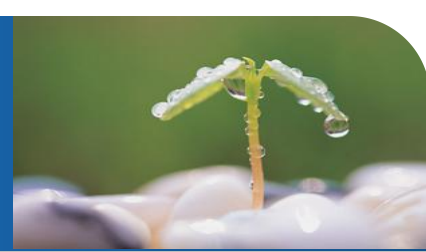


# DISEASES OF PLEURA

**Pleural effusion**  
胸腔积液  
**pneumothorax**  
气胸

南方医科大学江医院  
呼吸科  
夏虎

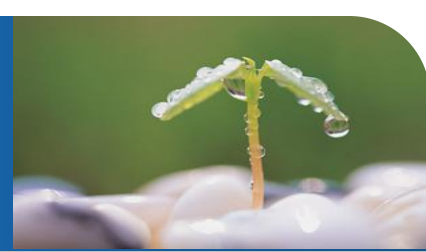
# PLEURA



The pleura, which is a **thin membrane** that covers the inner surfaces of the thoracic cavity (胸腔), consists of a layer of mesothelial cells (间皮细胞) supported by a network of connective and fibroelastic tissue. The visceral pleura (脏层胸膜) lines the lung, whereas the parietal pleura (壁层胸膜) lines the rib cage, diaphragm, and mediastinal structures.

The closed space between the visceral and parietal pleura is referred to as the **pleural space**. The vascular supply of the parietal pleural surface is from the **systemic circulation** (体循环), and it contains sensory nerves and lymphatics. By contrast, the visceral pleura is supplied with blood vessels from the **pulmonary circulation** (肺循环) and has no sensory nerves.

# PLEURAL EFFUSION



## EPIDEMIOLOGY AND PATHOBIOLOGY

Pleural effusions occur most frequently in patients with **pneumonia** (肺炎) or **heart failure** (心衰) .

Normally, a small amount of fluid in the pleural space forms a thin layer between the visceral and parietal pleural surfaces and acts as a lubricant (润滑剂) to minimize friction between the chest wall and lung as they move against each other during inspiration (吸气) and expiration (呼气) .

This flux of fluid depends on the **oncotic pressure** (渗透压) and **hydrostatic pressure** (静水压) within the parietal and visceral pleura as well as the pressure within the pleural space itself.

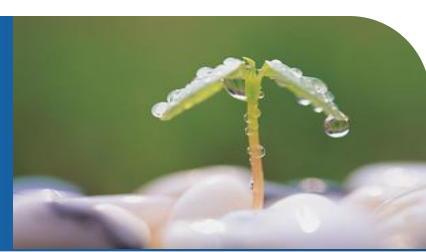
# PLEURAL EFFUSION



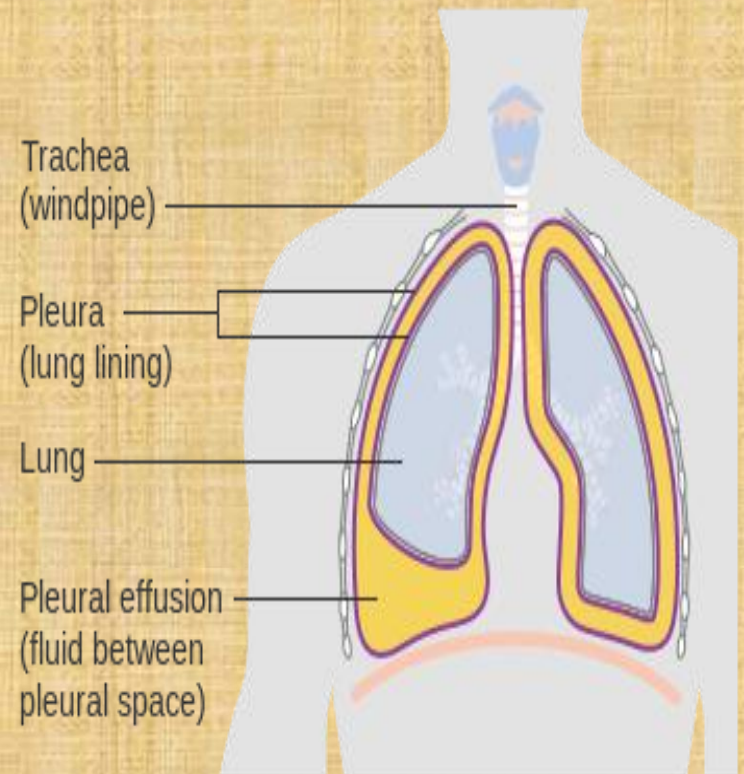
Hydrostatic pressure in the parietal pleura is similar to **systemic circulation (30 cm H<sub>2</sub>O)**, whereas that of the visceral pleura is similar to the **pulmonary circulation (10 cm H<sub>2</sub>O)**. Accordingly, most fluid in the pleural space is filtered from parietal pleura. Because the pressure within the pleural space itself is more subatmospheric at the apex than at the base, most of the fluid filters in from the less dependent upper lung zones.

Fluid is drained out primarily through lymphatics in the parietal pleura. The fluid enters through **lymphatic stomas** (淋巴孔) on the surface of the parietal pleura, which are located beneath the mesothelial monolayer. The normal turnover of fluid within the pleural space is 10 to 20 mL/day.

