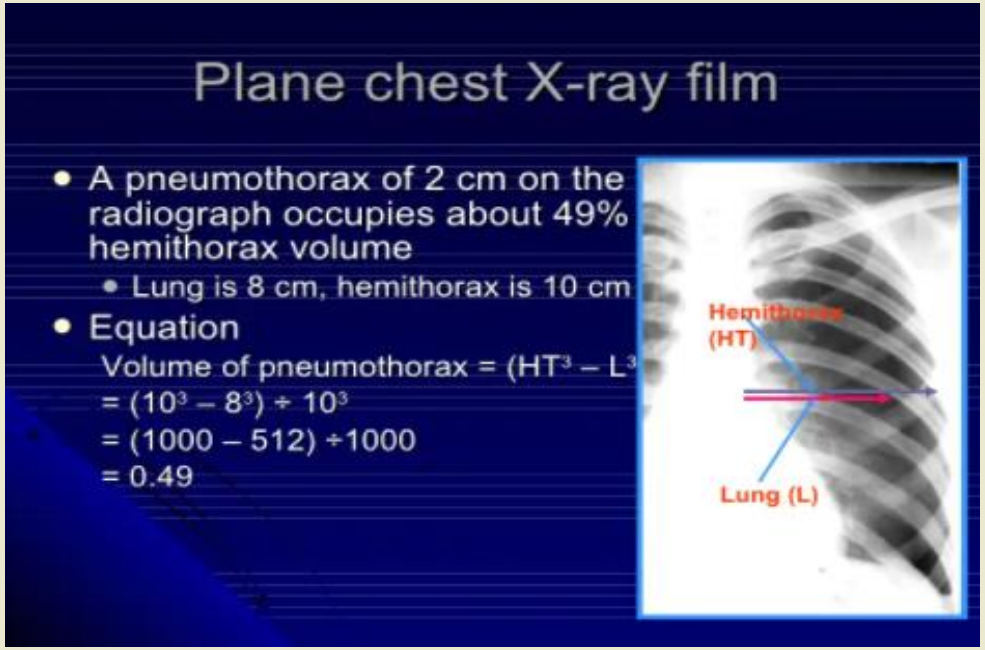
Congenital lobar emphysema

Skin fold

...DIAGNOSIS

- *In infants, anteroposterior radiographs typically are obtained in the supine position. In this position, the pneumothorax is difficult to detect because the air accumulates anteriorly. However, if the pneumothorax is large, the affected side may appear hyperlucent.*
- *Detection of smaller pneumothoraces may be improved by obtaining a radiograph taken with the infant in a* ***lateral decubitus position****, with the affected side up.*

- ***Transillumination of the chest***
- ***Estimation of size***
- ***Blood gas and pulse oximetry***
- ***Bedside ultrasound***



INITIAL MANAGEMENT

- *The management of pneumothorax has not been fully standardized, particularly for children.*

- *Although indications for conservative therapy are fairly well accepted, criteria for specific drainage procedures are controversial.*

Stable patients with small pneumothorax

- *For clinically stable patients with an initial primary spontaneous pneumothorax (PSP) that is small (ie, occupying <30 percent of the hemithorax), we recommend observation in hospital.. The pneumothorax should be reassessed by chest radiograph in 6 to 12 hours. If the PSP is resolving during the first 12 hours and the patient has no pain or respiratory distress, observation may be continued on an outpatient basis. Younger patients (eg, under 12 years of age) should be observed for longer. we would generally place a thoracostomy tube within 24 to 48 hours if the pneumothorax is not improving and earlier if it is increasing in size.*

- ***Supplemental oxygen – Nitrogen washout***

- ***Analgesics, antitussives, and other supportive care are provided if necessary.***

