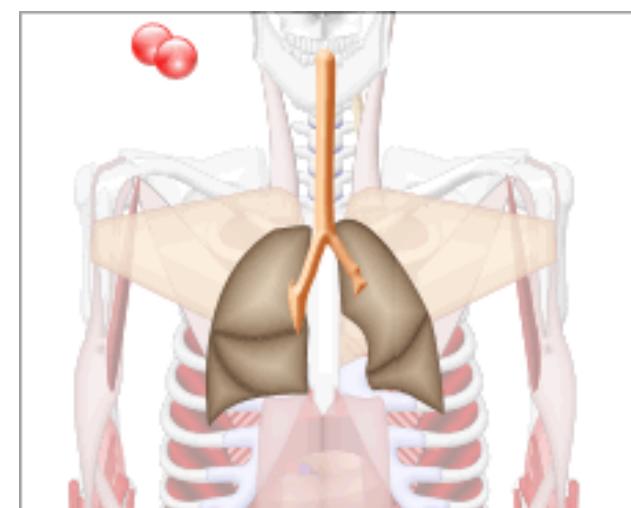
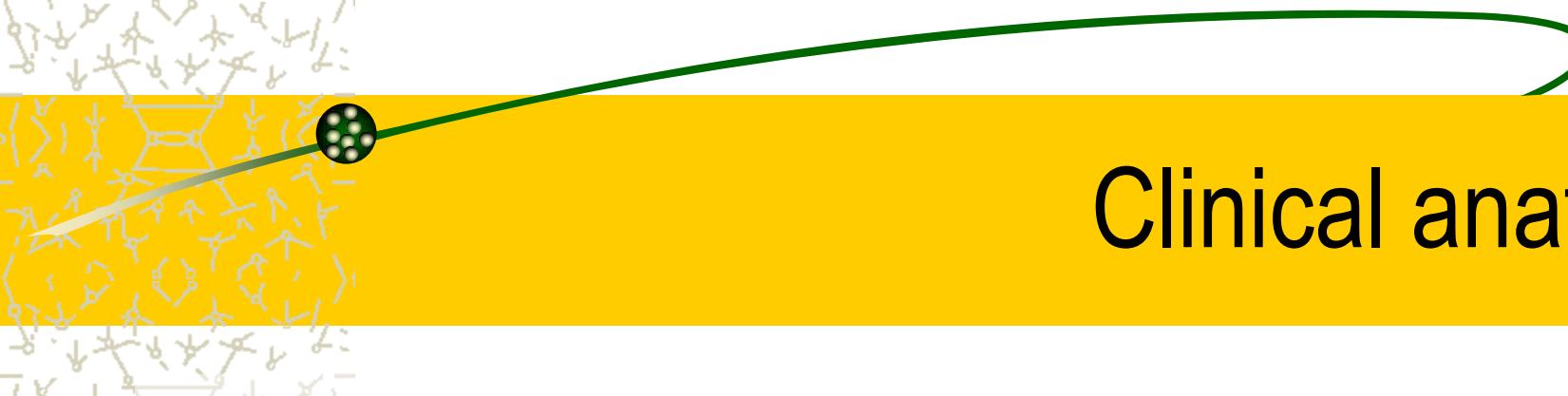


Examination of the patients with respiratory organ pathology: inquiry, inspection, palpation, percussion



**Head of the Propedeutics
to Internal Medicine Department N1,
Basis of Bioethics and Biosafety
Professor T. Ashcheulova**





Clinical anatomy



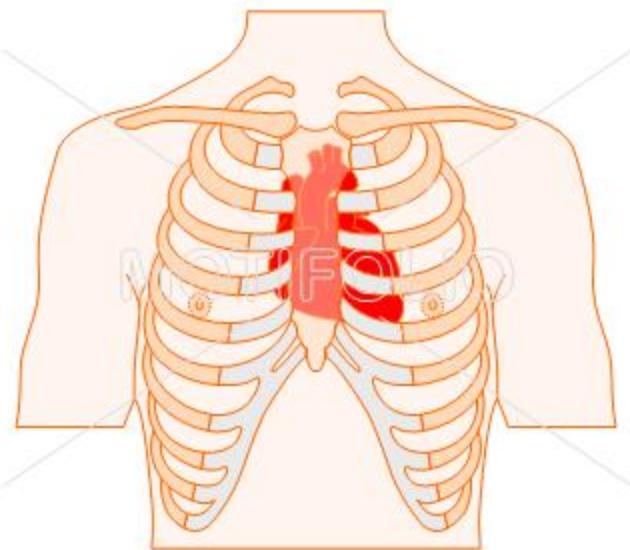
- The *respiratory organs* consist of the **upper respiratory tract**: which includes the nose, pharynx, larynx, and the **lower respiratory tract** – trachea, bronchi, and lungs

Topographic regions and lines of the chest

- ★ To describe an abnormality on the chest, you need to locate it in two dimensions: along vertical axis and around the circumference of the chest.
- ★ To locate vertically, you must be able to number the ribs and interspaces accurately

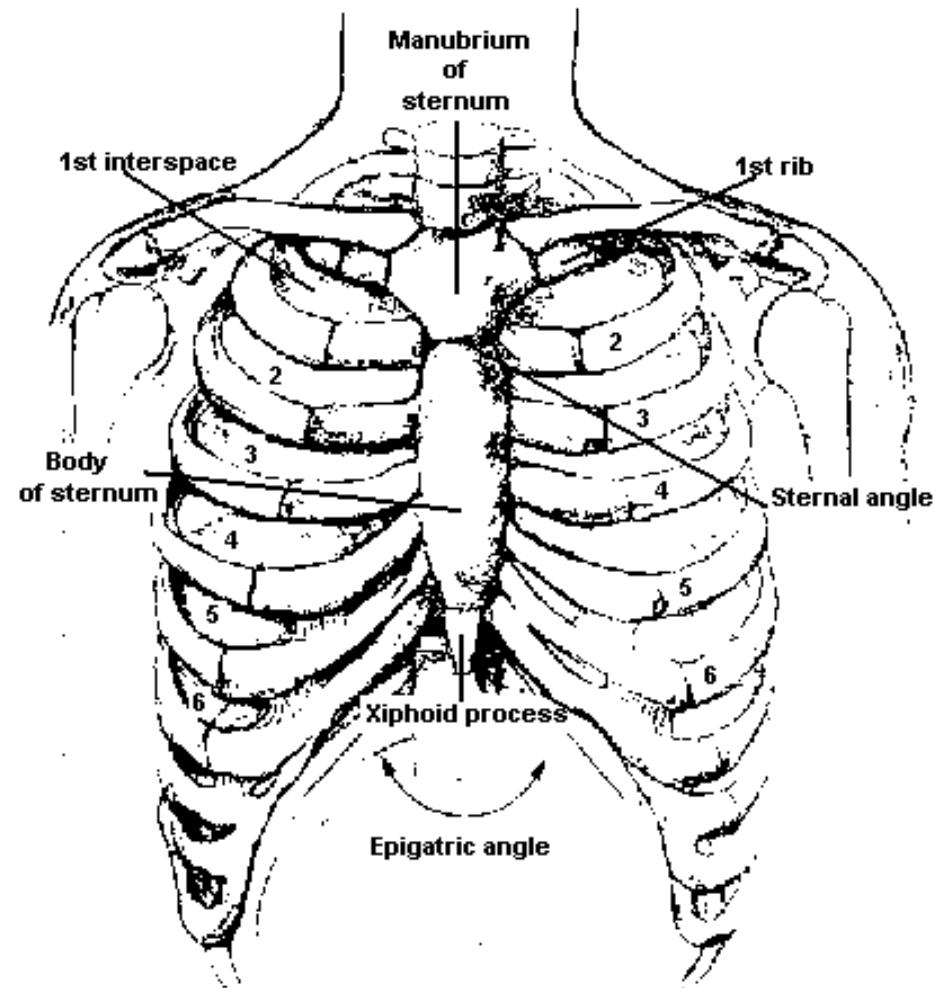
- ★ Note that an interspace between two ribs is numbered by the rib above it.

Male chest wall – anterior

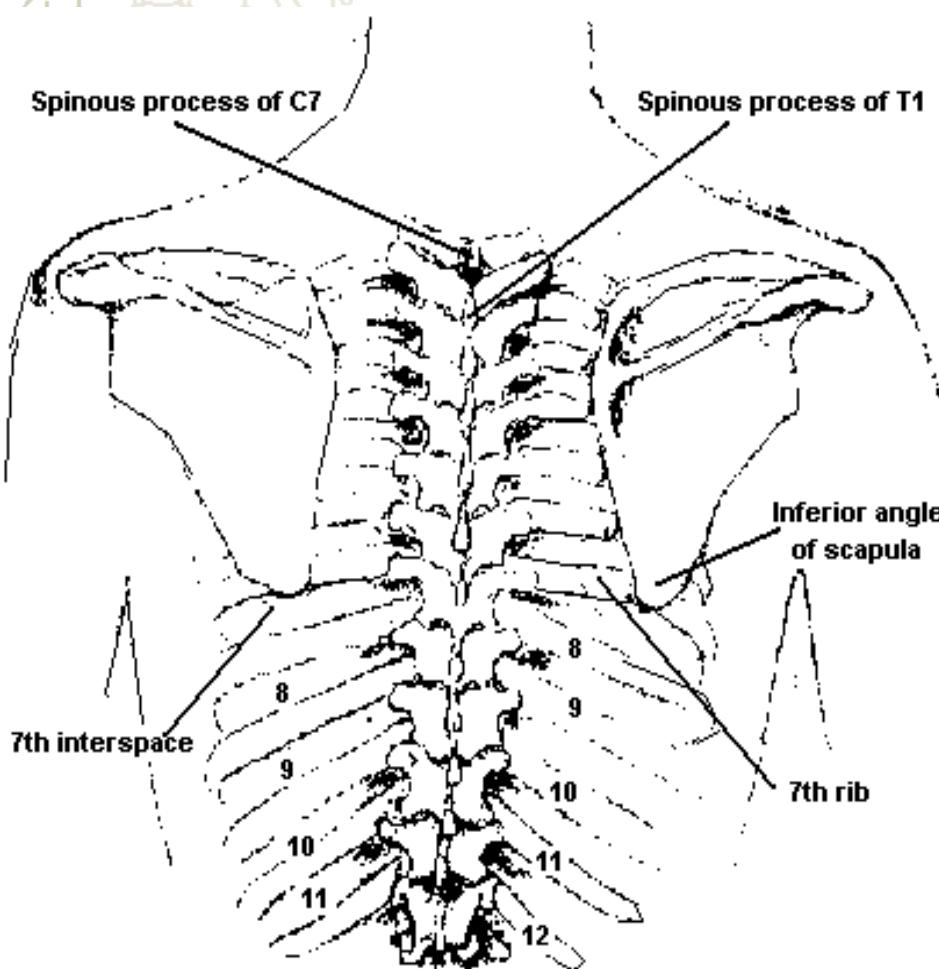


Topographic regions and lines of the chest Anterior view

- As the 1st rib is covered by clavicle, the 1st interspace is below it. From here, using two fingers, you can “walk down the interspaces”. Do not try to count interspaces along the lower edge of the sternum; the ribs here are too close together. Note that the costal cartilages of only the first seven ribs articulate with the sternum. Those of the 8th, 9th, and 10th ribs articulate instead with the costal cartilages just above them. The 11th and 12th ribs, the so-called floating ribs, have no anterior attachments. The cartilaginous tip of the 11th rib can usually be felt laterally, and the 12th rib may be felt posteriorly. Costal cartilages are not distinguishable from ribs by palpation.



Topographic regions and lines of the chest Posterior view

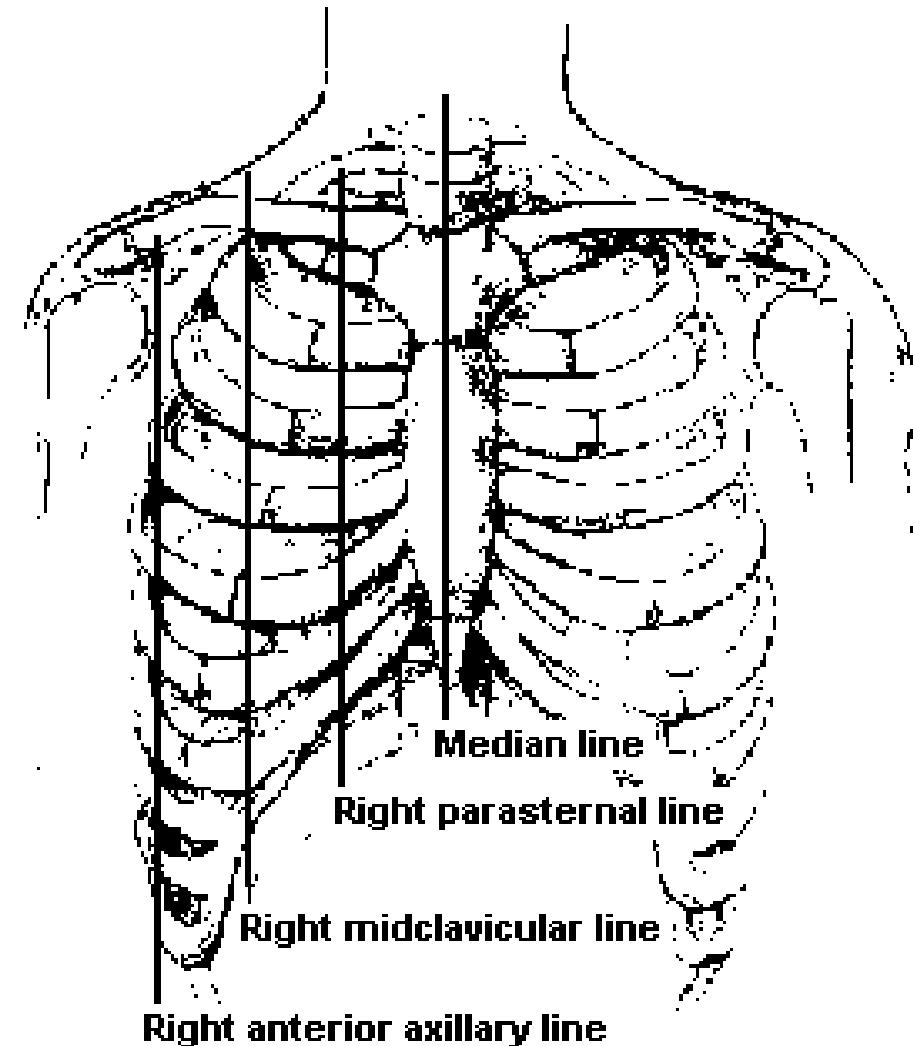


When estimating location posteriorly, remember that the inferior angle of the scapula usually lies at the level of the 7th rib or interspace.

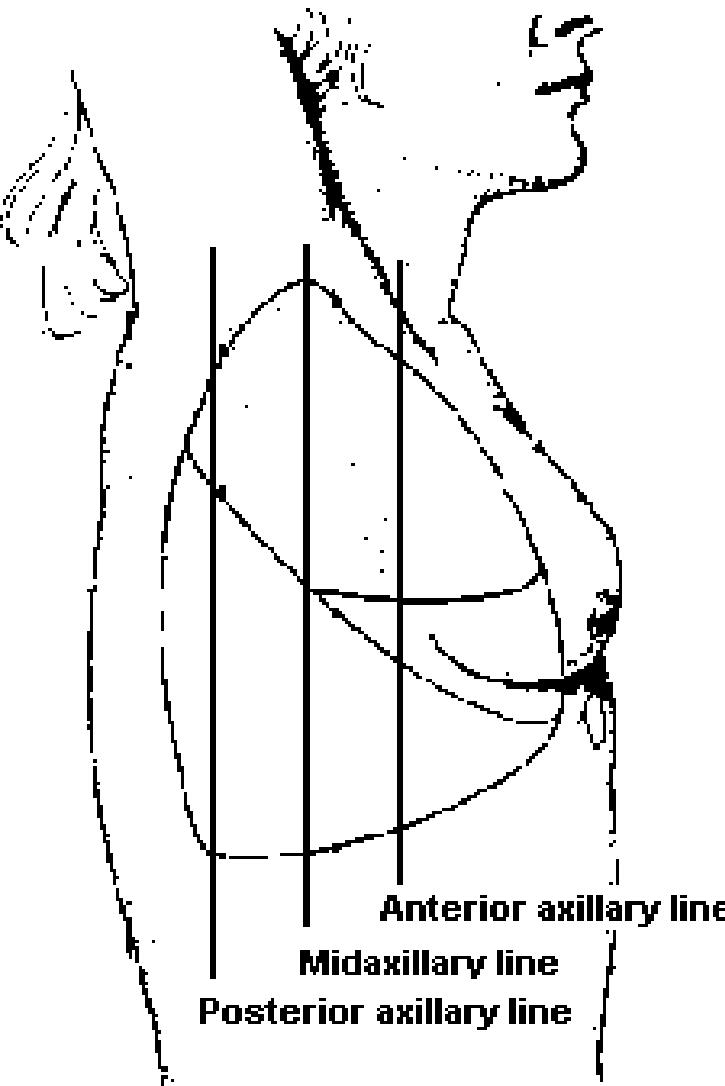
Findings may also be located according to their relationship to the spinous processes of the vertebrae. When a patient flexes the neck forward, the prominent process is usually that of the 7th cervical. When two processes are equally prominent, they are the 7th cervical and 1st thoracic. The processes below them can often be felt and counted, especially when the spine is flexed. The 12th rib gives you another possible starting point for counting the ribs and interspaces. This is especially useful in locating findings on the lower posterior chest.

Topographic regions and lines of the chest

- To locate findings around the circumference of the chest, use a topographic vertical lines. The median (or midsternal) and vertebral lines are precise; the others are estimated. The midclavicular line drops vertically from the midpoint of the clavicle. To find it, you must identify both ends of the clavicle accurately



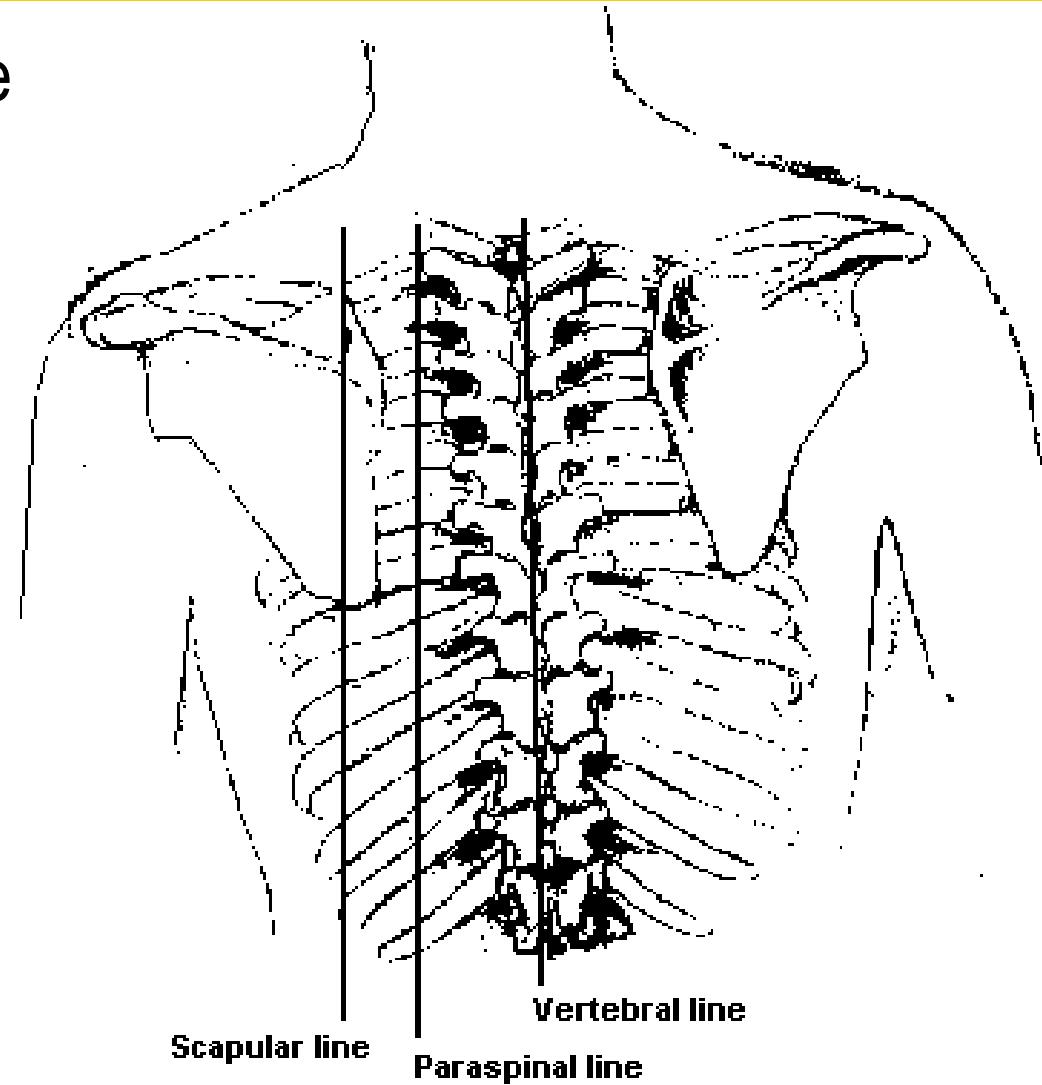
Topographic regions and lines of the chest



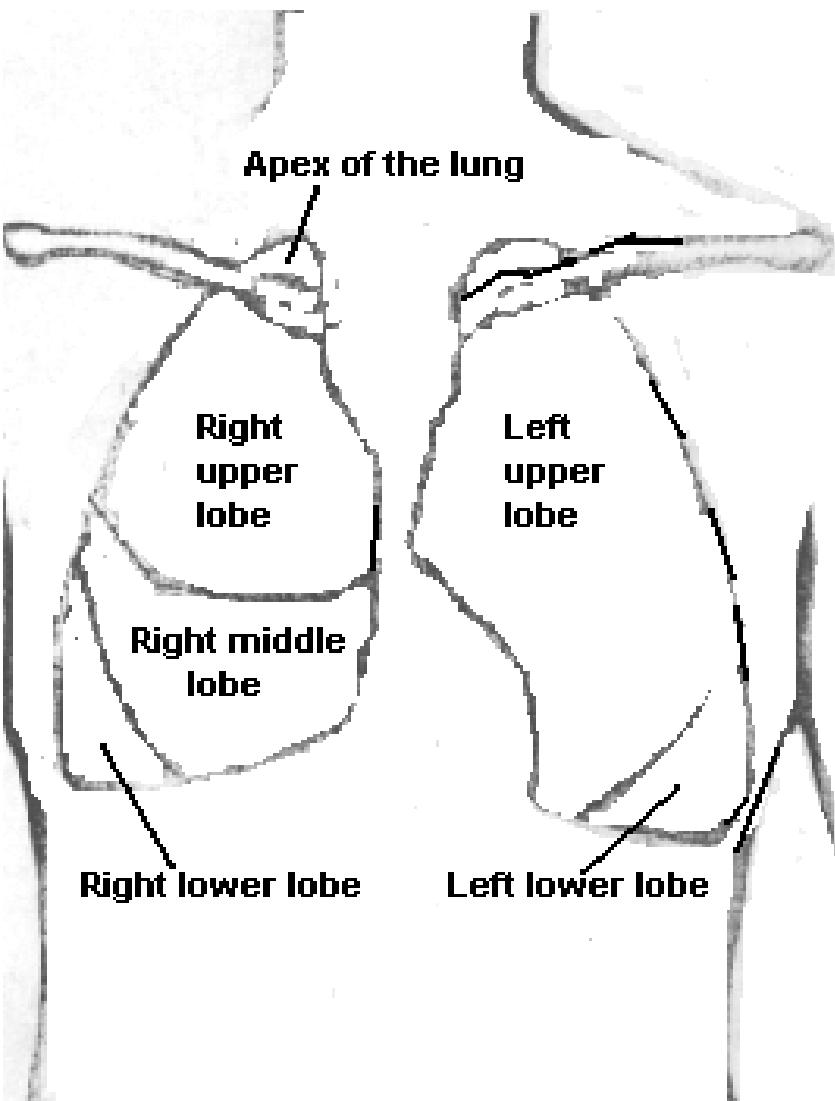
💡 The anterior and posterior axillary lines drop vertically from the anterior and posterior axillary folds (the muscles that border the axilla). The midaxillary line drops from the apex of axilla

