METHODS OF EXAMINATION Respiratory system

Department of internal medicine # 3

Lecture 2 for 2nd year dentistry faculties students

Docent Borzykh Oksana Anatoliivna

Inquiry

The main complaints of the patients with disease of the respiratory system are:

- dyspnea (breathlessness)
- cough
- chest pain
- sputum (color and quantity)
- hemoptysis

Dyspnea is determined as an abnormally uncomfortable awareness of breathing.

Patients use a large number of verbal expressions to describe these uncomfortable sensations, such as:

'breathlessness', 'short of breath',

'out of breath', 'cannot get enough air',

'air does not go all the way down'.

Dyspnea in its manifestation can be subjective, objective, and mixed.

- Respiratory diseases are often accompanied by *mixed dyspnea.*
- Dyspnea is possible with normal, rapid breathing (*tachypnea),* and slow rate of breathing *(bradypnea).*
- Three types of *dyspnea quality* are differentiated by the prevalent breathing phase:

inspiratory dyspnea (more difficult to breath in than out),

expiratory dyspnea (more difficult to breath out than in), and

mixed dyspnea when both inspiration and expiration phases become difficult.

- The symptom of ***dyspnea*** is related to a process such as obstruction of the airways or to conditions that are associated with decreased vital lung capacity and ventilation.
- ***Heavy dyspnea***, often followed by asphyxia is called suffocation.
- ***Asphyxia*** arising as sudden attack is asthma. In bronchial asthma the expiration is difficult, long, and noisy as a result of spasm of small bronchi.

Cough is a defensive reflex designed to clear and protect the lower respiratory tract.

- The cough reflex can be initiated by stimulation of irritant receptors in the larynx, trachea, and major bronchi.
- These receptors respond to mechanical irritation by intraluminal material such as mucus, dust, or foreign bodies, and to chemical irritation by fumes and toxic gases.

The clinical analysis of cough.

- Any disorder resulting in inflammation, constriction, infiltration, or compression of airways can be associated with cough.
- A cough without sputum; such type of cough is called ***dry***.
- The cough productive of sputum can be described as ***moist***.

Some diseases are accompanied only by dry cough:

- laryngitis, dry pleuritis or compression of the main bronchi by the bifurcation lymph nodes (tuberculosis, tumor metastases)
- Some disease, such as bronchitis, pulmonary tuberculosis, pneumosclerosis, abscess, or tumor of the lungs, can manifest by dry cough

Cough may be *periodic* or *permanent*

- Periodic cough occurs more frequently.
- Such cough is characteristic of influenza, pneumonia, pulmonary tuberculosis, and chronic bronchitis.
- Permanent cough occurs in laryngitis, acute bronchitis, bronchogenic tumor of the lungs, and in certain forms of tuberculosis.

Hemoptysis defined as the cough with blood.

- In the assessment of the hemoptysis it is important to establish first that the blood-stained material has come from the chest and not from the gastrointestinal tract.
- The most common site of bleeding is the airways, tracheobronchial tree, which can be affected by inflammation (acute or chronic bronchitis, bronchiectasis) or by neoplasm.
- Hemoptysis that is described as blood with of mucopurulent or purulent sputum often suggest bronchitis.

Chest pain.

- The greater part of the lower respiratory tract is not sensitive to pain.

The clinical analysis of the chest pain:

- Typical pleural pain has a sharp and knife-like character in pleuritis and is accentuated by respiratory movement.

Past medical history:

- asthma,
- bronchitis,
- emphysema,
- pneumonia,
- tuberculosis,
- pleurisy,
- last chest x-ray

Physical examination

Patients with symptoms of respiratory tract diseases need medical examination.

- Physical examination by a health care provider may reveal **fever** or sometimes low body temperature,
- an **increased respiratory rate**,
- low blood pressure,
- a fast heart rate, or
- a **low oxygen saturation**, which is the amount of oxygen in the blood as indicated by either pulse oximetry or blood gas analysis.

- People who are:
- struggling to breathe,
- confused, or
- who have cyanosis (blue-tinged skin)

require immediate attention.

Cyanosis, deep blue color of face and lips characteristic of death by asphyxia. G. Gresham, Color Atlas of Forensic Pathology, 1975.

General examination

- **Cyanosis: diffuse cyanosis! Not acrocyanosis.**
- **Respiratory rate (normal 12-14, tachipnoe, bradypnoe).**
- **The respiratory effort** is inspected, including:

(1) Overall ease or difficulty of respiration (**dyspnoe**)

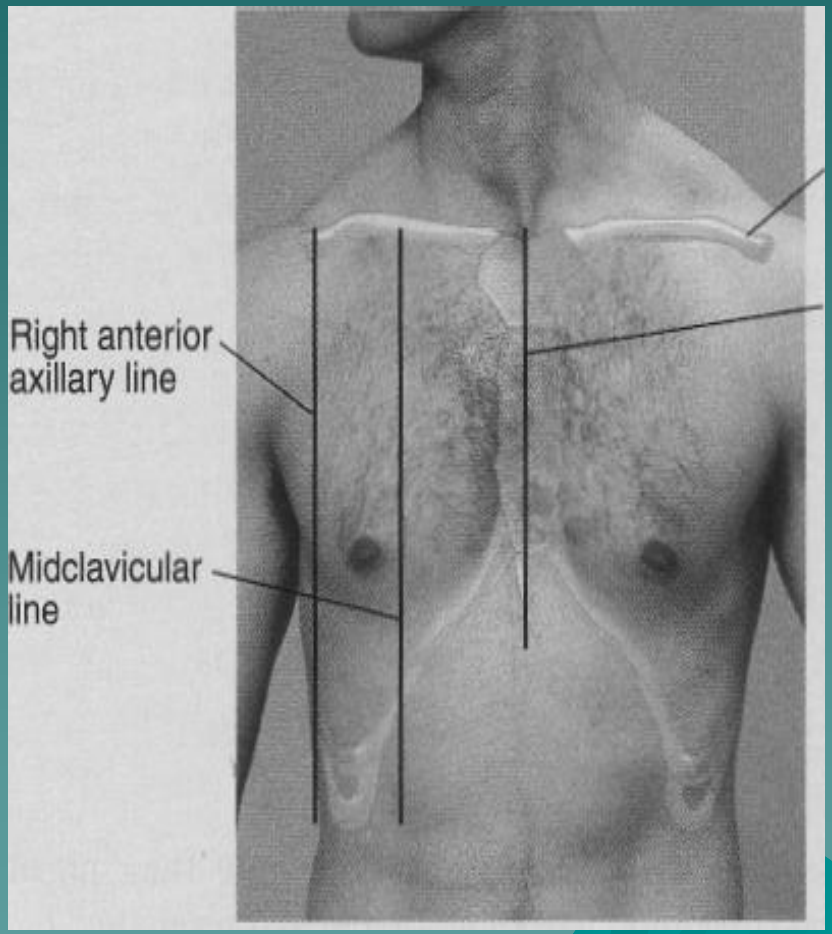
(2) Use of accessory muscles, such as trapezius, strap muscles, or sternocleidomastoids

(3) Intercostal muscle retractions (abnormal)

Palpation of the Chest

Palpation of the chest has three potential uses:

1. identification of the tender areas;
2. assessment of elasticity of the chest;
3. assessment of tactile fremitus.

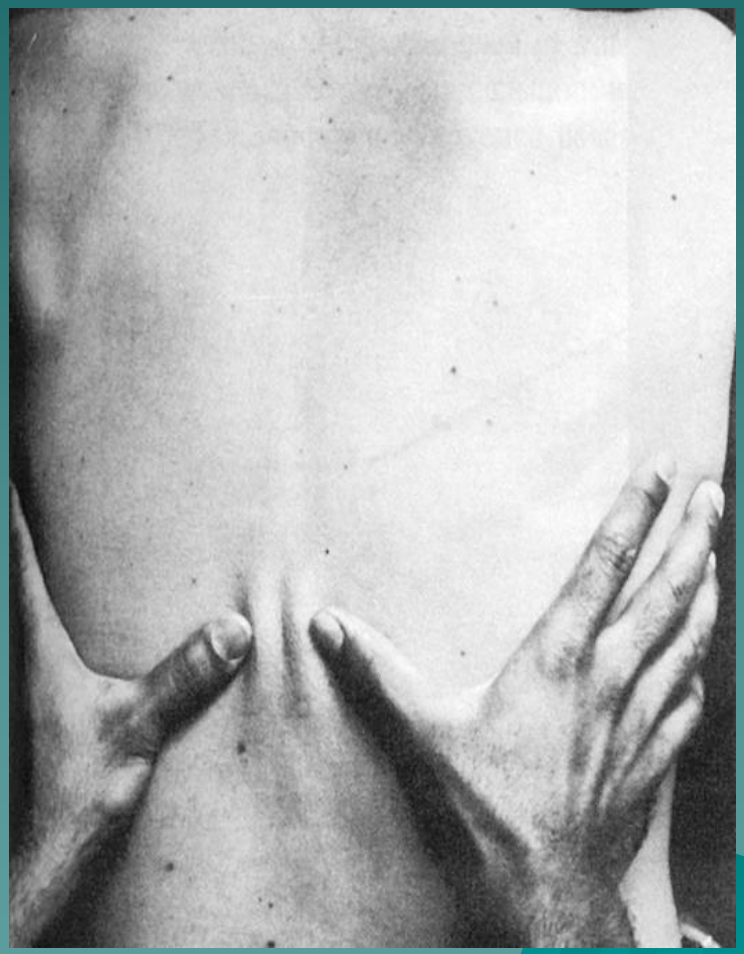


Assessment of tactile fremitus (vocal fremitus).

