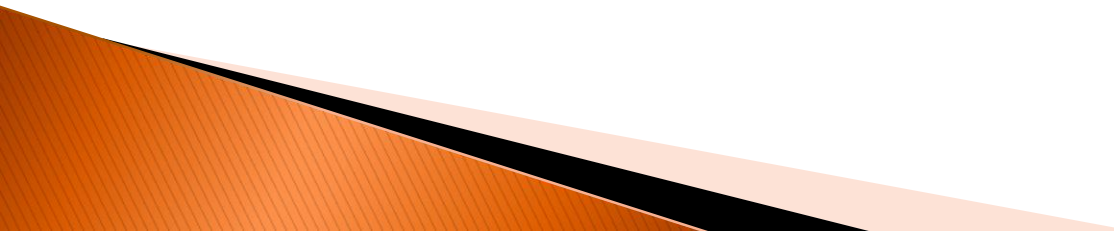

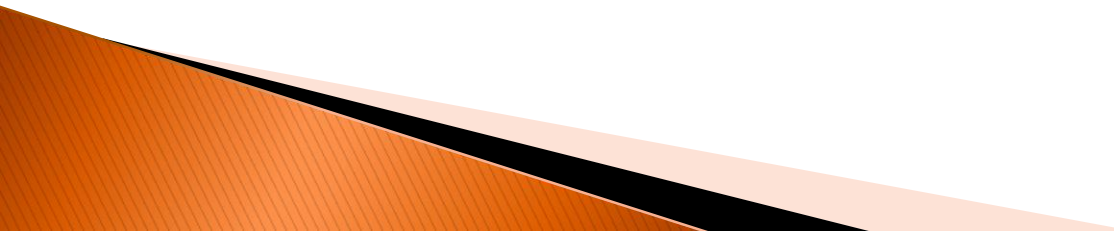
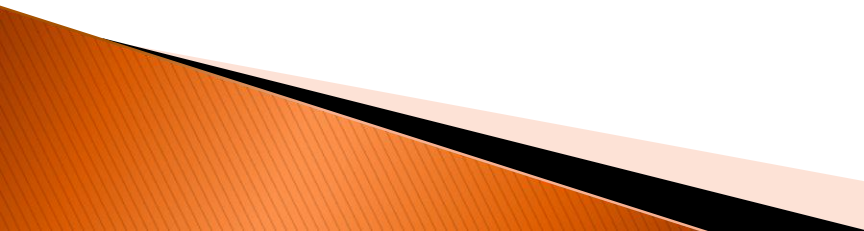


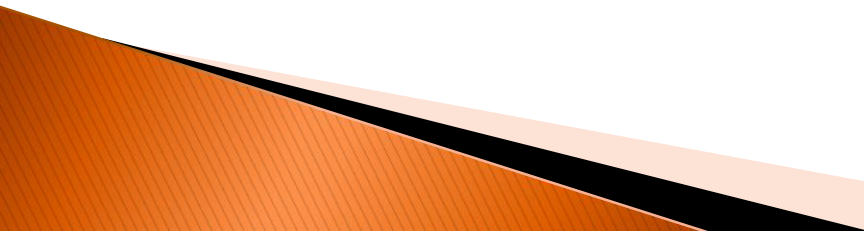
# DISEASES OF THE PLEURA

- ▶ **Normal Structure:**
  - ▶ Visceral pleura covers the lungs and extends into the fissures.
  - ▶ While the parietal pleura limits the mediastinum and covers the dome of the diaphragm and inner aspect of the chest wall.
  - ▶ The two layers between them enclose pleural cavity which contains less than 15 ml of clear serous fluid.
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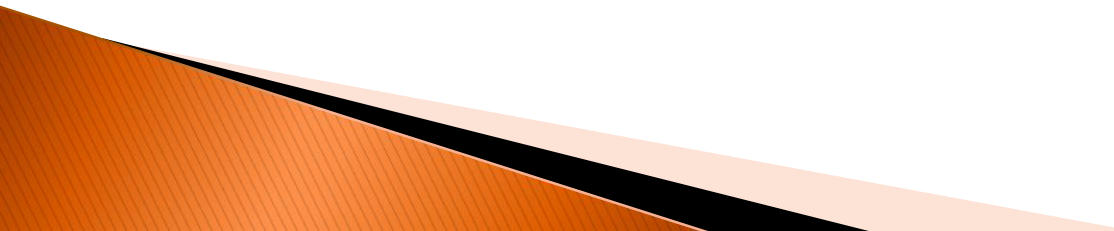
- ▶ **Microscopically:**
  - ▶ Both pleural layers are lined by single layer of flattened mesothelial cells facing each other.
  - ▶ Underneath the lining cells is a thin layer of connective tissue.
  - ▶ Diseases affecting the pleura are nearly always secondary to some other underlying disease.
  - ▶ **Broadly, they fall into:**
    1. Inflammations,
    2. Non-inflammatory pleural effusions,
    3. Pneumothorax,
    4. Tumors.
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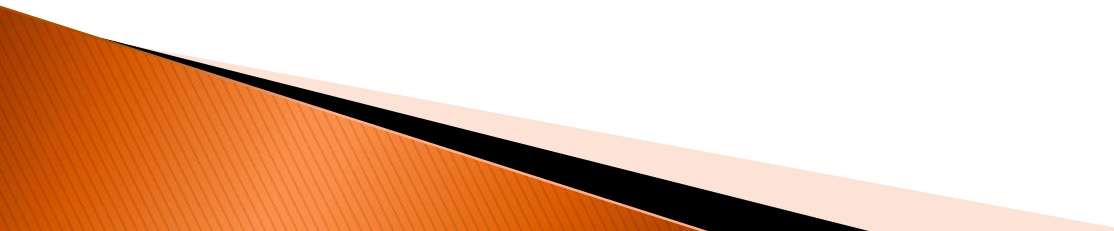
- ▶ Pathological involvement of the pleura is, with rare exceptions, a secondary complication of an underlying pulmonary disease.
  - ▶ Evidence of secondary infection and pleural adhesions are particularly common findings at autopsy.
  - ▶ **Important primary disorders are:**
    1. Primary intrapleural bacterial infections and
    2. Primary neoplasm of the pleura known as malignant mesothelioma.
- 