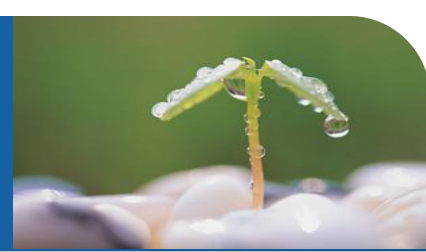
# PLEURAL EFFUSION



Under abnormal circumstances, fluid can accumulate within the pleural space. An increase in hydrostatic pressure, a decrease in oncotic pressure, decreased pressure in the pleural space, increased pleural membrane permeability, or obstruction of pleural lymphatics will promote pleural fluid accumulation.



# PLEURAL EFFUSION

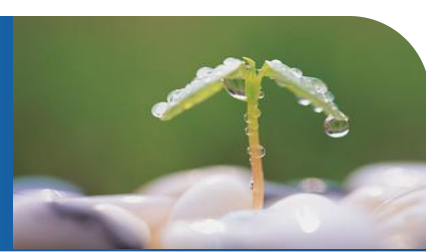


An increase in hydrostatic pressure or decrease in oncotic pressure will result in a low-protein collection of pleural fluid characterized as **transudates** (漏出液). For example, heart failure can produce transudates by increasing hydrostatic pressure in the pulmonary venous system, atelectasis (肺不张) can promote transudates by making pleural pressure more subatmospheric, and occasionally, oncotic pressure may be sufficiently reduced to cause transudates (hypoalbuminemia低蛋白血症).

Changes in pleural membrane permeability can produce high-protein effusions, which are characterized as **exudates** (渗出液) and can be seen in inflammatory states such as pneumonia, tuberculosis (结核病), or rheumatoid arthritis (类风湿关节炎).

**Tumors** can disrupt the integrity of the mesothelial layer or the integrity of the capillary epithelium, thereby resulting in exudative effusions, or they may block lymphatic drainage.

# PLEURAL EFFUSION

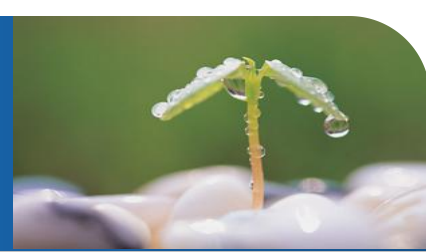


## CLINICAL MANIFESTATIONS

Patients with pleural effusions may be asymptomatic (无症状) or may experience dyspnea (呼吸困难). When the parietal pleura is actively inflamed, pain can be present, and it is generally unilateral (单侧), sharp, and worsens with inspiration.

At times, effusions may be sufficiently large to contribute to respiratory failure (呼吸衰竭). Physical findings include dullness to percussion (叩诊浊音) in the area of the effusion, along with diminished breath sounds (呼吸音减弱) and absent tactile fremitus (触觉语颤).

# PLEURAL EFFUSION

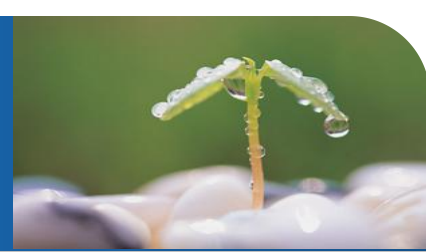


## DIAGNOSIS

Chest radiography is often the first imaging method used to detect an effusion. The volume of fluid in the pleural space needs to exceed 250 mL to be visualized on the chest radiograph. When an effusion is present, there is blunting of the costophrenic angle (肋膈角) on the posteroanterior chest radiograph, and a meniscus (新月液面) can be seen posteriorly on the lateral chest radiograph. Fluid may also collect in either the minor or major fissures.