- Fremitus refers to the palpable vibrations transmitted through the bronchopulmonary tree to the chest wall when the patient speaks.
- Ask the patient to repeat the words "ninety-nine" or "one-one-one".
- If fremitus is neak, ask the patient to speak more loudly or in a deeper voice.

assessment of *vocal fremitus*

- Palpate and compare symmetrical areas of the chest, using the palms of your both hands simultaneously.



- **Vocal fremitus is increased** in consolidation of the pulmonary tissue (lobar pneumonia, lungs infarction, pulmonary tumor, tuberculosis, com-pressive atelectasis).
- **Vocal fremitus is decreased** when the voice is soft in weak patients.
- Causes include separation of the lung by moderate amount of fluid (pleural effusion) or air (pneumothorax), obstructive atelectasis; and also a very thick chest wall (edema, subcutaneous fat).
- Tactile fremitus can be absent when significant amount of fluid or air are accumulated in the pleural cavity.

assessment of *vocal fremitus* *site of arms*

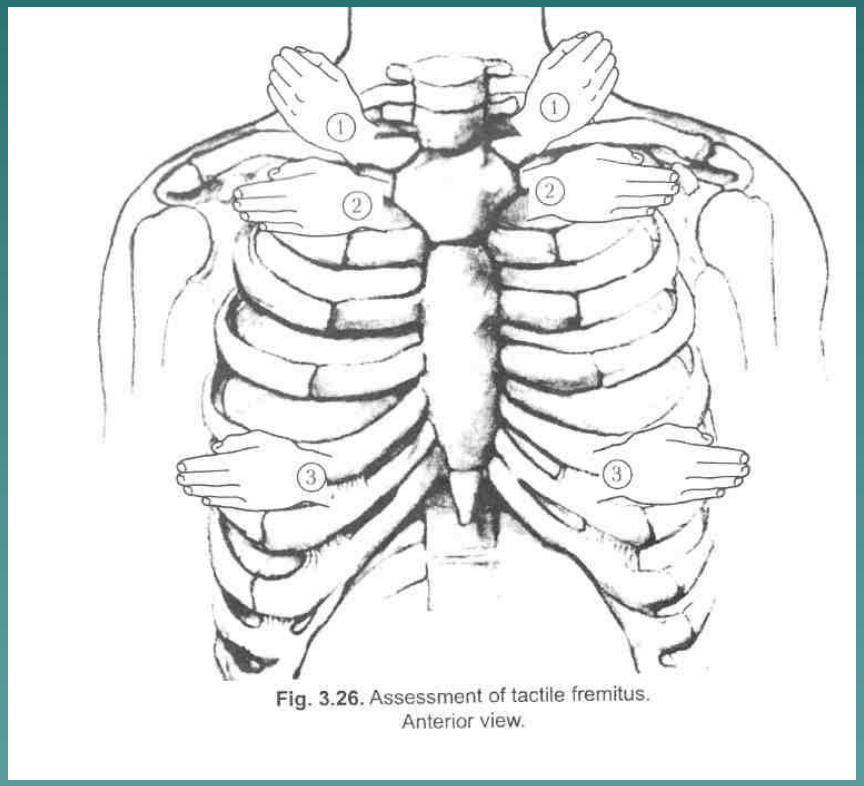


Fig. 3.26. Assessment of tactile fremitus.
Anterior view.

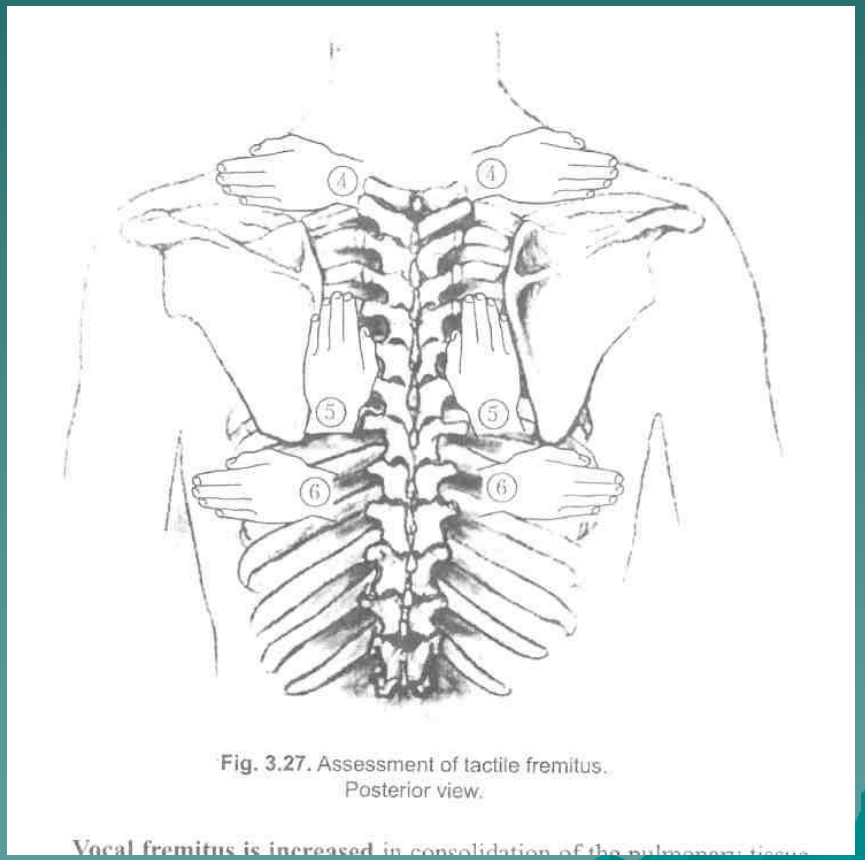


Fig. 3.27. Assessment of tactile fremitus.
Posterior view.

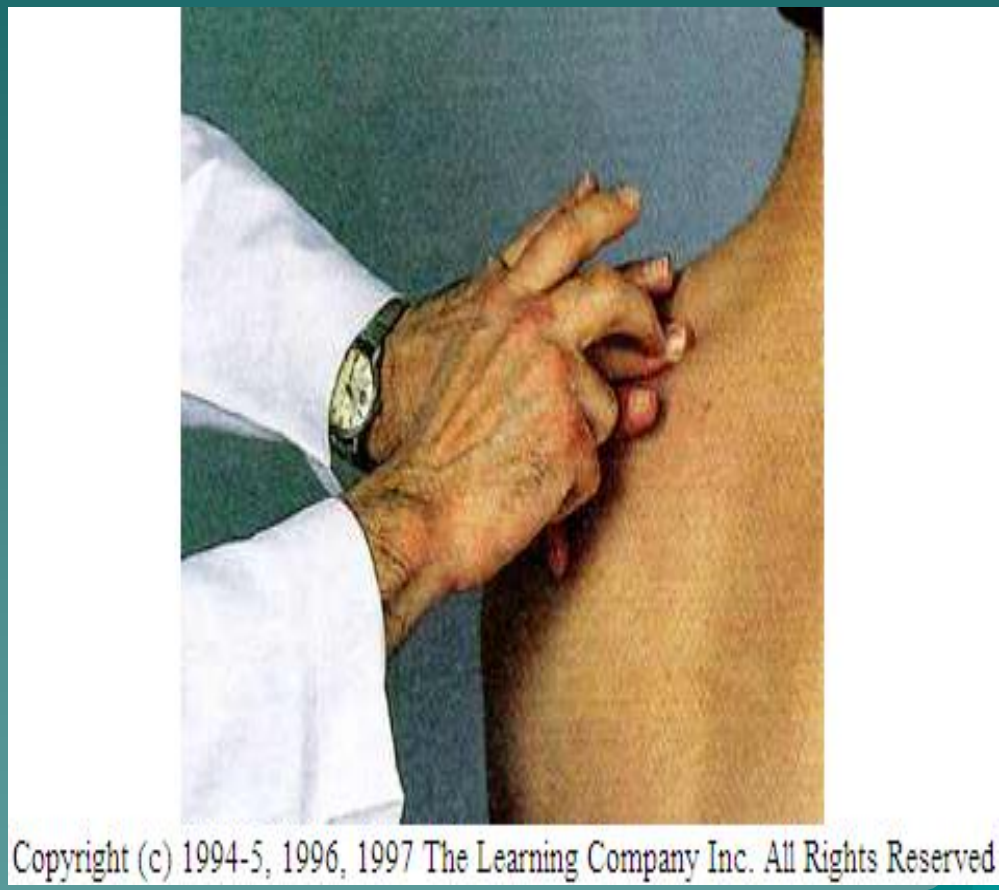
Vocal fremitus is increased in consolidation of the pulmonary tissue

Percussion of the Lungs

- Two types of percussion of the lungs - comparative and topographic -are existed.

Comparative percussion of the lungs

- The *task* of comparative percussion is to compare percussion sounds over the lungs on the opposite parts of the chest, and also on neighboring areas on the one side.



The technique of comparative percussion.

- The patient should be in a comfortable posture and relaxed.
- The best position is standing or sitting.
- Patients with grave diseases should be percussed in the lying posture.
- The room should be warm and protected from external noise.
- All areas of the chest are percussed, that is, the front, both axillary regions, and back.
- The air-containing lung tissue will give a clear pulmonary sound (resonance) in percussion.