- ▶ *The presence of fluid in the pleural space is known as pleural effusion.*
  - ▶ The fluid can be either transudate or exudate.
  - ▶ When the pleural fluid is *a transudate*, the condition is termed *hydrothorax*.
  - ▶ Hydrothorax from CHF probably is the most common cause of fluid accumulation in the pleural cavity.
  - ▶ *An exudate*, characterized by protein content greater than 3gm/dL and, often, inflammatory cells, suggests pleuritis.
- 

- ▶ ***The four principal causes of pleural exudate formation are:***
1. Microbial invasion through either direct extension of pulmonary infection or blood borne seeding (suppurative pleuritis or empyema),
  2. Cancer (lung carcinoma, metastatic neoplasms to the lung or pleural surface, mesothelioma),
  3. Pulmonary infarction, and
  4. Viral pleuritis.
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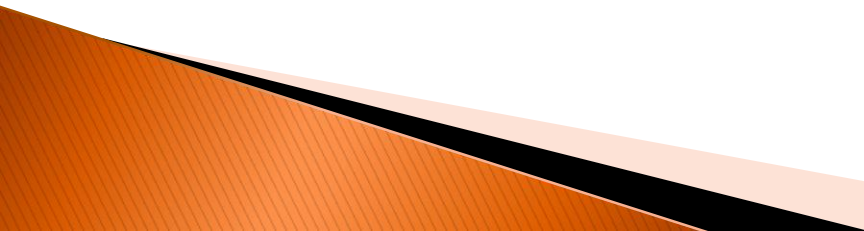
▶ *Other, less common causes of exudative pleural effusions are:*

1. Systemic lupus erythematosus,
  2. Rheumatoid arthritis,
  3. Uremia,
  4. Previous thoracic surgery.
- ▶ Malignant effusions characteristically are large and frequently bloody (hemorrhagic pleuritis).
- ▶ Cytological examination may reveal malignant and inflammatory cells.
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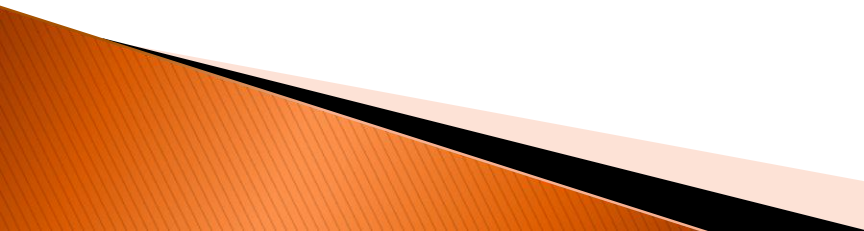
- ▶ Whatever the cause, transudates and serous exudates usually are resorbed without residual effects if the inciting cause is controlled or remits.
  - ▶ By contrast, fibrinous, hemorrhagic, and suppurative exudates may lead to fibrous organization, yielding adhesions or fibrous pleural thickening, and sometimes minimal to massive calcifications.
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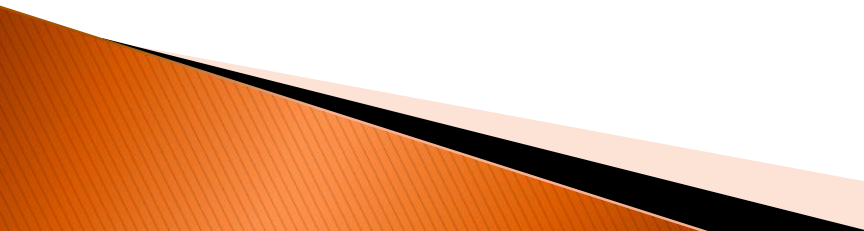