# PLEURAL EFFUSION



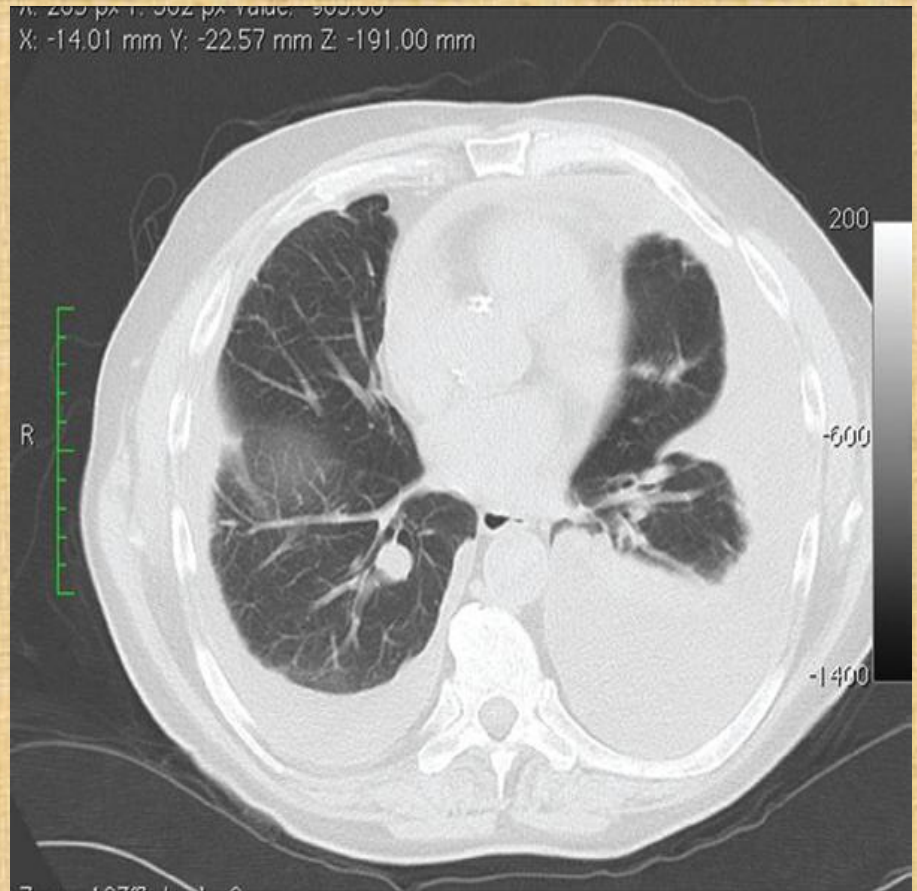
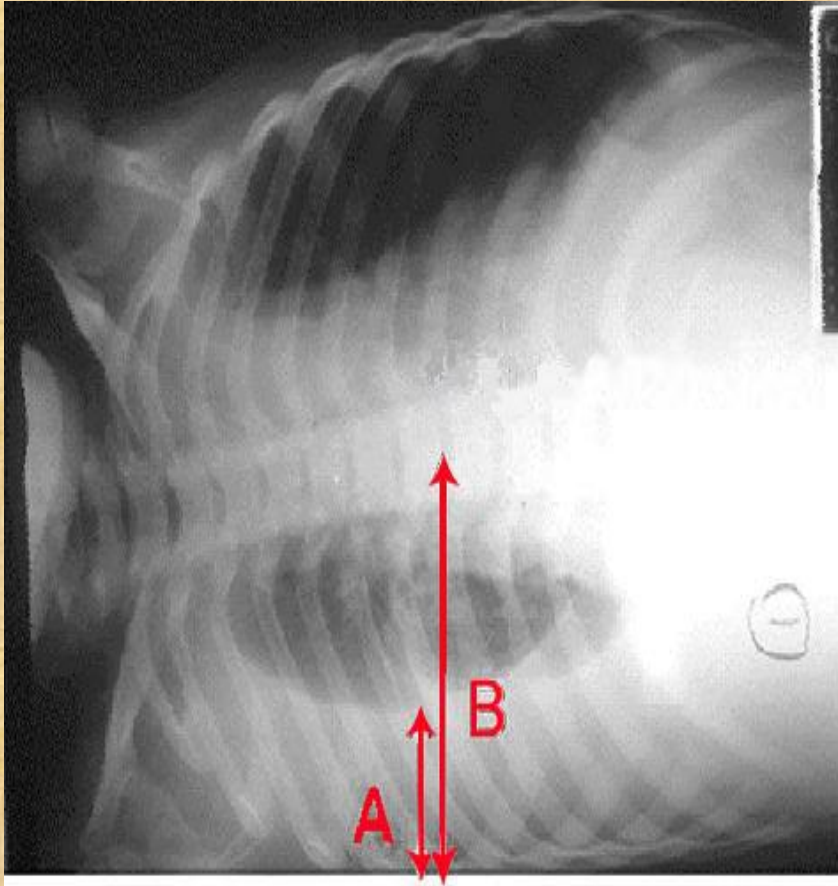
Occasionally, pleural fluid collections in the major or minor fissures may appear as a pulmonary mass (肺部团块) and are referred to as pseudotumors (假瘤). A lateral Decubitus (侧卧位) chest radiograph can be obtained to determine whether fluid is free flowing or loculated (包裹的).

Chest CT provides better characterization of pleural and parenchymal abnormalities by better defining loculated effusions, distinguishing between atelectasis (不张) and effusion, and distinguishing loculated effusion from lung abscess (肺脓肿)

# PLEURAL EFFUSION



# PLEURAL EFFUSION

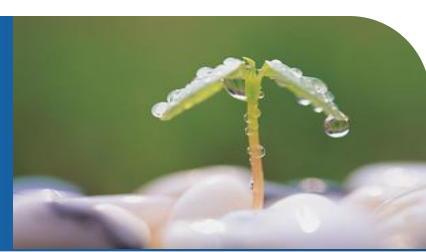


# PLEURAL EFFUSION



A sample of fluid from the pleural space by thoracentesis (胸腔穿刺) is the key to determining the etiology of a pleural effusion. The tests needed to make a diagnosis require a relatively small amount of fluid (30 to 50 mL). Larger volumes of fluid can be removed (1 to 1.5 L) in an attempt to alleviate symptoms (缓解症状). Removing volumes **greater than 1.5 L** may result in re-expansion pulmonary edema (复张性肺水肿). Most thoracenteses can be performed at the bedside, using ultrasound guidance (超声引导) to enhance the procedure's safety.