The common cause of percussion notes changes include:

- decreased airiness of the pulmonary tissue or full absence of air in a part of the lung;
- increased airiness of the pulmonary tissue; pleural accumulation of fluid;
- pleural accumulation of air.

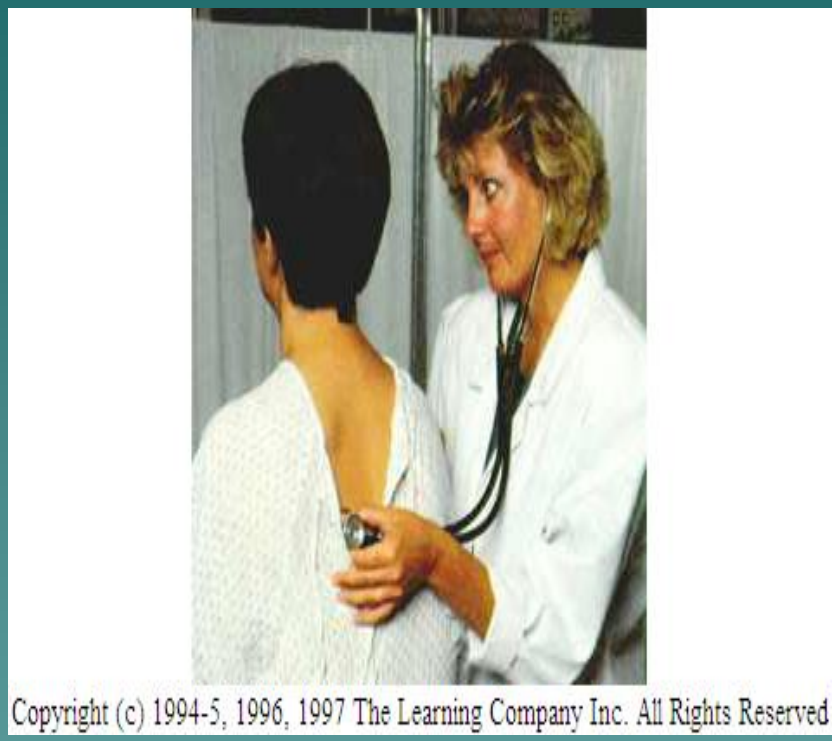
- In decreased amount of air in the lungs clear pulmonary sound becomes duller, that is intermediate. Causes include:
- 1. lobar pneumonia initial stage, when alveoli in addition to air contain also a small amount of fluid,
- 2. pneumosclerosis, fibrous-focal tuberculosis;
- 3. pulmonary edema due to the left ventricular failure;
- 4. compressive atelectasis (above fluid level);

Auscultation of **the Lungs**

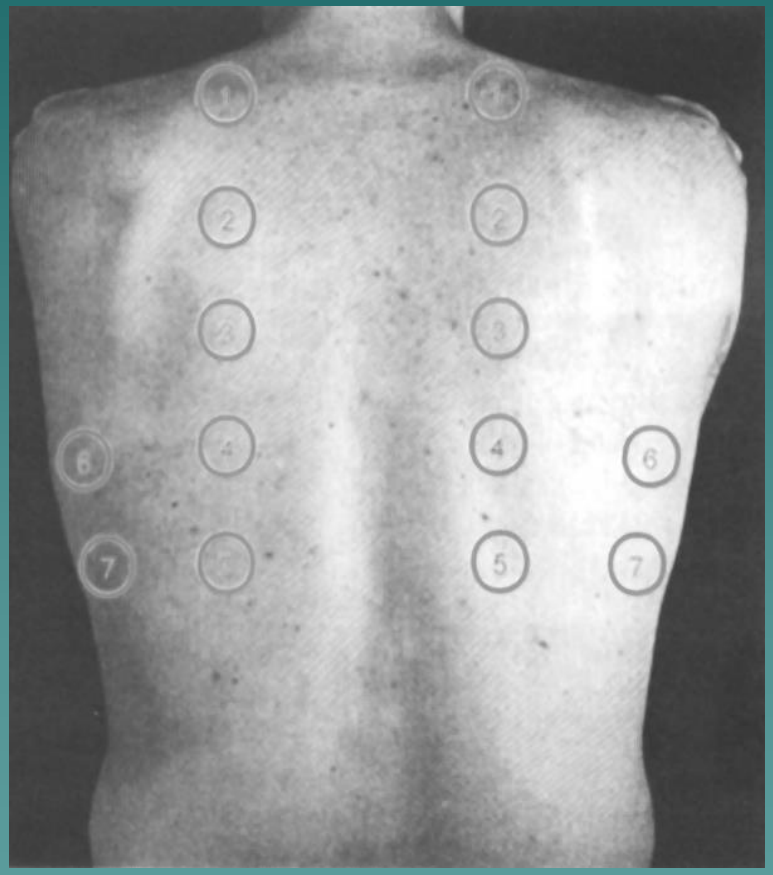
Auscultation of the lungs is the most importing examining technique for assessing airflow through the tracheobronchial tree.

Auscultation involves:

1. listening the sounds generated by breathing — breath sounds (respiratory sounds);
2. listening for any adventitious (added) sounds.



Two types of sound can be heard coming from the lungs: the **main respiratory sounds** (breath sounds) and **adventitious** (added) **sounds**



Main respiratory (breath) sounds:

- vesicular (alveolar) breath
- bronchial (laryngotracheal) breath sounds

Adventitious (added)

- rales
- crepitation
- pleural friction sounds

The main respiratory sounds (breath sounds).

Normal breath sounds have been classified into two categories:

- vesicular
- bronchial.

Vesicular breath sounds are heard normally over most of both lungs.

Adventitious (added) sounds.

Three types of adventitious sounds can be heard in breathing pulmonary pathology:

- rales,
- crepitation,
- pleural friction sound.

Rales are generated in bronchi and bronchioles.

Dry and moist rales are distinguished.

Mechanism and site of dry rales generation

- *Dry rales* can be caused by narrowing of airways, or by presence of viscous sputum in them.

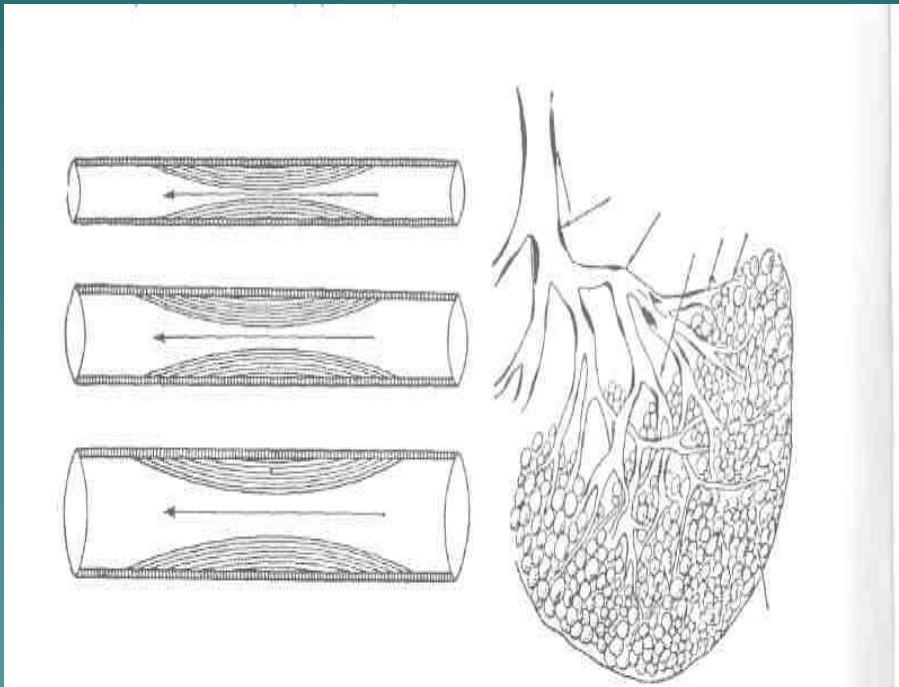


Fig. 3.48. Mechanism and site of dry rales generation.

- *Sibilant rales (wheezes)* are relatively high pitched, whistling sounds
- Sibilant rales signify obstruction in small bronchi in:
- • bronchial asthma (total bronchospasm during attack);
- • *bronchitis*
- *Sonorous rales (rhonchi)* are relatively low pitched, sonoring sounds Sonorous rales are generated by vibration of the viscous secretions or in widespread obstruction of medium and large bronchus. They may be also heard in bronchial asthma, tuberculosis, and bronchocarcinoma.
- *Moist rales (clackles)* are generated in bronchi and cavities in the lungs in the presence of liquid secretions (sputum, congestive fluid, blood).
- Airflow in liquid-containing bronchi causes formation of air bubbles, which break to produce specific cracking sound. Similar sound can be heard
- when bubbling air through the water using small tube. Such sounds are called bubbling or moist rales.