# Inflammation of the Pleura

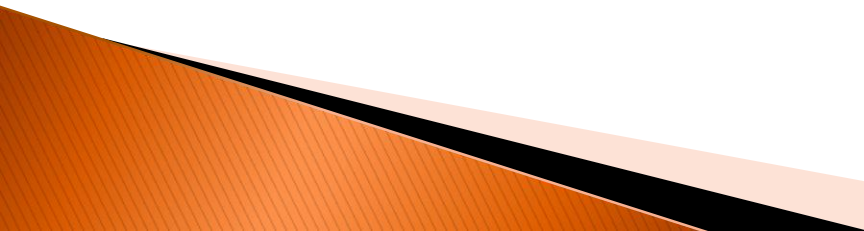
- ▶ Inflammatory involvement of the pleura is commonly termed pleuritis or pleurisy.
  - ▶ *Depending upon the character of resultant exudate, it can be divided into serous, fibrinous and serofibrinous, suppurative or empyema, and hemorrhagic pleuritis.*
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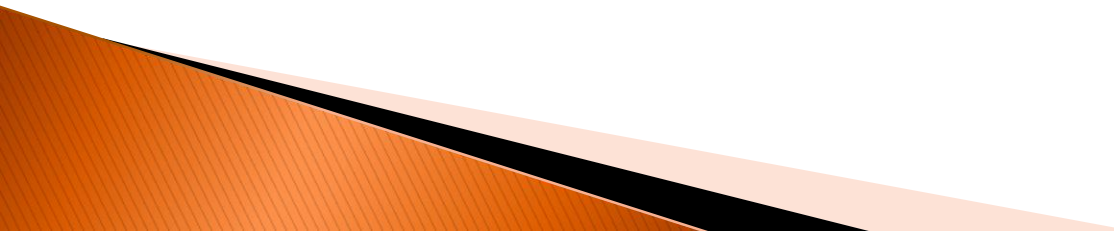
# PLEURITIS

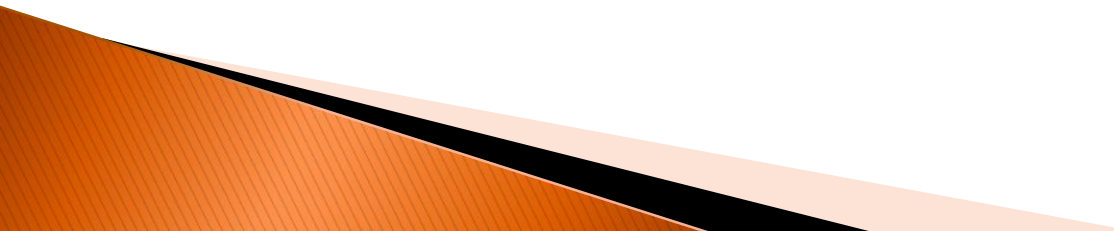
- ▶ **Serous, fibrinous, and sero-fibrinous pleuritis:**
  - ▶ Acute inflammation of the pleural sac (acute pleuritis).
  - ▶ Most of the causes of such pleuritis are infective in origin, particularly within the lungs, such as tuberculosis, pneumonias, pulmonary infarcts, lung abscess and bronchiectasis.
- 

- ▶ Other causes include collagen diseases (e.g. rheumatoid arthritis and SLE), uremia, metastatic involvement of the pleura, irradiation of lung tumors and diffuse systemic infections (e.g. typhoid fever, tularemia, blastomycosis and coccidioidomycosis).
  - ▶ Pleurisy causes pain in the chest on breathing and a friction rub is audible on auscultation.
  - ▶ In most patients, the exudate is minimal and is resorbed resulting in resolution.
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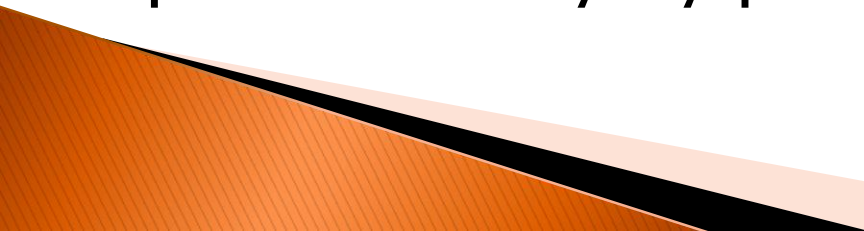
- ▶ Repeated attacks of pleurisy may result in organization leading to fibrous adhesions and obliteration of the pleural cavity.

- ▶ **Suppurative pleuritis (Empyema ):**
  - ▶ Bacterial or mycotic infection of the pleural cavity that converts a serofibrinous effusion into purulent exudate is termed suppurative pleuritis or empyema thoracis.
  - ▶ The most common cause is direct spread of pyogenic infection from the lung.
  - ▶ Other causes are direct extension from subdiaphragmatic abscess or liver abscess and penetrating injuries to the chest wall.
  - ▶ Occasionally, the spread may occur by hematogenous or lymphatic routes.
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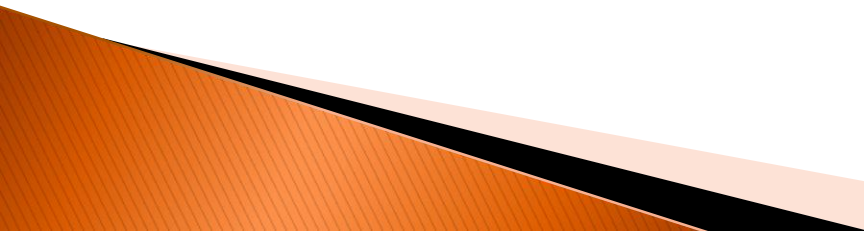
- ▶ In empyema, the exudate is yellow–green, creamy pus that accumulates in large volumes.
  - ▶ Empyema is eventually replaced by granulation tissue and fibrous tissue.
  - ▶ In time, tough fibro–collagenic adhesions develop which obliterate the cavity, and with passage of years, calcification may occur.
  - ▶ The effect of these is serious respiratory difficulty due to inadequate pulmonary expansion.
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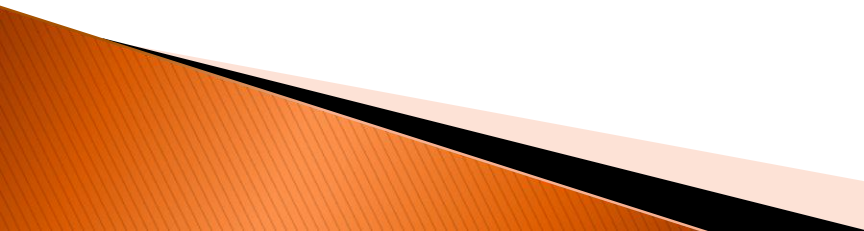
- ▶ **Hemorrhagic pleuritis:**
  - ▶ Hemorrhagic pleuritis differs from hemothorax in having inflammatory cells or exfoliated tumor cells in the exudate.
  - ▶ The causes of hemorrhagic pleuritis are metastatic involvement of the pleura, bleeding disorders and rickettsial diseases.
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# Non-Inflammatory Pleural Effusions