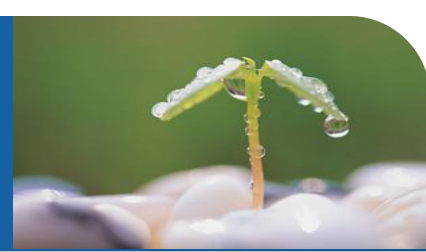
# PLEURAL EFFUSION



In instances when the effusion is small or fluid is loculated, a CT scan can help direct the thoracentesis catheter (胸腔穿刺导管) into fluid that would otherwise be difficult to drain. Relative contraindications (相对禁忌症) to a diagnostic thoracentesis (诊断性穿刺) include a **bleeding diathesis** (出血体质), a very small volume of pleural fluid, and a low benefit-to-risk ratio.

**To differentiate an exudate from a transudate**, the pleural fluid needs to be analyzed for protein and lactate dehydrogenase (LDH 乳酸脱氢酶). Simultaneous serum values of protein and LDH also need to be obtained.

# PLEURAL EFFUSION



## PLEURAL FLUID CHARACTERISTICS OF EXUDATES

### LIGHT'S CRITERIA

Protein  $>0.5$  pleural fluid/serum value

LDH  $>0.6$  pleural fluid/serum value

LDH  $>2/3$  upper limit of normal serum value

### TWO-TEST RULE

LDH  $>0.45$  upper limit of normal serum value

Cholesterol (胆固醇)  $>45$  mg/dL

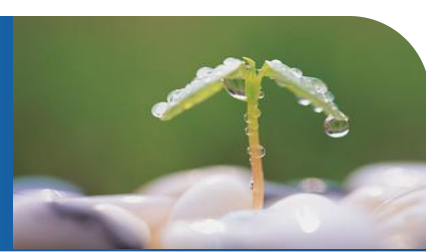
### THREE-STEP CRITERIA

LDH  $>0.45$  upper limit of normal serum value

Cholesterol  $>45$  mg/dL

Protein  $>2.9$  g/dL

# PLEURAL EFFUSION



## Transudates

Effusions that accumulate owing to changes in osmotic and hydrostatic forces usually form transudates.

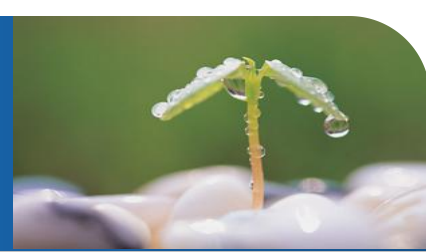
Transudative effusions are most commonly due to heart failure, in which the effusions are often bilateral (双侧).

Transudates may also be seen in cirrhosis (肝硬化), nephrotic syndrome (肾病综合征), myxedema (黏液水肿), pulmonary embolism (肺栓塞).

## Exudates

An effusion is characterized as an exudate if it meets one of the above criteria of exudative effusion.

# PLEURAL EFFUSION



## exudates

**Parapneumonic effusions**

(肺炎旁积液)

**Empyema (脓胸)**

**Tuberculous Effusions**

**Malignancy (恶性肿瘤)**

**Systemic Inflammatory Disorders**

(系统性炎症疾病)