Topographic regions and lines of the chest

- Posteriorly, the vertebral line follows the spinal processes of the vertebra. Paraspinal lines drop along vertebra; each scapular line drops from the inferior angle of the scapular



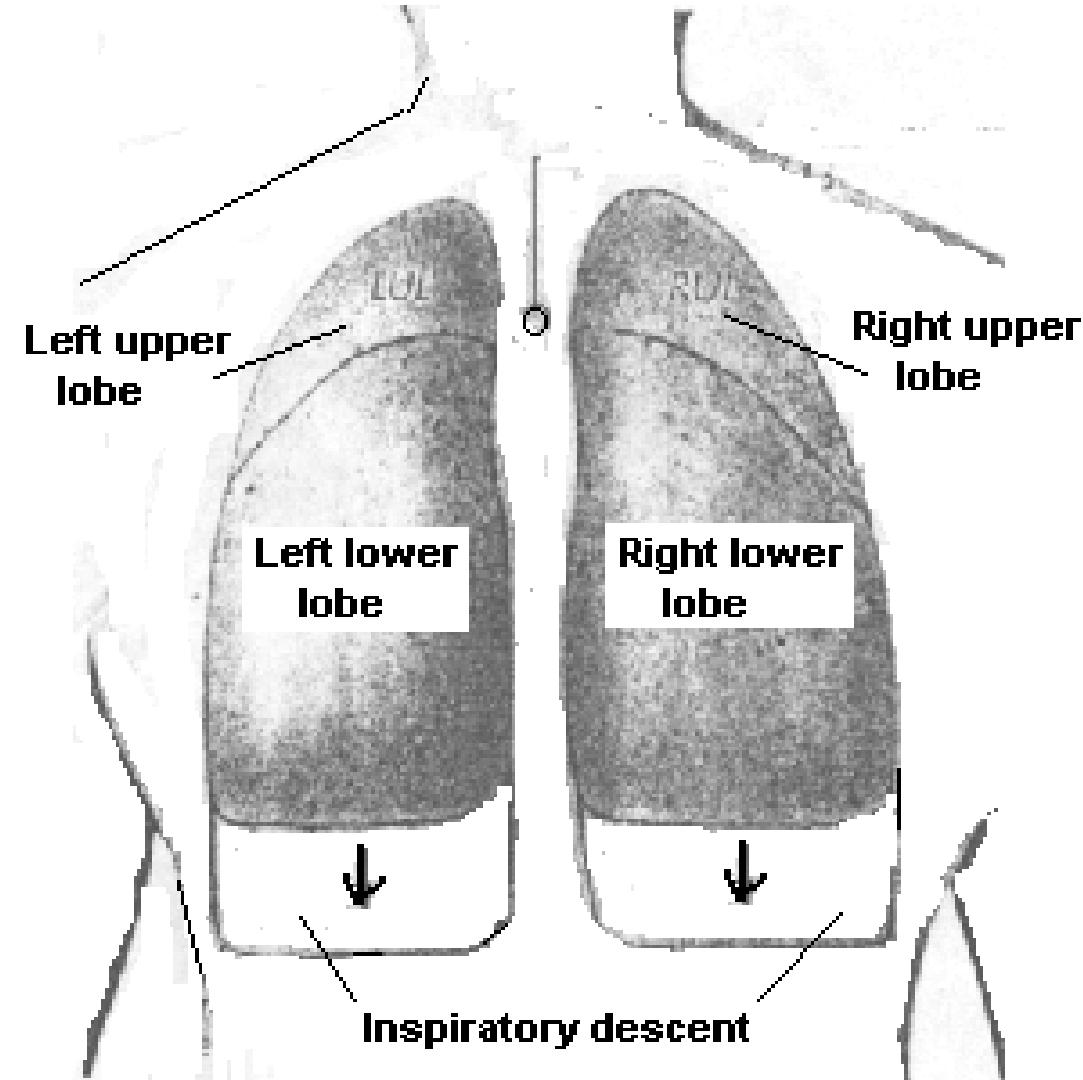
Topographic regions and lines of the chest



💡 The lungs lobes and fissures can be outlined mentally on the chest wall. Anteriorly, the apex of each lung rises about 2 cm to 4 cm above the inner third of the clavicle. The lower border of the lung passes the 6th rib at the midclavicular line and 8th rib at the midaxillary line.

Topographic regions and lines of the chest

- Posteriorly, the lower border of the lung lies at about the level of the 11th thoracic spinous process at the paraspinal line. On inspiration it descends



Topographic regions and lines of the chest

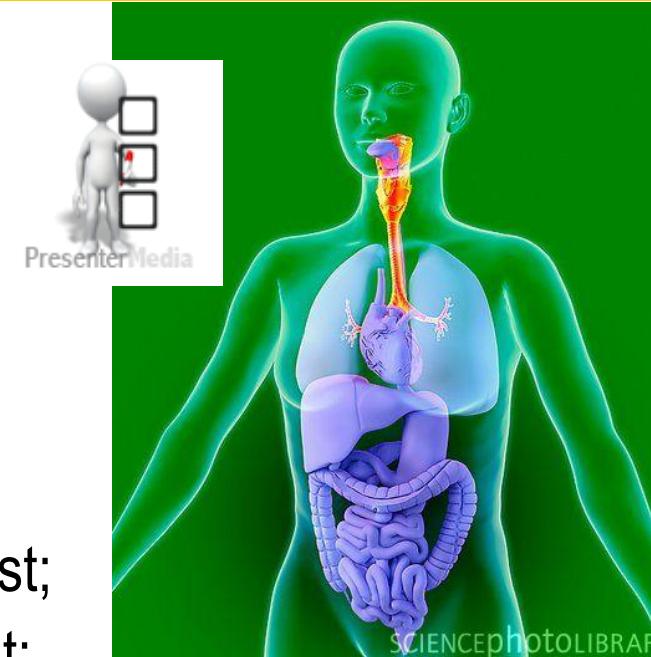


- ✿ You should usually locate your pulmonary findings in external terms, such as these:
- ✿ ***Supraclavicular region*** – above clavicles;
- ✿ ***Infraclavicular region*** – below clavicle;
- ✿ ***Suprascapular region*** – above scapulae;
- ✿ ***Interscapular region*** – between the scapulae;
- ✿ ***Infrascapular region*** – below scapular;
- ✿ ***Bases of the lungs*** – the lowermost points;
- ✿ ***Upper, middle, and lower lungs fields.***

THE BASIC METHODS OF RESPIRATORY SYSTEM EXAMINATION

I. Subjective

- Inquiring;
- Anamnesis morbi;
- Anamnesis vitae;



II. Objective

- General inspection;
- Inspection of the chest;
- Palpation of the chest;
- Percussion of the lungs: comparative and topographic;
- Auscultation of the lungs;



III. Instrumental examination of the respiratory system

IV. Laboratory examination

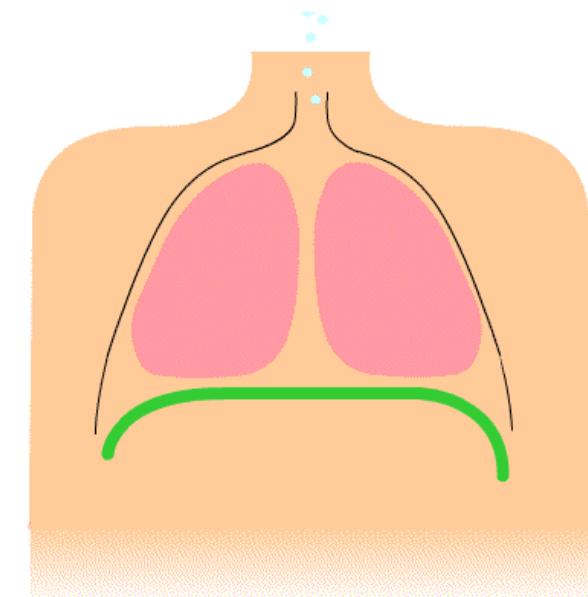


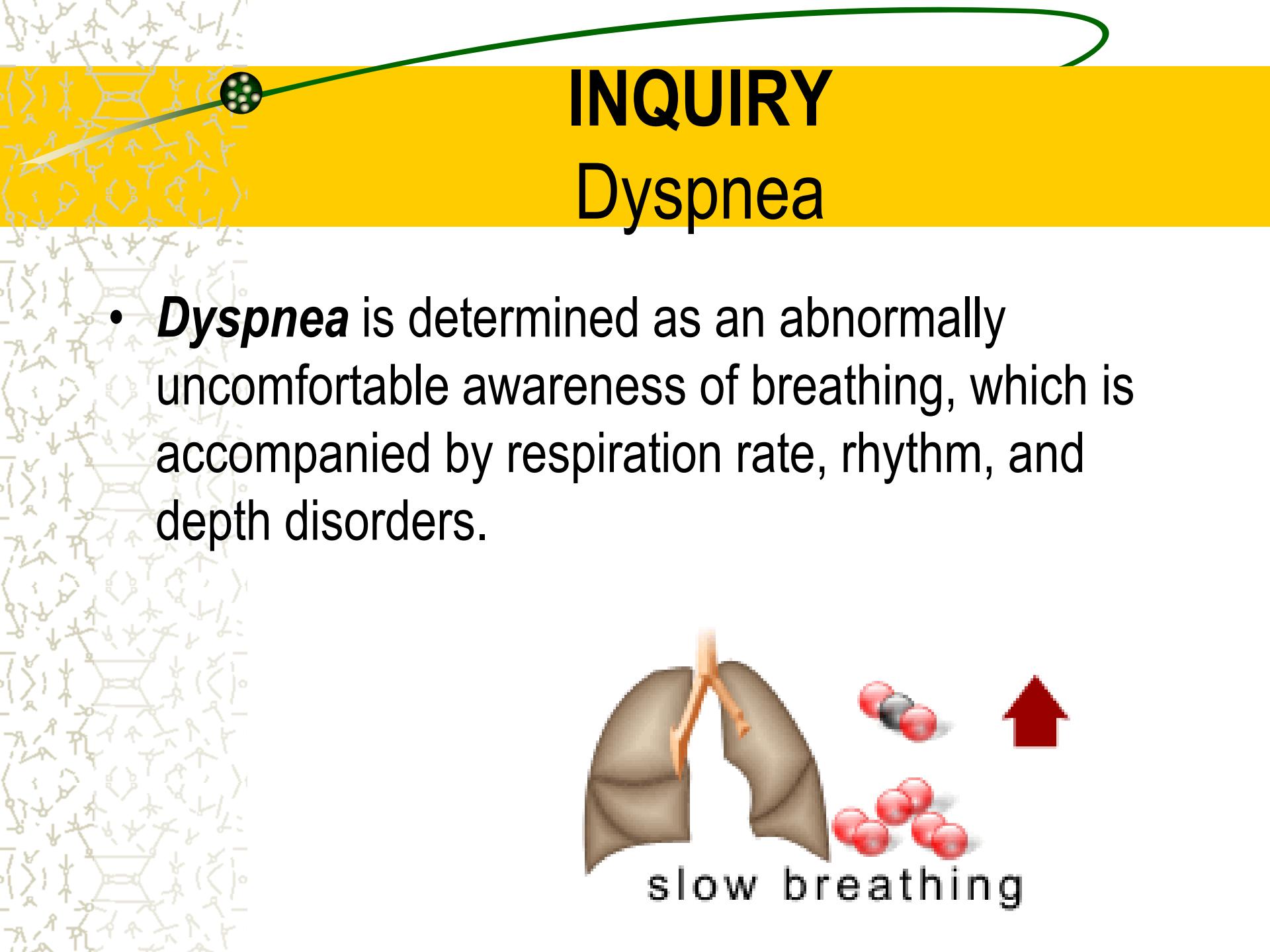


SUBJECTIVE EXAMINATION METHODS

INQUIRY

- The main complaints of the patients with disease of the respiratory system are:
 - ✿ dyspnea (breathlessness),
 - ✿ cough,
 - ✿ chest pain.

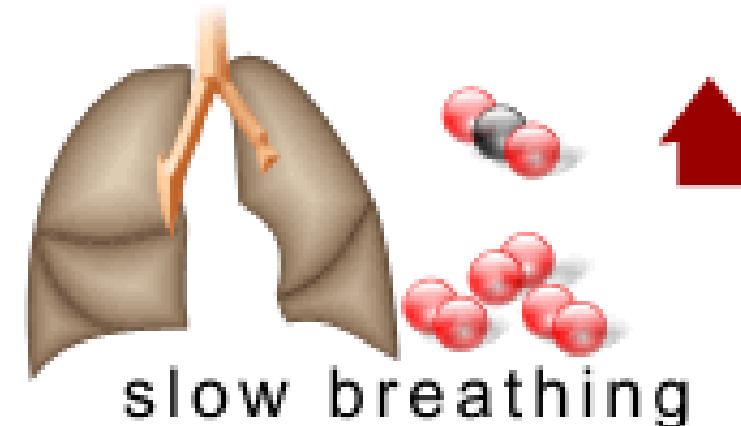


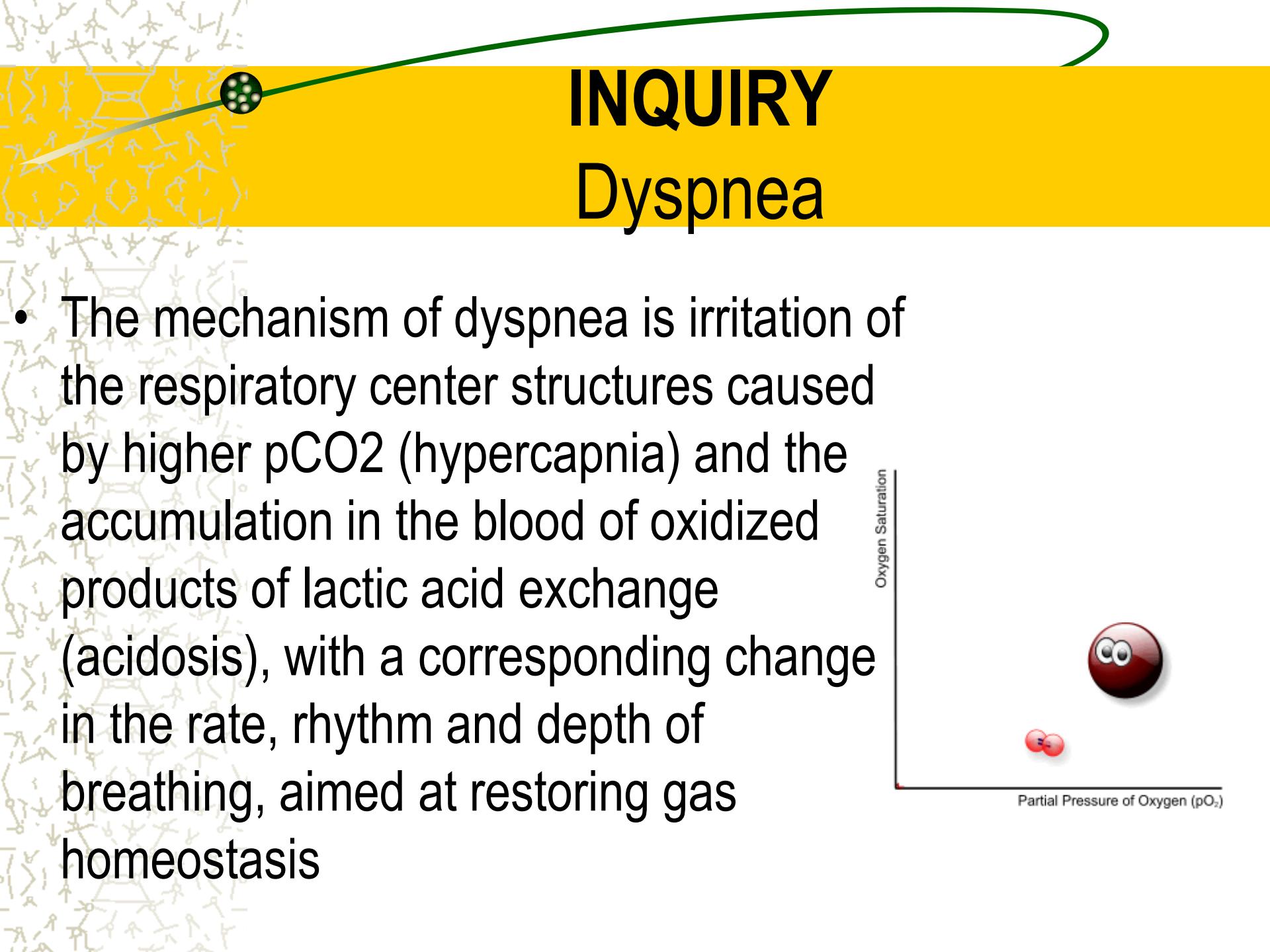


INQUIRY

Dyspnea

- **Dyspnea** is determined as an abnormally uncomfortable awareness of breathing, which is accompanied by respiration rate, rhythm, and depth disorders.

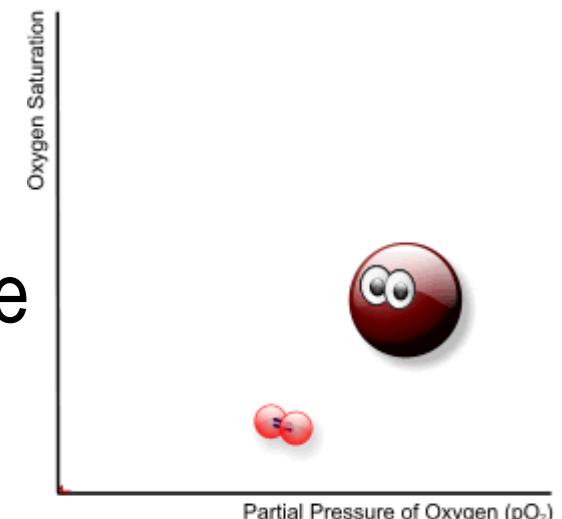




INQUIRY

Dyspnea

- The mechanism of dyspnea is irritation of the respiratory center structures caused by higher pCO₂ (hypercapnia) and the accumulation in the blood of oxidized products of lactic acid exchange (acidosis), with a corresponding change in the rate, rhythm and depth of breathing, aimed at restoring gas homeostasis



INQUIRY

Dyspnea classification

I. Physiological

II. Pathological

a) with respect to the patient:

subjective, objective, mixed;

b) according to appearance time:

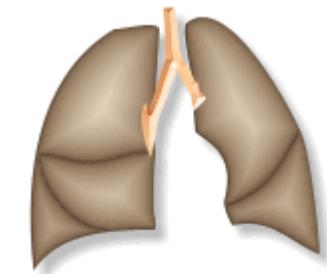
constant, periodic, paroxysmal;

c) according to respiratory cycle:

inspiratory, expiratory, mixed;

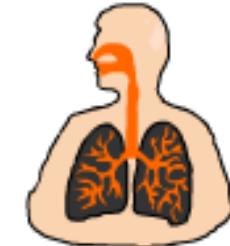
d) according to appearance mechanism:

restrictive, obstructive, paroxysmal obstructive,
vascular congestive.



INQUIRY

Dyspnea



Physiological dyspnea –

compensatory reaction of respiratory system on considerable physical or emotional exertion;

- Characterized by increased breathing rate and depth,
- Short-term,
- Passing themselves in 3-5 minutes
- Without any unpleasant sensations.

Pathological dyspnea –

caused by affection of different organs and systems, first of all respiratory and cardiovascular;

- More resistant respiration rate, rhythm, and depth disorders,
- Accompanied by unpleasant sensations (chest tightness, shortness of breath).

INQUIRY

Dyspnea

a) with respect to the patient:



Subjective dyspnea – breathing disorder, manifesting by subjective feeling of tightness in the chest, shortness of breath, difficulty in inspiration or expiration;

Characteristic of hysteria, neurasthenia.

Objective dyspnea – breathing disorder, manifesting by:

- Intermittent speech (the patient in conversation gasps)
- Tachypnea (respiration rate exceed 30 per min),
- Respiration rhythm disorders,
- Participation of accessory muscles in the breathing act,
- Cyanosis appearance;

Observed in respiratory, cardiovascular, central nervous, and systems diseases.

INQUIRY

Dyspnea

b) according to appearance time:

CONSTANT DYSPNEA remains at rest and increased at insignificant physical exertion (severe forms of respiratory and heart failure, pulmonary emphysema, pneumosclerosis).

PERIODIC (LONG-TERM) DYSPNEA arises in severe diseases and disappears during recovery (pneumonia, pleurisy with effusion, obstructive bronchitis, pneumo- and hydrothorax).

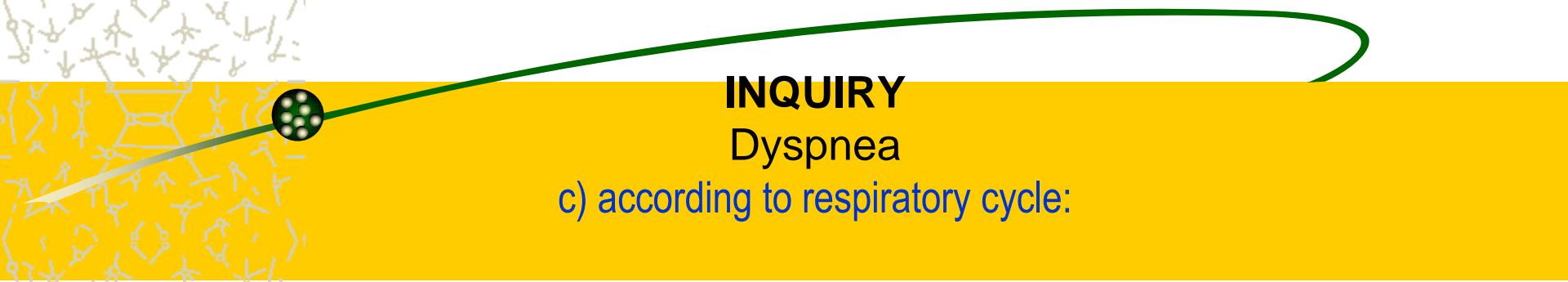
PAROXYSMAL DYSPNEA or ASPHYXIA - severe sudden (paroxysmal) shortness of breath caused by sharp stimulation of the respiratory center.

Are objective signs of acute respiratory failure

MAIN CLINICAL SIGNS OF ASPHYXIA:

- ✓ Sudden onset, intensity;
- ✓ Shortness of breath;
- ✓ Rapid growth of respiratory failure objective signs:
 - **Diffuse cyanosis;**
 - **Neck veins swelling,**
 - **Tachypnoe more than 30 per minute,**
 - **Forced posture – orthopnea**





INQUIRY

Dyspnea

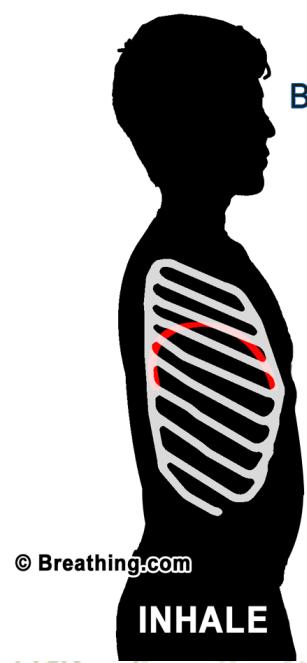
c) according to respiratory cycle:

INSPIRATORY DYSPNEA – respiratory disorder with inhalation difficulties.