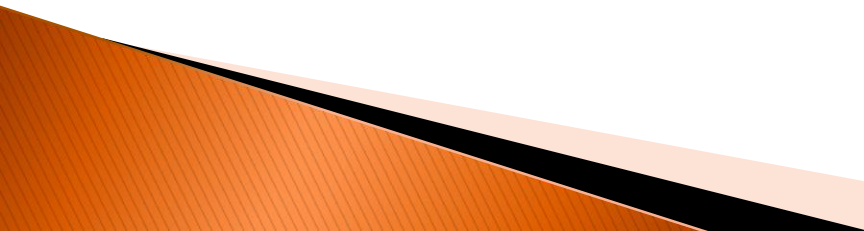
- ▶ These include fluid collections in the pleural cavity such as hydrothorax, hemothorax and chylothorax.
  - 1. **Hydrothorax:**
    - ▶ Hydrothorax is non-inflammatory accumulation of serous fluid within the pleural cavities.
    - ▶ Hydrothorax may be unilateral or bilateral depending upon the underlying cause.
    - ▶ Occasionally, effusion is limited to part of the pleural cavity by preexisting pleural adhesions.
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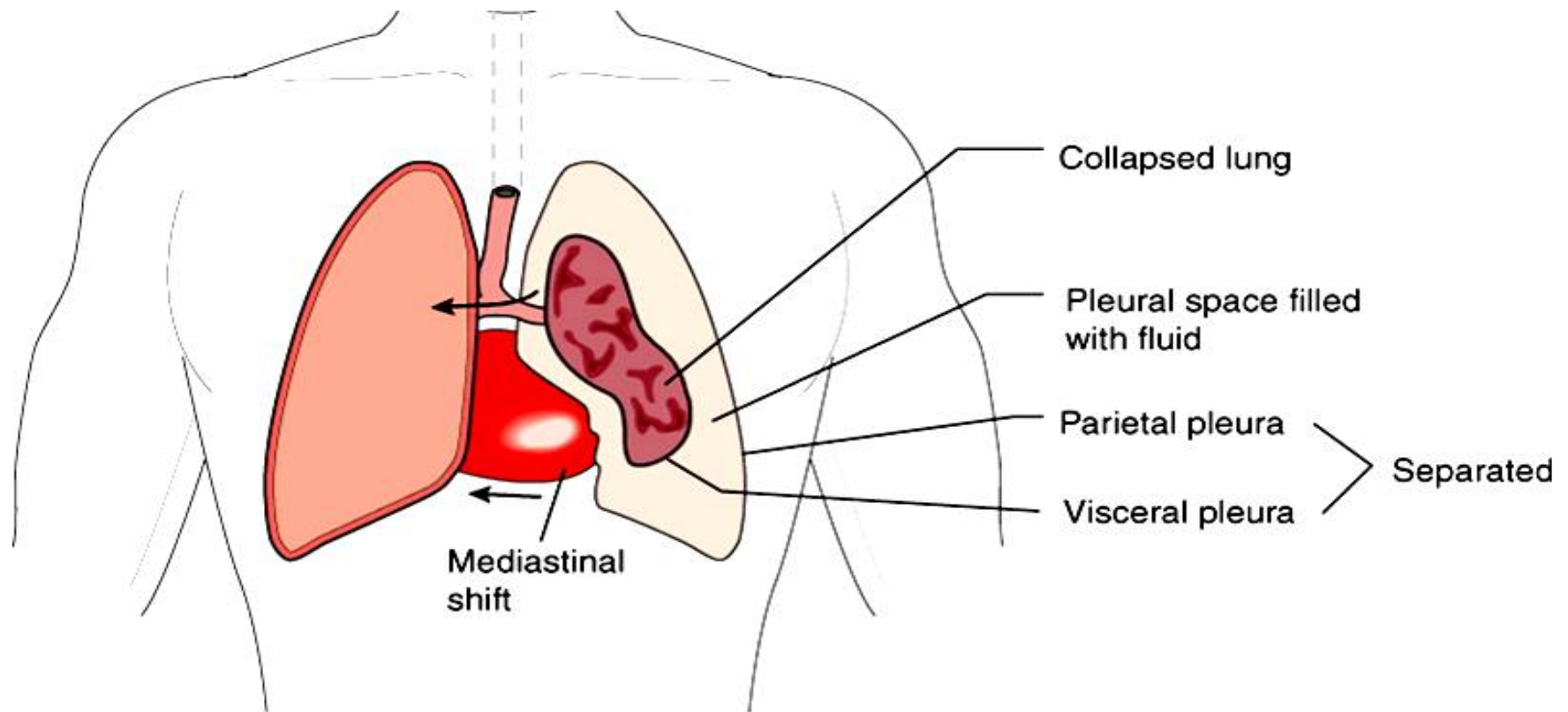