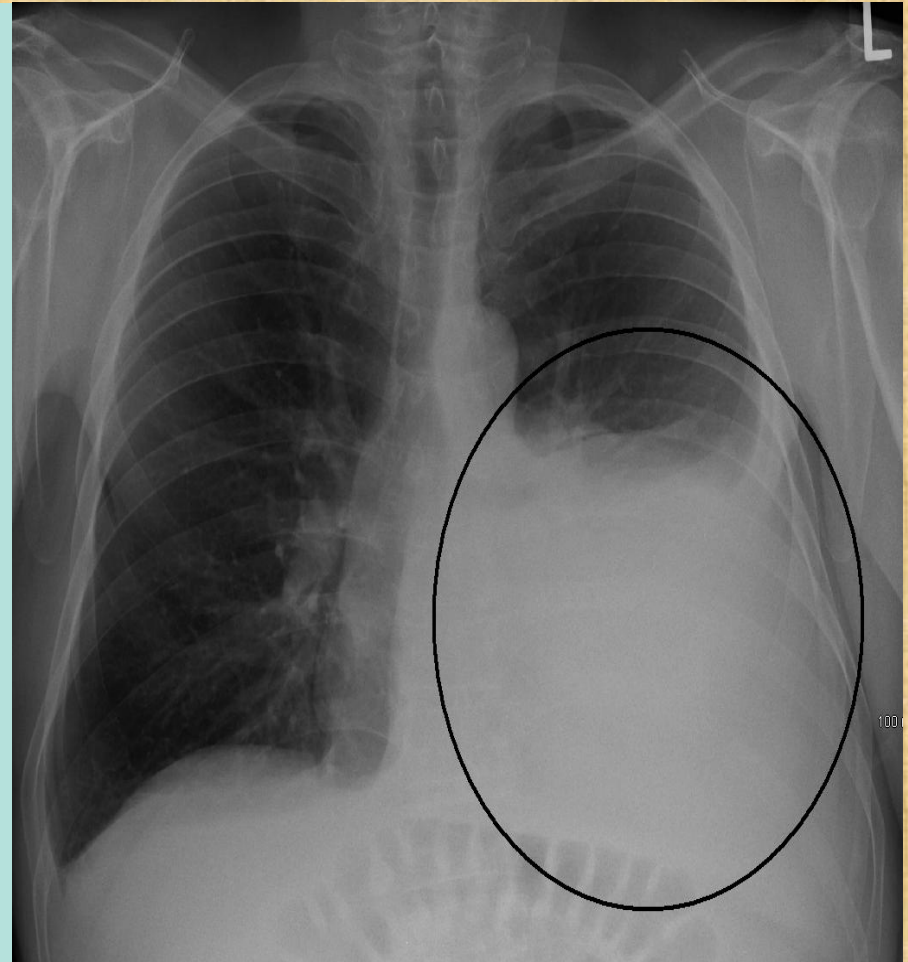
**Pancreatitis (胰腺炎)**

**Chylothorax (乳糜胸)**

**Hemothorax (血胸)**

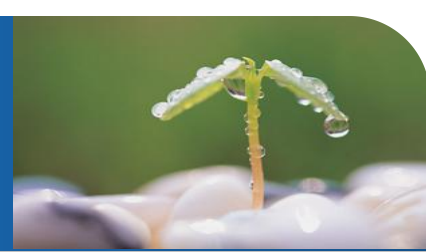
**Asbestos Exposure (石棉暴露)**

**Other Causes of Pleural Exudates**





# PLEURAL EFFUSION

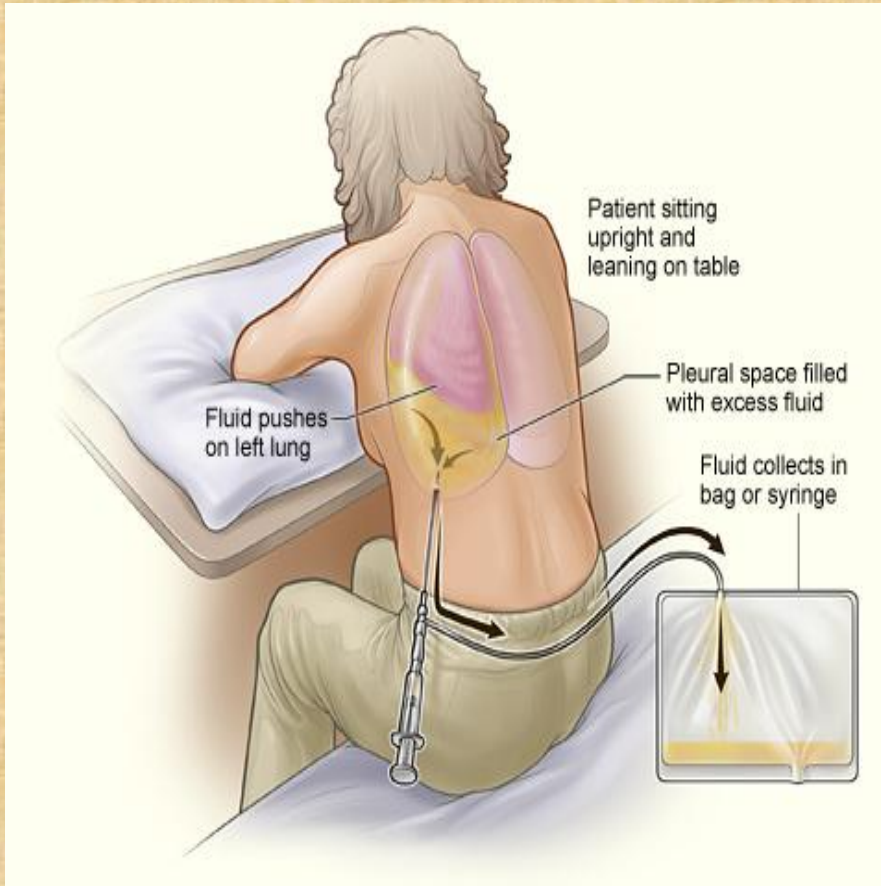


## TREATMENT AND PROGNOSIS

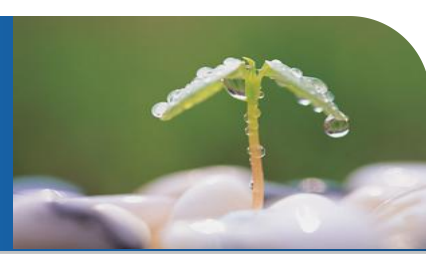
Treatment depends on the **underlying cause** of the pleural effusion.

- \*Therapeutic aspiration (治疗性抽吸) may be sufficient.
- \*Empyema and complicated parapneumonic effusions require drainage by tube thoracostomy (胸腔引流) in concert with appropriate antibiotic therapy.
- \*Treatment options for malignant pleural effusion include observation, chemical pleurodesis (胸膜粘连术) with talc or tetracycline (四环素) derivatives, drainage catheter, and treatment of underlying malignancy.
- \*Treatment of inflammatory effusions centers on the use of anti-inflammatory agents and corticosteroids (皮质激素).