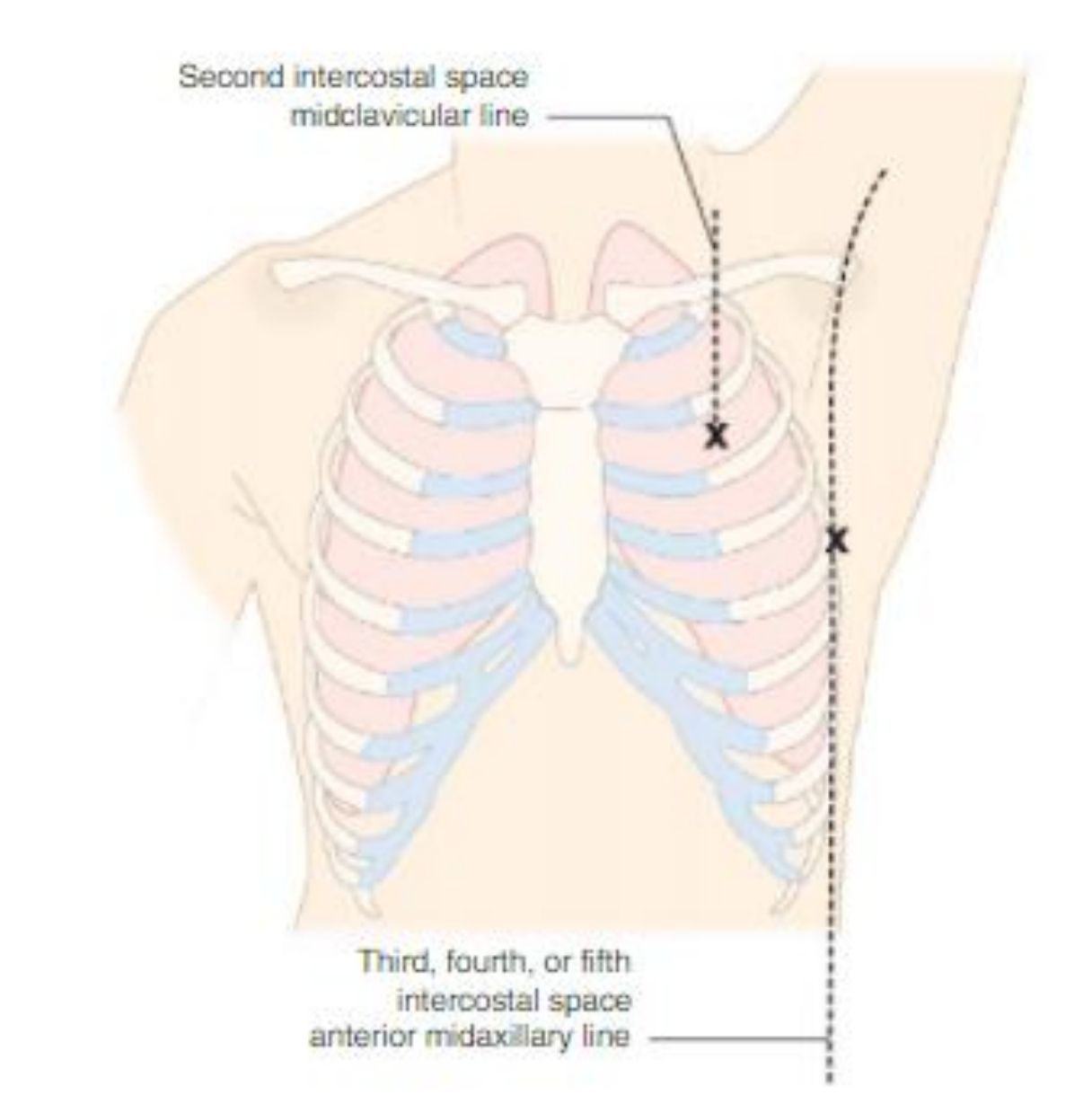
Stable patients with large pneumothorax

- *For patients with a first occurrence of a pneumothorax that is large (eg, occupying >30 percent of the hemithorax), we suggest needle aspiration, in addition to hospital admission and supplemental oxygen.*

- *If no further air can be aspirated, the stopcock is closed and the catheter is secured to the chest wall. A chest radiograph should be obtained after four hours of observation. If adequate expansion has occurred, the catheter can be removed and the patient observed for an additional two hours. Although an adult patient can be discharged if the lung remains expanded on the chest radiograph at this time , we recommend that children who require aspiration of a pneumothorax continue to be observed in the hospital for at least 24 hours with close monitoring or telemetry. A repeat chest radiograph should be obtained prior to considering hospital discharge.*

- *In patients treated with needle aspiration, the air will reaccumulate in 20 to 50 percent because of a persistent air leak, so close follow-up with serial chest radiographs is required .*

