



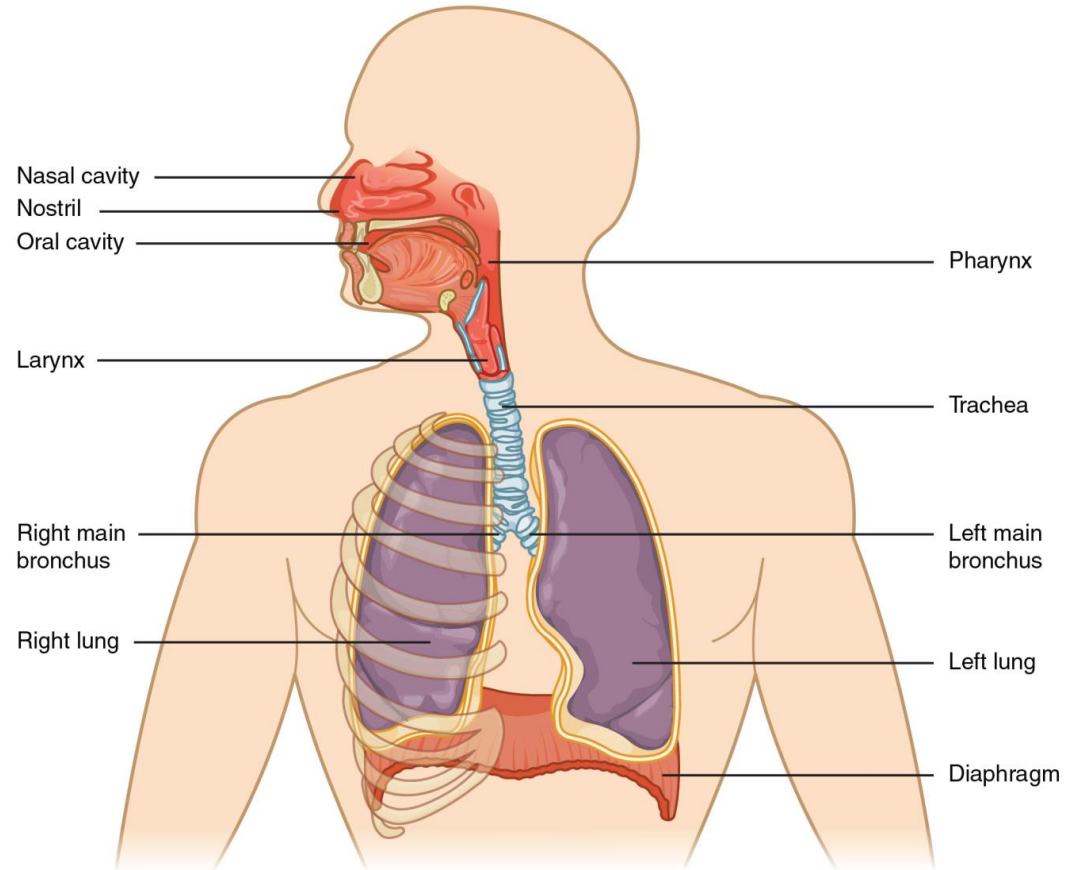
Pathophysiology-Respiratory Pathophysiology

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Respiratory System

- The respiratory system consists of 6 organs:
 - **Nose**
 - **Pharynx**
 - **Larynx**
 - **Trachea**
 - **Bronchial tubes**
 - **Lungs**
- **All organs should work together to perform respiration**



Lungs

2 lungs; right lung has 3 lobes and left lung has 2 lobes.

A lung is the total collection of the bronchi, bronchioles, and alveoli.

Spongy because they contain air.

Protected externally by the ribs.

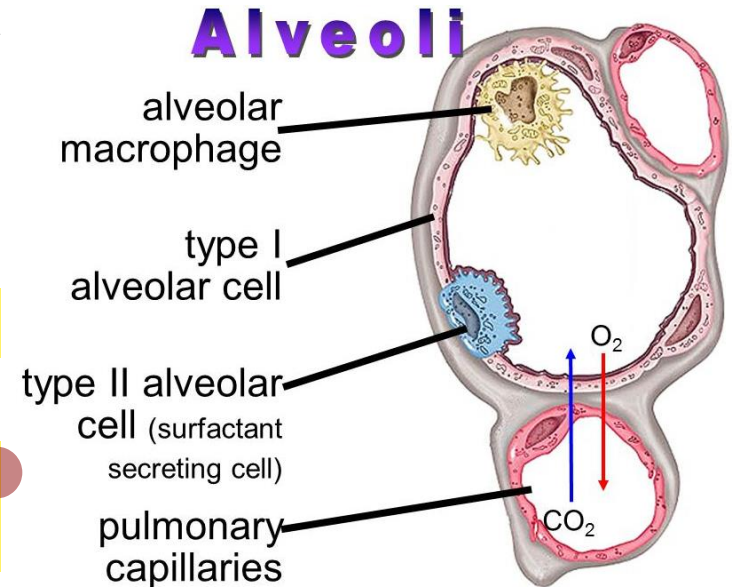
Protected internally by a double membrane called the pleura.

Pleura is folded to form a sac around each lung = **pleural cavity**.

Serous fluid is between the two pleural layers to reduce friction when the two layers rub together during ventilation.