# PLEURAL EFFUSION



# PLEURAL EFFUSION



THE END OF  
PLEURAL  
EFFUSION



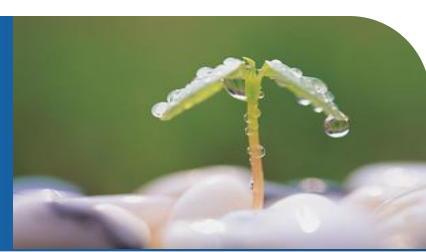
# PNEUMOTHORAX



**Pneumothorax (气胸) refers to the accumulation of air in the pleural space. Normally, the pressure within the pleural space is slightly subatmospheric. However, when more than a very small amount of air accumulates within the pleural space, pressure within it becomes positive, and there is compression of underlying lung.**



# PNEUMOTHORAX



## EPIDEMIOLOGY AND PATHOBIOLOGY

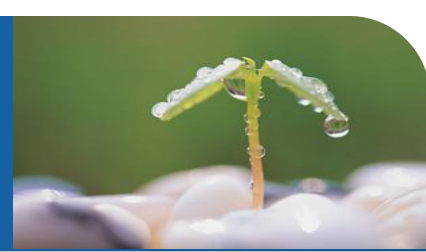
Pneumothorax is often associated with penetrating trauma.

With **penetrating trauma** (穿透伤), air may leak into the pleural space through the injured chest wall or into the pleural space from the injured lung.

Patients with lung disease undergoing **mechanical ventilation** (机械通气) may acutely develop a pneumothorax when high pressures disrupt lung tissue.

Pneumothorax also may occur spontaneously or be secondary to underlying lung disease. Typically, **spontaneous pneumothorax** (自发性气胸) occurs in tall, young, thin men, presumably as a result of rupture of preexisting apical blebs.

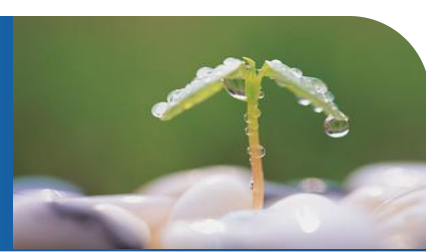
# PNEUMOTHORAX



Diseases that are associated with pneumothorax include emphysema (肺气肿), cystic fibrosis (囊性肺纤维化), granulomatous inflammation (肉芽肿性炎症), necrotizing pneumonia (坏死性肺炎), pulmonary fibrosis (肺纤维化), eosinophilic granulomatous disease (嗜酸粒细胞性肉芽肿性疾病), sarcoidosis (结节病), and endometriosis (子宫内膜异位症).



# PNEUMOTHORAX



## Causes of spontaneous pneumothorax

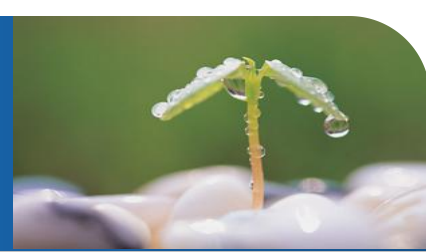
### Primary spontaneous

The cause of primary spontaneous pneumothorax is unknown, but established **risk factors** include male sex, smoking, and a family history of pneumothorax.

### Secondary spontaneous

Secondary spontaneous pneumothorax occurs in the setting of a variety of lung diseases. The most common is COPD, which accounts for approximately 70% of cases. Known lung diseases that may significantly increase the risk for pneumothorax are listed below.

# PNEUMOTHORAX



**Diseases of the airways:** COPD, acute severe asthma.

**Infections of the lung:** Pneumocystis pneumonia (PCP肺孢子虫肺炎), tuberculosis, necrotizing pneumonia.

**Interstitial lung disease:** Sarcoidosis (结节病), idiopathic pulmonary fibrosis, histiocytosis X, lymphangioleiomyomatosis (LAM淋巴管肌瘤病).

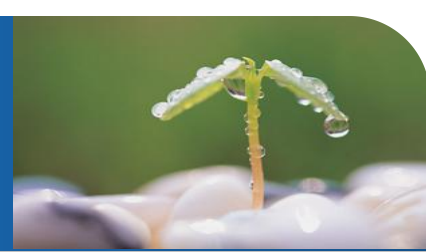
**Connective tissue diseases:** Rheumatoid arthritis, ankylosing spondylitis, polymyositis and dermatomyositis, systemic sclerosis, Marfan's syndrome.

**Cancer:** Lung cancer, sarcomas involving the lung.

**Miscellaneous:** Catamenial pneumothorax (月经性气胸) (associated with the menstrual cycle and related to endometriosis in the chest)



# PNEUMOTHORAX

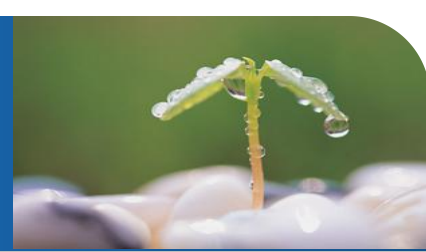


## CLINICAL MANIFESTATIONS AND DIAGNOSIS

Symptoms typically include **acute shortness of breath** and **sharp chest pain**.

Physical examination is characterized by tachycardia (心动过速), decreased breath sounds (呼吸音减弱), decreased tactile fremitus (语颤减弱), subcutaneous emphysema (皮下气肿), hyper-resonance to percussion (叩诊过清音), and a tracheal shift (气管移位) toward the uninvolved hemithorax.