- *If the air reaccumulates, these patients should be treated with thoracostomy tube.*

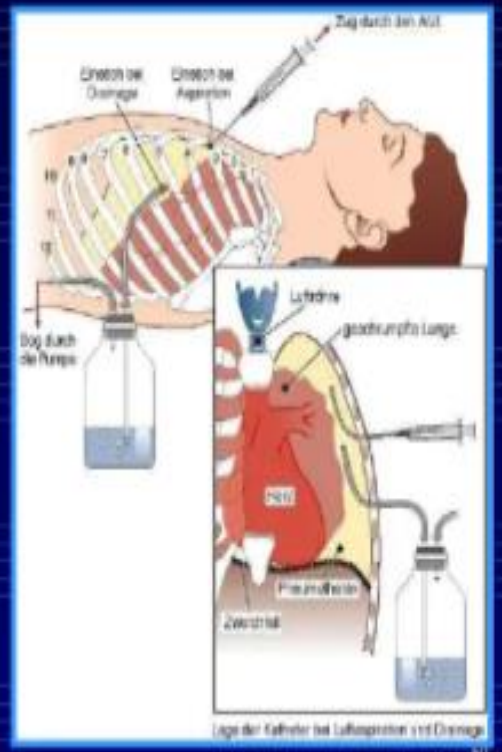

Second intercostal space
midclavicular line
Third, fourth, or fifth
intercostal space
anterior midaxillary line

Unstable Patients

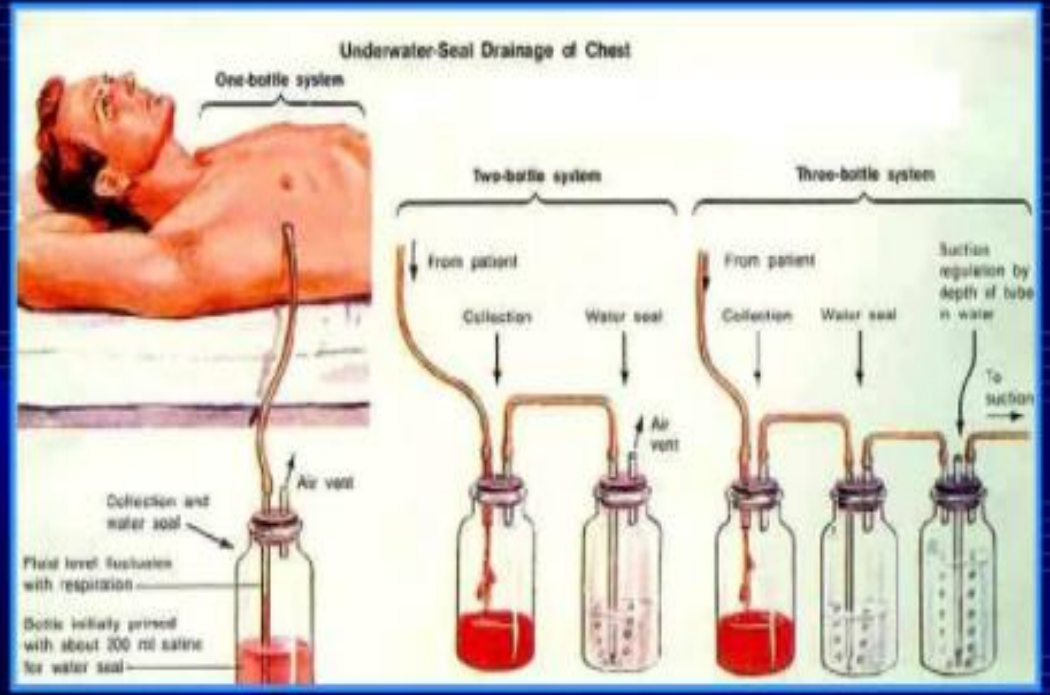
- *For patients with significant dyspnea, hypoxemia, or pain, we suggest thoracostomy tube or pigtail catheter insertion, in addition to hospital admission and supplemental oxygen.*
- *A thoracostomy tube requires the use of a one-way Heimlich valve or water seal device to prevent reaccumulation of air. If the lung does not fully expand after drainage, suction should be applied to a water seal device. Early use of strong suction is not recommended, because rapid expansion of the lung is associated with a risk of reexpansion-induced pulmonary edema.*
- *If no bubbles emanate from the thoracostomy tube for 12 hours or more, we recommend clamping the chest tube for an additional 24 hours to observe whether air reaccumulates, although the utility of this approach is unproven. The chest tube can be removed after 24 hours if there is no radiographic or clinical evidence of recurrence of the pneumothorax. We generally repeat the chest radiograph 12 to 24 hours after removal of the chest tube.*