- ▶ The most common cause of hydrothorax, often bilateral, is CHF.
  - ▶ Other causes are renal failure, liver cirrhosis, Meig's syndrome, pulmonary edema and primary and secondary tumors of the lungs.
  - ▶ The non-inflammatory serous effusion in hydrothorax is clear and straw-colored and has the characteristics of transudate with a specific gravity of under 1.012, protein content below 1 gm/dl and little cellular content.
- 

- ▶ If the fluid collection in the pleural cavity is less than 300 ml (normal is less than 15 ml).
  - ▶ No signs or symptoms are produced and may be apparent in chest X-ray in standing posture as obliterated costo-diaphragmatic angle.
  - ▶ If the pleural cavity contains abundant fluid, it produces a characteristic opaque radiographic appearance to the affected side with deviation of trachea to the opposite side.
  - ▶ In such cases, symptoms such as dyspnea are produced which are promptly relieved on withdrawal of the fluid.
- 


- ▶ **Hemothorax:**
  - ▶ Accumulation of pure blood in the pleural cavity is termed hemothorax.
  - ▶ The most common causes of hemothorax are trauma to the chest wall or to the thoracic viscera and ruptured intrathoracic aortic aneurysm that is almost always fatal.
  - ▶ With hemothorax, in contrast with bloody pleural effusions, the blood clots within the pleural cavity.
  - ▶ The blood will clot and organize → fibrous adhesions and obliteration of the pleural cavity.
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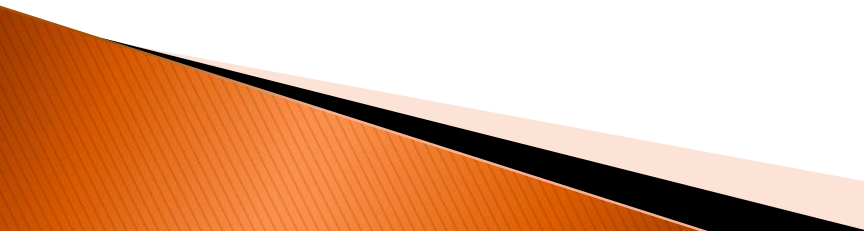
- ▶ **Chylothorax:**
  - ▶ Chylothorax is an uncommon condition in which there is accumulation of milky fluid of lymphatic origin into the pleural cavity.
  - ▶ Chylothorax implies obstruction of the major lymph ducts, usually by an intrathoracic cancer (e.g., a primary or secondary mediastinal neoplasm, such as a lymphoma).
  - ▶ Chylothorax is more often confined to the left side.
  - ▶ Chylous effusion is milky due to high content of finely emulsified fats in the chyle.
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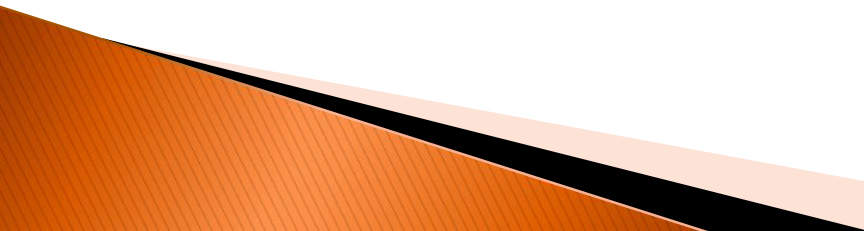


**A Pleural Effusion**

# PNEUMOTHORAX

- ▶ *An accumulation of air in the pleural cavity is called pneumothorax.*
  - ▶ *It may occur in one of three circumstances: spontaneous, traumatic and therapeutic.*
  - 1. ***Spontaneous pneumothorax** occurs due to spontaneous rupture of alveoli in any form of pulmonary disease.*
  - ▶ Most commonly, spontaneous pneumothorax occurs in association with emphysema, asthma and tuberculosis.
- 

- ▶ Other causes include chronic bronchitis in an old patient, bronchiectasis, pulmonary infarction and bronchial carcinomas.
  - ▶ In young patients, recurrent spontaneous rupture of peripheral subpleural blebs may occur without any cause resulting in disabling condition termed *spontaneous idiopathic pneumothorax*.
  - 2. *Traumatic pneumothorax* is caused by trauma to the chest wall or lungs, ruptured esophagus or stomach, and surgical operations of the thorax.
- 