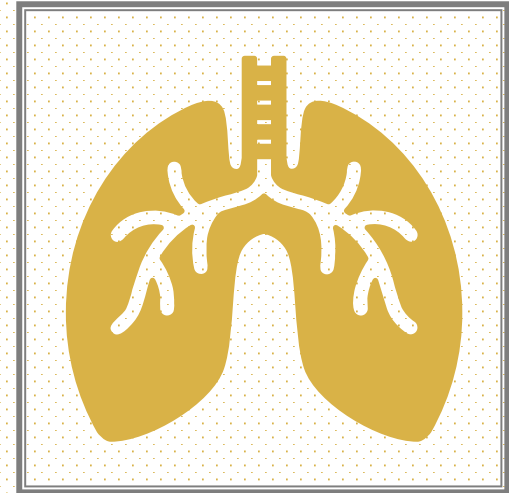
Function of the respiratory system

- The primary function is **gas exchange**, with oxygen from the air being transferred to the blood and carbon dioxide from the blood being eliminated into the atmosphere.
- There are two types of alveolar cells:
 - ★ • **Alveolar cell I:** provides surface area for gas exchange function of the lung. "oxygen exchange"
 - ★ • **Alveolar cell II:** secretes surface active surfactants that serve to decrease surface tension and mediate the immune destruction of pathogens that have entered the lung. "surfactant factory"
↳ decrease surface tension



Lung blood supply

- The lungs are provided with a dual blood supply:
 - ✓ The **pulmonary circulation** provides for the gas exchange function of the lungs.
 - ✓ The **bronchial circulation** supplies blood to the conducting airways and supporting structures of the lung.



parasympathetic

muscarinic
receptor

increase mucus
secretion

sympathetic

β_2 receptor

decrease mucus
secretion

Function of the respiratory system

The intervention of the lungs occurs by the way of sympathetic and parasympathetic divisions of the autonomic nervous system.

Parasympathetic innervation produces airway constriction and an increase in respiratory secretions.

Muscarinic receptors

Sympathetic innervation produces bronchodilation and a decrease in respiratory tract secretions.

B2 receptors

Breathing involve the movement of atmospheric air into and out of the alveolar structures in the lung.

It requires a system of open airways and alternating pressure changes resulting from the action of respiratory muscles in changing the volume of chest cage.

- Expiration=exhalation= recoiling

- Inhalation=inspiration=expansion

Function of the respiratory system

- The ease with which the lungs can be inflated reflects the elastic forces of the lung tissue (surface tension).

Airway resistance refers to the impediment to flow that the air encounters as it moves through the airways.

★ It varies with airway radius and lung volume, being the greatest in the bronchi with medium-sized radii and lowest in the bronchioles with their smaller radii.

Airway resistance decreases as the lungs expand and pull the airways open during inspiration and it increases as the lungs deflate during expiration.

Lung volumes reflect the amount of air that is exchanged during normal and forced breathing.

Pulmonary ventilation involves the movement of the diaphragm, intercostal muscles, and other respiratory muscles. These muscles are controlled by neurons of respiratory centers in the brain.

Lung volumes

Note: a **capacity** is a sum of ≥ 2 physiologic **volumes**.

Inspiratory reserve volume

Air that can still be breathed in after normal inspiration

Tidal volume

Air that moves into lung with each quiet inspiration, typically 500 mL

Expiratory reserve volume

Air that can still be breathed out after normal expiration

Residual volume

Air in lung after maximal expiration; RV and any lung capacity that includes RV cannot be measured by spirometry

Inspiratory capacity

IRV + TV

Air that can be breathed in after normal exhalation

★ إلى حجم
الديكورة

Functional residual capacity

RV + ERV

Volume of gas in lungs after normal expiration

Vital capacity

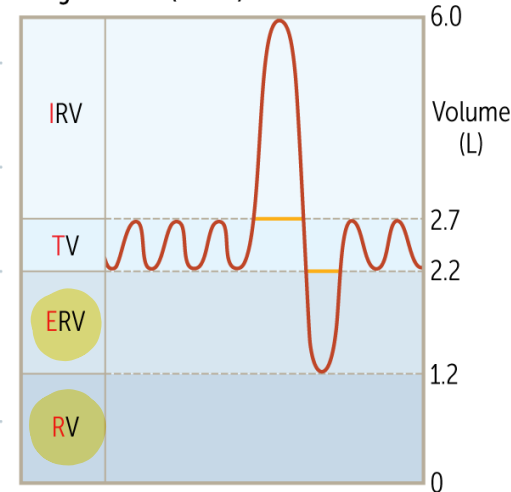
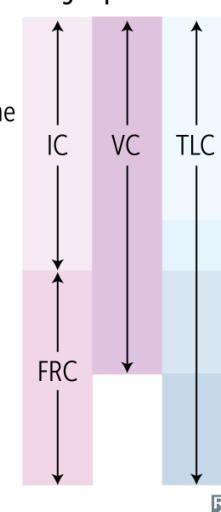
TV + IRV + ERV

Maximum volume of gas that can be expired after a maximal inspiration

Total lung capacity

IRV + TV + ERV + RV

Volume of gas present in lungs after a maximal inspiration

Lung volumes (LITER)**Lung capacities**

Control of breathing

Doctor's important addition

Central chemoreceptors respond mainly to:

- CO_2
- H^+

Peripheral chemoreceptors respond strongly to:

- Low O_2

Control of breathing has both automatic and voluntary components:

The automatic regulation of ventilation is controlled by two types of receptors:

- **Chemoreceptors** monitor blood levels of carbon dioxide, oxygen, and pH.
- **Lung receptors:** monitors the status of breathing as airway resistance and lung expansion. Muscarinic and adrenergic

Voluntary respiratory control is needed for integrating breathing and actions such as speaking, blowing, and singing.

Control of breathing

shortness
of
breath

- The cough reflex protects the lungs from the accumulation of secretions and from the entry of irritating and destructive substances. It is the primary defense mechanism of the respiratory tract.

- **Dyspnea:** is a subjective sensation of difficulty in breathing that is seen in cardiac, pulmonary, and neuromuscular disorders.

- It can present as air hunger, brought about by inadequate ventilation, labored or difficulty breathing due to weakened respiratory muscles, or chest tightness that occurs with bronchoconstriction.

Air hunger: not being able to get enough air

Hypoxia

specific tissue

Hypercapnia

❖ Is a decrease in blood oxygen level that results in a decrease in tissue oxygenation.

❖ It can occur as a result of ^① hypoventilation, ^② diffusion impairment, ^③ shunt, and ^④ ventilation-perfusion abnormalities.