Catheter aspiration

- Catheter aspiration of pneumothorax can be used where the equipment and experience is available



Intercostal tube drainage



Patients with underlying lung disease

- *For most patients with a large pneumothorax due to underlying lung disease (SSP), we suggest thoracostomy tube or pigtail catheter insertion.*

- *Needle aspiration is a reasonable alternative for selected patients who are stable and have moderate-sized pneumothorax*

Patients with recurrent pneumothorax

- *Patients with recurrent PSP or SSP (either ipsilateral or contralateral) should have their lung expanded with a tube thoracostomy, then undergo surgical intervention.*

- *Pleurodesis is typically performed during the thoracotomy procedure to help prevent additional recurrences.*

Failure to reexpand or recurrence

Indications for surgical intervention

- **Primary spontaneous pneumothorax (PSP)**

- *•A first PSP and an air leak that fails to resolve after approximately five days of thoracostomy drainage. This is the time period typically suggested for adults but is based on panels of experts rather than empiric evidence . In patients with a first PSP, the presence of small apical blebs on (CT) is not an indication for immediate surgical intervention, but we observe such patients closely and tend to move more quickly to surgical intervention if the patient does not improve with conservative management.*

- *•Recurrence of PSP (either ipsilateral or contralateral).*

Secondary spontaneous pneumothorax (SSP)

- *We suggest surgical intervention and a preventive intervention (eg, video-assisted thoracoscopic surgery [VATS] with pleurodesis) in the following groups of patients:*
- *•Recurrent SSP (either ipsilateral or contralateral).*
- *•Patients with cystic fibrosis and recurrence of a large SSP . Pleurodesis using mechanical abrasion rather than chemical pleurodesis is preferred and does not preclude subsequent lung transplantation.*
- *•Patients with a first episode of SSP due to other causes, if the underlying lung disease is severe, progressive, persistent, or is known to be associated with recurrent pneumothoraces. As examples:*
- *-We perform a preventive intervention for patients with bullous lung disease.*
- *-We do not usually perform preventive interventions for patients with mild or moderate asthma after a first occurrence of pneumothorax. Instead, the primary treatment for such patients is to optimize asthma treatment.*
- *-Children with necrotizing pneumonia are treated with proper antibiotics and pleural space suctioning. If they develop bronchopleural fistula, surgical intervention is warranted.*

Surgical Technique

- *Surgery for pneumothorax consists of stapling or oversewing ruptured blebs or tears in the visceral pleura and resection of abnormal lung tissue, if present. The approaches used include VATS, mini-thoracotomy, and conventional thoracotomy . None has been shown to be superior*

- *We usually use VATS, which provides adequate exposure for resection or stapling and an opportunity for abrasion or chemical pleurodesis. The morbidity of VATS is less than with conventional or mini-thoracotomy, and recurrence rates are approximately 5 percent in adults, although open thoracotomy and pleurectomy have the lowest recurrence rate*