Variety of inspiratory dyspnea – **stridor breathing** - noisy breathing with inspiration difficulties, accompanied by whistles, observed in strong narrowing of the trachea and the upper respiratory tract (foreign body, tumor, scarring or enlarged lymph nodes).

EXPIRATORY DYSPNEA – respiratory disorder with exhalation difficulties, caused by impaired patency of the small bronchi and bronchioles (bronchial asthma, COPD, bronchiolitis)

MIXED DYSPNEA – respiratory disorder with simultaneous inspiration and expiration difficulties, more frequently observed in decreased respiratory surface of the lungs, high diaphragm level that restricted lungs excursion, and also in combined affection of the lungs and heart.



Optimal
Breathing®
Pace

INHALE

INQUIRY

Cough

Cough (tussis) –

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.

COUGH SEMIOTICS ACCORDING TO RHYTHM

Variant	Characteristics	Pathologic state
CONSTANT	Cough in form of separate cough shocks	Chronic laryngitis, tracheitis, bronchitis, the initial stage of tuberculosis, heart failure, and compression n.vagus, neurosis.
PERIODIC (BRONCHOPULMONARY)	Series of cough shocks, repeated with a small interval	Exacerbation of chronic bronchopulmonary diseases (bronchitis, bronchiectasis, tuberculosis, emphysema, pulmonary fibrosis), inhalation of cold air
PAROXYSMAL	Suddenly onset of series of cough shocks, interrupted by noisy exhalation	Entering a foreign body in the airways, pertussis, cavitary tuberculosis, lung abscess

COUGH SEMIOTICS ACCORDING TO TIMBRE

Variant	Characteristics	Pathologic state
«CAREFUL»	Short discreet cough shock, accompanied by a painful grimace	Dry pleurisy, the initial stage of lobar pneumonia
BARKING	Loud, hacking, dry cough	Laryngitis, and compression of the trachea, hysteria
HUSKY	Quiet cough	Laryngitis
SILENT	Silent	Cancer, tuberculosis or syphilis of the larynx, sharply weakened patients

COUGH SEMIOTICS ACCORDING TO TIME OF APPEARANCE

Variant	Characteristics	Pathologic state
MORNING	Cough with expectoration on rising in the morning (5-7 hours AM)	Chronic inflammation of upper respiratory tract, cavity formation in the lungs, in smokers
EVENING	Increases in the second half of the day, in the evening	Bronchitis, pneumonia
NIGHT	Appears or gets worse at night	Enlargement of intrapulmonary lymph nodes (tuberculosis, bronchogenic cancer, blood disorders)

COUGH SEMIOTICS ACCORDING TO CONDITIONS OF APPEARANCE

Variant	Characteristics	Pathologic state
WITHOUT VISIBLE CAUSES	-	COPD, tuberculosis, bronchogenic tumor, lungs tumor
CHANGES OF POSTURE	Arise or increase in definite posture (frequently on healthy side)	Cavity formation in the lungs (bronchiectasis, abscess, cancer in stages of decomposition)
FOOD INTAKE	Dry cough during a meal or a cough with mucus and pieces of food in the sputum	Cancer of the esophagus with a break in the respiratory tract; diaphragmatic hernia

COUGH SEMIOTICS ACCORDING TO ACCOMPANIED SIGNS

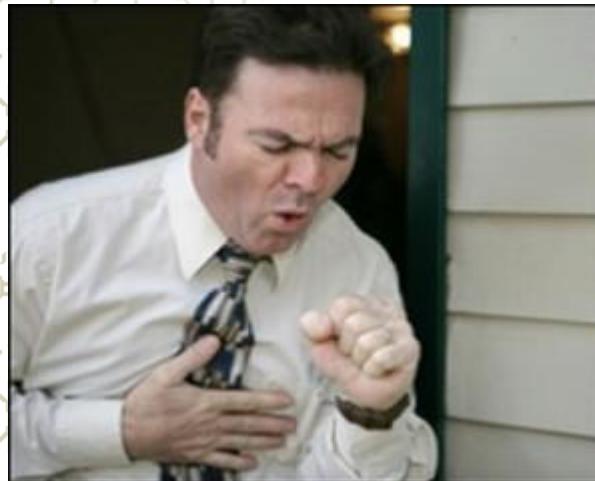
Variant	Characteristics	Pathologic state
VOMITING	During cough or after attack	Whooping cough, tuberculosis, chronic pharyngitis
VOICE CHANGES	Husky voice	Laryngitis, throat tumor, compression of recurrent laryngeal nerve
PAIN SYNDROME	Retrosternal In the lower-lateral parts	Mediastinal pleurisy Dry or metastatic pleurisy
SIGNIFICANT DYSPNEA		Alveolitis



COUGH SEMIOTICS ACCORDING TO CHARACTER

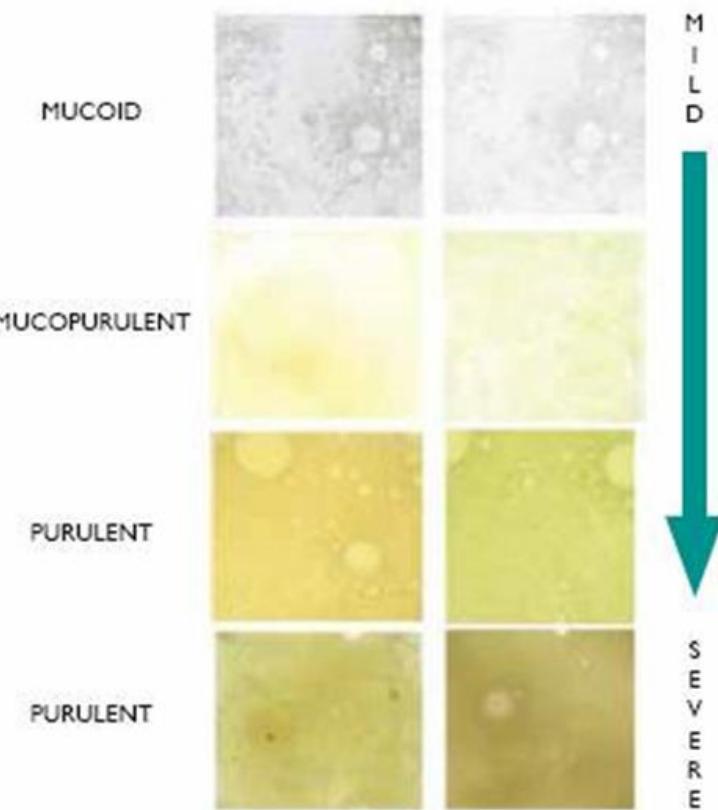
Variant	Characteristics	Pathologic state
DRY (Unproductive)	Cough with sputum expectoration	Bronchitis, pneumonia early stage, pulmonary infarction, pleurisy, the beginning of bronchial asthma
MOIST (Productive)	Cough without sputum expectoration	The acute stage of bacterial and viral infections, cavity formation in the lung

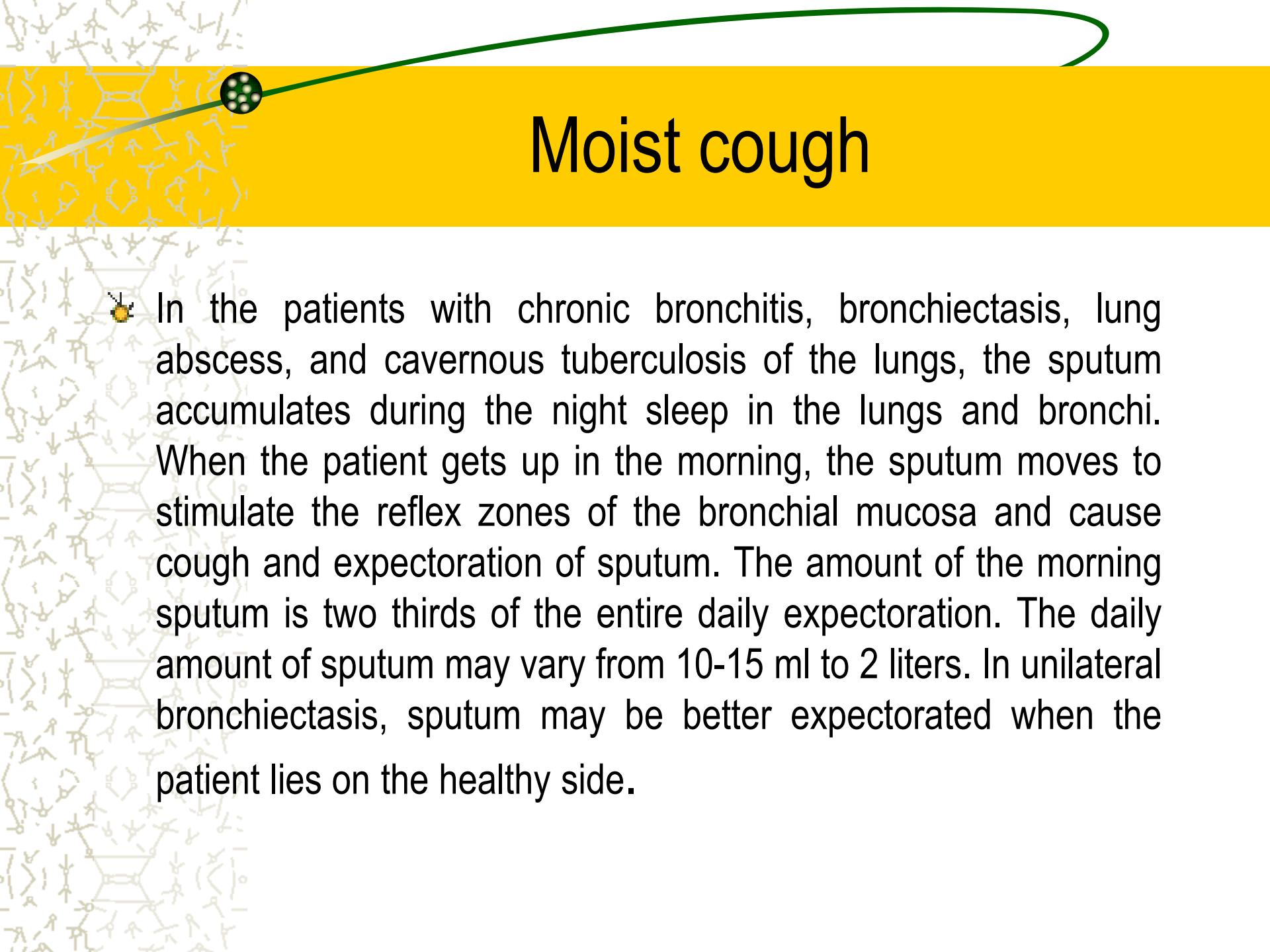
💡 Phlegm, the secretions of the lower respiratory tract, is admixed with nasal and pharyngeal secretions as well as saliva to give expectorated *sputum*.



Moist cough

- If the patient complains of cough with sputum you should try to determine:
 - the amount of sputum during one fit and during entire day;
 - the time of day when sputum is expectorated;
 - posture of the patient at which cough is provoked;
 - properties of the sputum (the color, odor, etc.).





Moist cough

- In the patients with chronic bronchitis, bronchiectasis, lung abscess, and cavernous tuberculosis of the lungs, the sputum accumulates during the night sleep in the lungs and bronchi. When the patient gets up in the morning, the sputum moves to stimulate the reflex zones of the bronchial mucosa and cause cough and expectoration of sputum. The amount of the morning sputum is two thirds of the entire daily expectoration. The daily amount of sputum may vary from 10-15 ml to 2 liters. In unilateral bronchiectasis, sputum may be better expectorated when the patient lies on the healthy side.

INQUIRY

Hemoptysis

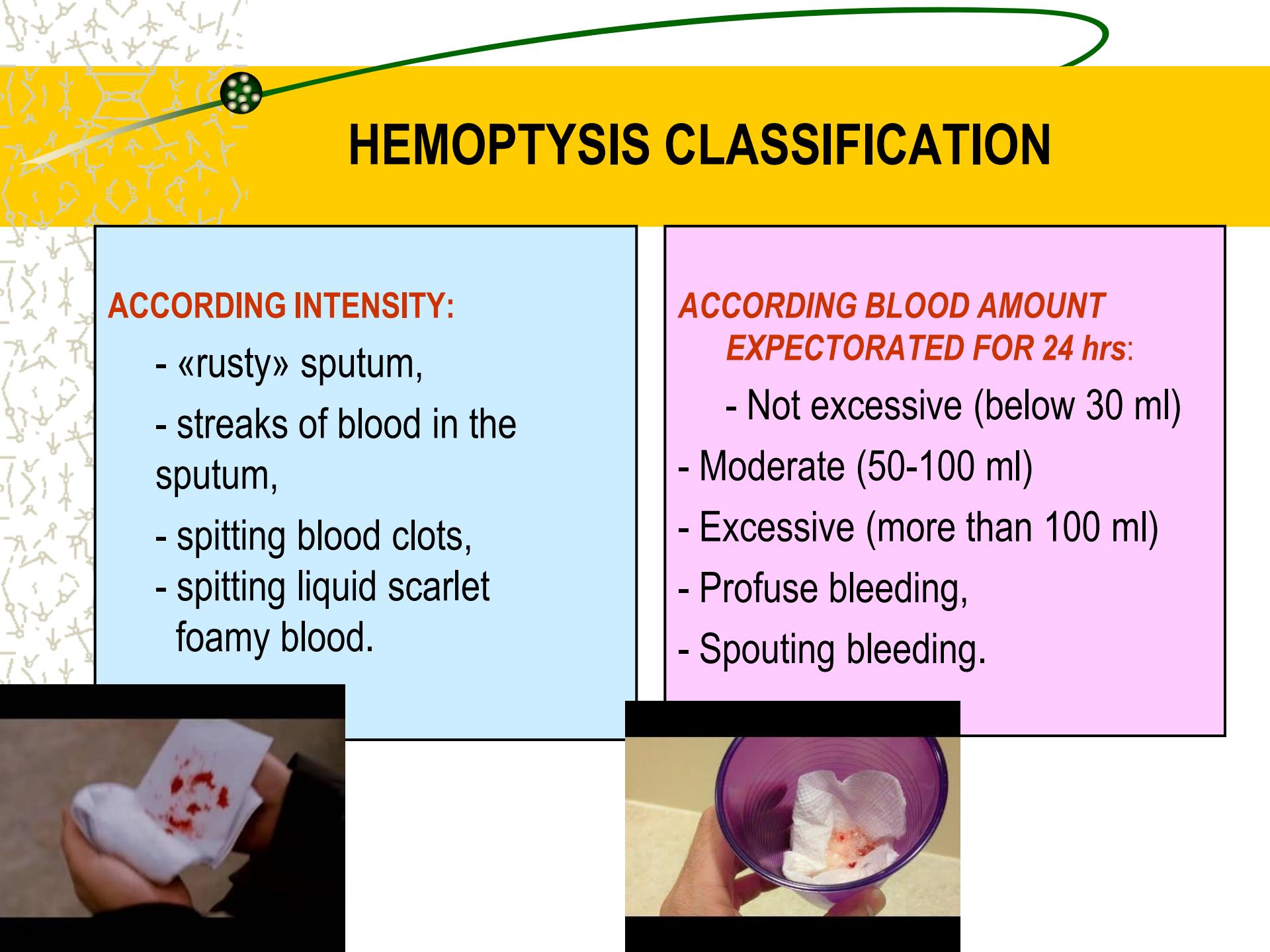
💡 **Hemoptysis** defined as the expectoration of blood from the respiratory tract.

The massive discharge of blood (more than 200 ml per day) is regarded as bleeding requiring surgical intervention.



DIFFERENTIAL DIAGNOSTICS OF HEMOPTYSIS AND PULMONARY BLEEDING

Sign	<i>Hemoptysis</i>	Pulmonary bleeding (pneumorrhagia)
Anamnesis	Diseases of lungs, heart, blood	Pulmonary diseases
Discharge conditions	During cough	During cough
Blood character	In the form of streaks in the sputum, clots, spitting of bright red blood	Pink, foamy sputum
Duration	Long-term (days, weeks)	Short-term (24 hours)



HEMOPTYSIS CLASSIFICATION

ACCORDING INTENSITY:

- «rusty» sputum,
- streaks of blood in the sputum,
- spitting blood clots,
- spitting liquid scarlet foamy blood.



ACCORDING BLOOD AMOUNT EXPECTORATED FOR 24 hrs:

- Not excessive (below 30 ml)
- Moderate (50-100 ml)
- Excessive (more than 100 ml)
- Profuse bleeding,
- Spouting bleeding.

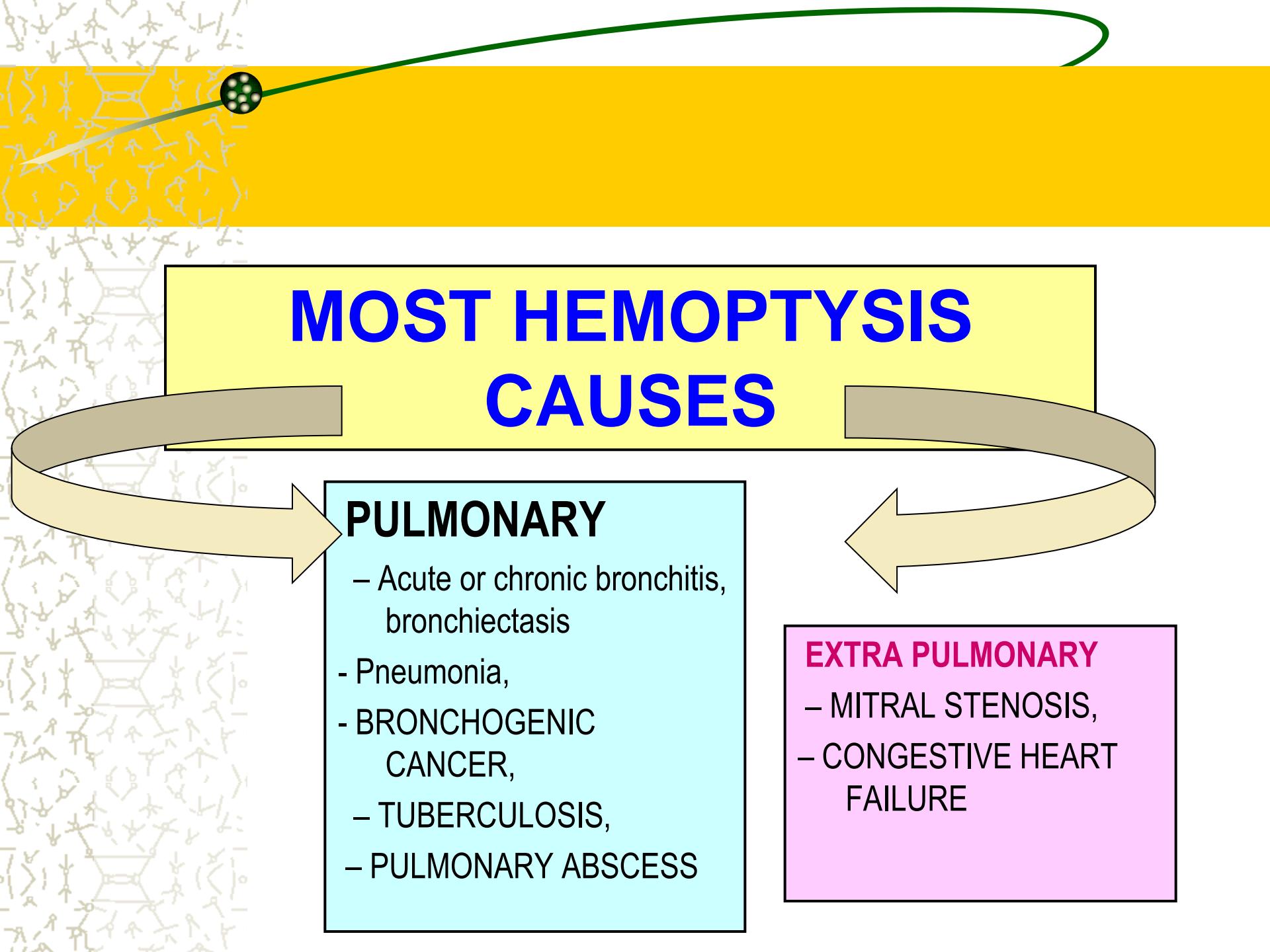


HEMOPTYSIS MECHANISM

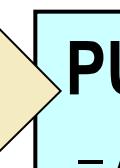
The mechanism of hemoptysis are:

- increased permeability (per diapedesis) of the vascular wall - the penetration of red blood cells in the lumen of the alveoli, bronchi through the intact vascular wall, accompanied not abundant hemoptysis;
- rupture or ulceration (per rhexis) of the vascular wall of arteries, veins, capillaries and blood entering the airway is accompanied by hemoptysis or profuse bleeding



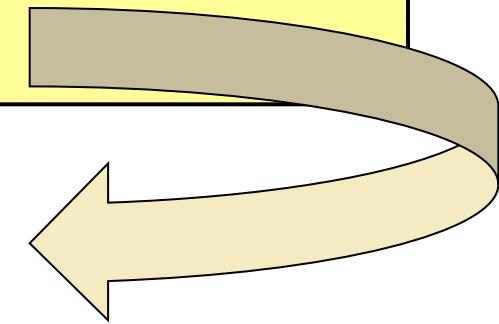


MOST HEMOPTYSIS CAUSES



PULMONARY

- Acute or chronic bronchitis, bronchiectasis
- Pneumonia,
- BRONCHOGENIC CANCER,
- TUBERCULOSIS,
- PULMONARY ABSCESS



EXTRA PULMONARY

- MITRAL STENOSIS,
- CONGESTIVE HEART FAILURE



Chest pain

The greater part of the lower respiratory tract is insensitive to pain. Most parenchymal lung disorders proceed to an advanced state without pain. However, the parietal pleura, is exquisitely sensitive to painful stimuli and unpleasant sensations can arise from the tracheobronchial tree.

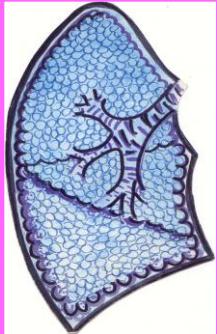
DISTINCTIVE FEATURE OF PAIN in respiratory diseases is their relationship with the breathing, cough, and change in body position.

According to character acute (spontaneous pneumothorax, pulmonary embolism) and permanent pain (pleurisy, pneumonia, tumors) are distinguished.

And according localization - surface (myositis, periostitis, neuritis, fractures) and deep (pulmonary, pleura, mediastinum affections).

CHEST PAIN CAUSES

PULMONARY	NON PULMONARY
<p>Pleura affection: pleurisy (dry, metastatic), adhesions (after purulent pleurisy), spontaneous pneumothorax</p> <p>Pulmonary disease with involvement of the pleura in pathologic process: lobar pneumonia, pulmonary infarction, tuberculosis, cancer, abscess, gangrene</p> <p>Trachea and bronchi affection: bronchogenic carcinoma, thermal and traumatic injuries of the trachea (burns, trauma)</p> <p>Bronchopulmonary lymph nodes affection</p>	<p>Cardiovascular system: angina pectoris, myocardial infarction, pulmonary embolism, dissecting aneurysm of the aorta.</p> <p>Musculoskeletal system: periostitis, fractures, myositis, arthritis, metastases, low back pain</p> <p>Nervous system: neuritis, intercostal neuralgia</p> <p>Blood system: leukemia, anemia Addison-Birmera, multiple myeloma</p> <p>Digestive system: cholecystitis, cholelithiasis, liver abscess, diaphragmatic hernia</p> <p>Other causes: Shingles</p>



PECULIARITIES OF PAIN SYNDROME IN RESPIRATORY ORGANS AFFECTION

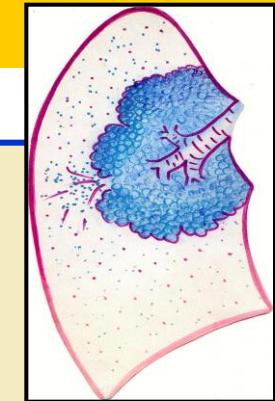
PLEURAL PAIN

- ✖ particularly acute,
- ✖ clearly localized,
- ✖ associated with breathing, coughing, sneezing, changes in body position (enhanced by bending the body in a healthy way)
- ✖ accompanied by a dry cough;
- ✖ long remains after recovery.