• Acute hypoxemia is manifested by increased respiratory effort (increased respiratory and heart rates), cyanosis, and impaired sensory and neurological function.

Tachypnea

Tachycardia

Increased ventilation as a systemic response: chemoreceptors activation.... while increased pulmonary vasoconstriction is a local response by smooth muscle cells leading to pulmonary hypertension the brain and the lungs are in conflict

• The body compensates for chronic hypoxemia by increased ventilation, pulmonary vasoconstriction, and increased production of RBCs ↑
"erythropoietin release" $O_2 \uparrow$

Increase oxygen and washing out of carbon dioxide

Respiratory diseases to be discussed

- Hay Fever.
- Bronchial asthma.
- Chronic Obstructive Pulmonary Disease (COPD).
- Emphysema.
- Pulmonary tuberculosis.
- Cancer. (lung cancer)

Hay fever (seasonal allergic rhinitis)

- Characterized by sensitivity to airborne allergens, especially from pollens of olive trees and grasses.
- Respiratory mucosa secretes excessive mucus causing a runny nose and congestion.
- Mucosal surfaces of the eyes also react to the allergens causing redness, watery secretions, and itching.
- Because the release of histamine causes these unpleasant effects, a substance that counteracts its action, an antihistamine, may give relief.



Bronchial asthma

hyperresponsiveness
bronchoconstriction
reversible airway obstruction

- Asthma is the most common chronic disease of childhood.
- Children younger than 4 years of age have the highest rate of emergency department visits and hospitalizations.
- by early adulthood, 30 to 70% will markedly improve or be symptom-free.
- Higher prevalence in minorities:
 - Urbanization.
 - Poor access to care.
- Significant burden on the healthcare system.
- Can be life-threatening if not properly managed:
 - Education is key to the prevention of death from asthma.

Bad side effects

- Antihistamine
- Beta adrenergic agonist (mainly) long term
- cortisone (short term)

mainly

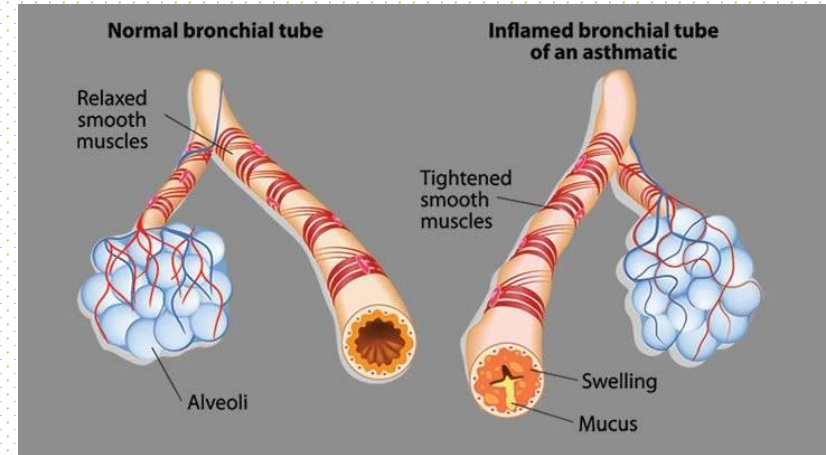
Bronchodilators: Beta-adrenergic agonists

Bronchial Asthma

- Characterized by hypersensitivity to various allergens like dust, mold, pollen, animal dander, and various foods
- Eighty percent of children with asthma and fifty percent of adult asthmatics have allergies.
- The allergens trigger constriction of smooth muscle in the walls of the bronchi, narrowing the lumen of the tubes. The spasm is a sustained contraction of the musculature, making breathing, particularly expiration, very difficult.

80% children Asthma
50% Adults

> have allergies



Expiration is affected more than inspiration.

Very common exam question

Bronchial Asthma

- bronchospasm
- mucosal edema
- excess mucus

mucosal edema

- The mucous membrane becomes swollen with fluid, also narrowing the lumen. Excessive secretion of mucus adds to the obstruction.
قدیم Stale air becomes trapped, which decreases the amount of fresh air that can enter the lungs.
- The wheezing sound results from air passing through the narrowed tubes. Psychogenic factors such as anxiety are frequently associated with an asthma attack.
- A tense situation or an emotional experience such as stress can trigger an attack.

Question 28 / 40

Bronchial asthma could be triggered by anxiety and stress.

1. ☒ True

2. ☐ False

Next

ملاحظة

Bronchial Asthma

triggers

Allergic	emotional	non allergic
dust pollen	anxiety stress	- overexertion (exercise) - infection - bronchitis

- Other nonallergic causes are overexertion, infection, or bronchitis. Exposure of the bronchial mucosa to irritants such as cigarette smoke, aerosol sprays, or perfume can also trigger an attack.
- There is no cure for asthma, but attacks may become less severe with age. It is important to identify the offending allergens and avoid contact with them as much as possible.
- Because overexertion may be involved, it is important for the athlete to take some extra time to “warm-up” and get adjusted to the situation before participating in physical activities and sports.

- Hives, also known as urticaria, are red and sometimes itchy bumps on your skin.

- Rhinitis, also known as coryza, is irritation and inflammation of the mucous membrane inside the nose.

Drug-Induced Asthma

COX

- Several pharmacologic agents provoke asthma, aspirin being the most striking example.
- Patients with aspirin sensitivity present with recurrent rhinitis and nasal polyps, urticaria, and bronchospasm.
coryza *hives*
- The precise mechanism remains unknown, but it is presumed that aspirin inhibits the cyclooxygenase pathway of arachidonic acid metabolism without affecting the lipxygenase route, thereby shifting the balance of production toward Leukotrienes that cause bronchial spasm vasoconstriction

Leukotrienes = vasoconstriction

Occupational Asthma

- This form of asthma is stimulated by fumes (epoxy resins, plastics), organic and chemical dust (wood, cotton, platinum), gases (toluene), and other chemicals.
- Asthma attacks usually develop after repeated exposure to the inciting antigen(s).