The most common causes of the moist rales include:

- acute and chronic bronchitis
- *bronchopneumonia* (consonating rales);
- *bronchiectasis* (of various caliber, over limited area, non-consonating rales);
- *pulmonary edema* due to the left ventricular failure

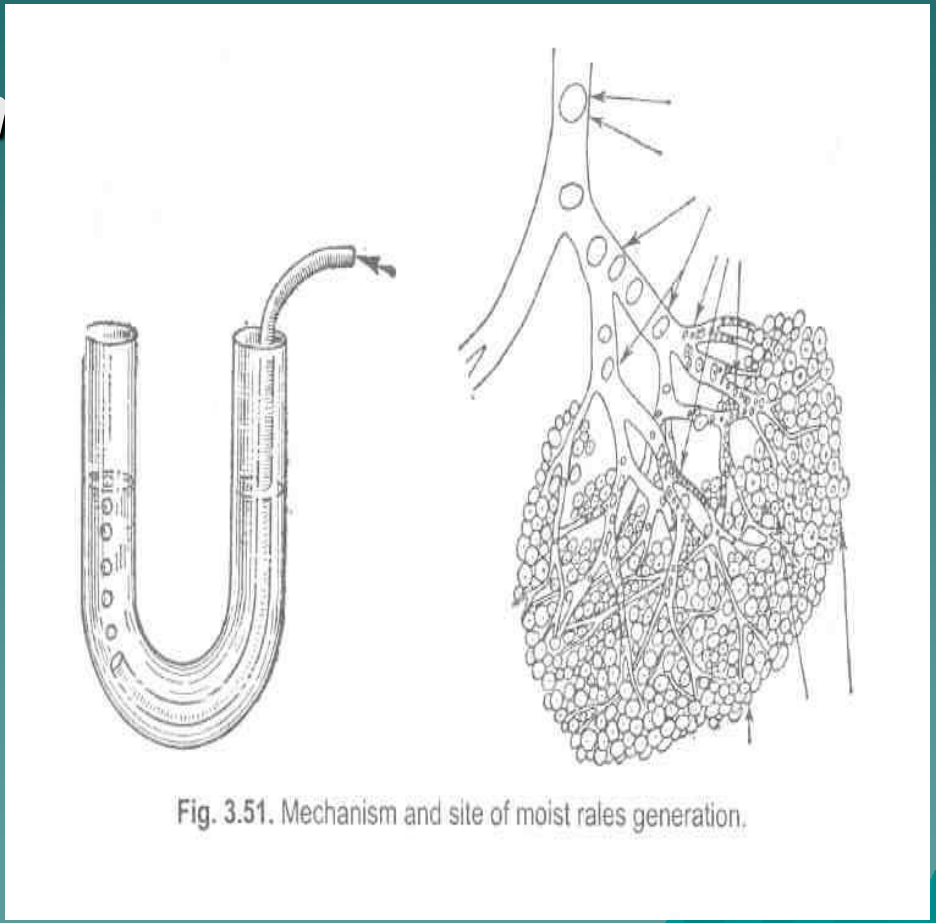


Fig. 3.51. Mechanism and site of moist rales generation.

Crepitation

Crepitation is generated in alveoli, when they contain small amount of liquid secretion.

During expiration alveoli stick together as a result of fluid presence.

Relatively constant crepitation can be due to:

- acute lobar pneumonia at the initial and final stages
- *pulmonary tuberculosis* (in small amount of inflammatory fluid in alveoli);
- *lung infarction* (in small amount of blood in alveoli);
- *congestive heart failure* (in small amount of congestive fluid in alveoli);

Pleural friction sound

Pleural friction sound (pleural rub, friction rub) is diagnostic added sound of pleuritis.

Adventitious sound known as pleural friction sound, generates as a result *of decreased amount of pleural fluid.*

*D*ry pleuritis due to dehydrotation:

- intestinal infections (cholera, dysentery);
- profuse bleeding;
- profuse diarrhea;
- profuse vomiting;

or when fibrin deposits on inflamed *pleura* to make it *surface rough* in:

- pleuropneumonia;
- rheumatic pleurisy;
- pleural tuberculosis;
- tumor;

Characteristics of added sounds.

Signs	Dry rales	Moist rales	Crepitation	Pleural friction sound
Relation to the respiratory phases	Best heard during expiration	Best heard during inspiration	Heard at the end of inspiration	Heard throughout respiratory cycle
Change during cough	Decrease or change character	Decrease or disappears	Without changes	Without changes
Pressure with the stethoscope	Without changes	Without changes	Without changes	Increase
Breathing movement with close nose and mouth	Absent	Absent	Absent	Only this sound is heard

Instrumental and Laboratory Methods

Diagnostic procedures for assessing the patients with suspected or known respiratory system disease include

- imagine studies,
- technique for obtaining biological specimens,
- and method used to characterize the functional changes developing as a result of disease.

Imagine studies

Imagine studies used to examine the patients with disorders of the respiratory system include:

- Roentgenoscopy
- Roentgenography (radiography)
- Fluorography
- Computed tomography (CT)
- Magnetic resonance imaging (MRI)
- Scintigraphic imaging
- Bronchography
- Pulmonary angiography
- Ultrasound examination

- Roentgenoscopy
- Roentgenography (radiography)

Technique for obtaining biological specimens

- **skin tests for tuberculosis,**
- **scratch or intradermal tests to detect atopic reactions (prick-test)**
- **appropriate serum complement fixation tests,**
- **sputum test,**
- **pleural fluid test,**
- **bronchial washings test,**
- **BRONCHOALVEOLAR LAVAGE**
- **THORACENTESIS AND PLEURAL BIOPSY**

Method used to characterize the functional changes

- **PULMONARY FUNCTION TESTS** (spirografy)
- Pneumotachymetry
- Measurement of blood gases

RESPIRATORY SYSTEM

Main syndromes

There are such syndromes of the diseases of respiratory system:

- the syndrome of the pulmonary tissue consolidation,
- the syndrome of increased airiness of the pulmonary tissue,
- the syndrome of bronchium obstruction (bronchospastic syndrome),
- the syndrome of fluid accumulation in pleural cavity (hydrothorax),
- the syndrome of air accumulation in pleural cavity (pneumothorax),
- the syndrome of the cavity in the lungs.

Syndrome of the pulmonary tissue consolidation

- The syndrome of the pulmonary tissue consolidation is one of the most widespread syndromes of the respiratory system pathology.
- It is based on the significant decrease or full disappearing of the pulmonary tissue airiness.

Etiology:

- - pulmonary tissue infiltration (pneumonia, tuberculosis);
- - thromboembolia of the pulmonary artery (TEPA), lung infarction;
- - pulmonary edema due to the left ventricular heart failure;
- - adhesion of the pulmonary tissue (compressive atelectasis) due to the external compression by air or fluid (pneumothorax, hydrothorax);
- - adhesion of the pulmonary tissue (obstructive atelectasis) due to the termination of air entrance to the lung tissue below bronchium obstruction (tumor, foreign bodies, enlargement intrathoracic lymphatic nodes);

Pathogenesis

Depending on the causes there are the next mechanisms of pulmonary tissue consolidation:

- decreased airiness of the pulmonary tissue due to the consolidation and infiltration of alveolus's walls via inflammatory edema (pneumonia, tuberculosis) or
- due to the interstitial edema (TEPA, congestive heart failure) via increased

Clinical features

Decreased airiness of the pulmonary tissue lead to the impaired lung ventilation, development of tissue and cellular hypoxia that clinically manifested by

- dyspnea,
- asphyxia,
- cough,
- hemoptysis,
- pain in the chest during respiration.

- *Dyspnea* — the major complaint in patients with the syndrome of decreased airiness of the pulmonary tissue.
- *Cough* - may be dry or with sputum discharge, periodic or permanent, from time to time accompanied with hemoptysis (pneumonia, tuberculosis).
- *Pain in the chest* - the onset of the pain is connected with the deep respiration, coughing or permanently increased in oncological pathology.

Objective examination.

- *General patient's condition* may be satisfactory (prodromal period, the stages of recovery or remission); may be middle grave, moderate; grave, extremely grave (lobar pneumonia, TEPA, cancer).
- *The posture of the patients* is frequently forced: orthopnea - in order to reduce dyspnea via decreased volume of circulating blood (lobar pneumonia) or lying on the affected side - in order to relieve the pain via limitation of the pleural layers movement (pneumonia, hydrothorax, pneumothorax, massive lung tumor).

Objective examination

- *Facies pneumonica* - one-sided blush on the same cheek as affected lung is specific for lobar pneumonia;
- *facies tuberculous* - exhausted, pale face with blush localized on the cheeks, "burning eyes", dry lips, excited countenance, half open mouth is specific for tuberculosis.
- *The color of the skin* is characterized by central or diffuse cyanosis due to the accumulation of the carbon dioxide and reduced restored hemoglobin.
- *Inspection of the chest* may reveal - asymmetrical chest with one half falls in the breathing act (pneumo- or hydrothorax).

Objective examination

- *Vocal fremitus* as usual increased, except obstructive atelectasis when it isn't detected on the affected side.
- *In comparative percussion* of the lungs determinates the changes of percussion sound from intermediate to dullness:
- - dullness (soft, high, short) — consolidation of the pulmonary tissue (lobar pneumonia consolidation stage, lung infarction).
- *In auscultation of the lungs:*
- -pathologically decreased vesicular breathing
- - pathologically bronchial breathing
- - over the regions with pathologically decreased vesicular breathing as usual is revealed crepitation.