3. ***Therapeutic (artificial) pneumothorax*** used to be employed formerly in the treatment of chronic pulmonary tuberculosis in which air was introduced into the pleural sac so as to collapse the lung and limit its respiratory movements.
- ▶ The effects of pneumothorax due to any cause depend upon the amount of air collected in the pleural cavity.
  - ▶ If the quantity of air in the pleura is small, it is resorbed.
  - ▶ Larger volume of air collection in the pleural cavity causes dyspnea and chest pain.
- 



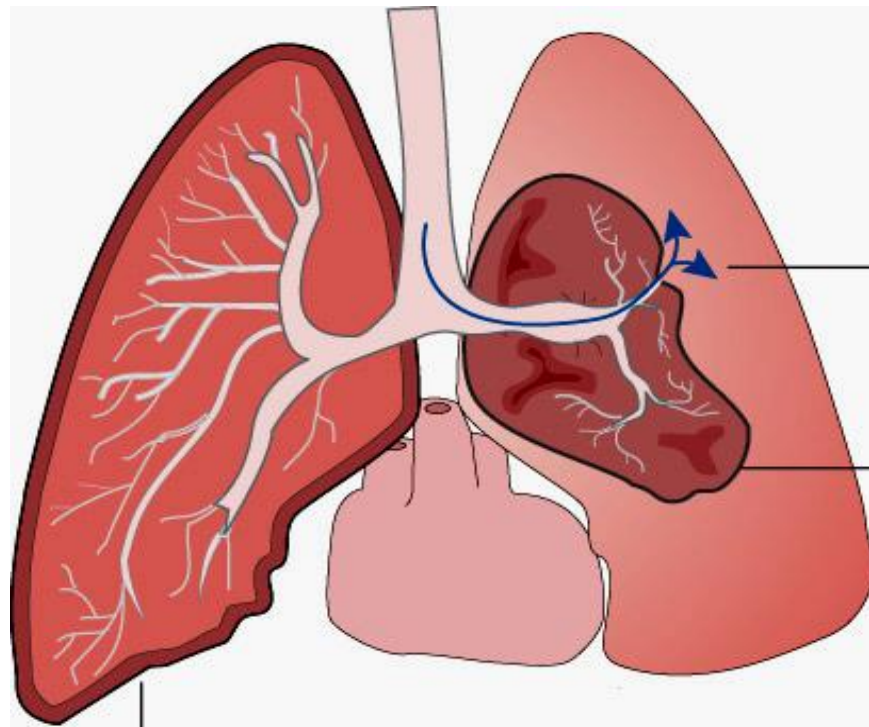
- ▶ Pneumothorax causes lung collapse and pulls the mediastinum to the unaffected side.
- ▶ Occasionally, the defect in the lungs acts as flap-valve and allows entry of air during inspiration but does not permit its escape during expiration, creating tension pneumothorax which requires urgent relief of pressure so as to relieve severe dyspnea and circulatory failure.
- ▶ If the leak seals and the lung is not re-expanded scarring may occur, serous fluid collects in the pleural cavity, creating hydropneumothorax.
- ▶ With prolonged collapse, the lung becomes vulnerable to infection, as does the pleural cavity.
- ▶ Empyema is an important complication of pneumothorax (pyopneumothorax).

## A Spontaneous Pneumothorax

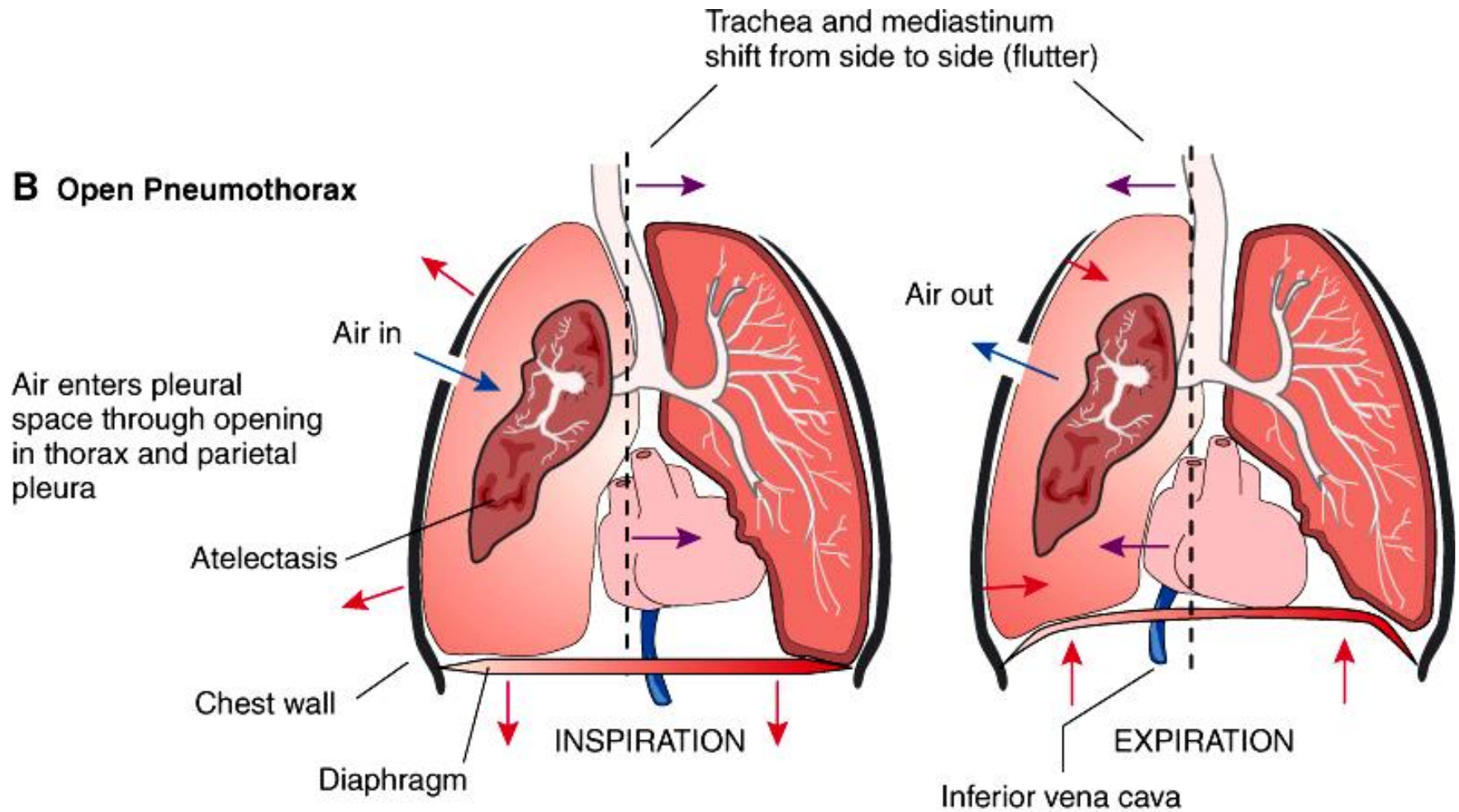
Tear in visceral pleura leads to air entering pleural space from lung