Acute versus chronic

Asthma Pathophysiology

early phase bronchoconstriction
late phase inflammation

bronchoconstriction

Early-Phase Response:

- Peaks 30-60 minutes post-exposure, subsides 30-90 minutes later
- Characterized primarily by bronchospasm (bronchoconstriction)
- Increased mucous secretion, edema formation, and increased amounts of
بلغم عند tenacious sputum.
- Patient experiences wheezing, cough, chest tightness, and dyspnea.

Asthma Pathophysiology

inflammation

Late-Phase Response:

- Characterized primarily by inflammation.
- Histamine and other mediators set up a self-sustaining cycle increasing airway reactivity causing hyperresponsiveness to allergens and other stimuli.
- Increased airway resistance leads to air trapping in alveoli and hyperinflation of the lungs.
- If airway inflammation is not treated or does not resolve, may lead to irreversible lung damage.

- Ephedrine sprays
- epinephrine injections

Treatment and Prognosis of Asthma

- Albuterol
- metaproterenol

Medication and allergy shots can reduce the incidence or severity of asthma attacks.

To counteract an ongoing attack, substances that dilate the bronchi are effective. Ephedrine sprays and epinephrine (adrenalin) injections are often effective.

Bronchodilators like **albuterol** and **metaproterenol** are sometimes prescribed.

Cortisone-like drugs and antihistamines are sometimes used, but these carry a risk of side effects.

Treatment and Prognosis of Asthma

ثقب
القصبة
الهوائية

- The most severe form of an asthma attack is called **status asthmaticus**, in which the [patient fails to respond to] (the usual treatment.) A procedure as drastic as a **tracheotomy**, an opening of the trachea surgically, may be required. If not treated, status asthmaticus may end in respiratory failure and death.
- Asthma kills at least 15 people daily in the United States, according to the American Lung Association.

RS ①

Question 38 / 40

Which of the following is **CORRECT** about the differences between hay fever and bronchial asthma?

1. ☐ People with hay fever suffer from sustained spasm in the bronchial musculature ×
2. ☐ People with bronchial asthma suffer from watery secretions from the eye ×
3. ☐ People with bronchial asthma suffer from redness and itching ×
4. ☐ People with bronchial asthma suffer from difficulty in breathing in few months of the year ×
5. ☒ None of the above

Next

إضافة ملاحظة

High-Yield Asthma Summary (Must Memorize)

1. Asthma is a reversible airway obstruction.
2. Three major changes:
 - Bronchospasm
 - Edema
 - Mucus hypersecretion
3. Expiration is affected more than inspiration.
4. Wheezing is the classic sign.
5. Aspirin → leukotrienes → bronchospasm.
6. Early phase = bronchospasm.
7. Late phase = inflammation.
8. β_2 agonists cause bronchodilation.
9. Status asthmaticus is life-threatening.

COPD

- chronic air flow limitation
- progressive worsening
- incomplete reversibility



Asthma	COPD
Reversible	Irreversible or partially reversible
Usually younger patients	Usually older smokers
Episodic attacks	Progressive disease
Allergic association common	Smoking association common

Tow types:

Chronic Bronchitis: Characterised by mucous production.

Emphysema: Characterised by structural changes.

COPD is not usually a clear cut, the above 2 conditions co-exist.

← شکل
تغیر
ال
lungs

00 : 55 : 24

Question 4 / 40

All COPD patients exhibit features of both chronic bronchitis and emphysema.

1. ☒ True
2. ☐ False

Next

False

Causes:

- Smoking: 99% of COPD cases.
- Environmental exposure: dust, silica, air pollutants.
- α -1 antitrypsin deficiency: due to genetic factors or it might be from liver failure.

33. The most common risk factor for COPD: *

(1 Point)

Biomass smoke

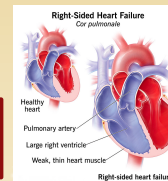
| Air pollution

Genetic susceptibility

✓ Cigarette smoke

COPD Pathophysiology

- Walls of the small airways and alveoli lose their elasticity and thicken.
- Closes off some of the smaller air passages and narrows the larger ones.
- Air can enter the alveoli but becomes trapped due to the collapsed airways:
 - ✓ Affects gas exchange and pathological changes occur.
- Blood is poorly oxygenated and tissue perfusion is less efficient.
- Carbon dioxide may accumulate to critical levels: *hypercapnia*
 - ✓ Respiratory acidosis.
 - ✓ Respiratory failure.
- Strains the heart:
 - ✓ Right ventricle can enlarge and thicken.
 - ✓ Abnormal rhythms called cor pulmonale.



COPD Symptoms

Early:

- Early morning cough with clear sputum.
- Periods of wheezing during or after colds.
- Shortness of breath on exertion.

Late:

- Mouth breathing.
- Puffing.
- Use of accessory muscles of breathing.
- Inability to finish sentence without catching one's breath.
- Sleep in semi-sitting position.

best respiratory treatment سؤال
أتوقع الجواب Bronchodilators

COPD Treatment

Oxygen.

Medications:

- Bronchodilators.
- Corticosteroids. Reduce exacerbation and enhance the bronchodilator response
- Antibiotics:
 - First sign of infection.
 - Yellow or green sputum.
- Other drugs to treat associated symptoms
 - Diuretics.
 - Analgesics.
 - Cough suppressants.
 - Anxiolytics.

مضادات فلف

In COPD, inhaled corticosteroids are primarily used to:

Anonymous Quiz

- ☐ A) Cure COPD
- ☐ B) Reduce exacerbations in selected patients
- ☐ C) Improve renal function
- ☐ D) Replace bronchodilators

Other COPD Treatments

- استعمال الممارسة -

- Bullectomy or lung reduction.
- Pulmonary rehabilitation:
 - ✓ Exercise. إعادة التأهيل
 - ✓ Oxygen.
 - ✓ Nutritional support.
- Intermittent mechanical ventilator support.

- Relaxation techniques:

- Breathing techniques.