Additional methods of examination

- ***clinical blood analysis:*** due to inflammatory process - leukocytosis, neutrophilia, shift of leukocyte formula to the left, accelerated Erythrocyte Sedimentation Mule (HSR);
- ***Sputum analysis:***

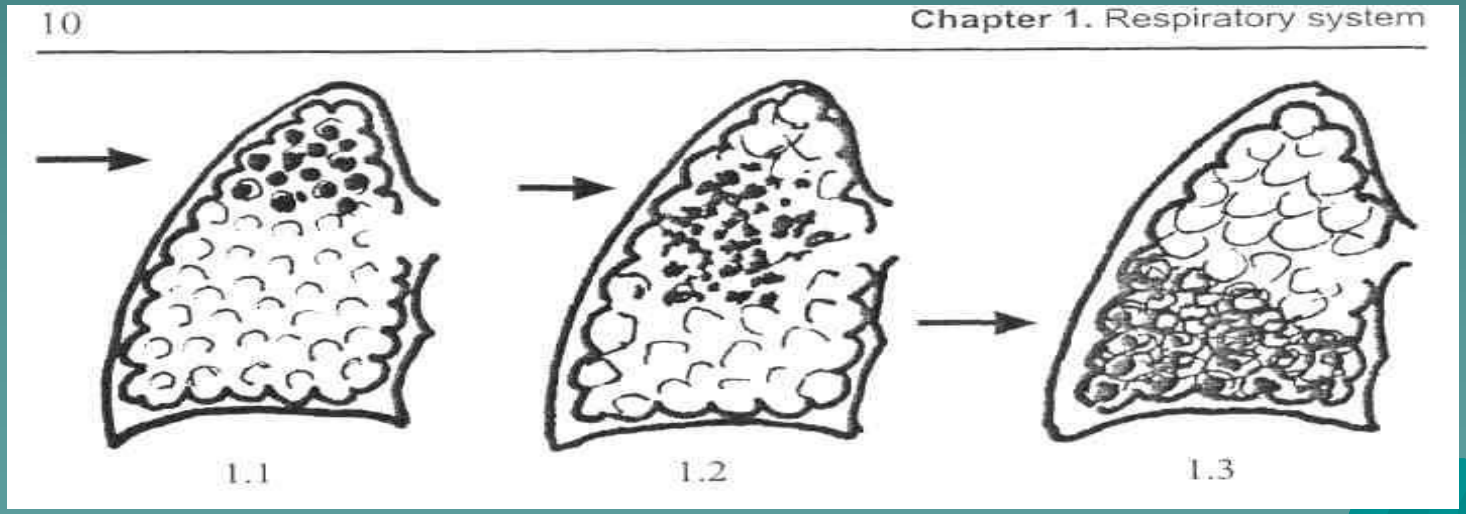
due to inflammatory process the character of the sputum is mucous-purulent or mucous-purulent bloody,

in microscopic study are revealed cellular elements (columnar, ciliary, alveolar macrophages, increased amount of leukocytes and erythrocytes), fibrous elements (fibrin fibers)

and presence of pneumococcus, streptococcus, staphylococcus in bacterioscopic study of the sputum; in destructive process are revealed large amount of cellular and fibrous elements, presence of mycobacterium tuberculosis or atypical cells.

Additional methods of examination

- *Roentgenoscopy and roentgenography (X-ray examination):* consolidation of the pulmonary tissue, tumor, the signs of bronchium obstruction, hydrothorax, pneumothorax.

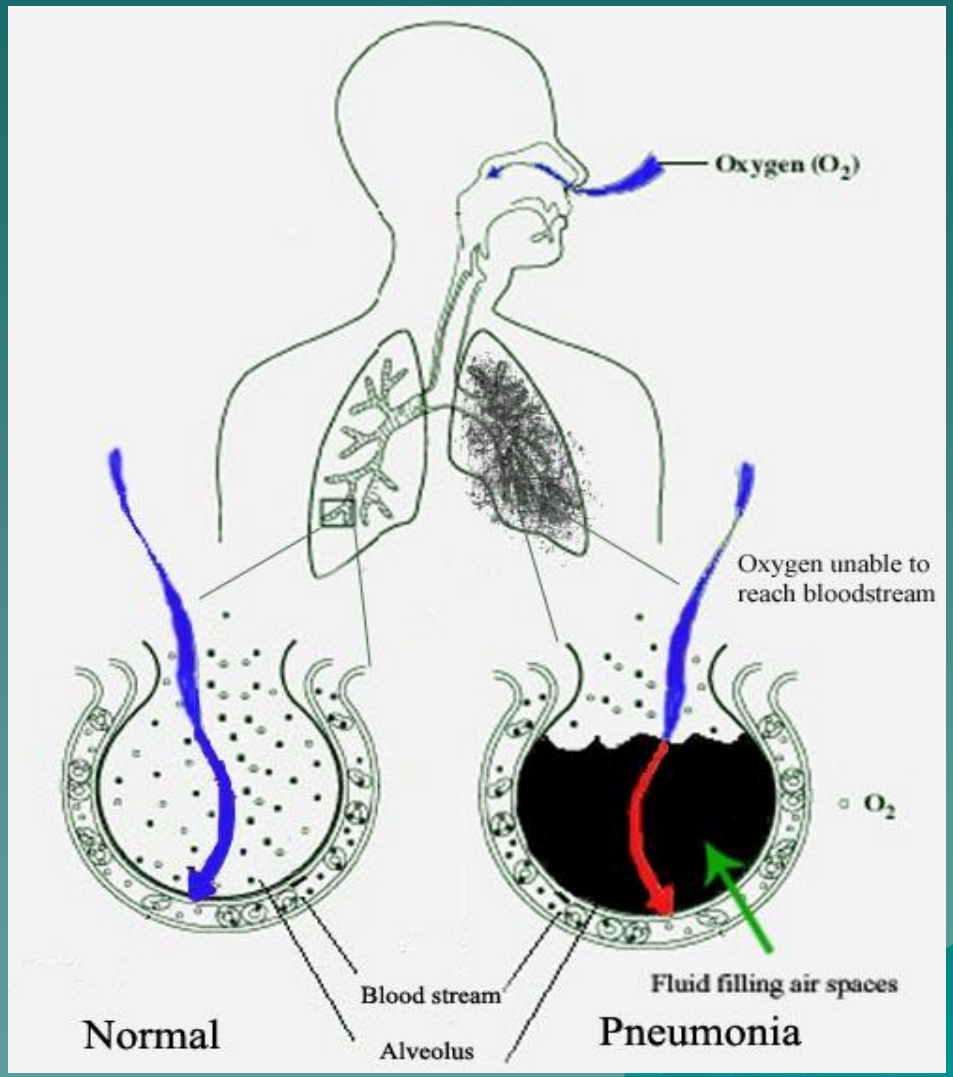


consolidation of the pulmonary tissue - pneumonia

Мал. 2. Вогнищева пневмонія ніжньої частки правої

Pneumonia

Pneumonia is an illness of the lungs and respiratory system in which the alveoli (microscopic air-filled sacs of the lung responsible for absorbing oxygen from the atmosphere) become inflamed and flooded with fluid.



Syndrome of increased airiness of the pulmonary tissue

The syndrome of increased airiness of the pulmonary tissue is based on the protracted enlargement of residual air volume in the lung that clinically manifests by emphysema.

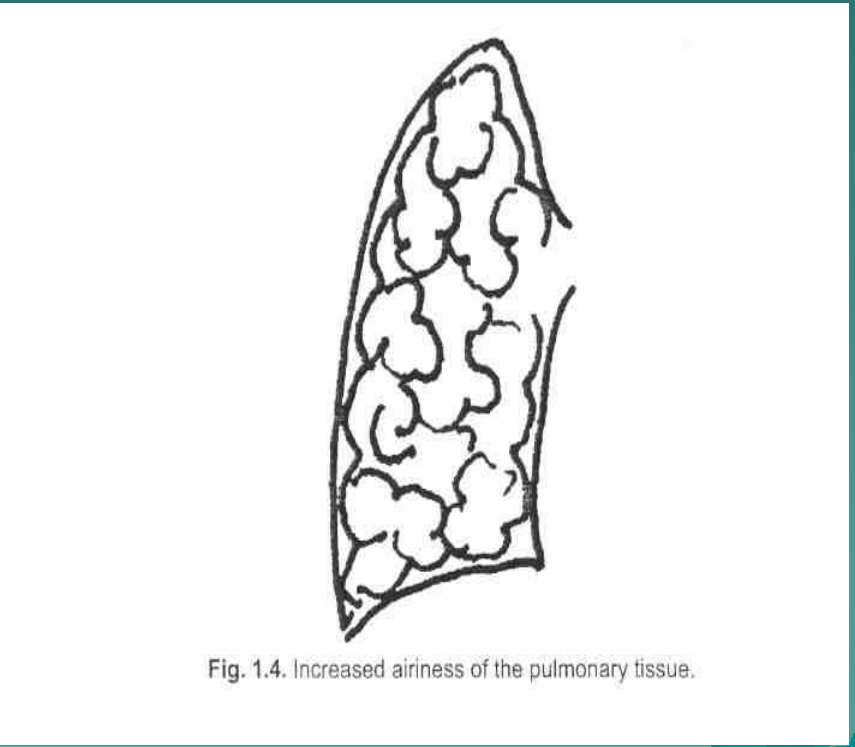


Fig. 1.4. Increased airiness of the pulmonary tissue.

Etiology:

- - chronic bronchial obstruction;
- - decreased of the pulmonary tissue elasticity;

Usually of bronchial obstruction has diffuse character, lung emphysema is most frequently bilateral process and assessed as complication of chronic lung diseases.

Clinical features

The main complaints in patients with increased airiness of the pulmonary tissue are dyspnea and cough.

- *Dyspnea-* has expiratory or mixed character and increased during physical activity.
- *Cough* - commonly dry and has reflex character, on destructive processes -with purulent sputum discharge.

Clinical features

Objective examination.