DIAPHRAGMATIC PLEURA AFFECTION

- ✖ pain radiating down
- ✖ simulating "acute abdomen" due to irritation diaphragmatic peritoneum

PAIN SYNDROME IN PNEUMOTHORAX

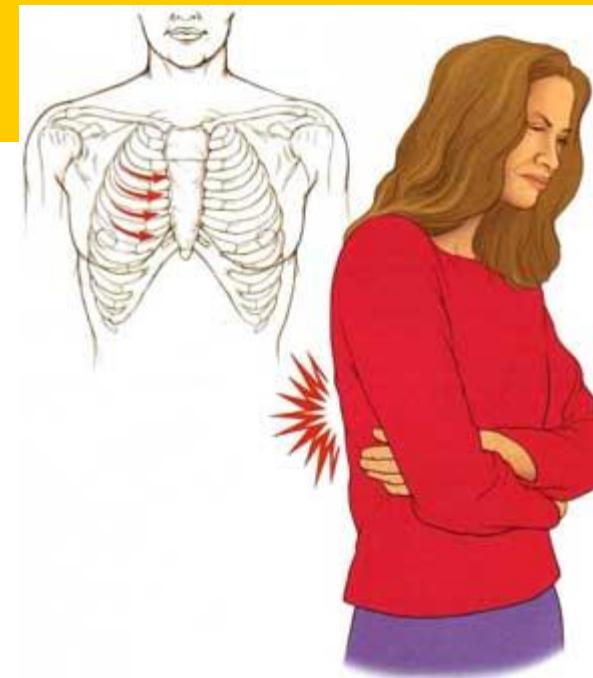


- ✖ Sudden attack of sharp pain in a limited area of the chest,
- ✖ Dramatically increasing shortness of breath due to:
 - rupture of visceral leaf pleura,
 - the development of compression
 - atelectasis,
 - hemodynamic disorders (collapse) due to the shift of the mediastinum.

PECULIARITIES OF PAIN SYNDROME IN CHEST AFFECTION

PAIN in intercostal neuralgia

- ✓ localized on the intercostal space,
- ✓ increases during inspiration and bending in a sick way
- ✓ accompanied by tenderness to palpation.



RIBS AFFECTION

- ✓ localized in the specific area,
- ✓ accompanied by pain,
- ✓ independent of breathing, aggravated by motion,
- ✓ accompanied by painful palpation on a limited portion of the ribs.

PAIN IN MYOSITIS

- ✓ moderate strength
- ✓ covers several intercostal,
- ✓ increased in inspiration and bending to a healthy side (Shepelman sign)

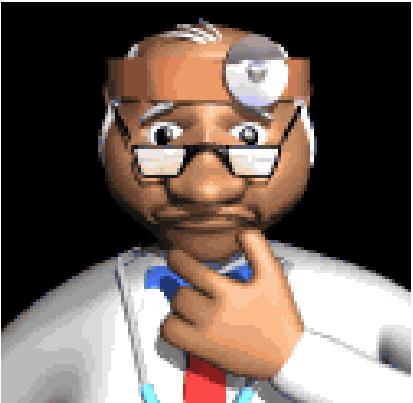


ANAMNESIS MORBI



During examination of the patients with pathology or suspicion on the bronchopulmonary system affection attention is paid to the medical history of the disease.

1. Information about the causes and precipitating factors of disease onset and development, especially its beginning, course and relapse.
2. Order of appearance, expression, development and the relationship of various symptoms of the disease
3. Information about laboratory and instrumental studies and their results (in dynamics)).
4. Information about conducted therapeutic and prophylactic measures and their effectiveness.

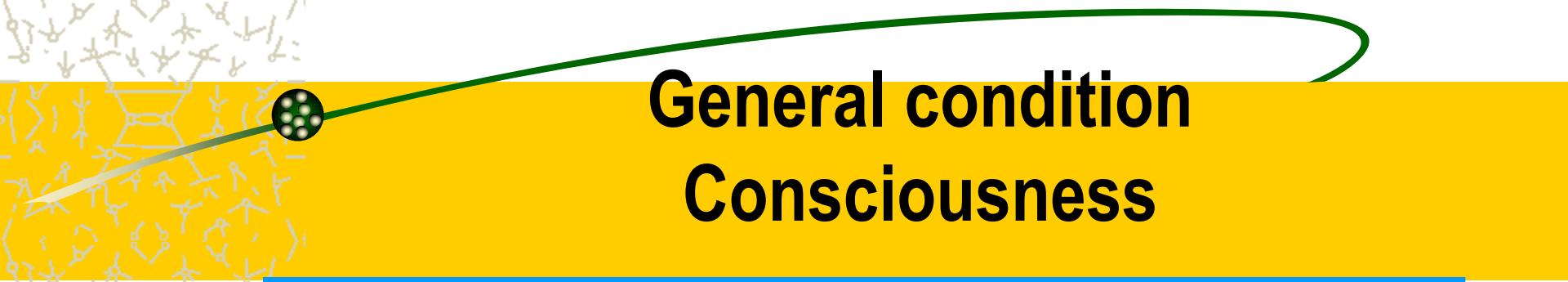


OBJECTIVE EXAMINATION METHODS

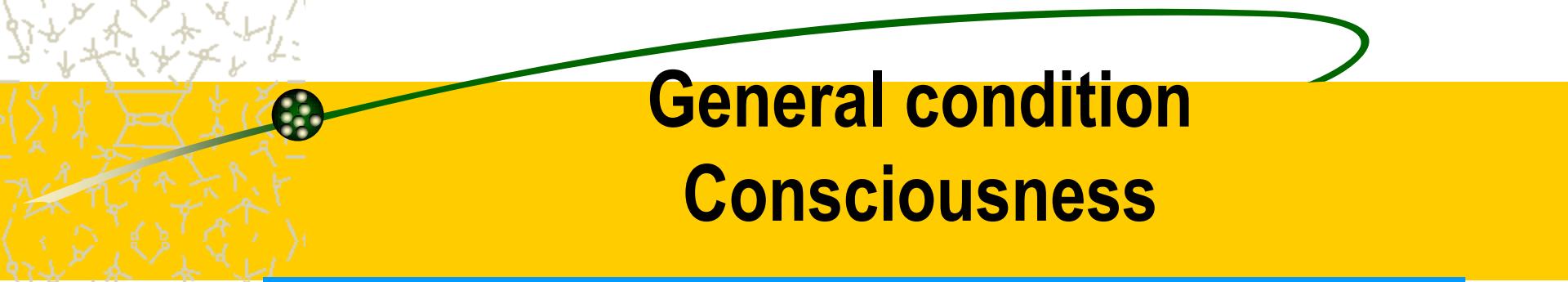
GENERAL INSPECTION PLAN

- General condition
- Consciousness
- Posture of the patient
- Facial expression, inspection of the neck
- Skin and visible mucosa
- Lymph nodes
- Musculoskeletal system





General condition Consciousness

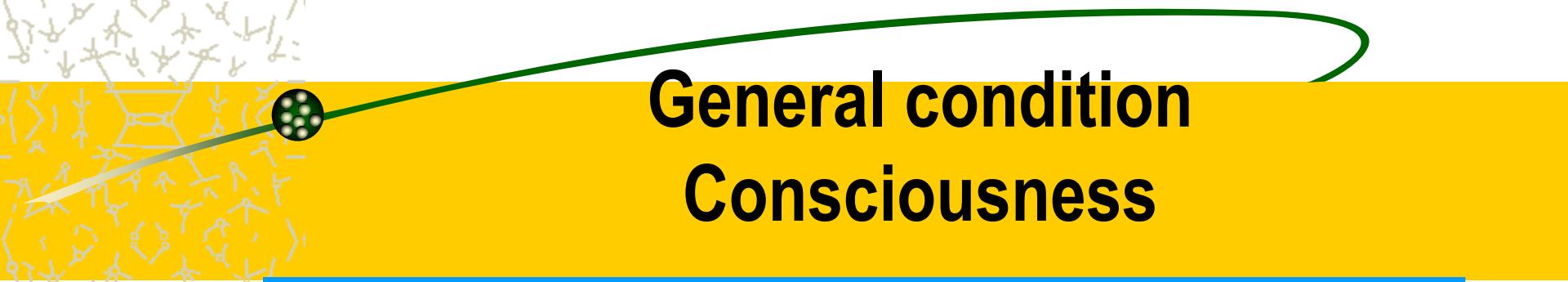


General condition of patients, depending on the severity and stage of disease can be:

satisfactory (prodromal period, remission or recovery);

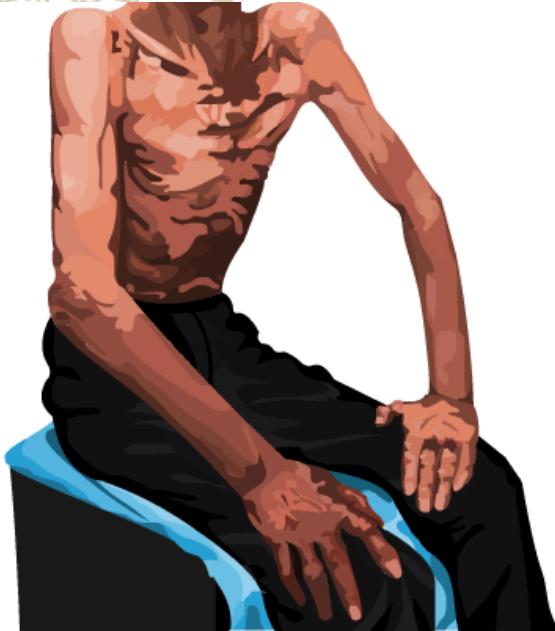
moderate (acute disease or exacerbation of chronic diseases);

severe and very severe (asthma status, spontaneous pneumothorax, pulmonary embolism, pulmonary infarction, COR-pulmonale).



Consciousness in the majority of patients of respiratory diseases remains clear. However, in severe hypoxia, resulting in chronic pulmonary heart failure or intoxication (tuberculosis, cancer), it may be in violation in a form of a stupor or sopor.





POSTURE OF THE PATIENT

Position of the patient indicates the severity of the disease, or may be less likely due to the specific pathological process. Patients with respiratory diseases can take an active, passive and forced posture.

- **Active posture** indicates the preservation of consciousness patient, the absence of overt signs of pulmonary and cardiopulmonary diseases, pain syndrome.
- **Passive posture** is typical for patients with severe toxic central nervous system affection (miliary tuberculosis, coma, the agony).
- **Forced position** occupied by patients to ease their condition (symptoms of dyspnea, pain, or stop coughing, sputum discharge).

Forced posture

Posture	Pathophysiologic mechanisms	Pathologic condition
Orthopnea focusing hands	With the palm of hands is fixing the shoulder girdle and the inclusion in the process of breathing auxiliary respiratory muscles, which facilitates the phase of expiration and reduces breathlessness	Bronchial asthma attack
Orthopnea without the palm rest	Othopnea facilitates diaphragm movements, increases the volume of the chest, improves gas exchange in system "alveolus, pulmonary capillary" and cerebral vessels, which leads to a decrease of respiratory center excitability and reduced dyspnea	Foreign body, lung tumor, lobar pneumonia, pleural effusion, pneumothorax, partial paralysis of the respiratory muscles
On affected side	Reducing of compression and compensatory hyperventilation of healthy lung, a reduction of friction of inflamed pleura; decrease sputum discharge and cough reflex	Dry pleurisy, a lung abscess, bronchiectasis, tuberculosis
Prone position (Face down)	Diaphragm respiration is restricted	Diaphragmal pleurisy

DIAGNOSTIC SIGNIFICANCE OF THE PATIENT FACE IN RESPIRATORY DISEASES

- facies asthmatica – pale, cyanotic face, expression of the general tension and the desire to breathe more air, observed during an attack of asthma.



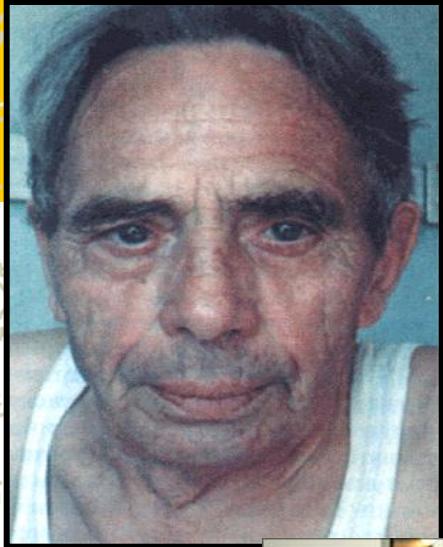
DIAGNOSTIC SIGNIFICANCE OF THE PATIENT FACE IN RESPIRATORY DISEASES



- facies tuberculous – exhausted, pale face with blush localized on the cheeks
“burning eyes”, dry lips, excited countenance, half open mouth



DIAGNOSTIC SIGNIFICANCE OF THE PATIENT FACE IN RESPIRATORY DISEASES



Patient with chronic pulmonary heart failure
(diffuse cyanosis)



Facies pneumonica – one-sided blush on the same cheek as affected lung, cyanosis, often herpes on the lips and nose;



- Stokes collar – means edematous neck with associated with edematous face due to the compression of lymph ducts and veins with enlarged mediastinal lymph nodes, tumor of mediastinum, adhesive mediastinopericarditis, excessive effusion in the pleural and pericardial cavity.

INSPECTION OF THE NECK

On examination of the neck attention should be paid on filling and increased pulsation of neck veins due to:

increase in intrathoracic pressure
increased central venous pressure as a result of violations of the outflow of blood from the superior vena cava or the development of pulmonary hypertension



DIAGNOSTIC SIGNIFICANCE OF NECK INSPECTION

Character of the neck veins changes	Pathogenic mechanisms	Pathological conditions
Neck veins filling	Increase in intrathoracic pressure and increased central venous pressure as a result of violations of the outflow of blood from the superior vena cava or the development of pulmonary hypertension	<ul style="list-style-type: none">Chronic lung disease with severe, chronic pulmonary heart failure (cor-pulmonare);primary pulmonary hypertension (Aerza disease);mediastinal tumor;lymph nodes enlargement (tuberculosis, leukemia, metastases)
Increased neck veins pulsation	Increase in intrathoracic pressure and sharp fluctuation of increased central venous pressure	<ul style="list-style-type: none">Right ventricular or total heart failure;tricuspid valve regurgitation;acute pericardial effusion, chronic constrictive pericarditis

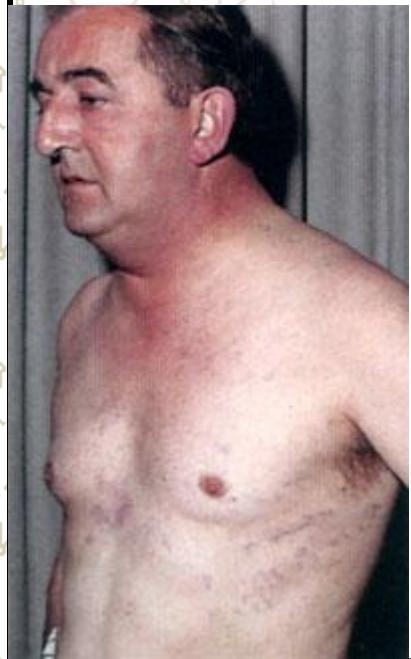
DIAGNOSTIC SIGNIFICANCE OF SKIN INSPECTION

SYMPTOM	PATHOGENIC MECHANISMS	PATHOLOGICAL CONDITIONS
CYANOSIS a) diffuse b) peripheral cyanosis (on face, neck, upper extremities region) c) significant cyanosis of the face	The imbalance between ventilation and perfusion, the accumulation of carbon dioxide in the blood and reduced hemoglobin, peripheral vasodilatation The sudden expulsion of breath of lung tissue Compression of the superior vena cava, phlebostasis Primary and secondary pulmonary artery sclerosis leads to disruption of gas perfusion	COPD, chronic suppurative disease (abscess, bronchiectasis), bronchial asthma, pneumonia, emphysema, pulmonary fibrosis, tuberculosis Pulmonary embolism, spontaneous pneumothorax Bronchogenic lung cancer Primary (Aerza disease) and secondary pulmonary hypertension
One-sided face hyperemia on background of cyanosis	Reflex vessels of the face vasodilation on the affected side	Lobar pneumonia
PALENESS a) moderate b) pronounced pallor	Violation of the ventilation process and compensatory spasmodermia hemorrhagic anemia	Pleural effusion Massive pulmonary hemorrhage, decaying lung cancer, bronchiectasis,
Erythema nodosum	Alveolar hyperventilation	Pulmonary sarcoidosis

EDEMA AND LYMPH NODES

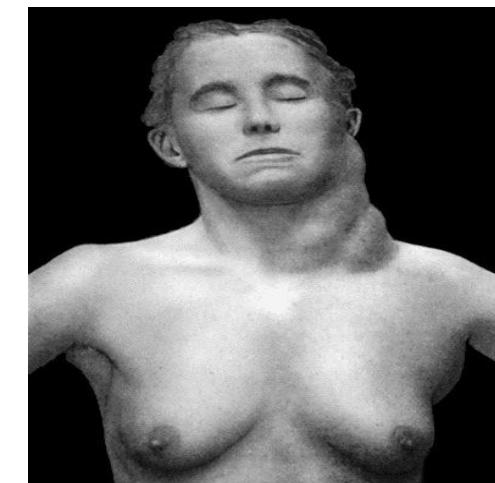
EDEMA SYNDROME

in patients with lung disease is a manifestation of right heart failure due to chronic lung disease.



LYMPH NODES

Swollen lymph nodes may occur with pulmonary tuberculosis, sarcoidosis, lung tumors (metastases).



Locomotor system

Characteristic changes:

terminal phalanges in the form of "drumsticks" and

nail shape the type of " watch glass" (Hippocrates nails) -

hypertrophic pulmonary osteoarthropathy

(chronic purullent lung disease, bronchogenic cancer, fibrosing alveolitis).

At the base of symptom is growth of periosteum terminal phalanges in chronic hypoxia. In this case, the terminal phalanges thicken, take the form of "drumsticks", and the nails are raised and hard, like a watch glass.

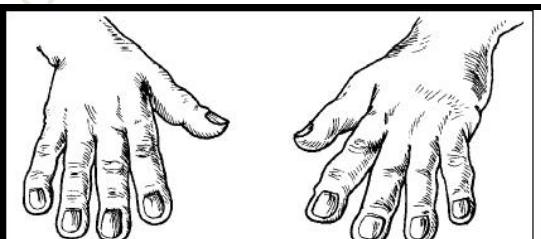


Рис. 40. Пальцы в виде барабанных палочек



Clubbing of the Nails



A sign of chronic hypoxia

221



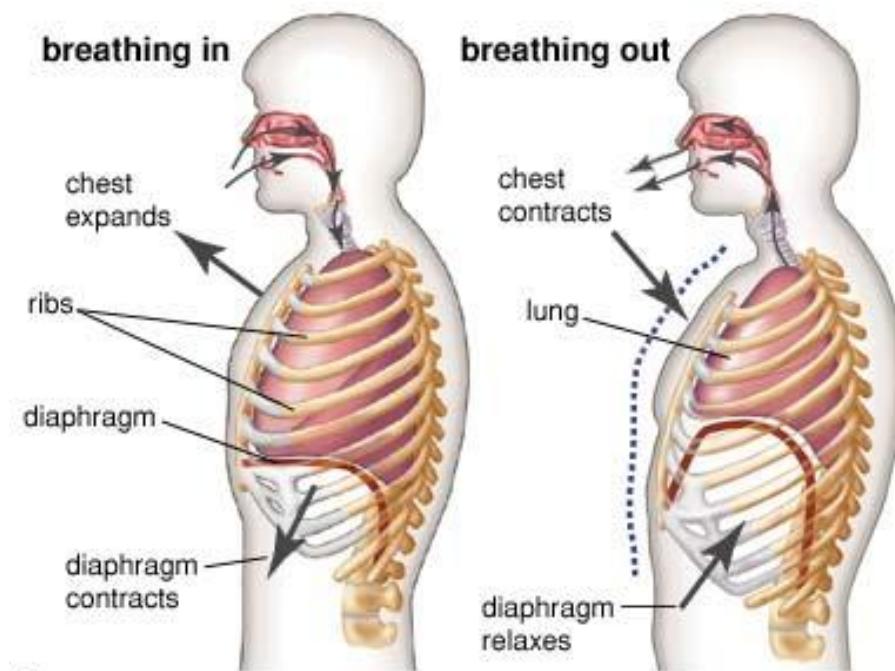
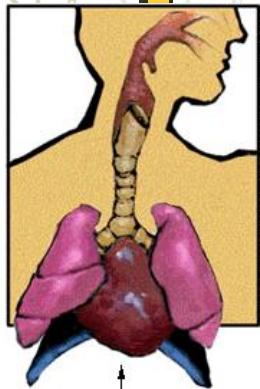
INSPECTION OF THE CHEST

I. Static inspection

- Shape of the chest;
- Symmetry of the chest

II. Dynamic inspection

- The type of respiration;
- Respiration rate;
- Respiration depth;
- Respiration rhythm; Participation of the both half of chest in the breathing act



INSPECTION OF THE CHEST

The signs that characterize the chest form

1. Pronounce of supraclavicular fosses:

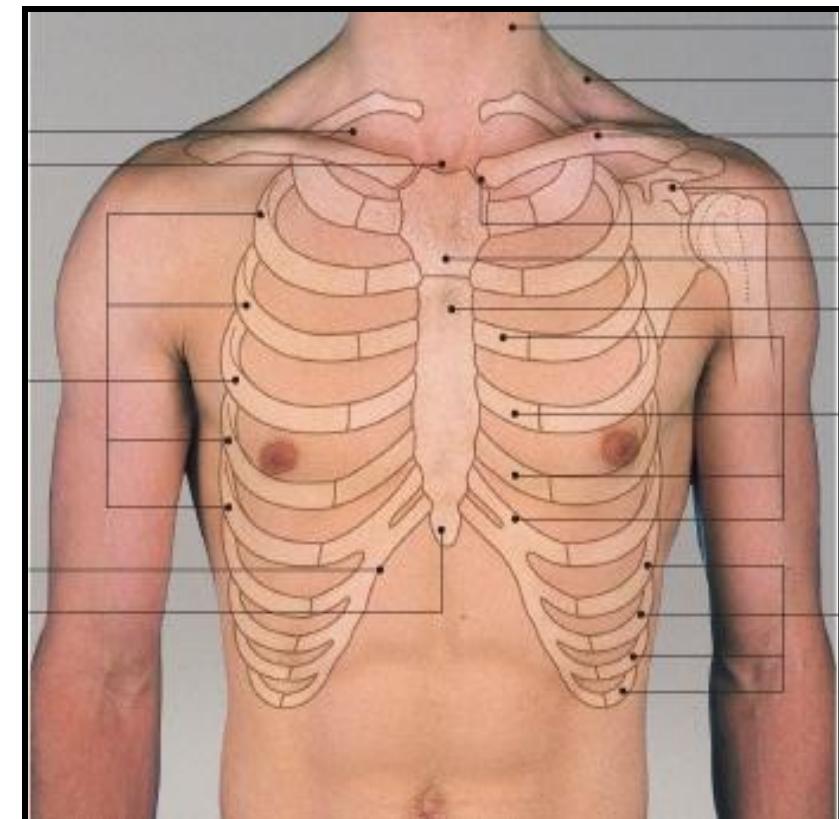
- Moderately pronounced;
- Slightly pronounced;
- Smoothed;
- Protruded;
- Distinctly pronounced;