Pleurodesis

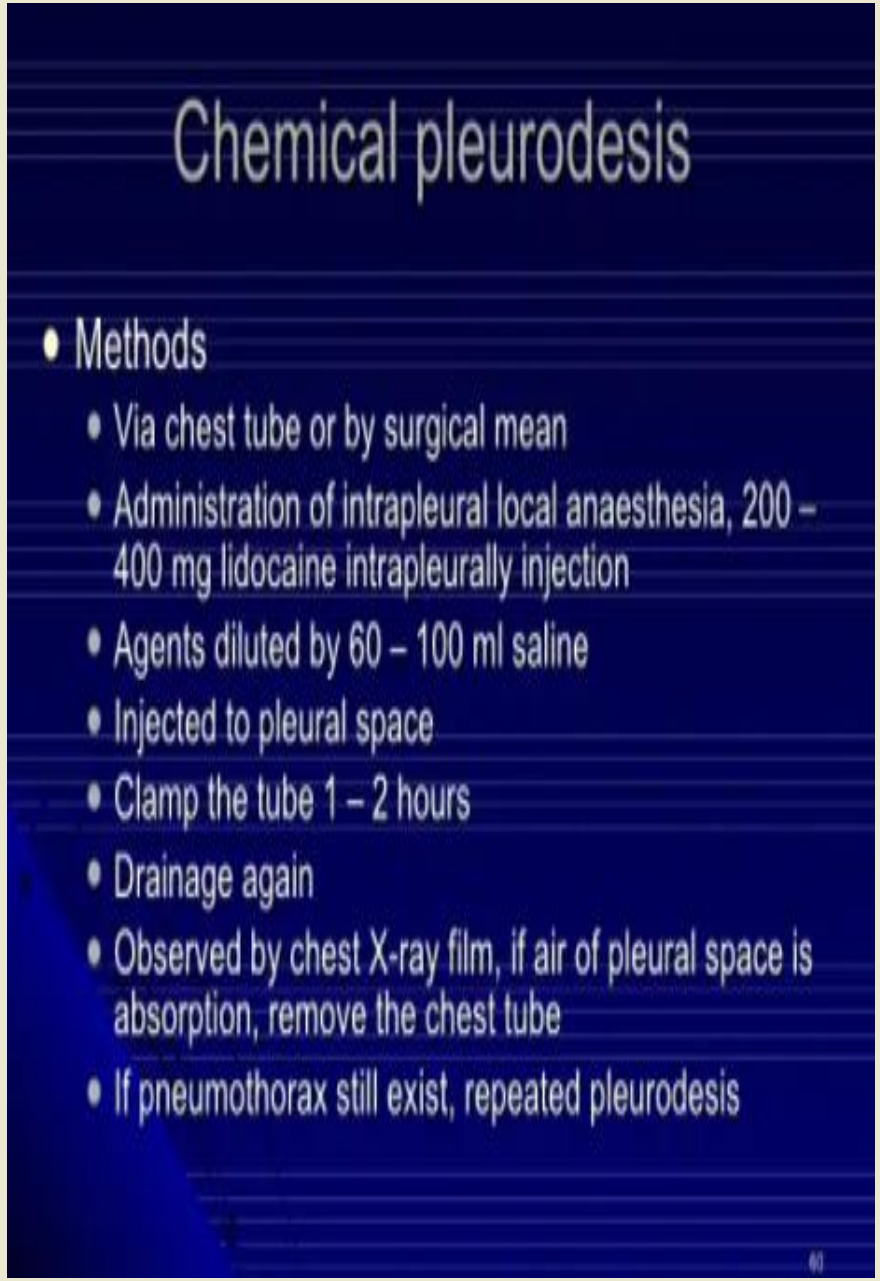
pleurodesis may be indicated for the first episode of a secondary pneumothorax, due to the high incidence of recurrence that could be life-threatening . With no underlying lung disease (primary pneumothorax), the procedure is usually reserved for a recurrence.

Pleurodesis also is recommended for individuals who participate in activities associated with increased risk of pneumothorax, such as deep sea diving or flying in small, unpressurized aircraft.