General patient s condition may be:

- satisfactory (early slntfe of the disease, the stage of remission);
- middle grave, moderate grave or grave (progression of bronchiectatic disease, destructive process in the lung, bronchial asthma attacks).
- Due to the acute or gradual chronic hypoxia may be observed the deranged consciousness.

Clinical features

- ***The posture of the patients*** is frequently active. May be observed the forced posture in form of orthopnea (spasm of bronchi, attacks of bronchial asthma, decreasing the breath surface).
- ***The color of the skin*** is characterized by central or diffuse cyanosis due to the accumulation of the carbon dioxide and reduced restored hemoglobin.
- ***Inspection of the chest*** may reveal barrel-like (emphysematous) form of the chest with protruded supra- and subclavicular fosses, horizontal direction of the ribs, smoothed and narrow intercostals spaces, increased anteroposterior diameter.
- May be observed tachypnea with shallow respiration depth.

Clinical features

- *Palpation of the chest.* Elasticity of the chest is decreased (rigid chest), the chest is painless. Vocal fremitus is badly transmitted.
- *Percussion of the lungs.* In comparative percussion of the lungs generalized hyperresonance (bandbox sound) may be heard over the hyperinflated lungs of emphysema.
- *Auscultation of the lungs.* In auscultation of the lungs may be observed patho-logically decreased vesicular breathing and dry rales.

Additional methods of examination

- ***Clinical blood analysis:*** secondary erythrocytosis; leukocytosis, neutrophilia, accelerated ESR (during progression of chronic diseases), eosinophilia (bronchial asthma).
- ***Sputum analysis:*** data depends on the main disease.
- *X-ray examination:* the signs of increased airiness of the pulmonary tissue, low diaphragm's position.

Syndrome of bronchium obstruction (bronchospastic syndrome)

Bronchospastic syndrome - the grouping of symptoms that developed due to the impaired air entrance to the pulmonary tissue through bronchus and accompanied by decreased lung's ventilation, enlargement of residual air volume in them, clinically manifests by intensive cough and resulted in emphysema.

- **Etiology:**
- - spasm of the smooth muscles;
- - inflammatory infiltration and edema of the tracheobronchial tree mucus;
- - non-uniform swelling of the bronchial mucus due to the inflammation or viscous sputum narrows the lumen of bronchi;
- - deformity of the bronchial tree;
- - expiratory bronchi collapse;

The main complaints in patients with bronchium obstruction are dyspnea and cough.

- *Dyspnea* commonly has expiratory character, gradually increased (chronic obstructive lung diseases) and frequently transformed to periods of asthma (bronchial asthma).
- *Cough* is commonly periodic, moist with difficult sputum expectoration that has mucous or mucopurulant character, tenacious consistency, with yellow traces color.

Objective examination.

- *The posture of the patients* is frequently forced in form of orthopnea - sitting postion fixing the shoulder girdle in order to reduce dyspnea via assistance of accessory muscles and diaphragm to take part in respiration.
- *The color of the skin* depends on the variant of obstruction.
- *The data of chest inspection, palpation and percussion* include clinical features of bronchium obstruction complications: emphysematous form of the chest with accessory respiratory muscles participation in the breathing act, decreased excursion of the chest, badly transmitted vocal fremitus and generalized bandbox sound over the lungs during percussion.

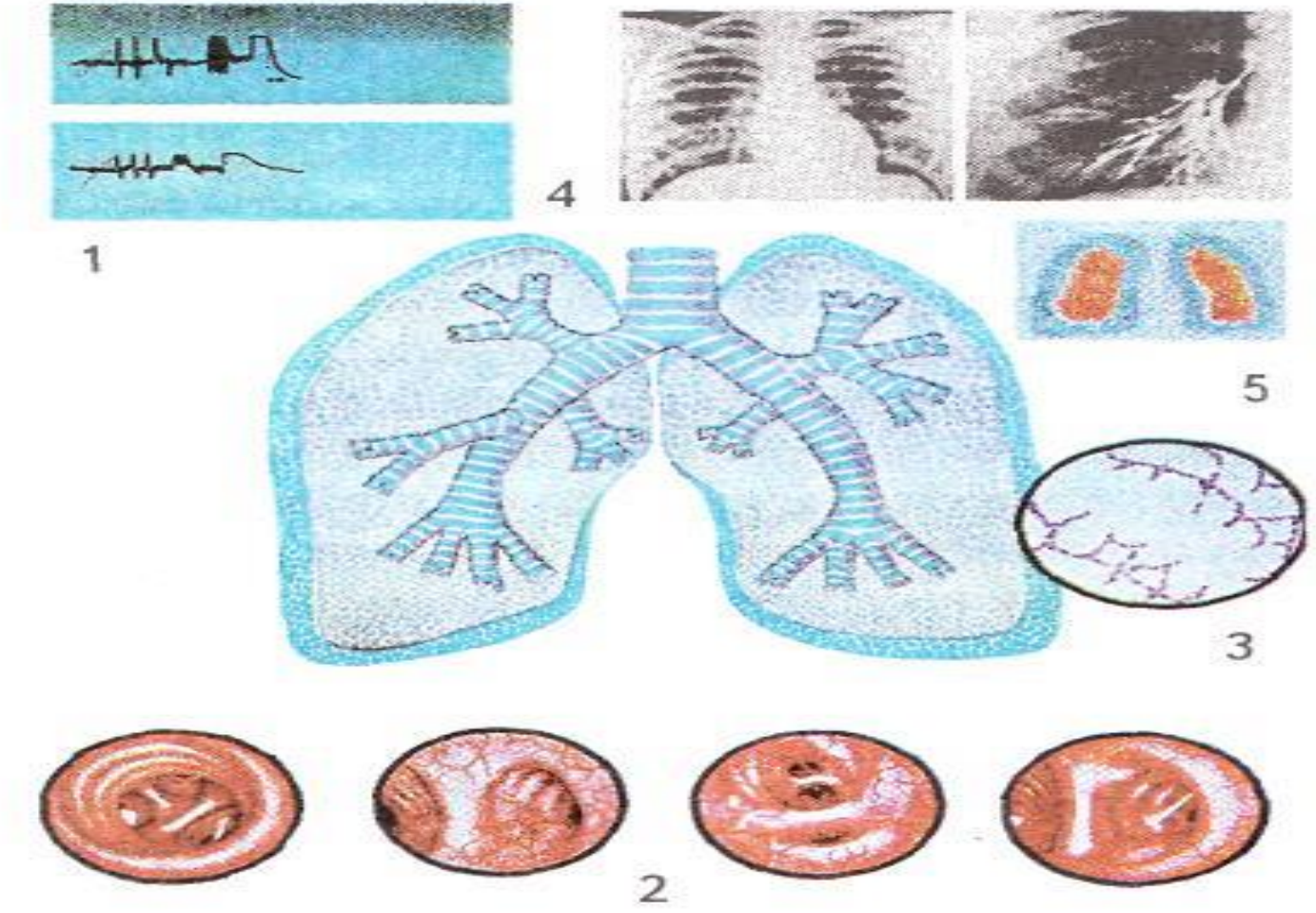
Objective examination.

- *Auscultation of the lungs.* Auscultative data are the main specific in patients with bronchospastic syndrome: they characterized by dry rales over the pathologically increased vesicular breathing.
- Moreover, the particularities of the rales give possibility to evaluate the cause of the obstruction, the size and depth of the affected.

Additional methods of examination

- ***Clinical blood analysis:*** secondary erythrocytosis; leukocytosis, neutrophilia, accelereted ESR (during progression of chronic diseases), eosinophilia (bronchial asthma).
- ***Sputum analysis:*** the character of the sputum is mucous or muco-purulant, tenacious or tenacious thick consistency. In microscopic study are revealed columnar, ciliary epithelium, leucocytes, alveolar macrophages, eosinophils, fi-brin fibers, Charcot-Leyden crystals and large amount of microorganisms (bacterial flora).
- *X-ray* ***examination:*** augment and deformity of lung picture over increased in transparent lung tissue.