2. Direction of the ribs:

- Moderately slanting;
- More vertical;
- More horizontal;
- Horizontal;

3. Pronounce of intercostals space:

- Moderately pronounced;
- Smoothed;
- Protruded;
- Depressed;



INSPECTION OF THE CHEST

4. Width of the intercostals space:

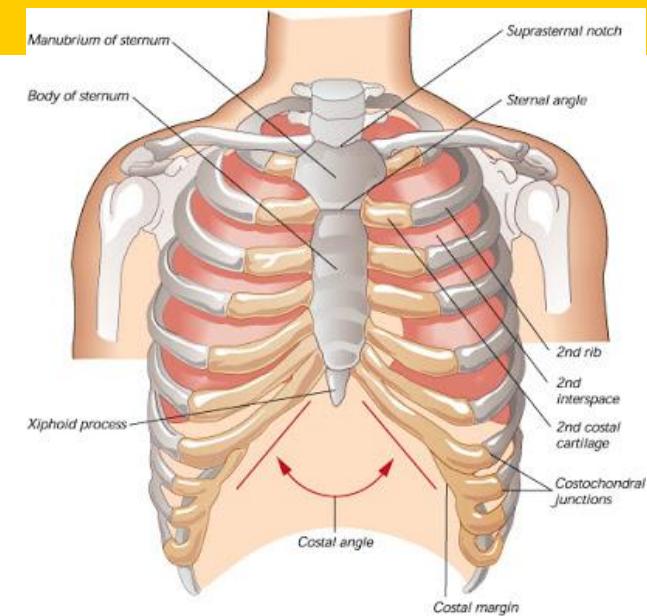
- ✖ Moderate (near 2 cm);
- ✖ Narrow (less than 2 cm);
- ✖ Wide (more than 2 cm);

5. The size of epigastric angle:

- ✖ Near 90;
- ✖ Less than 90;
- ✖ More than 90;

6. Attitude of the anteroposterior diameter to the lateral:

- ✖ $\frac{2}{3}$;
- ✖ Near 1;
- ✖ More than 1;
- ✖ Less than $\frac{2}{3}$;



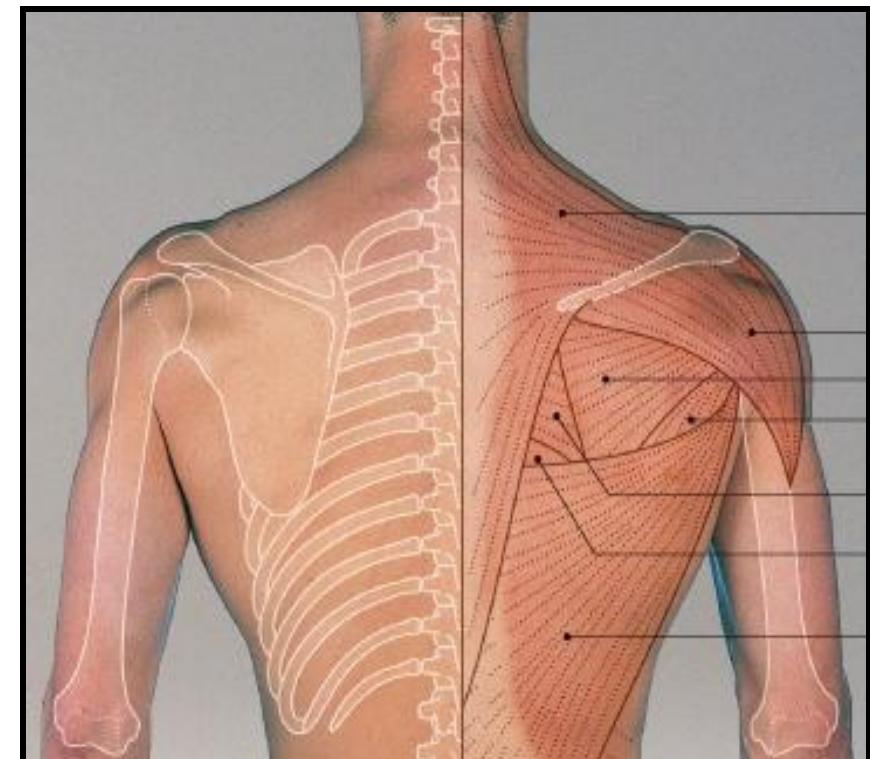
INSPECTION OF THE CHEST

7. Position of the shoulder blades:

- Closely fit to the chest;
- Slightly separated from the chest;
- “wing-like shoulder blades”

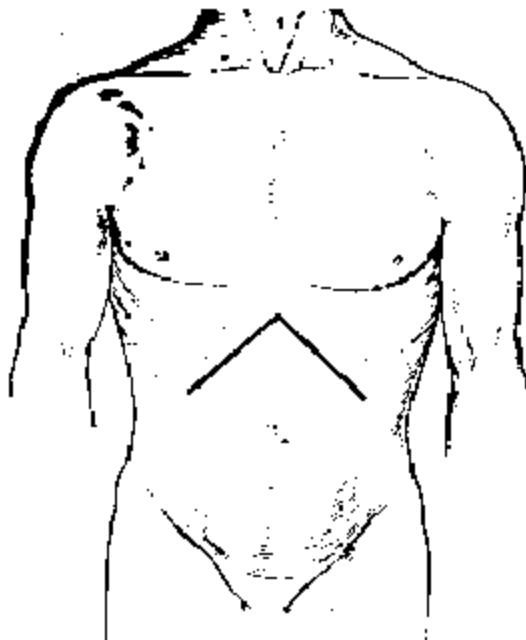
8. Character of the chest part of the spine:

- Without deformities;
- Scoliosis
- Kyphosis;
- Lordosis;
- Kyphoscoliosis;

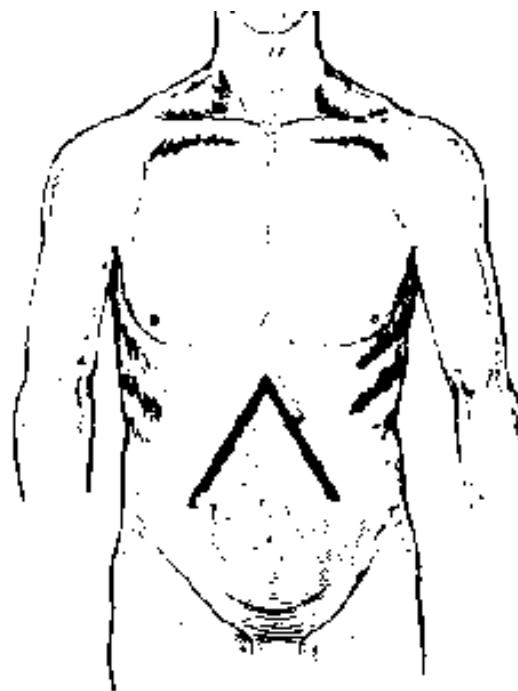


STATIC INSPECTION OF THE CHEST

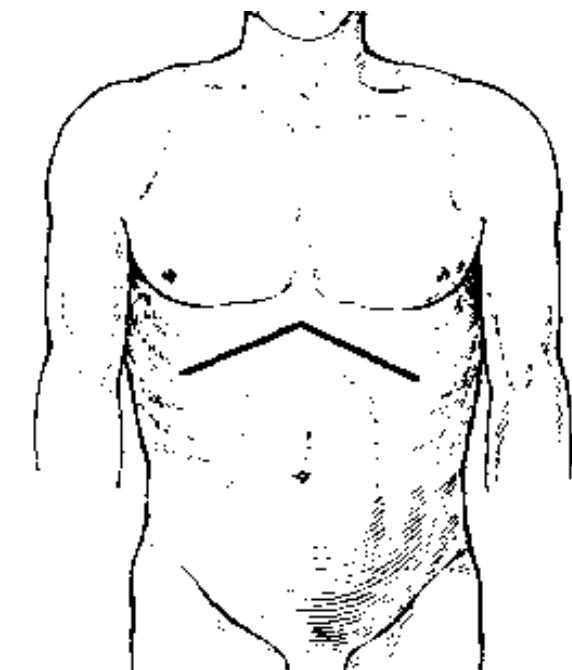
Physiological shape of the chest



Normosthenic;



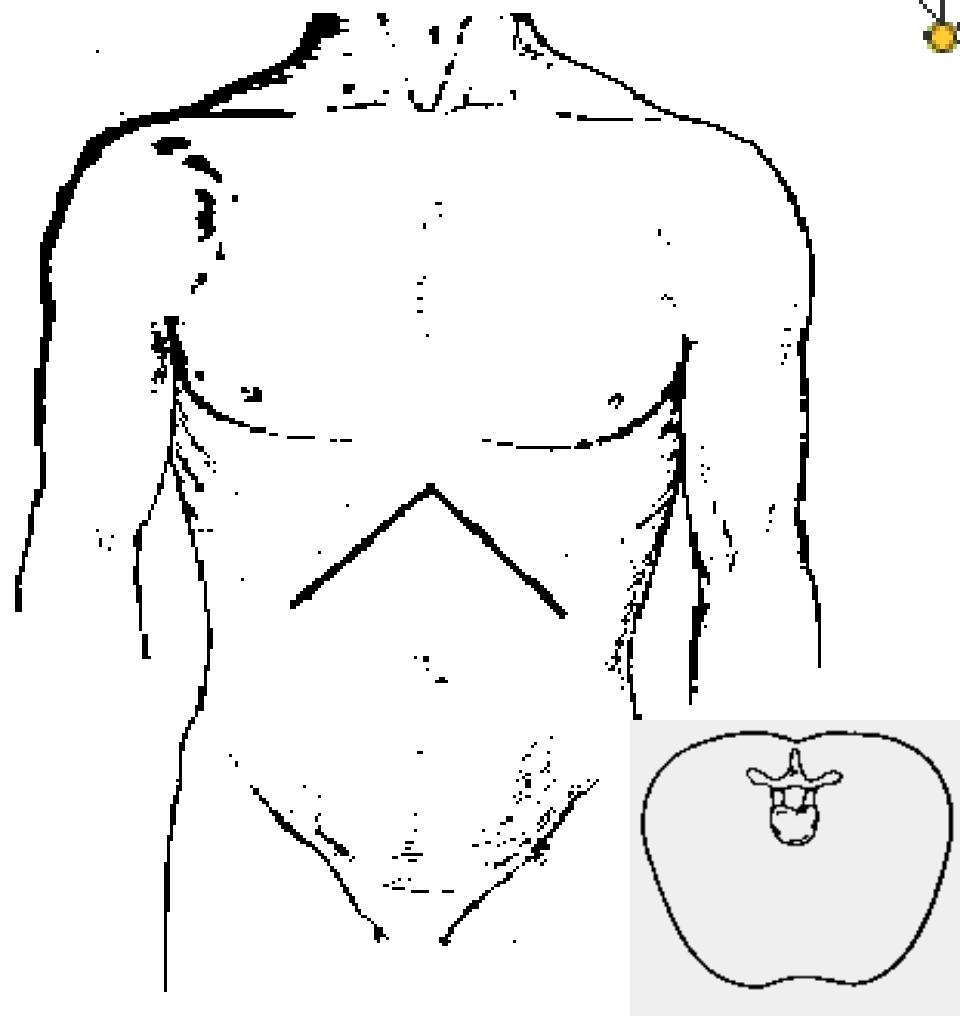
Asthenic;



Hypersthenic;

STATIC INSPECTION OF THE CHEST

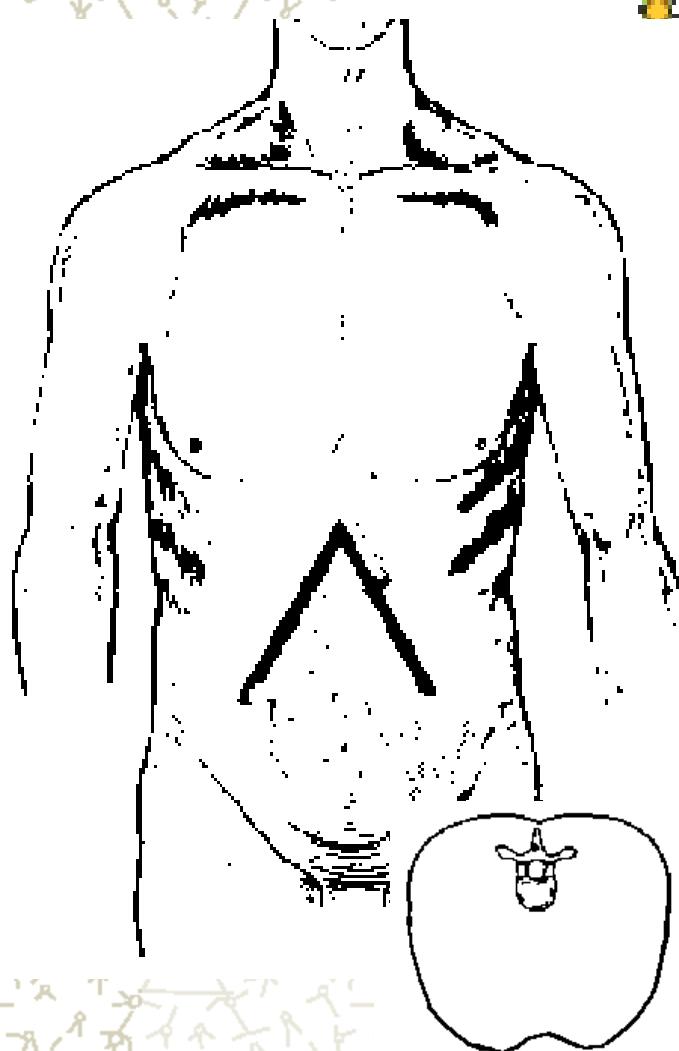
Physiological chest shape



Normosthenic chest: the shoulders are under the right angle to the neck, supra- and infraclavicular fossae feebly expressed, the ribs are moderately inclined, the interspaces are visible, but moderate expressed, epigastric angle is near 90° , the lateral diameter is larger than anteroposterior, shoulder blades closely fits to the chest and are on the same level. The thorax is about the same height as abdominal part of the trunk

STATIC INSPECTION OF THE CHEST

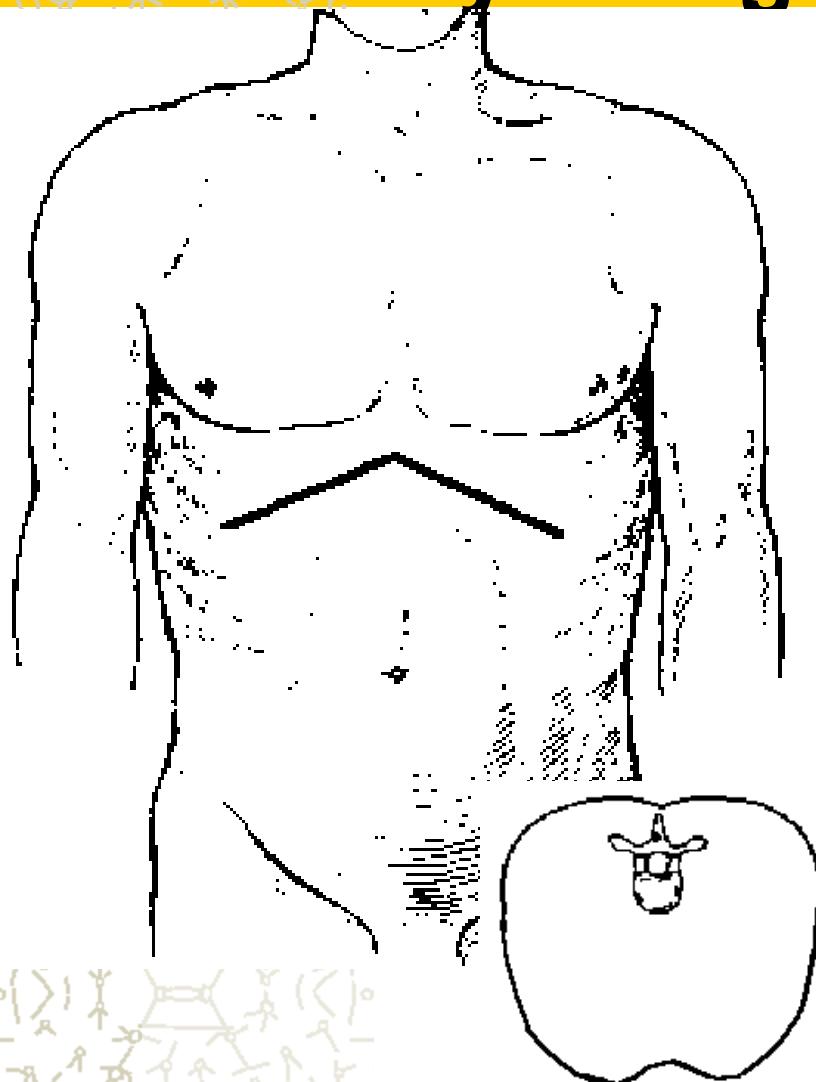
Physiological chest shape



Asthenoic chest: the shoulders are sloping and are under the dull angle to the neck, clavicles are well visible, supra- and infraclavicular fossae are distinctly pronounced, the ribs direct downward abruptly, more vertical at sides, the 10th ribs are not attached to the costal arch, the interspaces are wide and pronounced, epigastric angle is less than 90°, both lateral and anteroposterior diameter are smaller than normal, the chest narrow and elongated, the shoulder blades are separate from the chest and their angles are well visible. The muscles of the shoulder girdle are underdeveloped. The thorax is longer than abdominal part of the trunk

STATIC INSPECTION OF THE CHEST

Physiological chest shape



💡 **Hypersthenic chest:** the shoulders are wide and the neck is short, supra- and infraclavicular fossae are absent (level with the chest), direction of the ribs are nearly horizontal, the interspaces are narrow and slightly expressed, epigastric angle exceeds 90° , the lateral diameter is about the same as anteroposterior, the chest has form of a cylinder, the shoulder blades closely fit to the chest. The thorax is smaller than abdominal part of the trunk

STATIC INSPECTION OF THE CHEST

Pathological chest shape

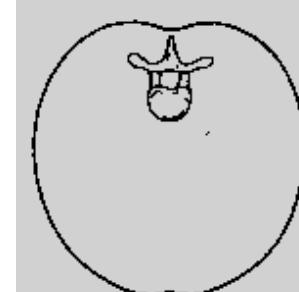
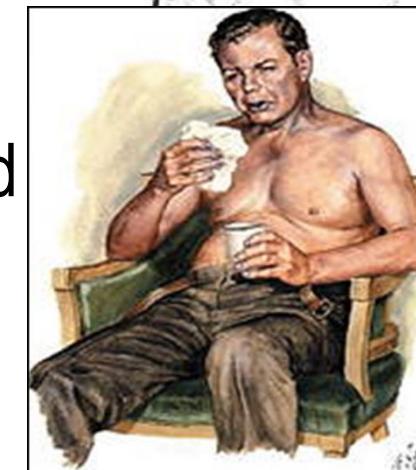
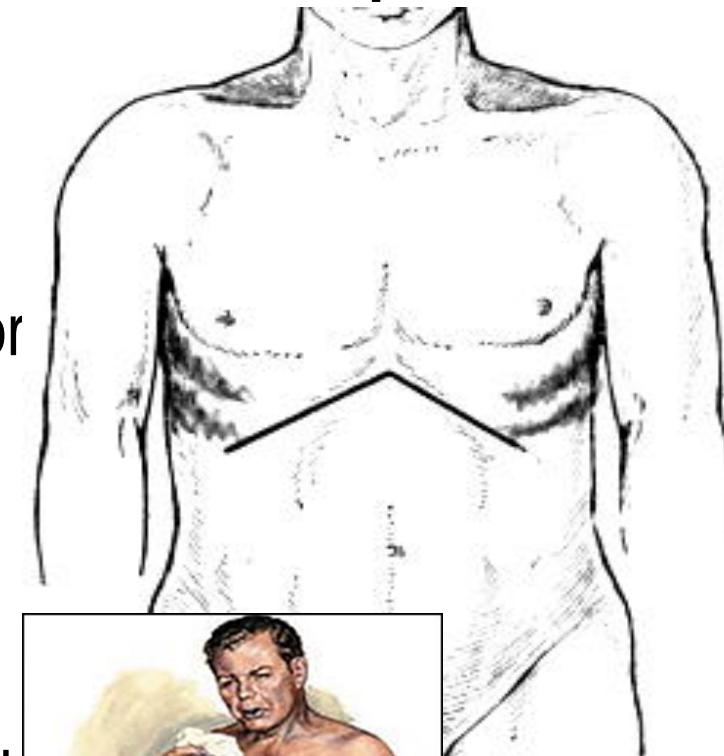
- ***Pathological shapes*** of the chest can be caused either by
 - chronic diseases of the lungs and pleura (emphysematous, paralytic chest), or by
 - pathology of the thorax costal skeleton (rachitic, funnel, and foveated chest), or by
 - various deformities of the spine (scoliosis, kyphosis, lordosis, kyphoscoliosis).