# PNEUMOTHORAX

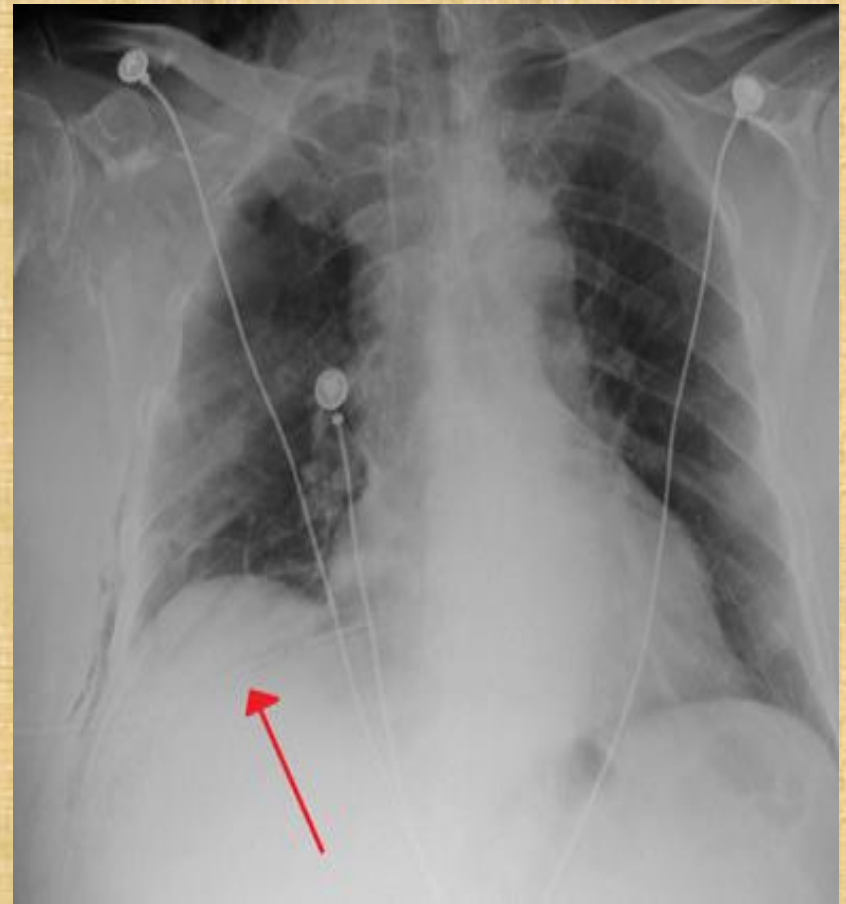
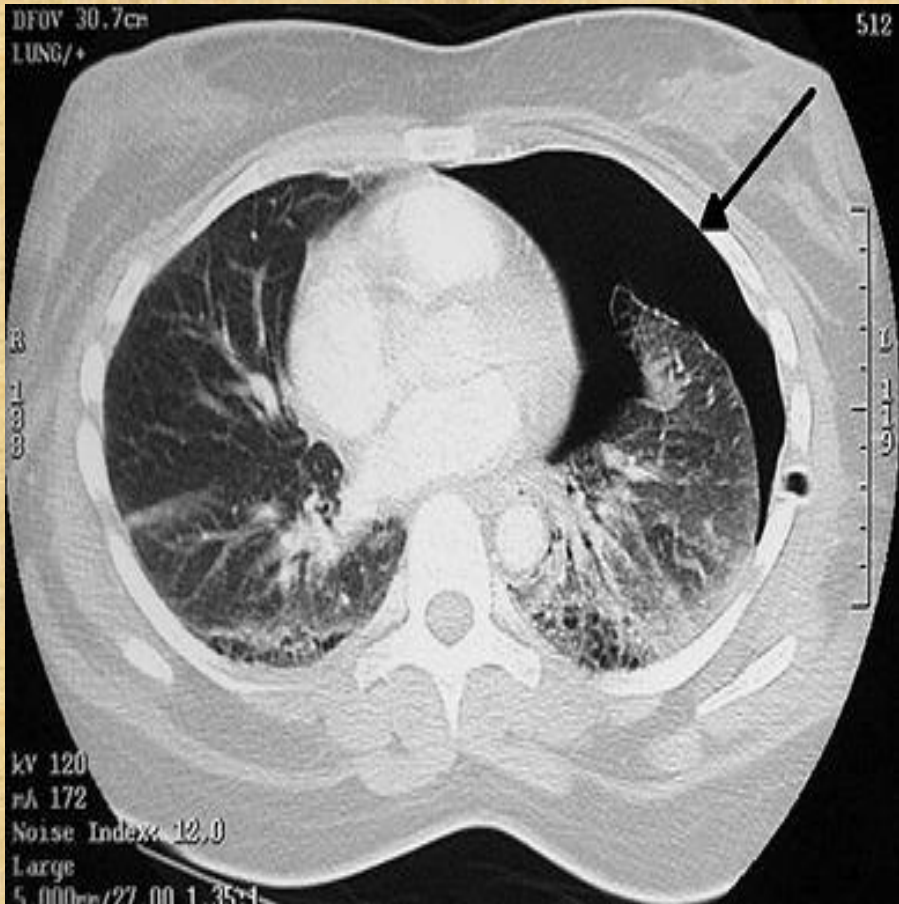