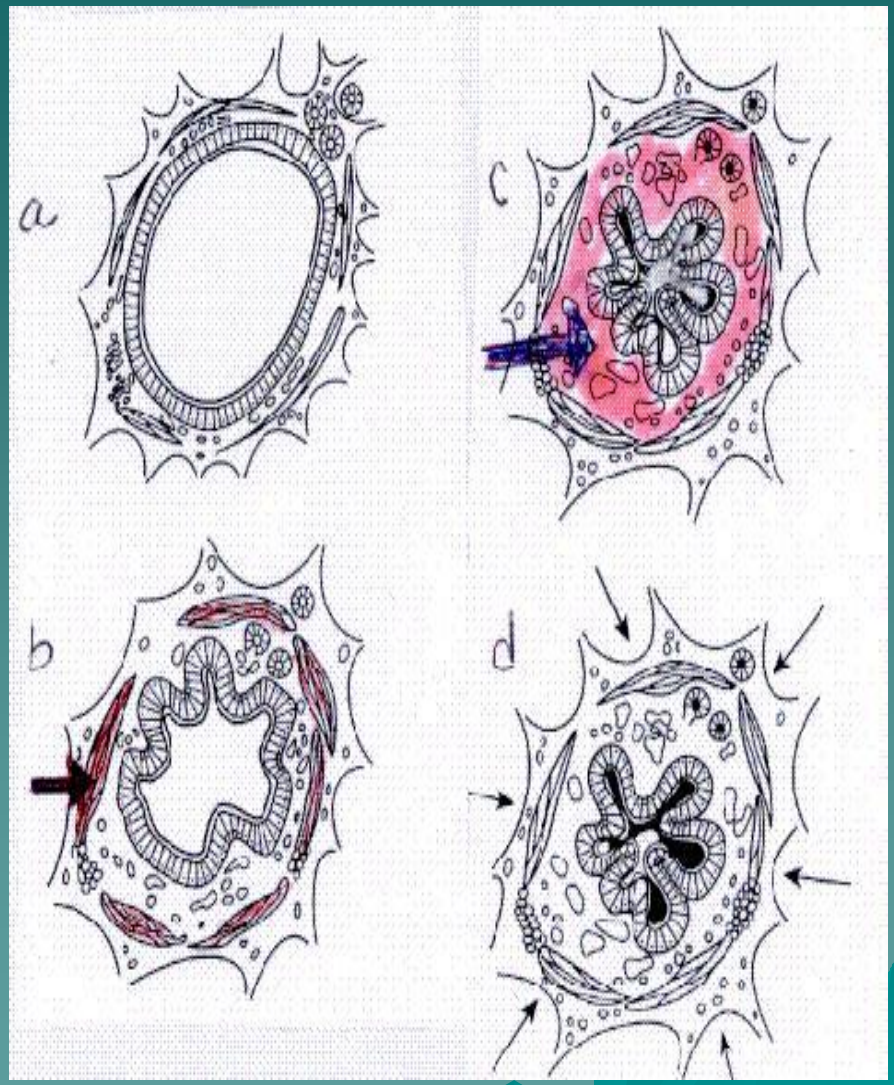
Syndrome of bronchium obstruction (bronchospastic syndrome)



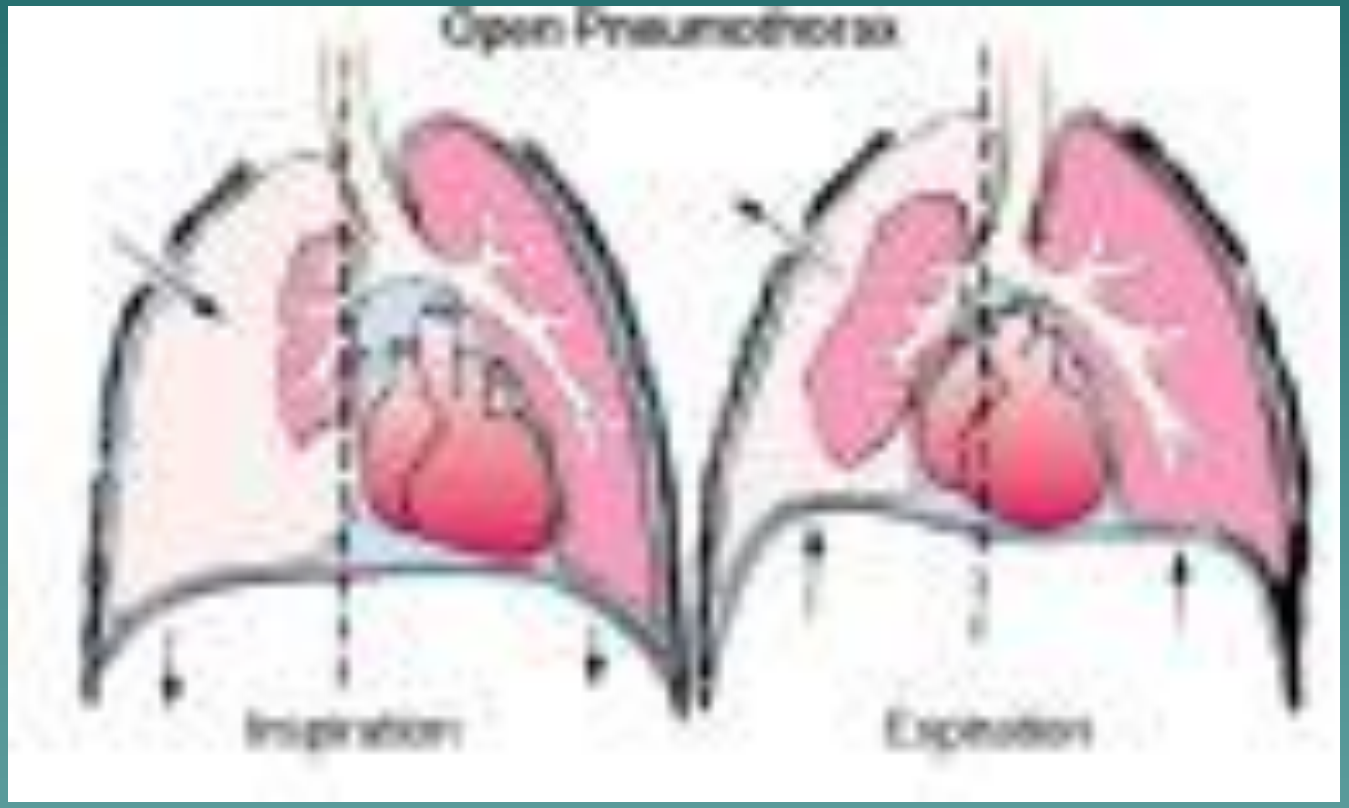
Мал. 1. Хронічний обструктивний бронхіт

Asthma

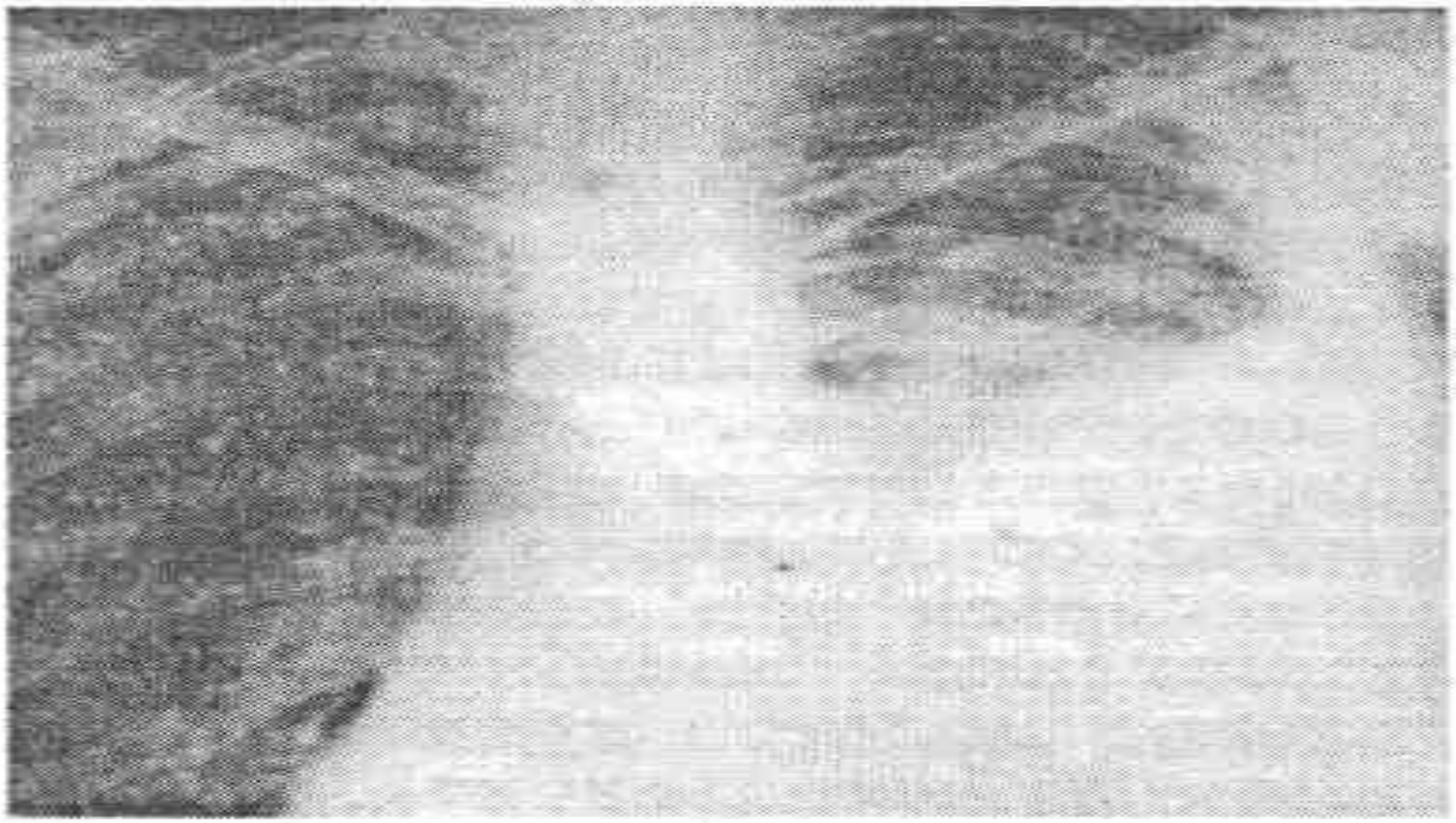
Asthma is a chronic disease of the respiratory system in which the airway occasionally constricts, becomes inflamed, and is lined with excessive amounts of mucus, often in response to one or more triggers.



The syndrome of air accumulation in pleural cavity - Pneumothorax



The syndrome of fluid accumulation in pleural cavity (hydrothorax),



Мал. 3. Ексудативний плеврит

Inspection of respiratory system organs from point of view of dentistry.