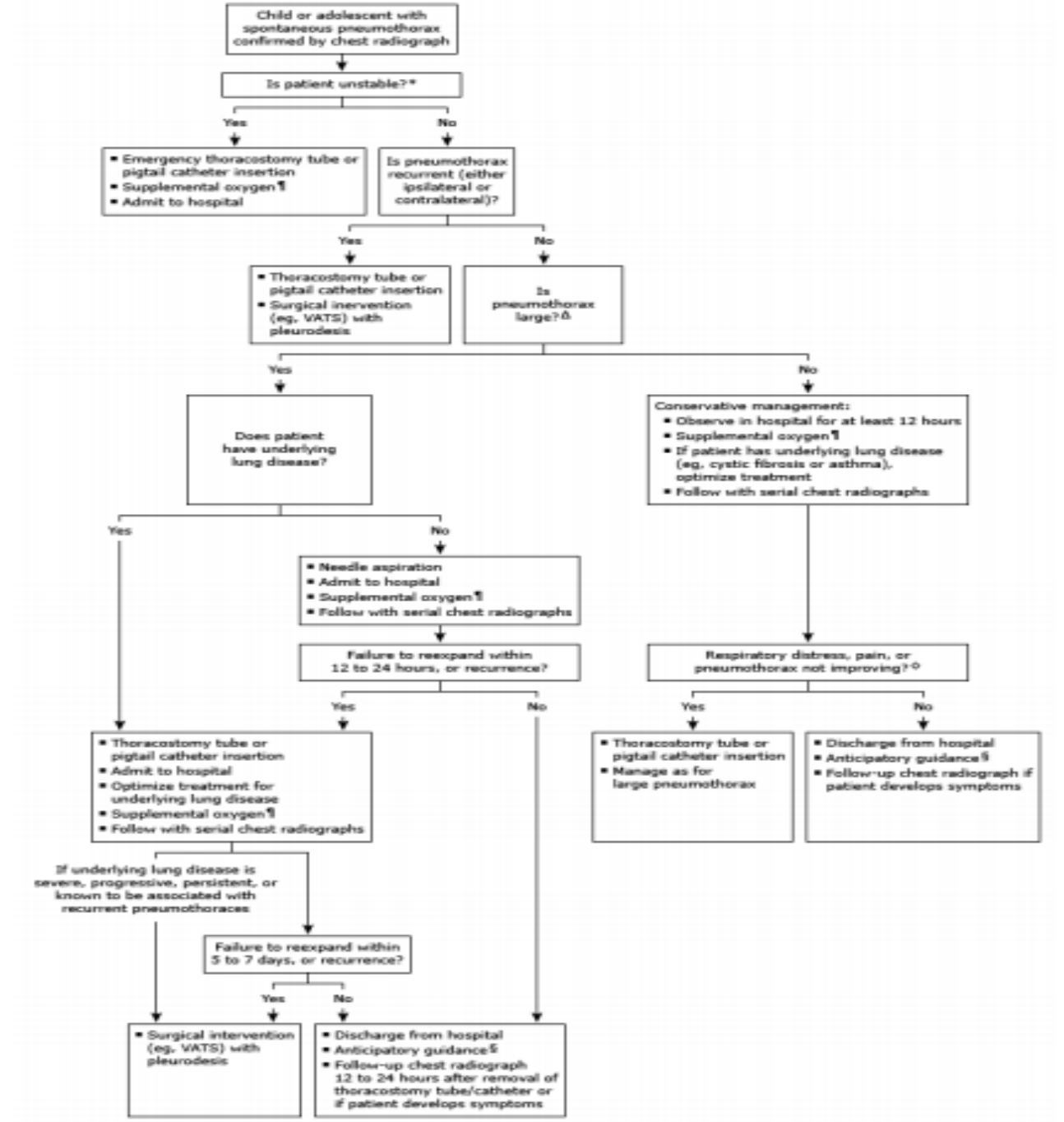
Numerous chemical irritants have been used to induce pleurodesis:

talc, tetracycline, minocycline, doxycycline, silver nitrate, iodopovidone, bleomycin, Corynebacterium parvum with parenteral methylprednisolone acetate, erythromycin, fluor ouracil, interferon beta, autologous blood, mitomycin , cisplatin, cytarabine, doxorubicin, etop oside, bevacizumab (intravenous or intrapleural) and Streptococcus pyogenes A3

The choice among these agents is determined by several factors, including local expertise, availability of individual agents, and the underlying process for which chemical pleurodesis is needed.



Management of spontaneous pneumothorax in children and adolescents



Resolution of pneumothorax

- *Once a pneumothorax has resolved after conservative management or thoracostomy tube, the patient can be discharged, with instructions to return for any new symptoms. For patients managed conservatively, we do not repeat imaging unless the patient develops new symptoms. For patients who had a thoracostomy tube, the pneumothorax should be reevaluated by chest radiograph within 12 to 24 hours after removal of the thoracostomy tube.*

- *All patients with resolved PSP or SSP should be strongly advised not to smoke tobacco.*