**Air within the pleural space will separate the visceral from parietal pleura and appears as an area of lucency (透亮) on the chest radiograph.**

**With a small pneumothorax, the lucency is best appreciated at the lung apex when the patient is upright.**



# PNEUMOTHORAX

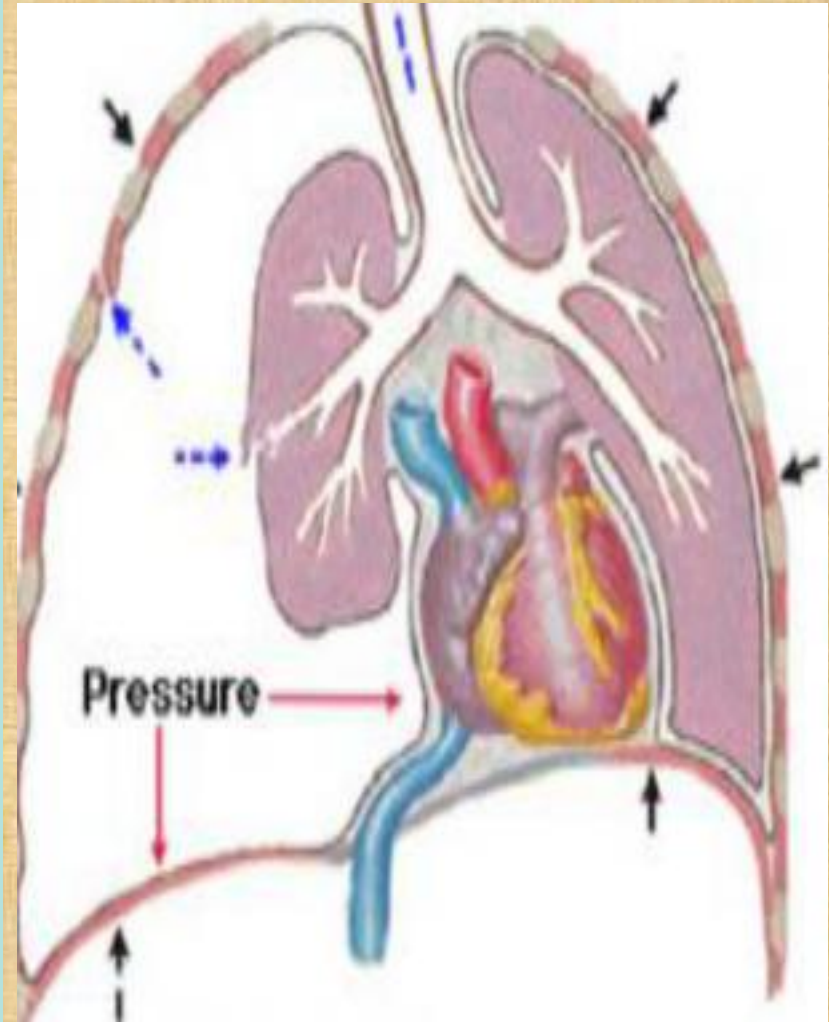


# PNEUMOTHORAX

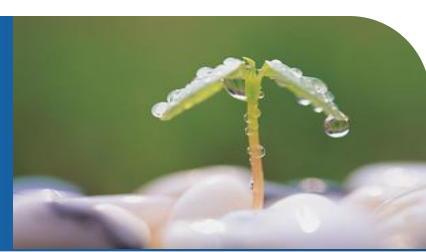


A **tension pneumothorax** (张力性气胸) is defined as a pneumothorax associated with a mediastinal shift (纵膈移位) and hemodynamic compromise (血流动力学不稳定), usually because high intrathoracic pressures compress the vena cava (腔静脉) and atrium (心房).

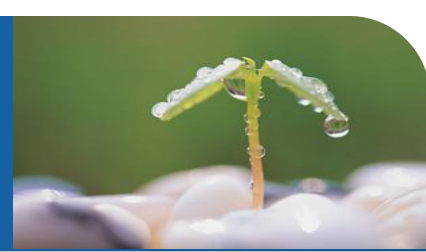
This pathophysiology implies an ongoing leak of air into the pleural space.



# PNEUMOTHORAX



# PNEUMOTHORAX



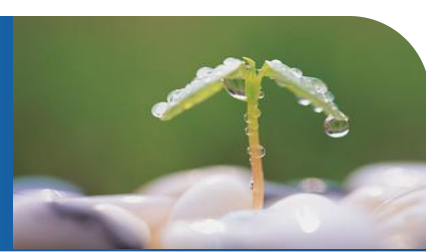
## TREATMENT AND PROGNOSIS

If the pneumothorax is small and the patient is not in distress, tube thoracostomy is not needed, and **inhaling oxygen** may be sufficient.

If a pneumothorax occupies more than 50% of the hemithorax, the patient develops symptoms, or a tension pneumothorax develops, **tube thoracostomy** and **suction** followed by water-seal drainage are indicated.

If there is a continuing leak despite tube thoracostomy, a bronchopleural fistula may be suspected. In this instance, **chemical pleurodesis** or **surgical correction**, usually by video-assisted thorascopic surgery, may be necessary.

谢谢



Questions?