- Clearing airway passages:

- Postural drainage.

- Chest percussion.

- Controlled coughing.

- Tracheal suctioning.



COPD complications

- ① Decrease ventilation leads to ② hypoxic vasoconstriction, which leads to pulmonary hypertension, then increase the workload ③ on right ventricle which can lead to right ventricular ④ hypertrophy and failure (cor pulmonale).

Question 8 / 40

Right ventricular hypertrophy and failure is one of the complications of

1. ☐ Liver cirrhosis
2. ☐ PUD
3. ☒ COPD
4. ☐ Bronchial asthma
5. ☐ Tuberculosis

Next

→ Alveolar destruction

Emphysema

suffocating feeling

- A crippling and debilitating (weakening) disease with chronic lung obstruction and destruction.
- The word *emphysema* means inflation. The lungs become filled with air that is high in carbon dioxide CO_2 . This air cannot be adequately exhaled to allow oxygen to enter. The person experiences a suffocating feeling and great distress from the inability to breathe. Severe pain accompanies the difficult breathing.
- The cause of emphysema is not known, but it is most frequently associated with heavy cigarette smoking.

Emphysema

↳ α -1-antitrypsin deficiency

- An inherited form has been identified also. Individuals with a ^① deficiency in **alpha-1-antitrypsin** are prone to alveolar destruction characteristic of emphysema.
- ^② Air pollution and long-term exposure to irritants of the respiratory tract also seem to be factors of its etiology.
- Emphysema is a frequent complication of **chronic bronchitis**. Whatever the cause, the ^① alveolar walls break down, ^② adjacent alveoli fuse, and the lungs lose their elasticity.

③

Emphysema

① Irritant
inside the
alveoli

② Phagocytosis by
alveolar
macrophages

③ Cytokines
released

⑥ Elastase
breaks down
elastin

⑤ Neutrophiles
releases proteases
enzymes mainly
elastase

④ Cytokines
activates
neutrophiles

Elastin

- It's connective tissue.
- Its function is:
 - **Recoil:** helps lungs to contract and exhale the air outside.
 - **Keeps the airway open:** elastic tissues in the airway generate opposing pressure during exhale to keep the airway open.
 - **Form the integrity of the alveoli wall.**
 - By breaking down elastin by elastase, lungs cannot contract very well and the airway will be collapsed, in addition, to alveoli wall damage which decreases the surface area for gas exchange.

α 1- antitrypsin

- Released by the liver to the blood.
- Its anti-protease enzyme.
- It breaks down elastase which helps to keep the elastin intact. سليم
- Deficiency leads to increase elastase levels and breaking down elastin.

جابت :alpha 1 antitrypsin deficiency

الجواب none

More break down elastase

More elastin

Help lung to exhaled

Preserving integrity

How does a deficiency in $\alpha 1$ -antitrypsin contribute to the development of emphysema?

- A. It allows elastase to break down lung elastin unchecked
- B. It causes the hypersecretion of histamine in response to pollen
- C. It leads to an overproduction of mucus in the bronchial tubes
- D. It prevents the phagocytosis of bacteria by alveolar macrophages

A

In emphysema, what is the specific role of α 1-antitrypsin in maintaining lung integrity?

- A. It triggers the release of cytokines to attract neutrophils
- B. It provides the structural recoil needed for exhalation
- C. It acts as an anti-protease that inhibits elastase
- D. It facilitates the repair of damaged alveolar walls

Bernoulli principle

- Air leaves the lung in a high-velocity manner, so, the airway should be a low-pressure airway.
- The low pressure comes from the opposite pressure which is generated from the elastic tissue in the airway.
- If the airway loses this elastic tissue, the airway will be collapsed during exhale (against the low) which causes air trapping.

Emphysema

- Leads to:
 - Hypoxemia
 - Hypercapnia

★ Hypoxemia and hypercapnia are late stages in emphysema but early stages in chronic bronchitis.

Emphysema based on the morphology changes:

- **Centriacinar emphysema:** Changes in the alveoli wall in the upper part of the lung.
- **Panacinar emphysema:** affect the lower part of the lung.
- **Distal acinar emphysema:** affects parts near to pleura. This can cause rupture of the alveoli and lead to pneumothorax.

اجا سؤال عن ال panacinar emphysema

عدة خيارات وانه شو الجواب الصح

الصح: affect the lower part of lung

Signs and Symptoms of Emphysema



Typically, a person with emphysema has an **increased rate of breathing** and a **greater than normal expansion of the chest**. This hyperventilating clears out carbon dioxide that is building up internally because of poor lung functioning.



Permanent expansion of the chest (“barrel” chest); abnormal respiratory sounds called rales.



Right-sided heart failure or **cyanosis** because of marked hypoxemia.



Hypoventilation reduces oxygenation.

Signs and Symptoms of Emphysema



Emphysema can last for many years, causing irreversible damage to the lungs. As in any serious disease, complications often develop. With the breakdown of alveolar walls, the surrounding blood capillaries are damaged.



This interference with circulation in the lungs can lead to an obstruction of the pulmonary artery. The large air sacs, formed by the fusion of the alveoli, tend to rupture. This allows air into the pleural cavity, the space between the lungs and the chest wall. Air in this space can cause the lung to collapse.

Diagnosis and Treatment of Emphysema

- physical therapy
- elimination
- medications

- Treatment involves eliminating the source of the irritation. A smoker will be told to quit smoking and to avoid polluted air containing smoke, fumes, and irritating dust. The patient should observe ozone warnings and limit outdoor activity when the ozone level is high.
- Medications that clear mucus from the lungs help prevent infection. Some medications give relief from the feeling of not being able to breathe, such as albuterol or metaproterenol.
- Physical therapy is sometimes helpful in teaching individuals to use all the possible muscles for respiration in the abdomen and chest wall.