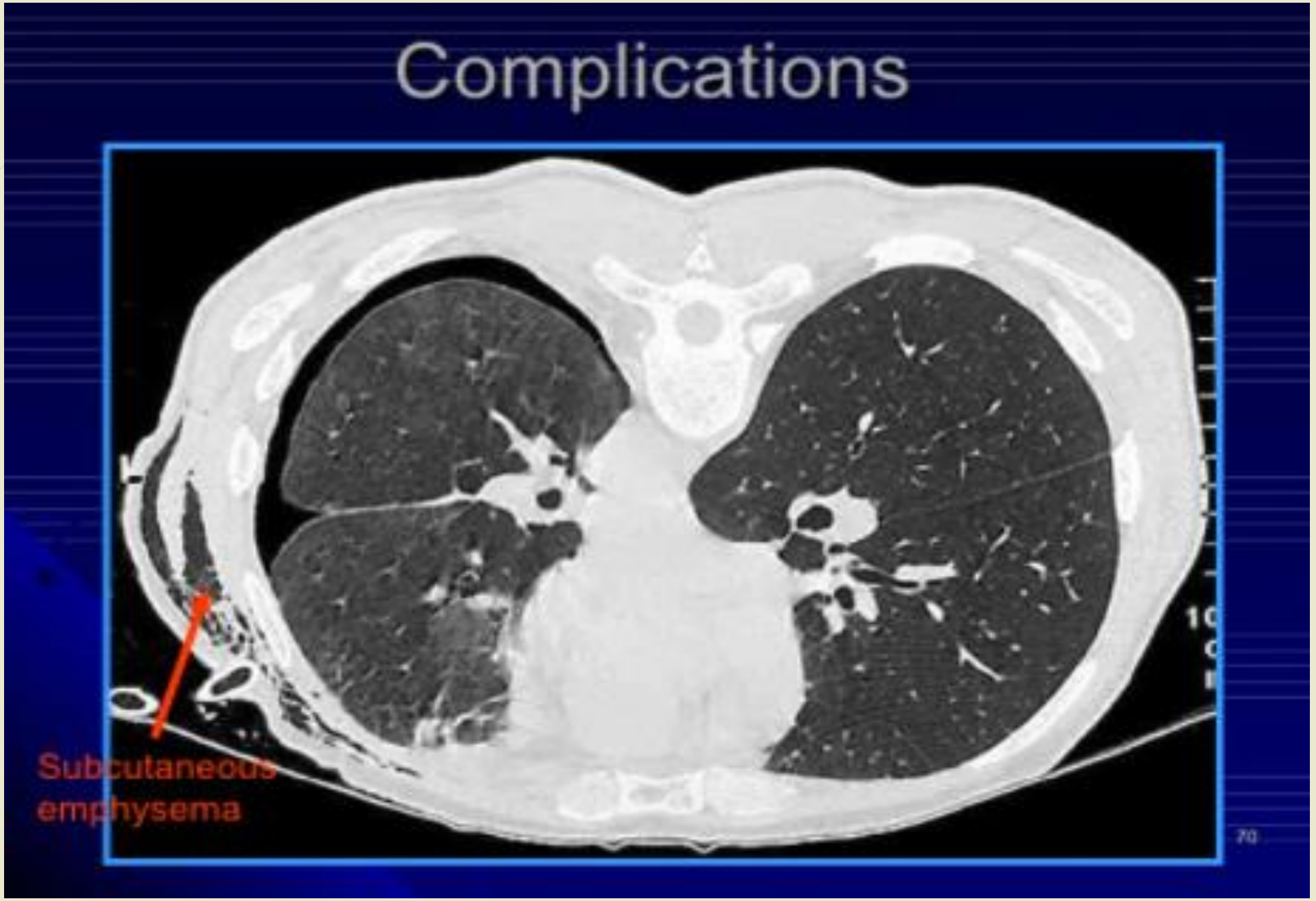
- *avoidance of air travel until at least 2 week after full resolution of the pneumothorax.*

- *Activities such as deep sea diving or flying in small, unpressurized aircrafts are associated with increased risk of pneumothorax and should be avoided in individuals who did not undergo pleurodesis.*

OUTCOME

- *The recurrence risk for pediatric patients with SSP is unclear but probably depends substantially on the underlying lung disease; patients with cystic fibrosis and pneumothorax have a recurrence rate of 50 to 80 percent if a preventive procedure is not performed*

Complications



Thank You
Thank You
Thank You!!!!