STATIC INSPECTION OF THE CHEST

Pathological chest shape

Emphysematous or barrel

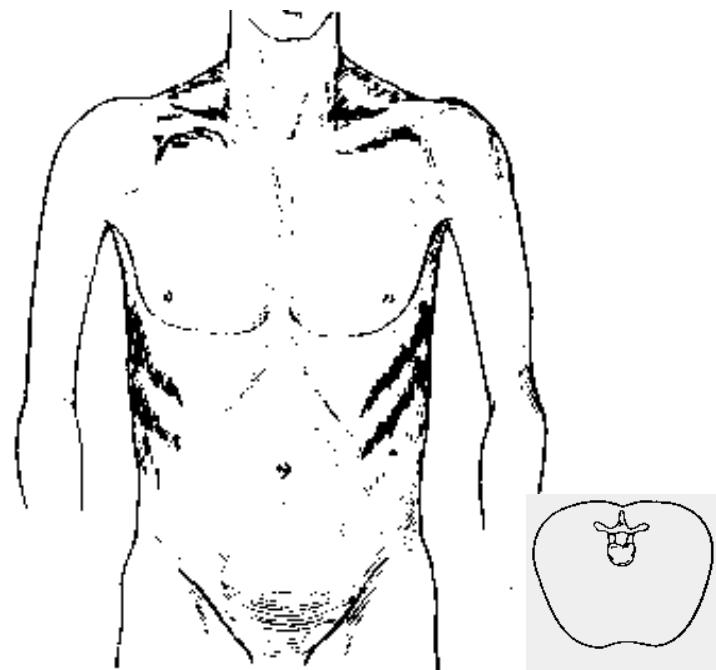
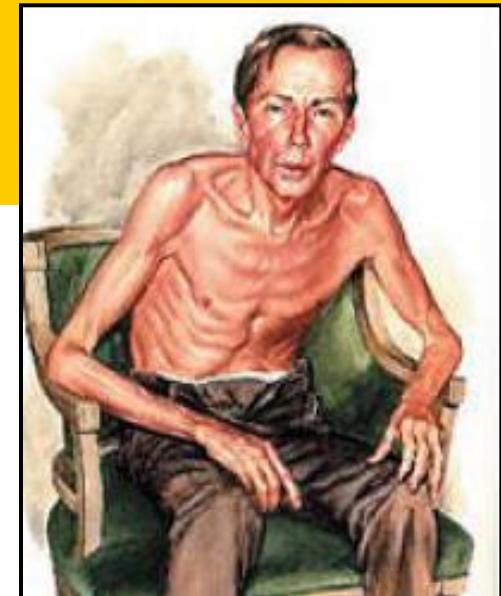
chest resembles hypersthenic in its shape. Supra- and infraclavicular fossae are absent or even protruded, the ribs are horizontal, the interspaces are enlarged, epigastric angle is more than 90° , the chest wall is prominent, chest has an increased anteroposterior diameter and that is why chest has a barrel-like configuration



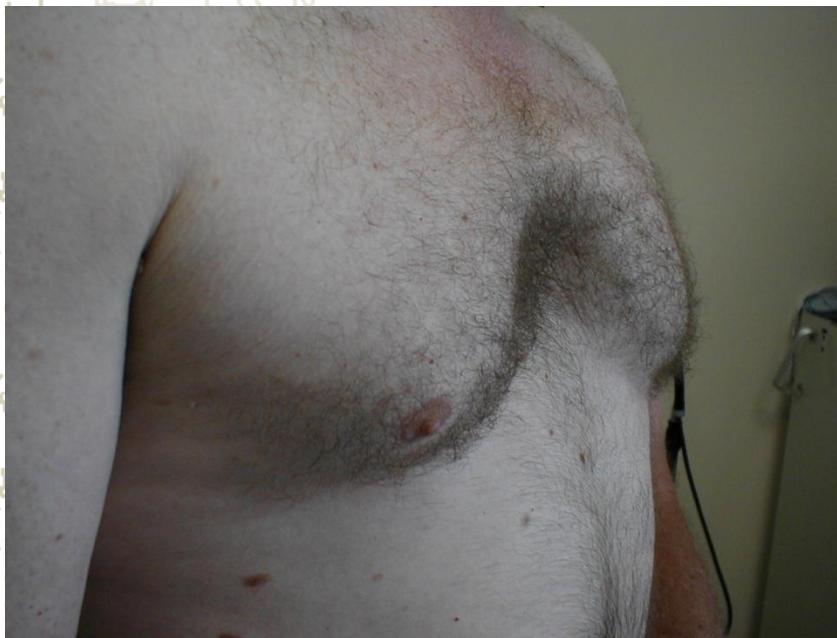
STATIC INSPECTION OF THE CHEST

Pathological chest shape

● **Paralytic chest.** The same signs that peculiar to the asthenic chest but more pronounced characterize paralytic chest. The shoulders are sloping, clavicles are asymmetrical and pronounced, supra- and infraclavicular fossea depresses, the ribs are vertical, the interspaces are wide and depressed, marked atrophy of the chest muscles, epigastric angle is less than 90°, the shoulder blades are not on the same level, and their movement during breathing are asynchronous



Barrel Chest: Increased Anterior/Posterior Diameter



PARALYTIC AND EMPHYSEMATOUS CHEST

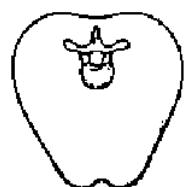
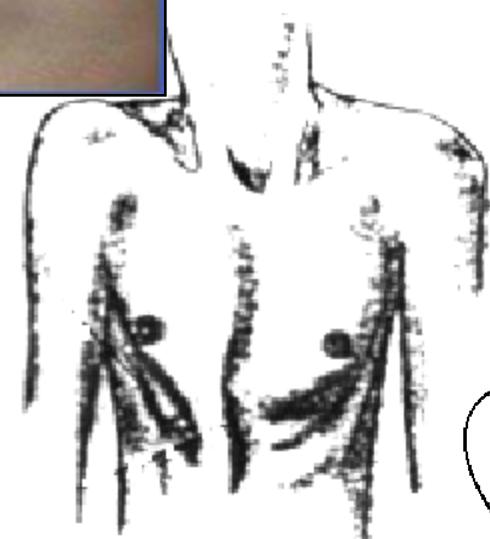


To the left is a "**pink puffer**" and to the right is a "**blue bloater**".

STATIC INSPECTION OF THE CHEST

Pathological chest shape

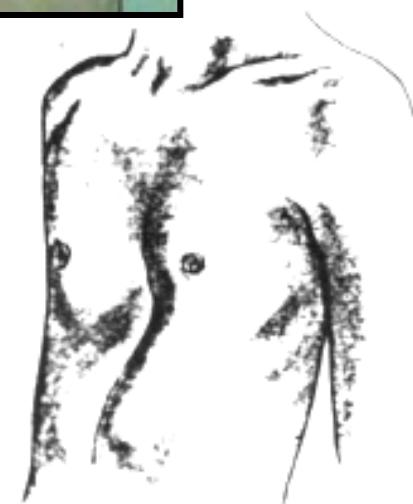
💡 **Rachitic or pigeon chest** is a result of abnormal skeleton formation in childhood in the patients with rachitis. In a pigeon chest, the sternum is displaced anteriorly, increasing anteroposterior diameter, resembling the keel of the boat. The ribs meet at an acute angle at the sternum, the costal cartilages thicken like beads at points of their transition to bones (rachitic beads)



STATIC INSPECTION OF THE CHEST

Pathological chest shape

- Funnel chest is characterized by a depression in the lower portion of the sternum near the xiphoid process. This deformity can be the result of abnormal development of the sternum or prolonged compressing effect. But exact cause is now unknown. In older times such shape of the chest was found in shoemaker adolescents, and was explained by permanent pressure of the chest against the shoe. Therefore, the funnel chest is also called 'cobbler chest'



STATIC INSPECTION OF THE CHEST

Pathological chest shape

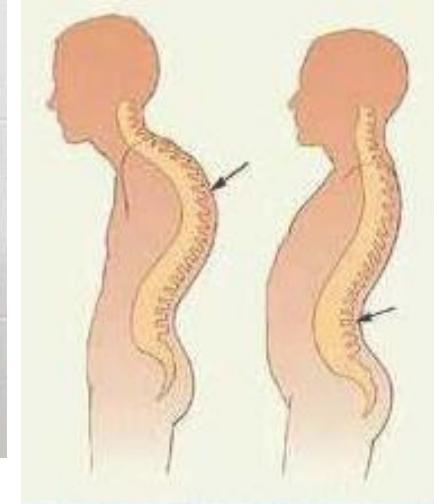
- ★ **Foveated chest** is characterized by vertical depression on the upper and middle parts of the anterior surface of the chest. This deformity arises in syringomyelia, a rare disease of the spinal cord.



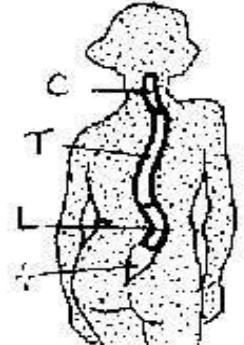
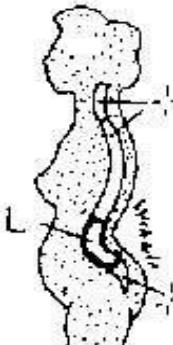
STATIC INSPECTION OF THE CHEST

Pathological chest shape

- Pathological shapes of the chest caused by various deformities of the spine as a result of injuries, tuberculosis of the spine, rheumatoid arthritis, etc.
- Four types of spine deformities are distinguished:
 - Scoliosis
 - Kyphosis
 - Lordosis
 - Kyphoscoliosis



Vertebral Disorders



Kyphosis

Lordosis

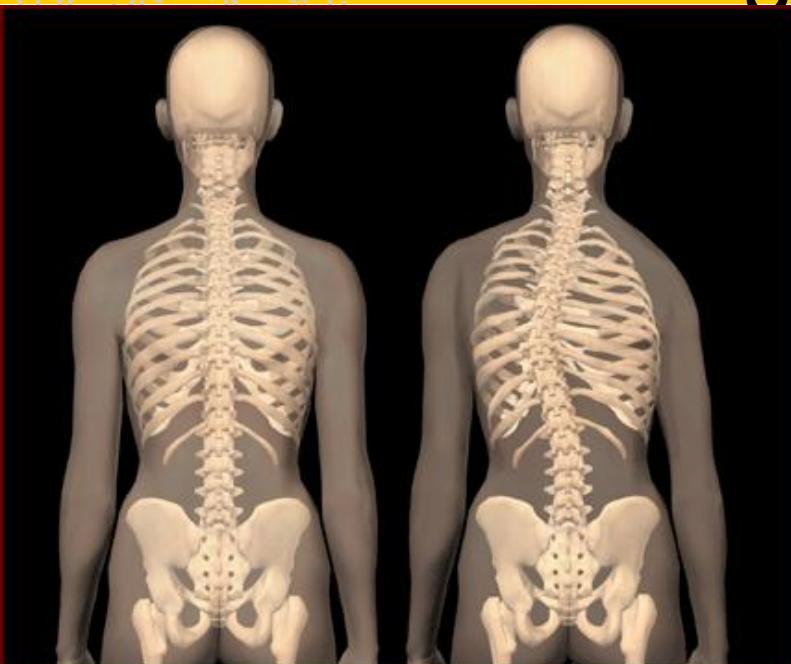
Scoliosis

STATIC INSPECTION OF THE CHEST

Pathological chest shape

💡 Scoliosis – lateral

curvature of the spine, is most common. It develops in schoolchildren due to bad habitual posture.



Normal vs. Scoliosis

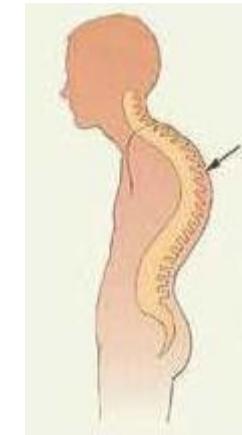
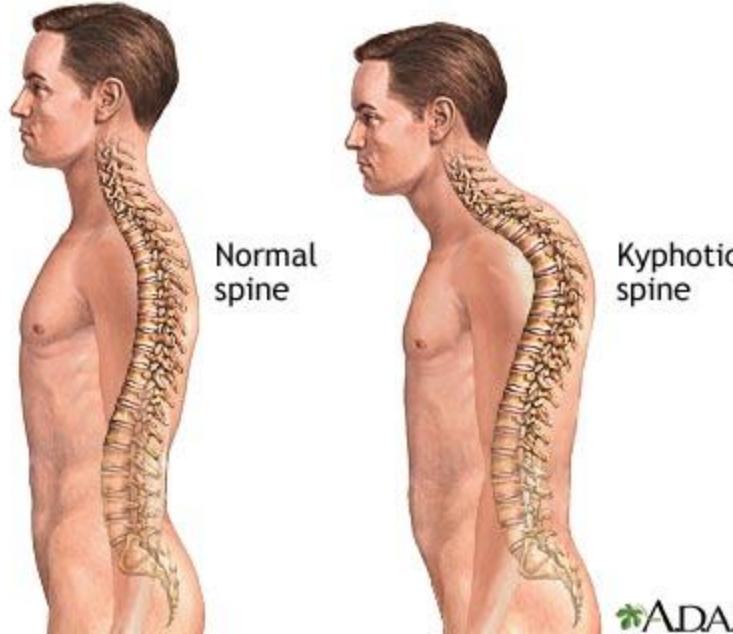


STATIC INSPECTION OF THE CHEST

Pathological chest shape



💡 **Kyphosis** – backward curvature of the spine with formation of the gibbus, occurs less frequently.

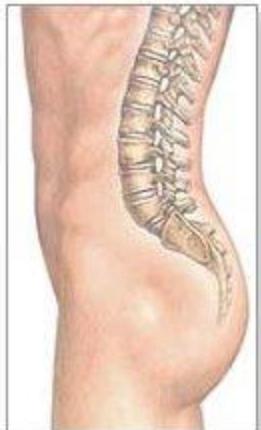


STATIC INSPECTION OF THE CHEST

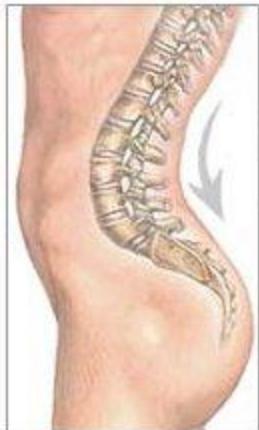
Pathological chest shape

- Lordosis – forward curvature of the spine, generally in the lumbar region, occurs in rare cases.

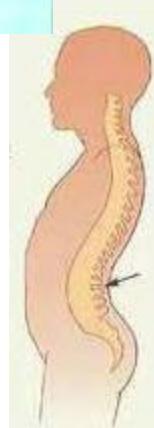
Normal spine



Lordosis of the spine



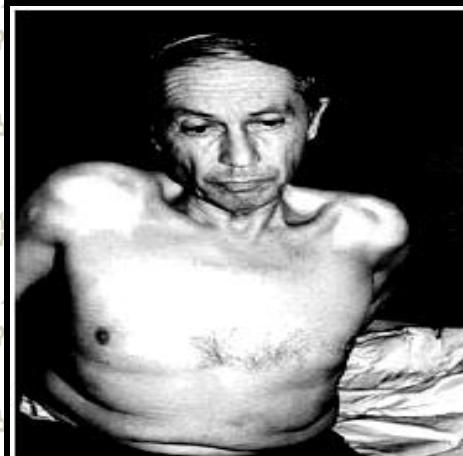
Exaggerated
lumbar
curve



STATIC INSPECTION OF THE CHEST

Pathological chest shape

- **Kyphoscoliosis** – combination of the lateral and backward curvature of the spine



STATIC INSPECTION OF THE CHEST

Symmetry of the chest

★ The right and left sides of the normal chest are symmetrical, the clavicles and shoulder blades are on the same level, the supra- and infraclavicular fossae and interspaces equally pronounced on both sides. One-sided enlargement or decreasing of the chest (asymmetry) due to the pulmonary and pleural diseases are of great diagnostic value. These changes can transient or permanent.



STATIC INSPECTION OF THE CHEST

Symmetry of the chest

- *Enlarged volume of one half of the chest* observes in accumulation of considerable amount of fluid (exudates, transudate, blood, pus) in the pleural cavity, or in penetration of air inside the chest in injuries (pneumothorax).
- During examination of the enlarged part of the chest you can see asymmetry of the clavicles; leveling or protrusion of the interspaces, and they more wide; the distance between nipple and median line, and from inside edge of scapula to the spine on affected side is larger than on healthy one. Enlarged part of the chest lags in the breathing act. The patient slightly bends to the affected side of the chest. The chest assumes normal symmetrical shape after the fluid or air is removed from the pleural cavity.

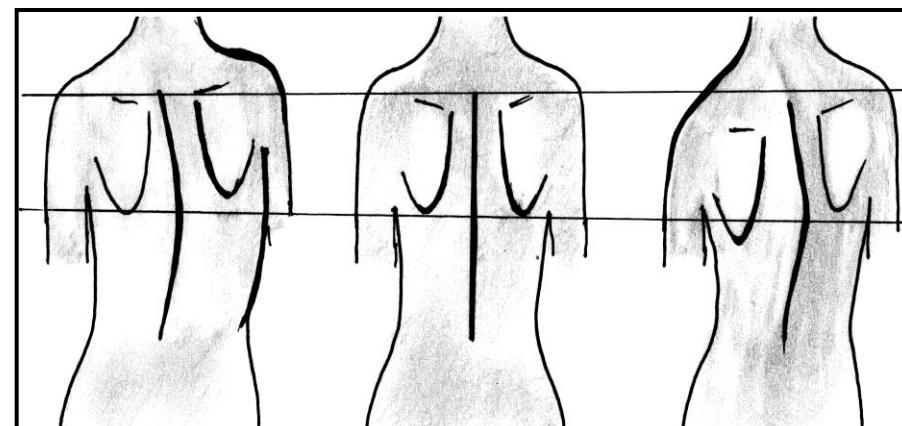
STATIC INSPECTION OF THE CHEST

Symmetry of the chest

Decreased volume of the one part of the chest observes in:

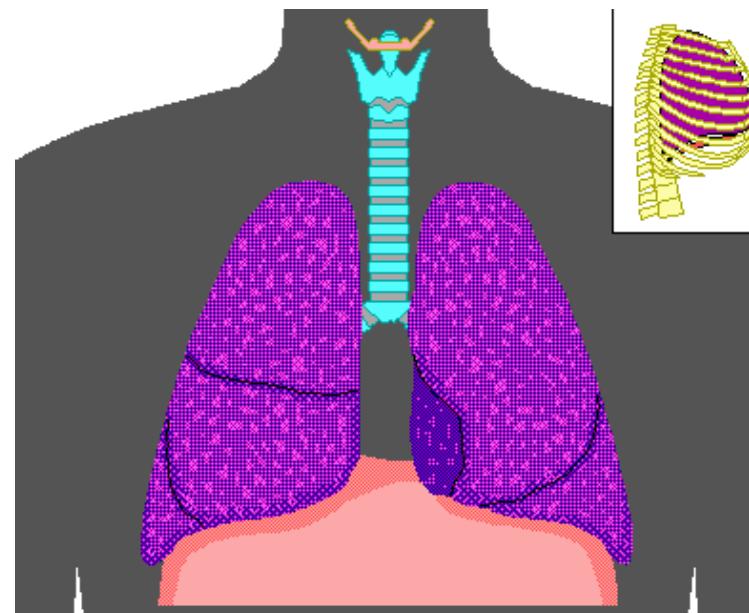
- contraction of a considerable portion of the lung due to the growth of connective tissue – pneumosclerosis, after acute or chronic inflammatory processes, such as acute pneumonia (with subsequent carnification of the lung), lung infarction, pulmonary abscess, tuberculosis;
- pleural adhesion or contraction of the pleural membranes after resorption of fluid;
- obstructive atelectasis;
- resection of a part or the entire lung.

During examination of the decreased part of the chest you can see that the shoulder and clavicle lowers, supra- and infraclavicular fossae are more depressed, the interspaces are decreased in size or invisible, the nipple is nearer to the sternum as compared with healthy side, and the scapula lowers. The respiratory movement of clavicle and scapula become slower and limited on affected side.



DYNAMIC INSPECTION OF THE CHEST

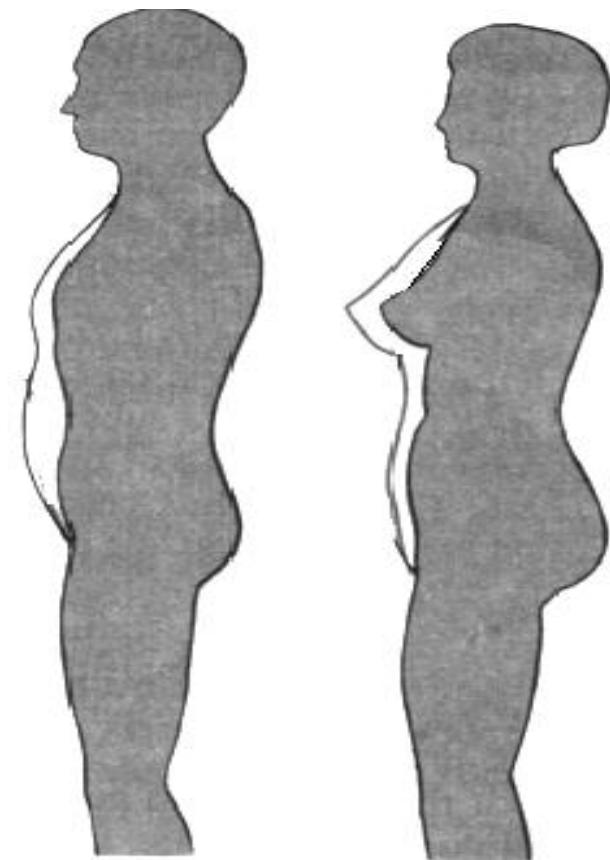
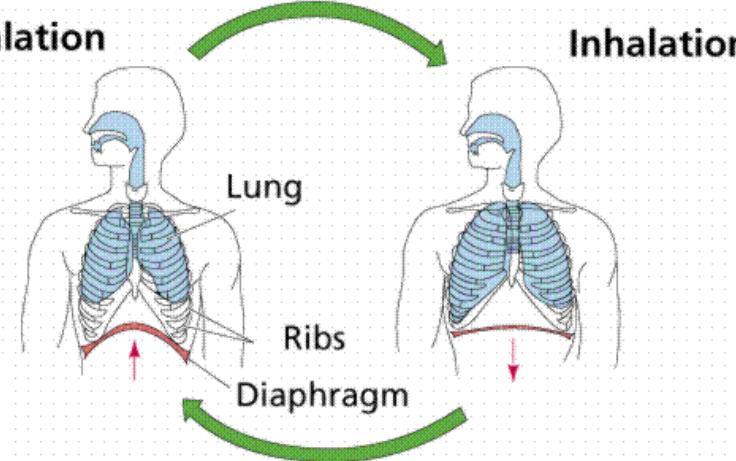
- In dynamic inspection of the chest the pattern of breathing (type of respiration, participation of the chest wall in breathing act, respiration rate, depth and rhythm) must be observed.