Chronic Bronchitis

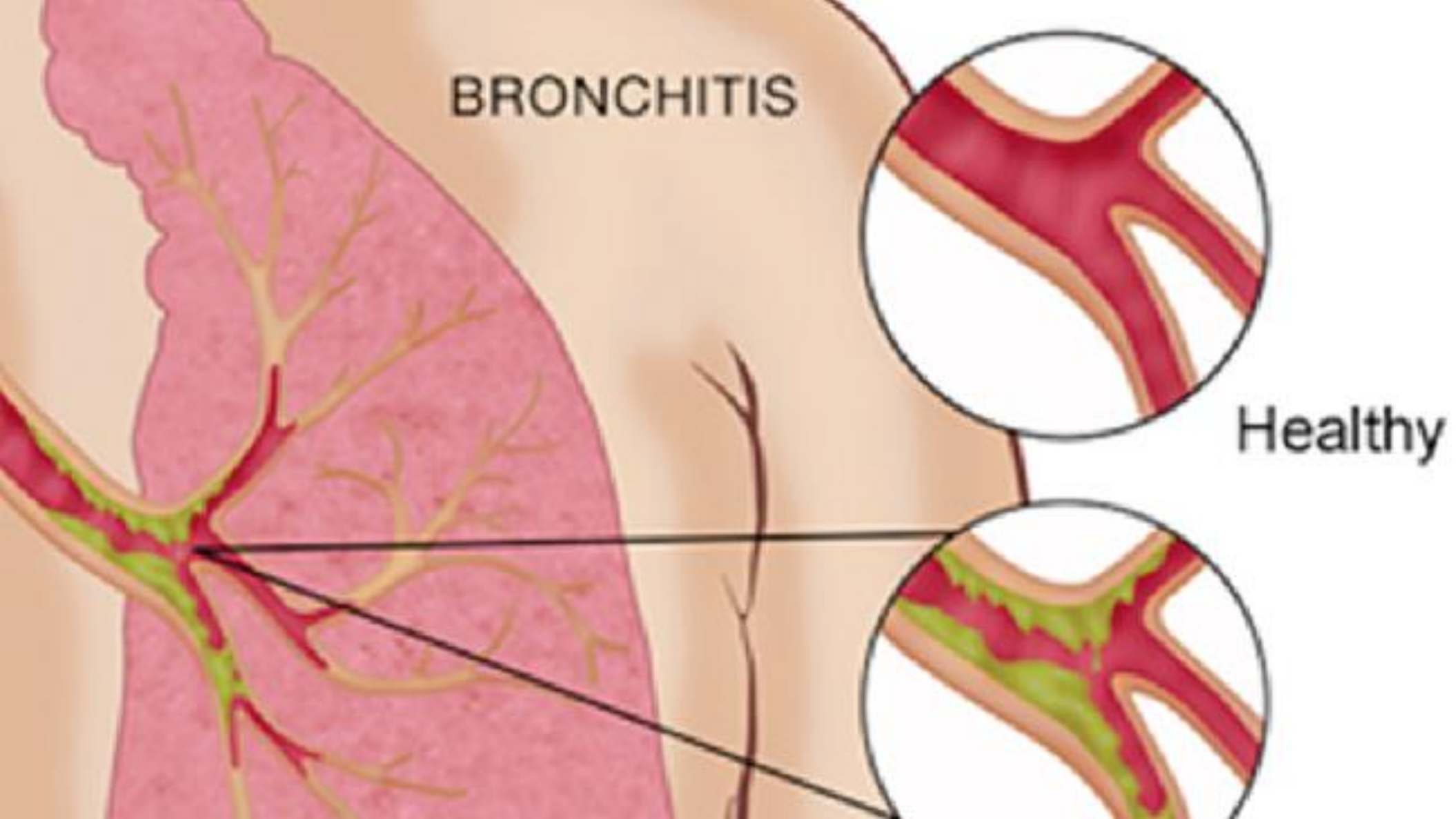
The mucous production increases significantly which severely narrows the airway.

Due to continuous exposure to irritants, hypertrophy and hyperplasia occurs to mucous glands as well as goblet cells.

Ciliary dysfunction: shortening and less motility of the cilia which make the mucous hard to be removed.

Air trapping: due to mucous accumulation, CO₂-rich air is trapped inside the lung.

BRONCHITIS



Healthy

- Due to less oxygen inhaled and less CO_2 exhaled the following conditions will occur:
 - Hypoxemia: decrease in PO_2
 - Hypercapnia: increase in PCO_2
- Chronic bronchitis can lead to Pneumonia by increasing the risk of infection with:
 - Haemophilus influenza (H. Flu).
 - Moraxella catarrhalis (M. Catarrhalis).

inflammation of the lungs

Pulmonary tuberculosis

Is a chronic respiratory infection caused by Mycobacterium tuberculosis.

Caused by inhaling droplets from the respiratory secretion created by coughing, sneezing or talking of a person with active tuberculosis.

Bacteria

Patient may stay asymptomatic (latent tuberculosis) as the M.O. is surrounded by T lymphocytes and macrophages to prevent spread of the disease.

Patients with weak immune system as children and HIV patients develop active disease.

The destructiveness of the disease results from the cell mediated hypersensitivity response that the bacillus evokes rather than its inherent destructive capabilities.

Cavities are formed as a result of immune response.

In rare conditions the bacteria may erode to the blood leading to spread into brain, meninges, liver, kidney and bone marrow.

"metastasis"

Pulmonary tuberculosis (TB)

- Infection of the lung tissue with airborne bacteria called *mycobacterium tuberculosis*.
- It affects alveolar tissue specifically.
- M. tuberculosis has 3 fates inside the alveoli:
 - Elimination.
 - Retention (bacteria stays inside the macrophages): latent TB
 - Active infection: active TB.

TB pathophysiology

- When bacteria enter the lungs, macrophages will phagocyte them, however, mycobacteria [★] inhibit the lysosomes activity in these macrophages, then bacteria may reproduce and get released others that will phagocyte them, and the accumulation of macrophages leads to destruct the lung and form granuloma or tuberculoma.