A dentist must utilize the knowledge about internal disease in a few basic directions:

- 1. for the prophylaxis of negative influence of internal pathology to the teeth and tissue of oral cavity.
- 2. for the prophylaxis of internal diseases when the factor of risk of these diseases is pathology of oral cavity.
- 3. for providing of the first aid.

Inspection of respiratory system organs from point of view of dentistry.

- Diseases of the respiratory system, especially ***chronic obstructive lung diseases and bronchial astma*** with the phenomena respiratory insufficiency accompanied the hypoxia of tissue of oral cavity, negatively influence on the state of teeth, tissue and mucous membrane of oral cavity.

- At patients of ***chronic obstructive lung diseases*** more frequent developing caries and pathology of paradontium.

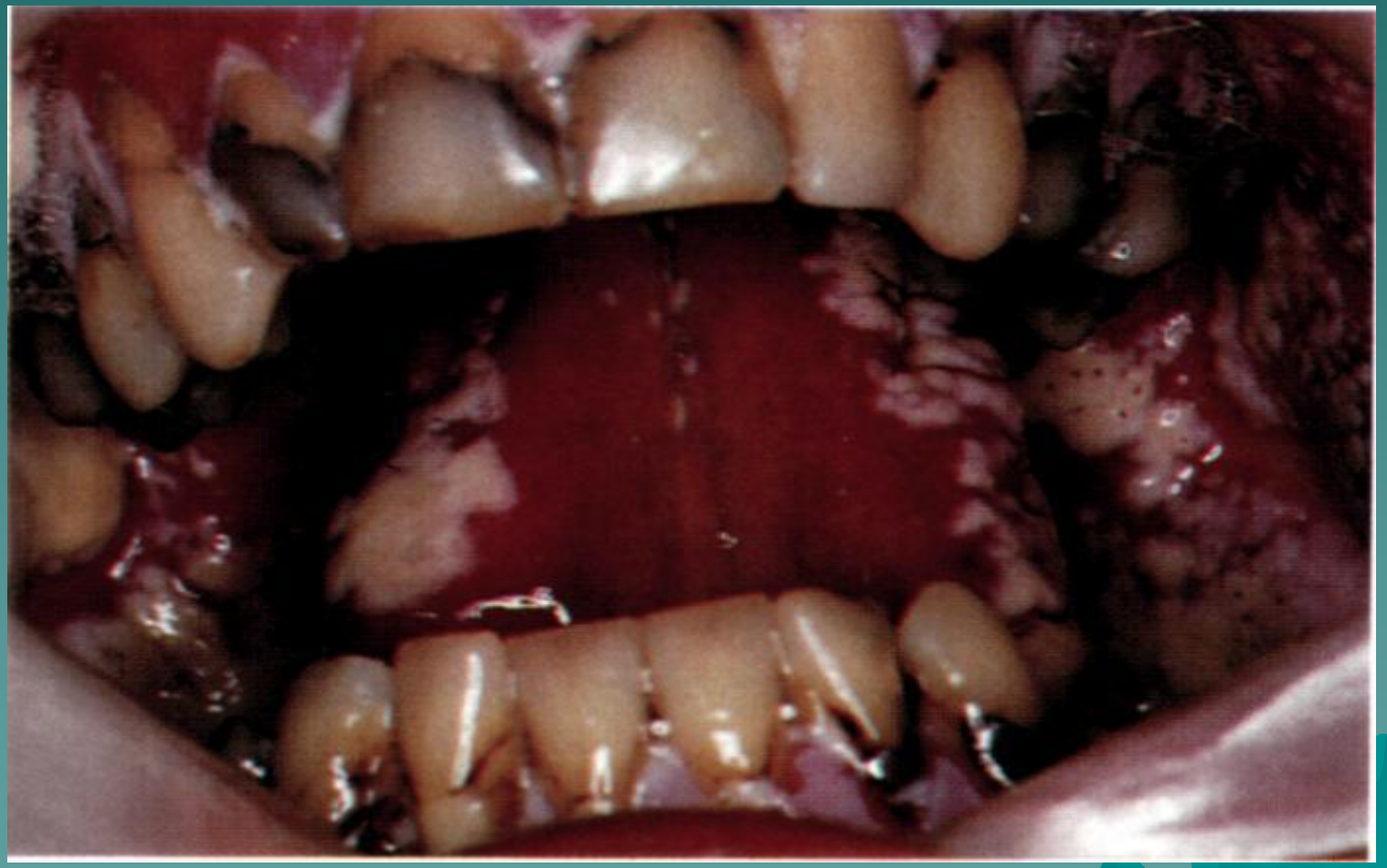
- A chronic infection of the oral cavity is the factor of risk of development of ***chronic obstructive lung diseases and bronchial astma***

- Therefore during the sanation of oral cavity dentist hinders development of these illnesses.

Inspection of respiratory system organs from point of view of dentistry.

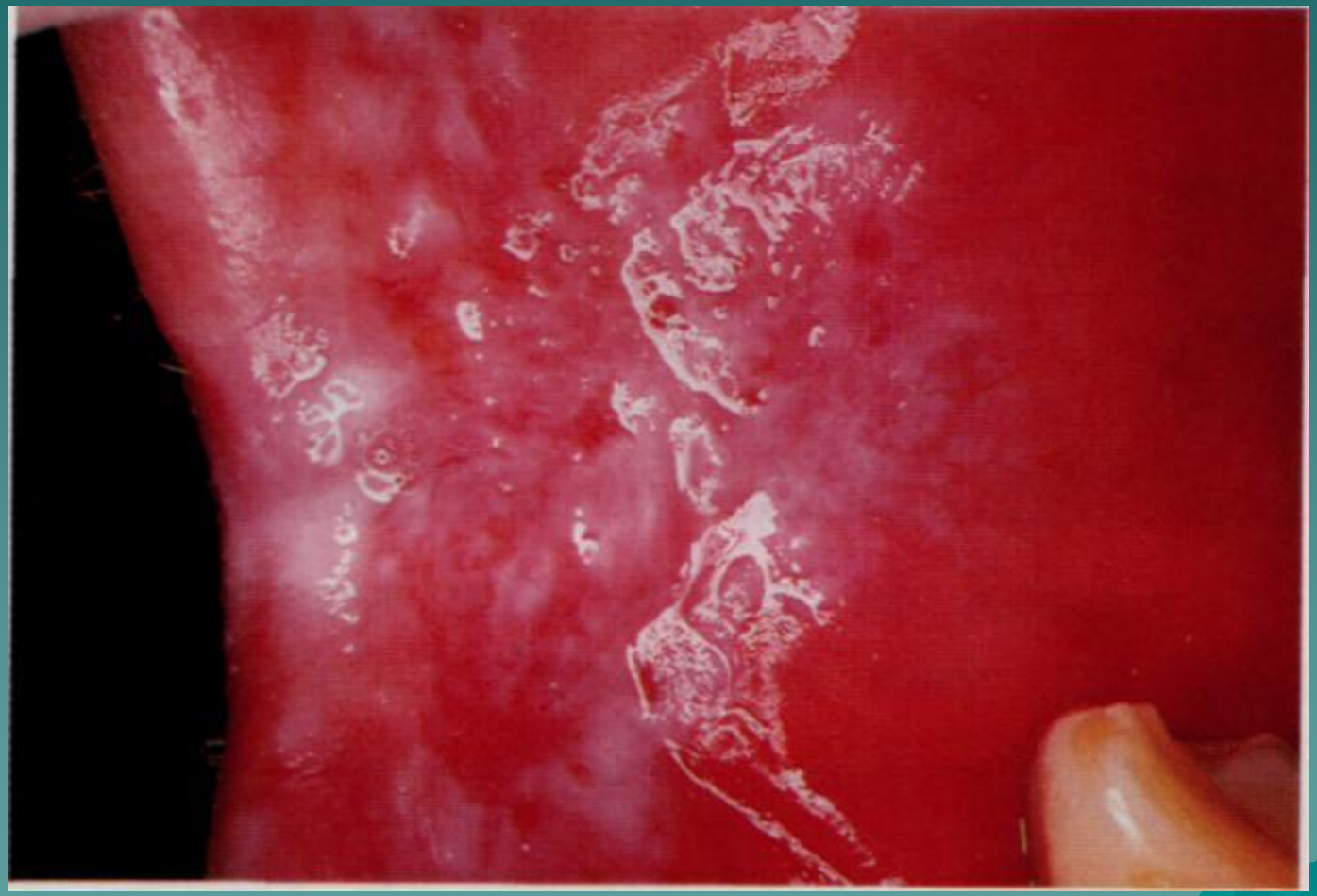
- Patients with ***chronic obstructive lung diseases and bronchial astma*** permanent accept inhalation medicine which have influence on the state mucous membrane of oral cavity.
- Patients with pneumonia accept antibiotics, for them development of Candidosis in oral cavity is possible.

Acute pseudomembraneous candidosis



Acute erythematous candidosis

Chronic hyperplastic candidosis



Change in the oral cavity at the diseases of lungs.

- White or brown raid on the lateral surface of tongue.
- Due to pneumonia there is folds and cracks of mucous membrane of inside of tongue.
- Due to ***chronic obstructive lung diseases*** there is a foam raid on front third of tongue.
- Due to emphysema of lungs and respiratory insufficiency is a raid on the front third of tongue of dark colored.

Pneumonia - there is folds and cracks of mucous membrane of inside of tongue.

Мал. 4. Язик при пневмонії

Emphysema of lungs and respiratory insufficiency - a raid on the front third of tongue of dark colored.