DYNAMIC INSPECTION OF THE CHEST

The type of respiration:

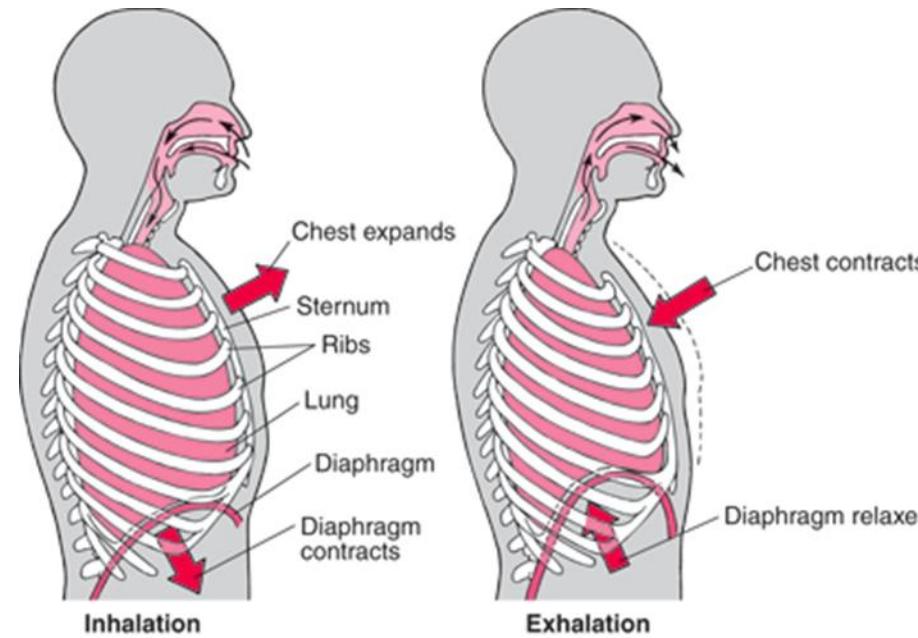
- Thoracic;
- Abdominal; Exhalation
- Mixed;



DYNAMIC INSPECTION OF THE CHEST

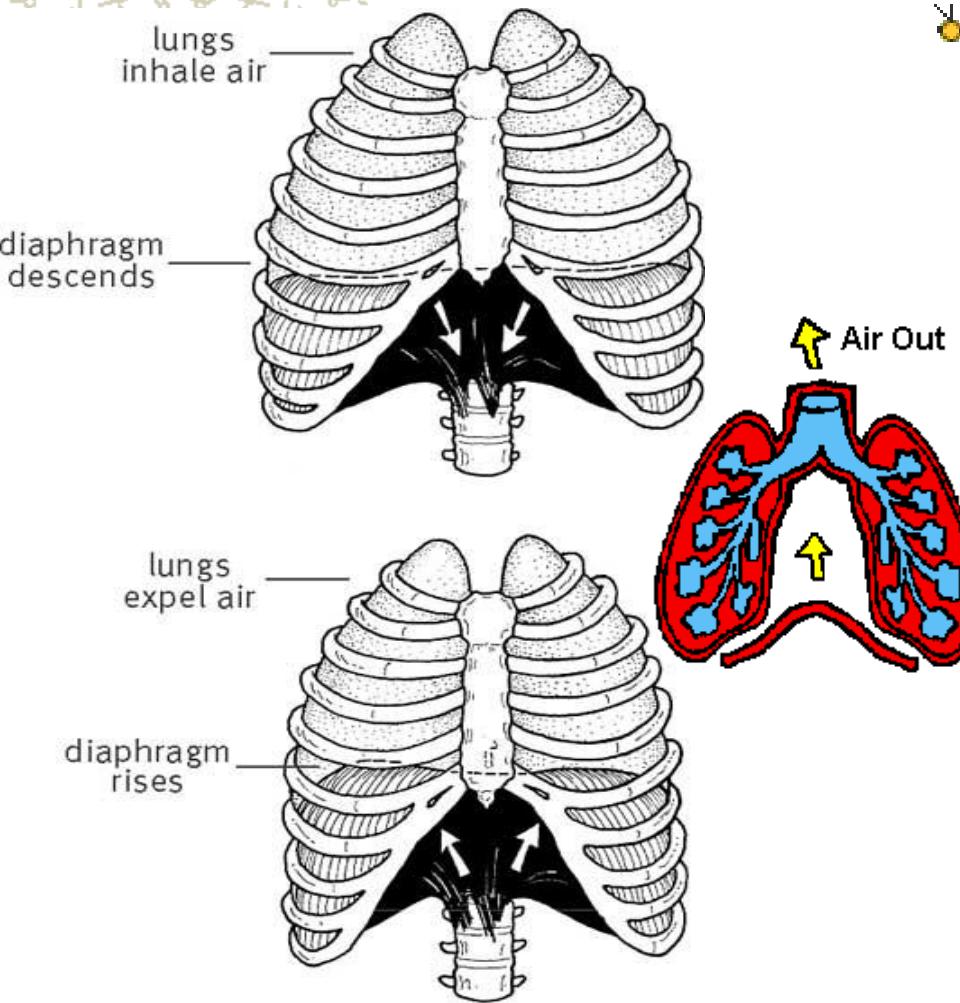
Respiration type

Thoracic (costal) respiration. Mainly the intercostals muscles carry out respiratory movements. In *inspiration* the intercostals muscles contract and elevate the ribs, these movements increase the internal capacity of the lungs. As the thoracic wall expands, the lungs also expand and draw in air. In *expiration*, the thoracic capacity decreases as the inspiratory muscles relax – the lungs then shrink by their own elasticity. This type of breathing is known as costal and is mostly characteristic of women



DYNAMIC INSPECTION OF THE CHEST

Respiration type

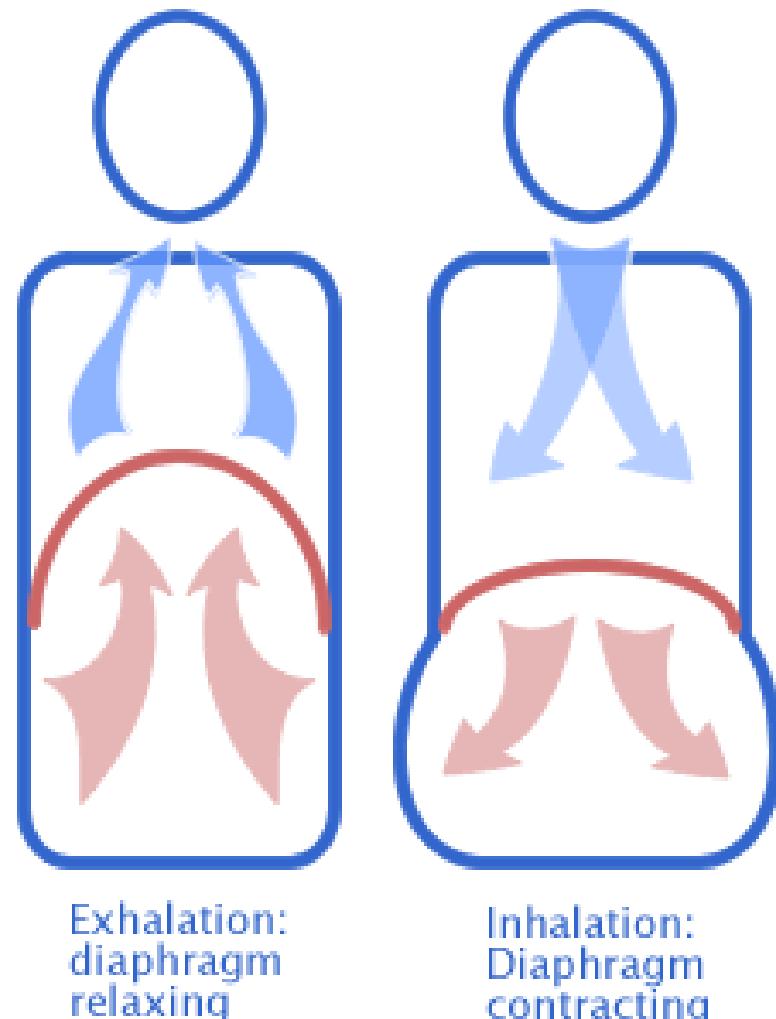


💡 **Abdominal respiration.** The diaphragm is the primary muscle in this type of respiration. In *inspiration* the diaphragm contracts, descends in the chest and enlarges the thoracic cavity. The thoracic enlargement decreases intrathoracic pressure, draws air through the tracheobronchial tree into the alveoli, and expands the lungs. At the same time it compresses the abdominal contents, pushing the abdominal wall outward. In *expiration* the chest wall and lungs recoil, the diaphragm rises passively, air flows outward, and the chest and abdomen return to their initial position. This type of breathing is also called diaphragmatic and is mostly characteristic of men.

DYNAMIC INSPECTION OF THE CHEST

Respiration type

- ★ **Mixed respiration.** The diaphragm and the intercostals muscles simultaneously carry out respiratory movements. This type of respiration observes in the aged persons and some pulmonary and digestive diseases.
- ★ *In women* mixed respiration occurs in dry pleurisy, pleural adhesion, myositis, thoracic radiculitis, and lung emphysema.
- ★ *In men* mixed respiration occurs in persons with underdeveloped diaphragmatic muscle, diaphragmatitis, acute cholecystitis, perforating ulcer.



DYNAMIC INSPECTION OF THE CHEST

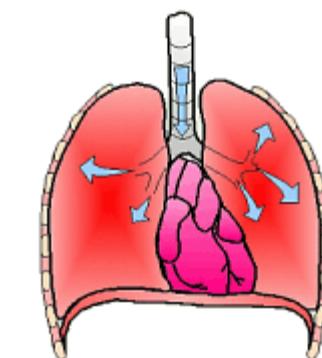
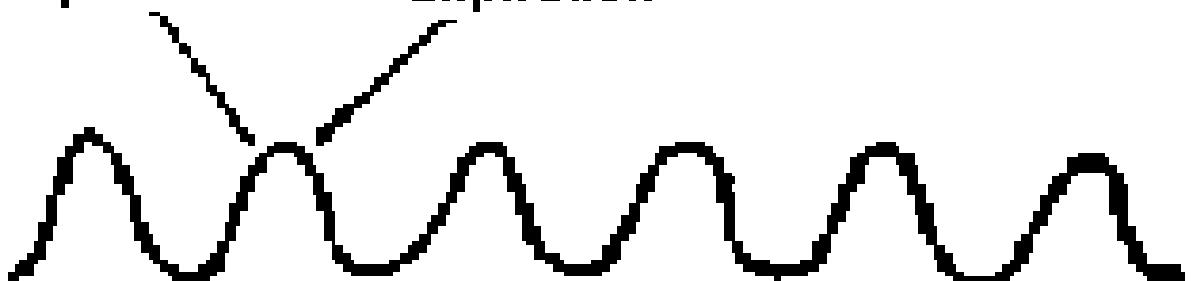


Respiration rate

The repeated cycles of inspiration followed by expiration (*respiratory cycle*) occur in adults at rest about 16-20 times per minute (the *respiratory rate*), with inspiration lasting approximately 2 seconds and expiration 3 seconds

Inspiration

Expiration

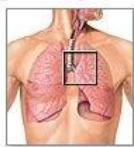


Normal breathing

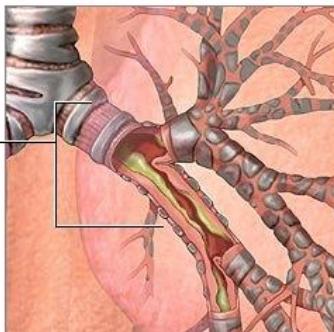
DYNAMIC INSPECTION OF THE CHEST

Respiration rate

- Pathological rapid breathing above 20 per minute is called **tachypnea**



Inflamed primary and secondary bronchi



Acute bronchitis usually results from an infection such as a cold or flu

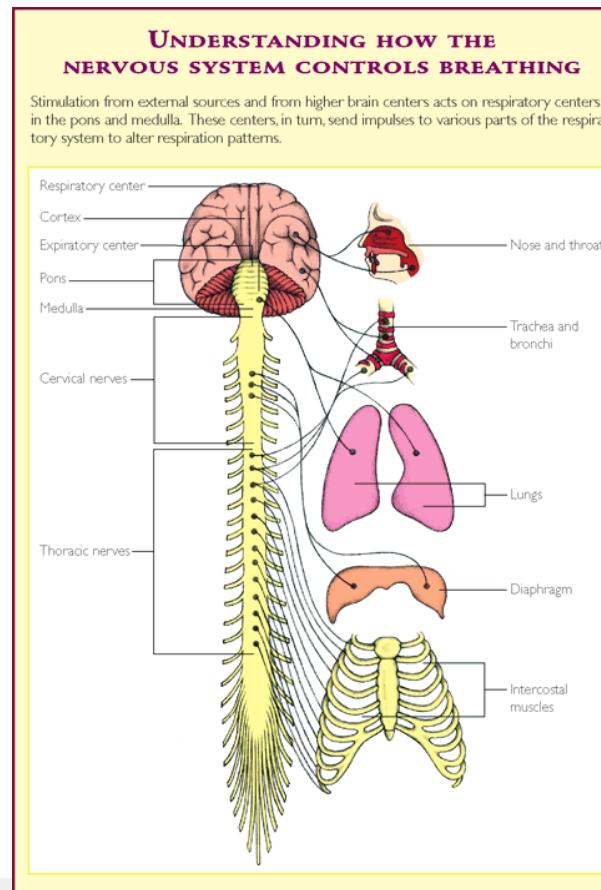
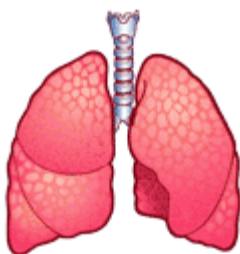
©ADAM.

- Tachypnea has a number of causes:
 - conditions associated with **decreased respiratory surface of the lungs:** inflammation, tuberculosis, compressive atelectasis (hydrothorax, pneumothorax, mediastinal tumor), obstructive atelectasis, pulmonary emphysema, and pulmonary edema;
 - narrowing of the small bronchi** due to spasm or diffuse inflammation of their mucosa (bronchiolitis), which interfere normal air passage into alveoli;
 - shallow respiration** as a result of difficult contractions of the respiratory muscles in acute pain (dry pleurisy, acute myositis, intercostals neuralgia, rib fracture) and in elevated abdominal pressure and high diaphragm level (ascitis, meteorism, late pregnancy).

DYNAMIC INSPECTION OF THE CHEST

Respiration rate

- Pathological slow breathing below 16 per minute is called **bradypnea**



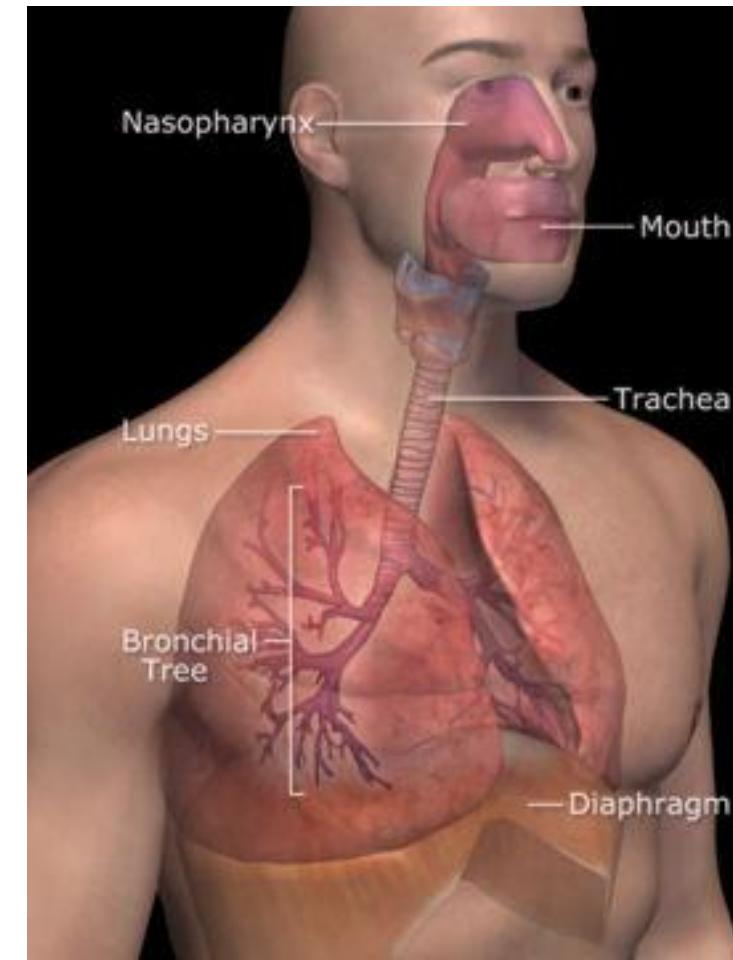
Bradypnea may be secondary to such causes as increased intracranial pressure (cerebral tumor, hemorrhage, meningitis, brain edema) due to inhibition of the respiratory center, and also due to the toxic effect on respiratory center in uremia, diabetic or hepatic coma, and drug-induced respiratory depression.



DYNAMIC INSPECTION OF THE CHEST

Respiration depth

- The volume of the inhaled and exhaled air at rest in adults varies from 300 to 900 ml (500 ml on the average). Depending on depth, breathing can be shallow or deep.



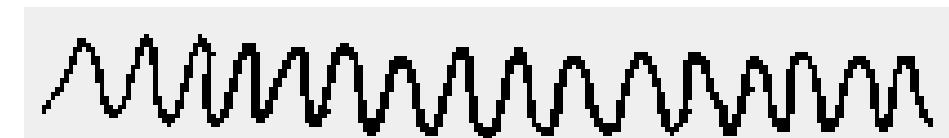
DYNAMIC INSPECTION OF THE CHEST

Respiration depth

★ **Shallow respiration** is characterized by short inspiratory and expiratory phases. Shallow breathing is usually rapid.



★ In some cases, however, shallow respiration can be slow due to inhibition of the respiratory center, pronounced pulmonary emphysema, and sharp narrowing of the vocal slit or trachea.



DYNAMIC INSPECTION OF THE CHEST

Respiration depth

★ **Deep respiration** is characterized by elongation of the inspiratory and expiratory phases. As a rule, deep respiration is slow.



★ Rapid deep breathing has several causes, including exercise, anxiety, fever, anemia, and metabolic acidosis.



DYNAMIC INSPECTION OF THE CHEST

Respiration depth

Deep rapid breathing, with marked respiratory movements, accompanied by noisy sound is called

Kussmaul respiration.

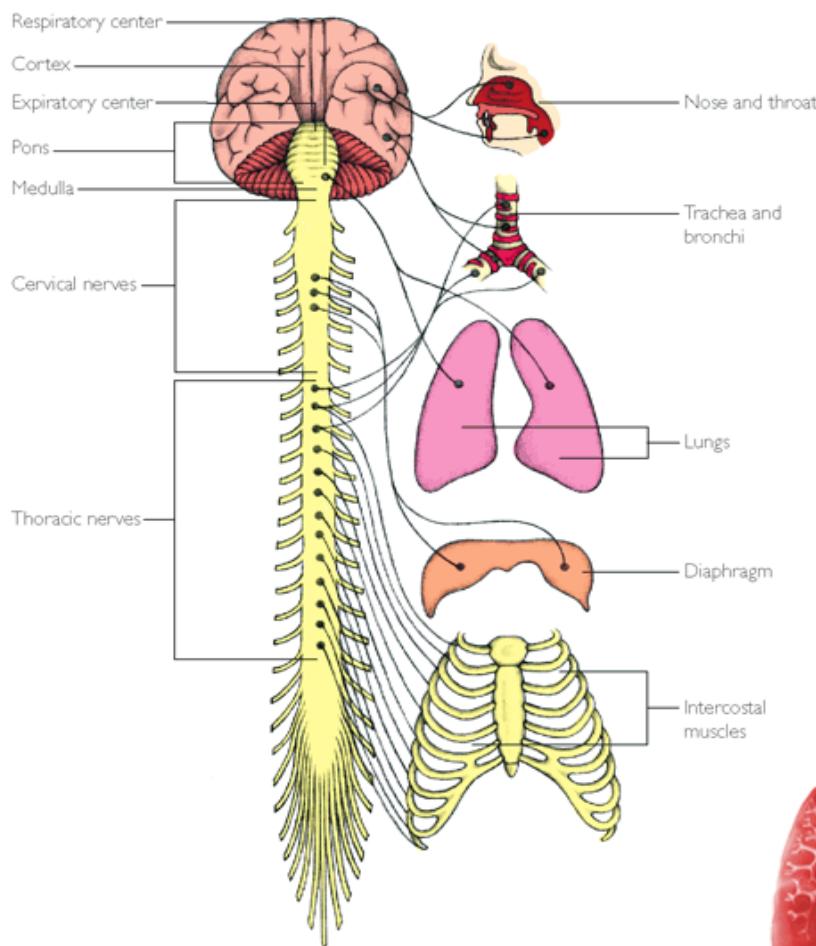
This type of breathing observes in the comatose patients due to metabolic acidosis.



DYNAMIC INSPECTION OF THE CHEST

UNDERSTANDING HOW THE NERVOUS SYSTEM CONTROLS BREATHING

Stimulation from external sources and from higher brain centers acts on respiratory centers in the pons and medulla. These centers, in turn, send impulses to various parts of the respiratory system to alter respiration patterns.



Respiration rhythm

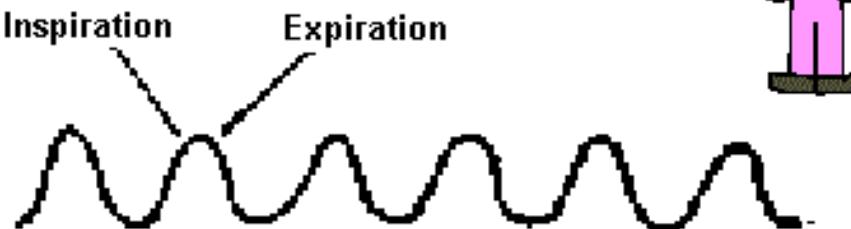
- 💡 A normal rhythm of breathing is controlled by groups of nerve cells in the brainstem, called the *respiratory center*. These nerve cells send impulses down the spinal cord to act on the spinal nerve fibers that supply the diaphragm and intercostals muscles.



DYNAMIC INSPECTION OF THE CHEST

Respiration rhythm

Respiration of a healthy person is **rhythmic**, and characterized by uniform depth, and approximately equal duration of inspiratory and expiratory phases



In depression of the respiratory center breathing becomes **arrhythmic**. Periods of breathing alternate with readily detectable elongation of respiratory pause from few seconds to a minute or with apnea (temporary arrest of breathing) and also respiration may be of different depth. Such type of respiration is called *periodic* and includes Cheyne-Stokes respiration, Grocco's respiration, and Biot's respiration.

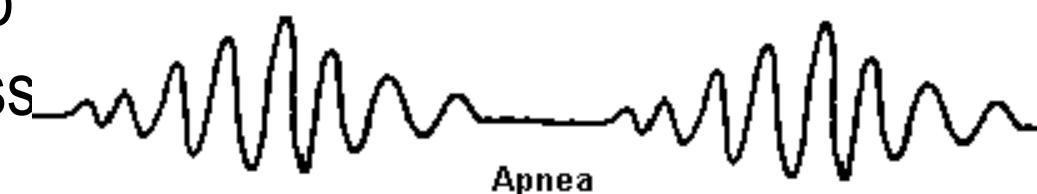
DYNAMIC INSPECTION OF THE CHEST

Respiration rhythm

Cheyne-Stokes respiration.

Noiseless shallow respiration quickly deepens, becomes noisy to attain its maximum at the 5-7 inspirations and slows down gradually. Such periods alternate with periods of apnea (from few second to a minute), during which patient can loses orientation in surroundings or even faints to recover from unconsciousness after respiration restores.

⚠ Children and aged people normally may show Cheyne-Stokes respiration in sleep. Other causes include heart failure, uremia, drug-induced respiratory depression, and brain damage (acute or chronic failure of the cerebral circulation, cerebral hypoxia, meningitis).

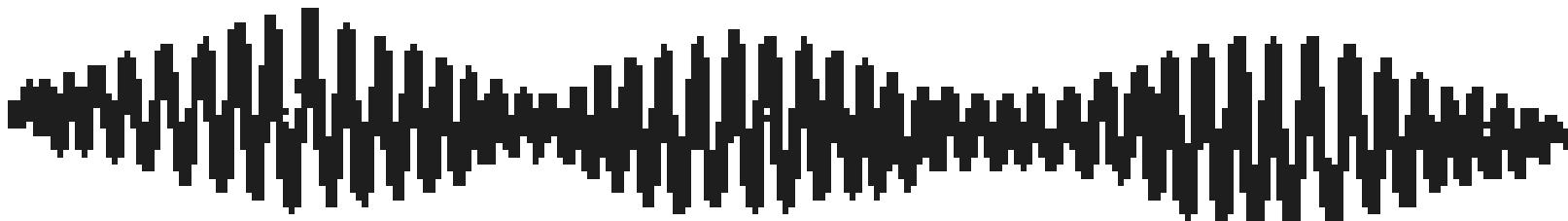


DYNAMIC INSPECTION OF THE CHEST

Respiration rhythm

★ **Grocco's respiration** resembles Cheyne-Stokes respiration except that shallow respiration occurs instead of apnea

★ Grocco's respiration is caused probably by early stages of the same conditions as Cheyne-Stokes respiration.

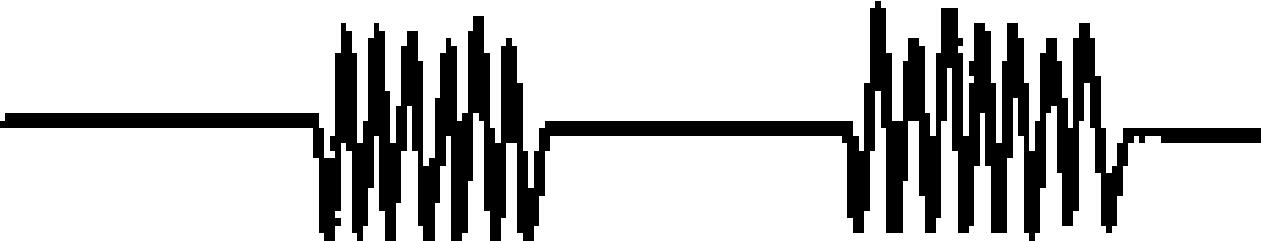


DYNAMIC INSPECTION OF THE CHEST

Respiration rhythm

✿ **Biot's respiration.** In this type of breathing deep rhythmic respiration alternate with apnea (from few seconds to half minute).