TB pathophysiology

- Once granuloma is big enough to see, this is called Gohn focus.
- If the infection is not treated, the infection will spread over to the lymph node in the lungs to form Gohn complex (Gohn focus and lymph node). This is called primary infection and 90% of the TB cases are stays in this stage as latent TB which remains in the person's entire life without causing any problem.

Question 21 / 40

In which step 90 percent of the TB cases stay?

1. ☐ Granuloma
2. ☐ Tuberculoma
3. ☐ Gohn focus
4. ☒ Gohn complex
5. ☐ None of the above

Next

TB pathophysiology

- Around 5% of the cases will have a progressive infection which manifested as ^{inflammation of the lungs} tuberculosis pneumonia. Or some of them will go beyond local infection, the infection disseminates to other organs such as the liver, brain, and kidney (infection appears as tiny spots called miliary TB).

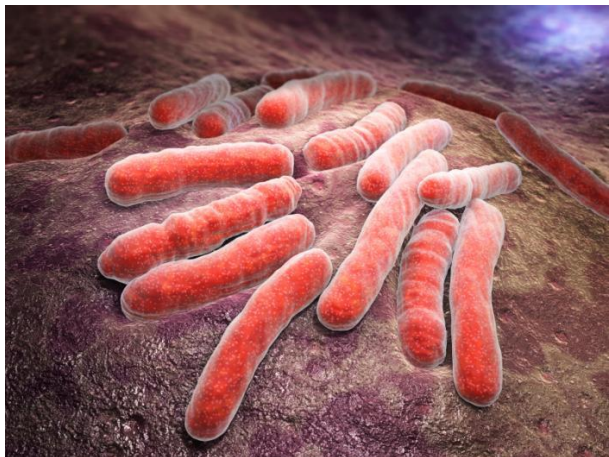
Miliary tuberculosis is defined by which clinical presentation?

- A. A single calcified lesion in the upper lobe
- B. The formation of large cavities within the bronchial tubes
- C. Total lung collapse due to pleural effusion
- D. Disseminated infection appearing as tiny spots across various organs

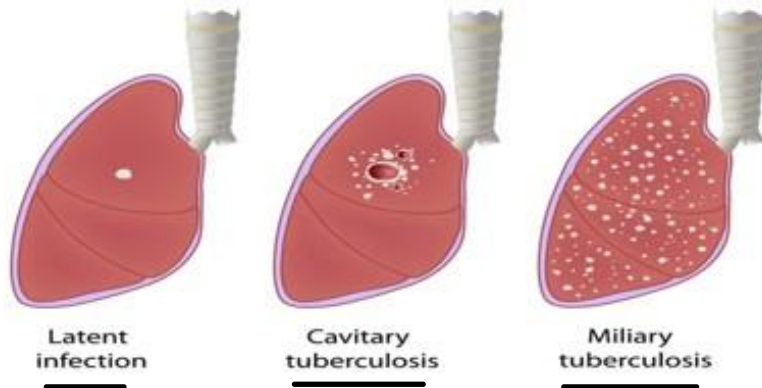


TB pathophysiology

- In the other 5% of the patients, latent TB becomes reactivated to cause the **secondary infection**.
- Secondary infection may happen months to years after the primary infection due to depressed immune systems, such as in HIV and chemotherapeutics, also, DM and smoking will increase the risk.



Tuberculosis (TB)



Tuberculosis Symptoms



Pulmonary Tuberculosis-Diagnosis and Treatment

- It is diagnosed by:
 - Culture of the organism (12 weeks).
 - DNA amplification (several hours).
 - ID injection of tuberculin (detect presence of antibodies) is used for screening.
intra dermal protein is giving subcutaneously
- The treatment focuses on the elimination of the tuberculosis bacilli from [infected persons] and eliminating its spread which requires multiple medications.
- The primary drugs used in the treatment are Isoniazid, rifampin, ethambutol and pyrazinamide for active tuberculosis for two months followed by isoniazid and rifampin for another 4 months.
- Persons who are in contact with the person with tuberculosis should be prophylactically treated usually by isoniazid. بشكل وقائي
- Drug resistance could complicate the problem, which is solved by drug susceptibility test.
for rifampin

Lung cancer

- Lung cancer is the leading cause of cancer death among both men and women. Death from lung cancer includes about 28% of all cancer deaths. Approximately 80% of lung cancer is related to cigarette smoking; lung cancer is ten times more common in smokers versus nonsmokers.
- Other causes include inhalation of carcinogens (cancer-causing agents) which may be an occupational hazard among workers who are constantly exposed to air pollution including Arsenic, Chromium, Nickel, and vinyl chloride, exhaust gases, and industrial fumes.
- The great danger in Lung cancer is **blockage of the airway by the malignant tumor as it grows into the lumen of the bronchus.** The affected part of the lung collapses for lack of air.
- Danger of airway obstruction; death results from complications of obstruction or from the effects of metastatic tumors.