Atelectasis

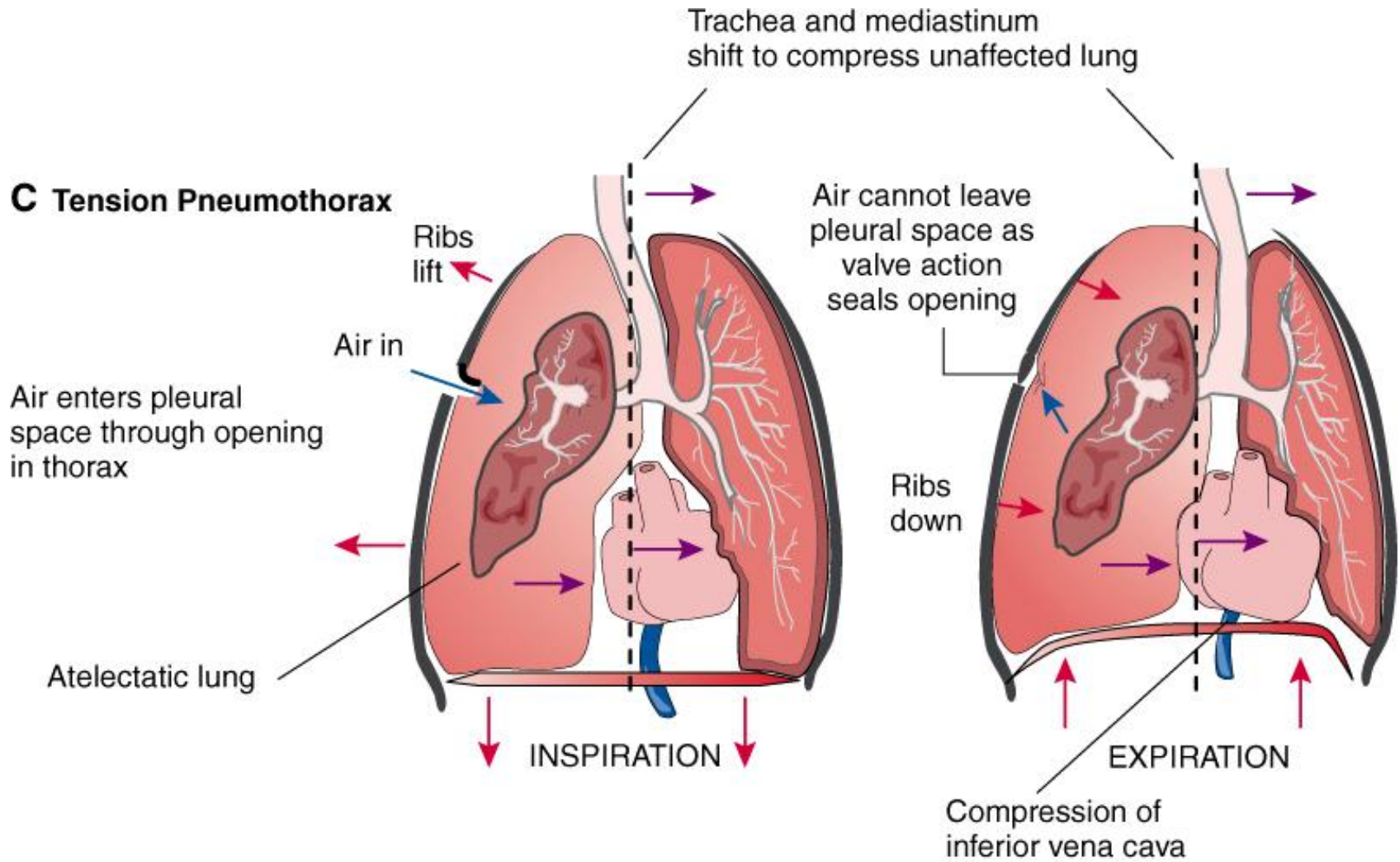
Normal lung with intrapleural pressure lower than intra-alveolar pressure or atmospheric pressure