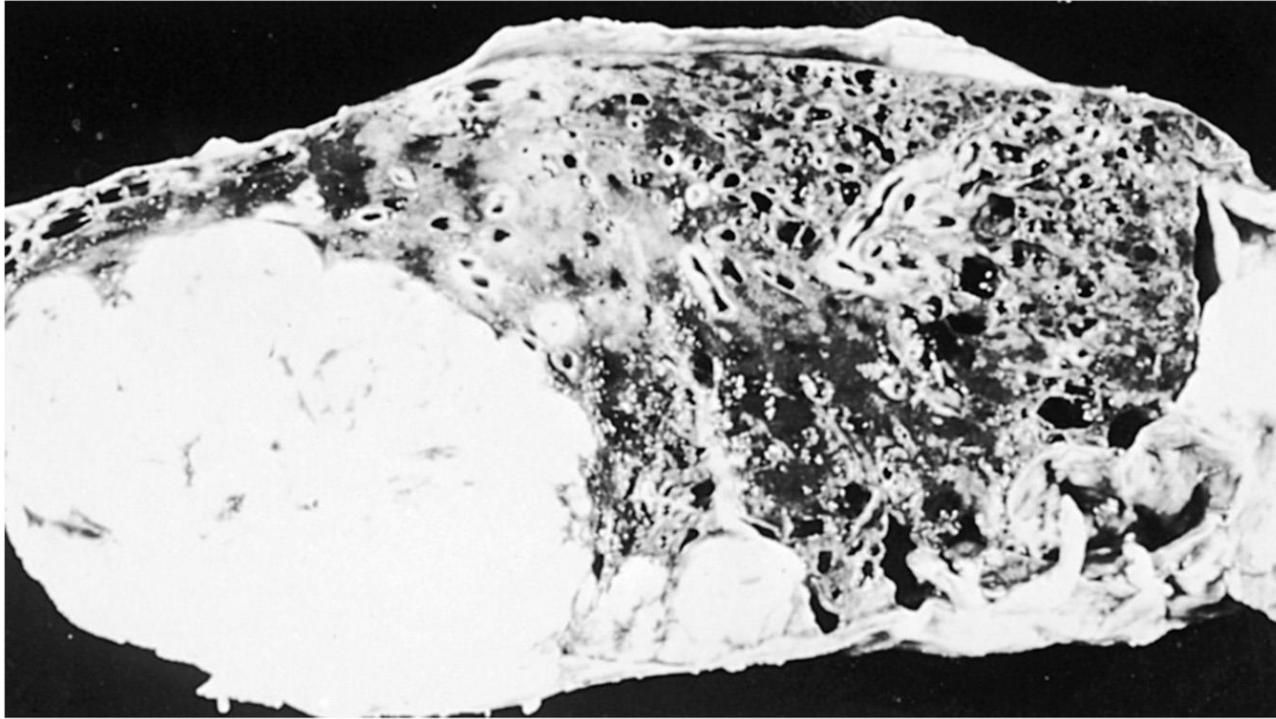


Figure 9-7: Carcinoma of the lung (large white area).
(Courtesy of Dr. David R. Duffell)

Lung cancer

non
small
cell
carcinoma

small
cell
carcinoma
smoker

squamous
cell
carcinoma

Adenocarcinoma

large cell
carcinoma

- It divided into:

✓ Non small cell carcinoma:

depends
on
type

male
smoker

- **Squamous cell carcinoma:** more common in men and correlated to smoking. Early detected by cytological examination of the sputum. It extends to the major bronchi and pulmonary lymph nodes. Central cavitation tumor is frequent.

non
smoker
women

- **Adenocarcinoma:** the most common in north America in women and nonsmokers. It is a malignant epithelial cell tumor with glandular differentiation a mucin production by the tumor cells. Associated with pleural fibrosis and scarring with poor prognosis

اسود واحد فتح

- **Large cell carcinoma:** have large polygonal cell which are highly neoplastic and difficult to categorize. It occurs in the periphery of the lung, invading subsegmentally bronchi and larger airway. It has poor prognosis because of tendency to spread to distant sites early in the course.

✓ Small cell carcinoma:

smoker

الأنحدر

smoking



Small cell lung carcinoma

ADH ↑
cortisol ↑
Ca²⁺ ↑ (parathyroid hormone)

- Characterized by distinctive of type-small round to oval cells that are in the size of lymphocytes.
- Tumors arise from nonexocrine cells of the bronchial epithelium, and some are able to secrete hormonally active products, such as **syndrome of inappropriate antidiuretic hormone secretion (SIADH)** with strongest association with cigarette smoking.
absorption of water ↑
- It is highly malignant with **70% of the cancers of detectable metastasis**.
- **Brain metastasis is very common** and may give the same evidence of the tumor.
- **Cure rate is excellent with 50-60% response in limited disease** but only short term 6-8 months. **Recurrence of the disease tends to have a mean survival length of 3-4 months**
- The 2-year survival is 20-40% in limited disease and 5% in the extensive disease

Symptoms of Lung Cancer

- Lung cancers are/aggressive, locally invasive and widely metastasizing tumors.
- The clinical features depend on the location of the tumor, the present metastasis and the occurrence of the paraneoplastic syndrome.
- The symptoms or signs of early-stage lung cancer may be undetected, but **later there is a persistent cough, shortness of breath, wheezing and hemoptysis.** The blood in the sputum results from the erosion of blood vessels by the growing malignancy.
- Dull, intermittent, poorly localized pain is common as **pain receptors are limited.** But it becomes persistent, more localized and more severe when the disease invades to the pleura.
- Non-specific symptoms include **anorexia, weight loss, and weakness accompany the disease.** The poor oxygenation of the blood explains the generalized weakness. Symptoms include difficulty in breathing caused by the obstructed airway.
- Symptoms develop late in the disease, so prevention and early detection are essential.

Symptoms of Lung Cancer

- For some types of tumors, hoarseness of the voice and difficulty in swallowing may occur.
- Further complication may lead to pleural effusion, which compress the lung leading to dyspnea.

* Paraneoplastic syndrome includes hypercalcemia due to release of parathyroid hormone-like peptide, Cushing syndrome (ACTH secretion), SIADH, neuromuscular syndrome and hematological disorders.

$Ca^{+2} \uparrow$

$ADH \uparrow$

Diagnosis and treatment

- Diagnosis of lung cancer is made from ¹chest radiography, detecting cancer cells in the sputum, washings from the ²bronchoscopy examination, a needle biopsy of the tumor, or ³biopsy of lymph nodes. ⁴
- CT scan and MRI and ultrasonography are used to locate the lesions.
- SCLC patients should have CT and MRI for the brain.
- Average age for diagnosing lung cancer is age 60.

Diagnosis and treatment

Surgery for removal of localized small tumors (lobectomy, Pneumonoectomy or segmental resection).

Chemotherapy, used singly or in combination, depending on the particular tumor with radiation therapy.



In addition to primary carcinoma of the lungs, the lungs are a frequent site of metastases from the breast, GI tract, female reproductive system, and kidneys.