## B Open Pneumothorax

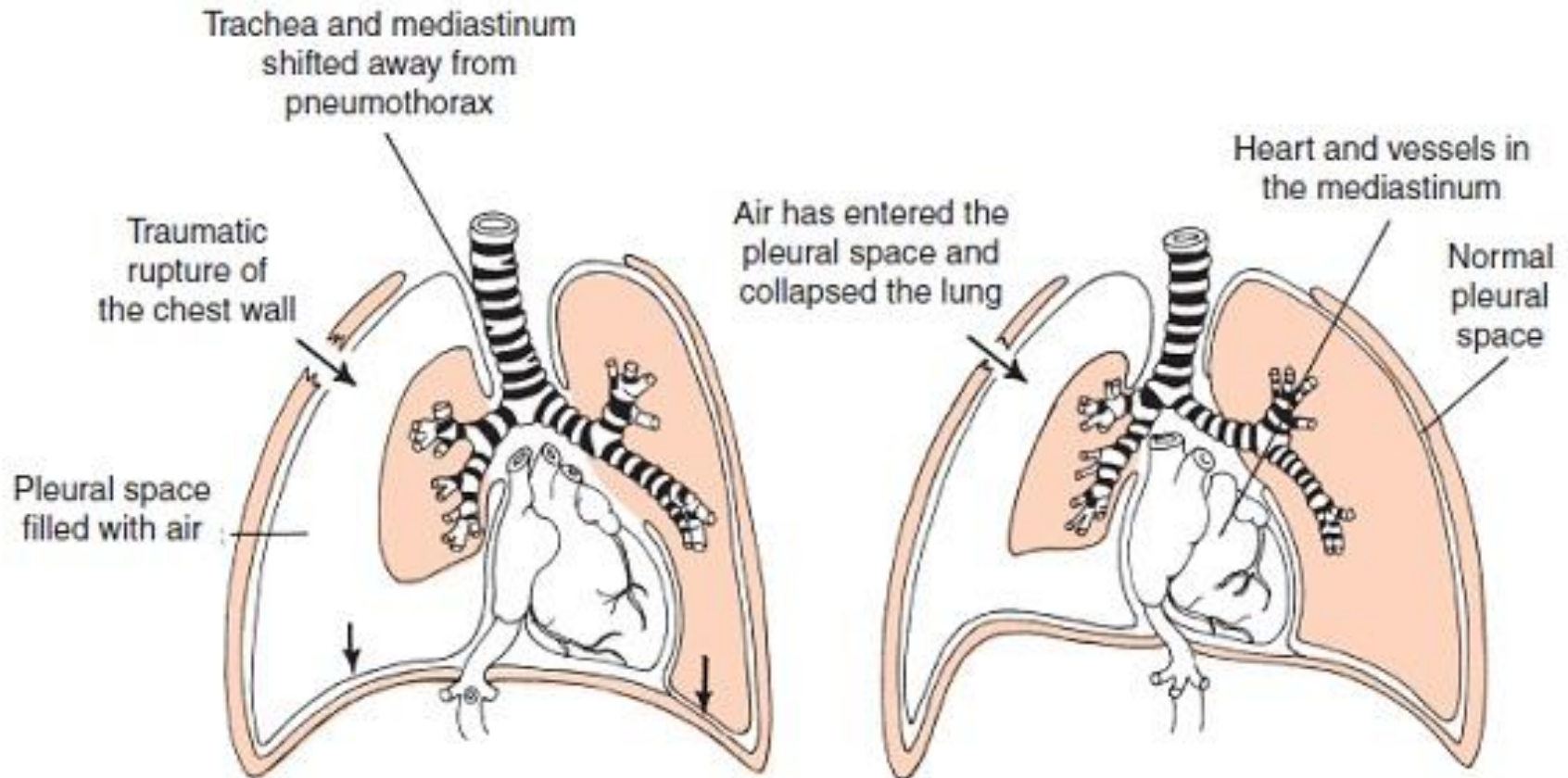


### C Tension Pneumothorax





(Chest wall injury permits  
air to flow in and out of the pleural  
space on the affected side)



Inhalation: air enters the injured  
side, causing collapse of the lung  
and shift of the mediastinum and  
heart toward the unaffected side

Exhalation: the air is partially  
forced from the affected side  
pleural space and the mediastinum  
shifts toward the affected side

A close-up photograph of a bouquet of roses. The roses are in various stages of bloom, with some showing deep pink petals and others being mostly white with pink edges. Green leaves and stems are visible among the flowers. The background is a soft-focus outdoor scene with a blue sky and some greenery. The text "THANK YOU" is written in a yellow, serif font with a black outline, positioned in the lower center of the image.

THANK YOU