✿ Causes include respiratory depression and brain damage (meningitis, agony with disorders of cerebral circulation).



PALPATION OF THE CHEST

Palpation of the chest has three potential uses:

- assessment of elasticity of the chest;
- identification of the tender areas;
- assessment of tactile fremitus;



PALPATION OF THE CHEST

💡 ***Assessment of elasticity of the chest.***

- Assess elasticity by pressing the chest in anteroposterior and lateral directions. Place your hands parallel: right on the middle of the sternum, left – on the spine and press the chest. Then by both hands press the chest in lateral direction.



PALPATION OF THE CHEST

- The chest of a healthy person is **elastic**, and yields under the pressure. **Rigidity** of the chest indicates presence of fluid in the pleural cavity or pleural tumor, and pulmonary emphysema. In aged persons the chest become rigid due to ossification of the costal cartilages.



University of Cape Town



PALPATION OF THE CHEST

- ✿ ***Identification of tender areas.***
- ✿ Carefully palpate from the 1st interspaces on the anterior chest (5 steps), then along midaxillary lines (3 steps), and along the spine on the posterior chest (10 steps).

✿ In rib fracture pain is localized over a limited area, careful displacement of bone fractures attends by a specific sound (crunch). Intercostals tenderness commonly has musculoskeletal origin. Such pain is called superficial, it intensifies during deep breathing, and when the patient bends or lies on the affected side.

PALPATION OF THE CHEST

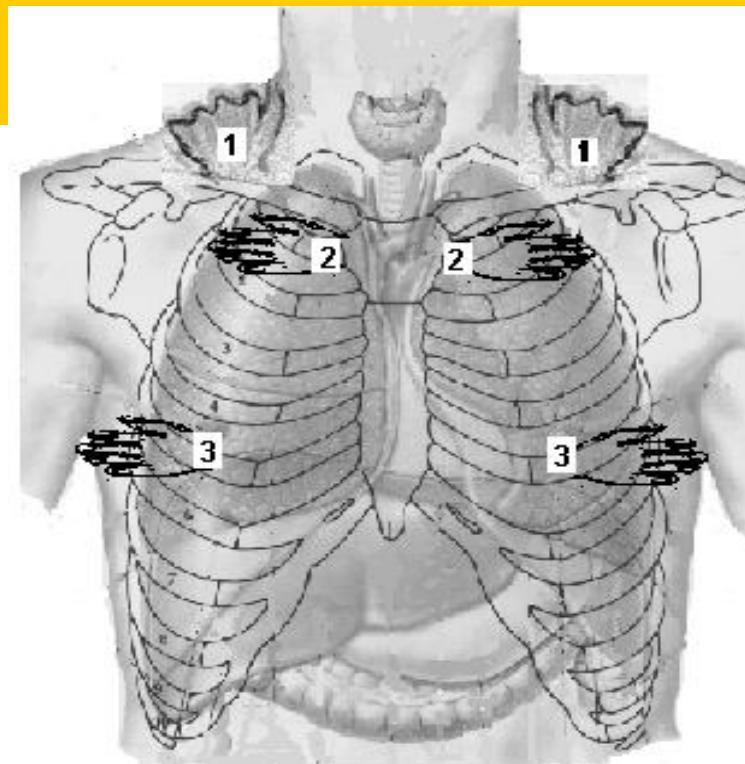
Assessment of tactile

fremitus (*vocal fremitus, s. pectoralis*). 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 faint, ask the patient to speak more loudly or in a deeper voice.
- Palpate and compare symmetrical areas of the chest, using the palms of your both hands simultaneously.

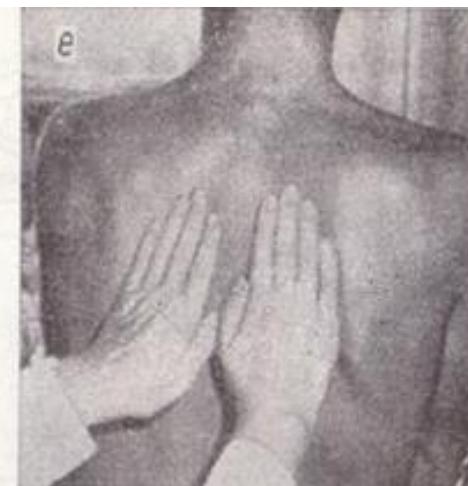
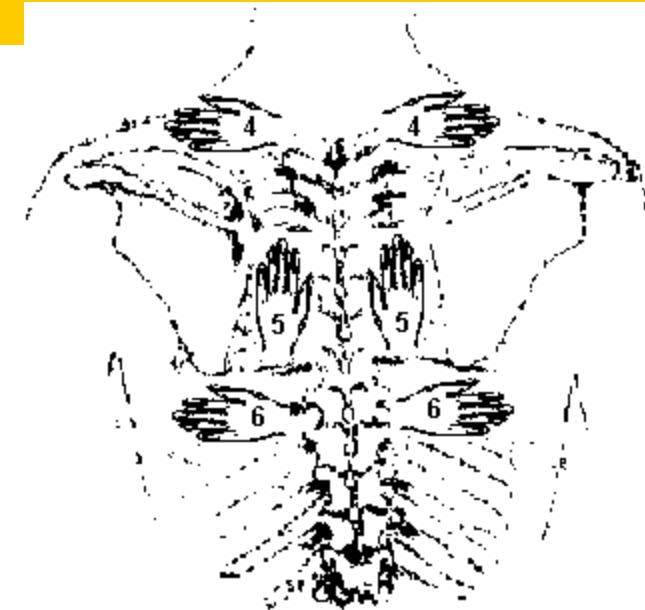
PALPATION OF THE CHEST

- Firstly, place your hands on the patient's shoulder over the lungs apices projection, then in the infraclavicular regions, and axillary regions, using the vibratory sensitivity of your hands to detect fremitus



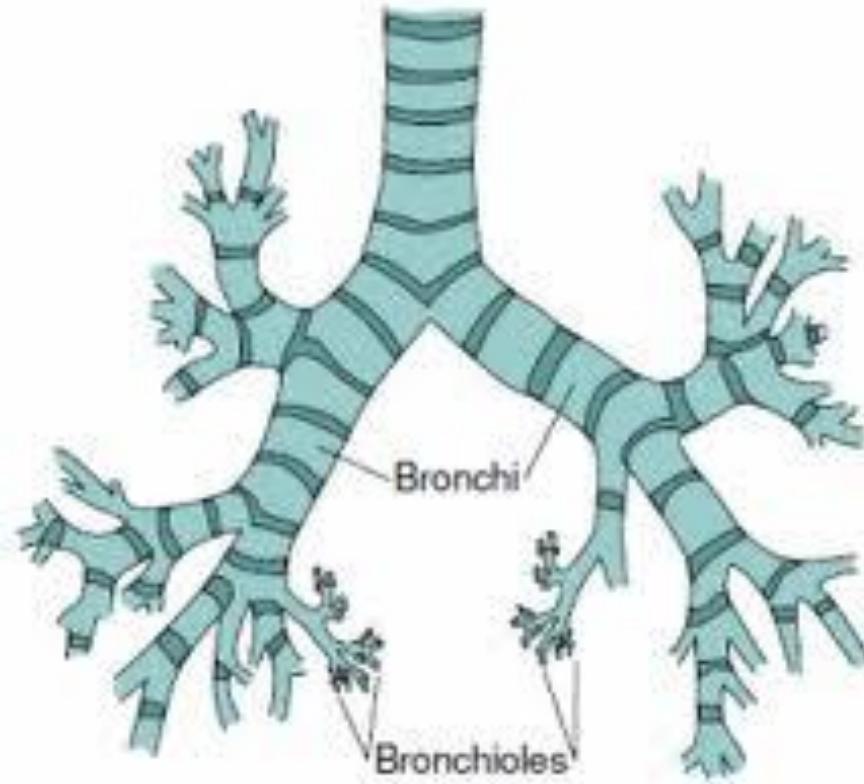
PALPATION OF THE CHEST

- Posteriorly, you should assess vocal fremitus in the supra-, inter-, and infrascapular regions





PALPATION OF THE CHEST

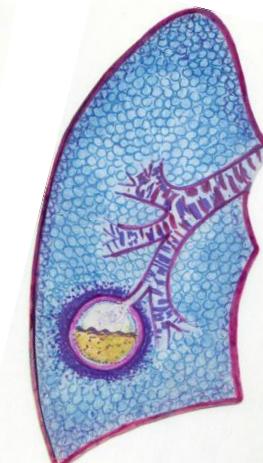
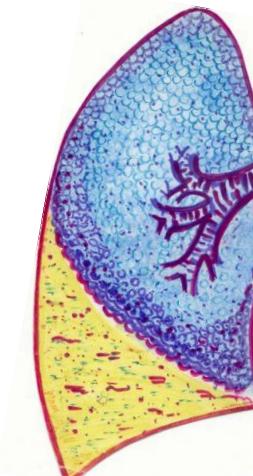


- 💡 Tactile fremitus is typically more prominent in men than in women and children; in the upper lung fields than in the lower one; and more prominent on the right side (voice transmission is better through the shorter right main bronchus) than on the left.

PALPATION OF THE CHEST

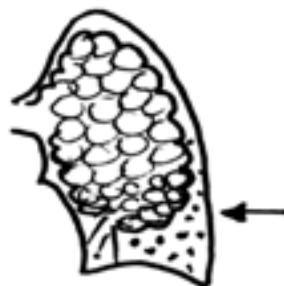
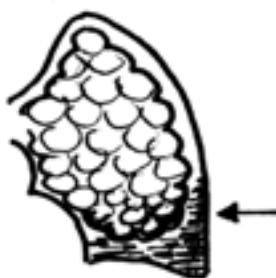
Clinical value of the vocal fremitus changing

- **Vocal fremitus** is
- increased in: consolidation of the pulmonary tissue (lobar pneumonia, pulmonary tumor, tuberculosis,
- compressive atelectasis);
- presence of the air cavity communicated with bronchus;



PALPATION OF THE CHEST

Clinical value of the vocal fremitus changing



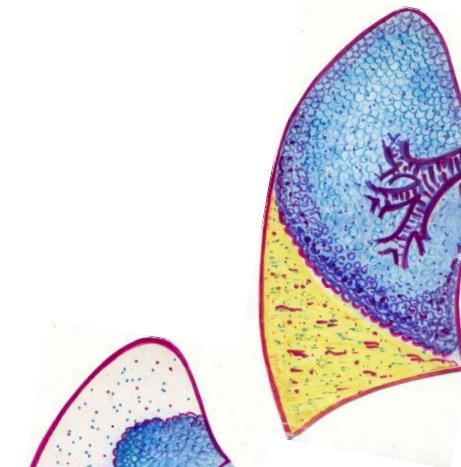
- ✿ **Vocal fremitus** is
- ✿ **decreased**: separation of the lung by moderate amount of fluid (pleural effusion) or air (pneumothorax);
obstructive atelectasis;
very thick chest wall (edema, subcutaneous fat);

PALPATION OF THE CHEST

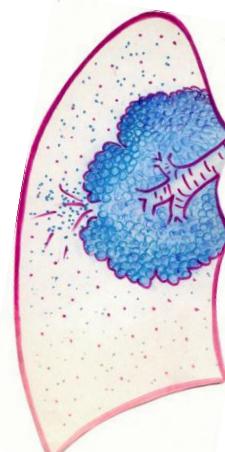
Clinical value of the vocal fremitus changing

- **Vocal fremitus**

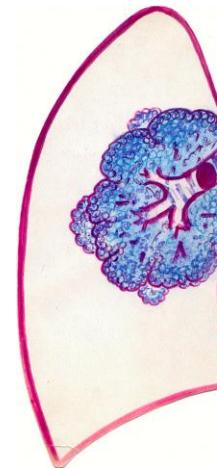
- can be absent when significant amount of fluid or air are accumulated in the pleural cavity.



Hydrothorax



Pneumothorax



**Obstructive
atelectasis**

PERCUSSION OF THE LUNGS

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



PERCUSSION OF THE LUNGS

Comparative percussion of the lungs

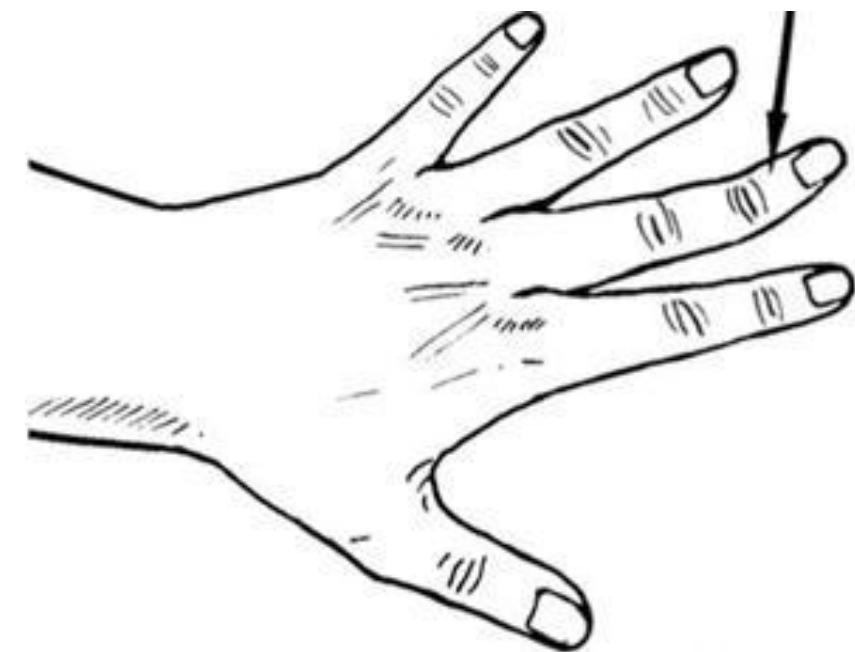
The *task* of comparative percussion is to compare percussion sounds over the lungs on the opposite parts of the chest, and also on neighboring areas on the one side.



PERCUSSION OF THE LUNGS

*The technique of
comparative
percussion.*

Percussion consists of setting up vibrations in the chest wall by means of a sharp tap. The middle finger of the left hand (pleximeter finger) is placed in close contact with the chest wall in the intercostals space.



PERCUSSION OF THE LUNGS

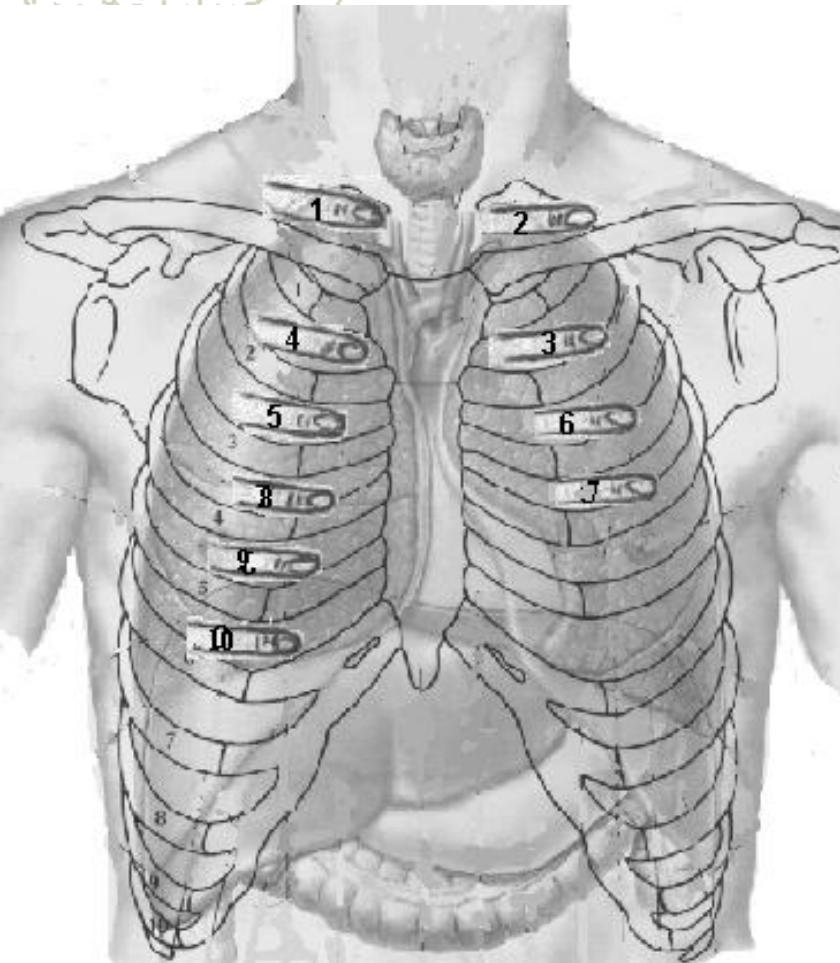
★ A firm sharp tap is then made by the middle finger of the right hand (plexor finger) kept at right angles to the pleximeter finger.

Loud percussion (with a normal force of tapping) is used.

All areas of the chest are percussed, that is, the front, both axillary regions, and back.

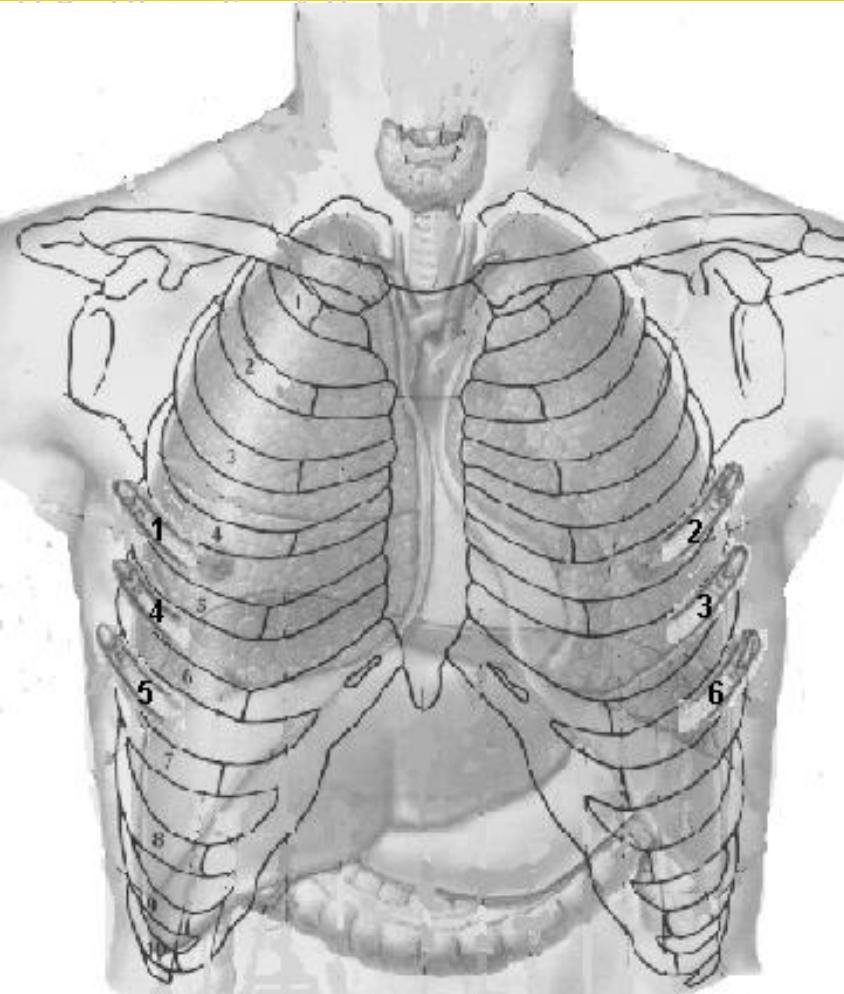


COMPARATIVE PERCUSSION OF THE LUNGS



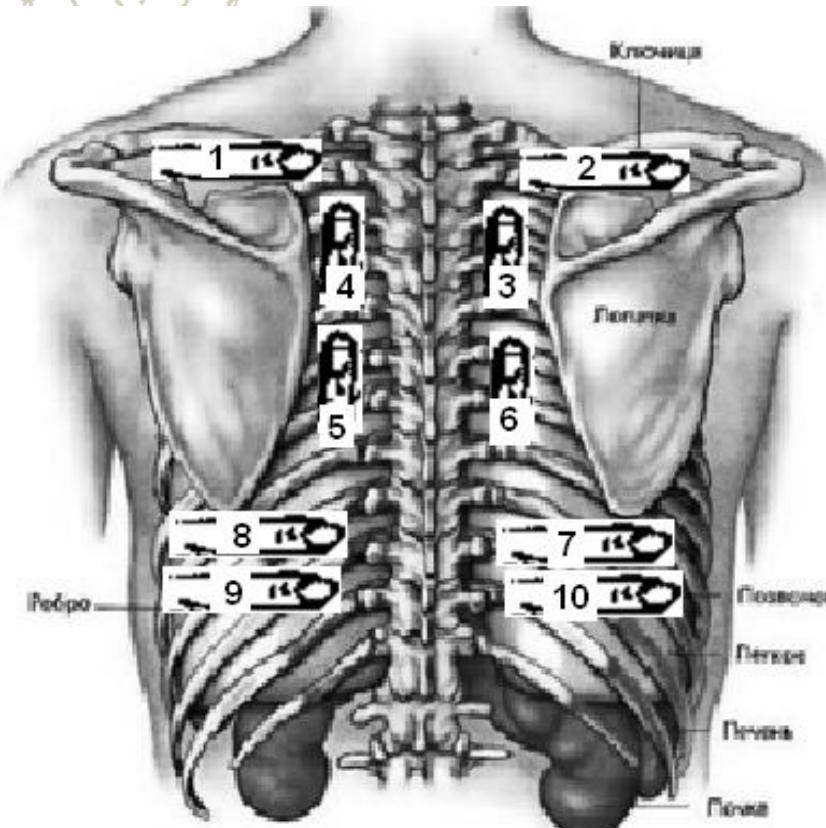
- 💡 In ***anterior percussion***, place pleximeter finger parallel to the clavicle in the right, in the left supraclavicular regions, and then along midclavicular line. On the left side percussion is carried out only to the 3rd interspace, because underlying heart below this level changes percussion sound

COMPARATIVE PERCUSSION OF THE LUNGS



✿ **Axillary regions** are percussed with the patient's arms folded at the back of the head. Percuss lateral chest along midaxillary line.

COMPARATIVE PERCUSSION OF THE LUNGS



When percussing ***posteriorly*** the patient keeps both arms crossed in front of the chest to move scapulae anteriorly. Place pleximeter finger in the suprascapular regions horizontally, in the interscapular regions vertically, and in infrascapular again horizontally.

COMPARATIVE PERCUSSION OF THE LUNGS

Percussion notes can usually be distinguished in their basic qualities of sound:
intensity, pitch, and duration.

Sounds may be loud and soft in *intensity*, depending on amount of air in the underlying organs. Sound is loud over airiness organs, and low over airless organs. Loud  Soft 

The *pitch* of the sound depends on vibration frequency. Low pitched and high pitched sounds are distinguished



Percussion sounds may be of long and short *duration*



It should be remembered that these qualities could be not equal in healthy person on symmetrical part of the chest

Location	Changes of qualities	Cause
Over the right upper lobe as compared with left one	Softer and shorter	Left upper lobe locates below the right due to the shorter right main bronchus
2nd and 3rd interspaces to the left of the sternum	Softer and shorter	Close location of the heart
Over the upper lobes of the lungs as compared with lower lobes	Softer and shorter	Smaller amount of pulmonary tissue
Right axillary region as compared with left one	Softer and shorter	Close location of the liver
Left axillary region	Louder and higher (with tympanic character)	Resonant effect of the stomach

COMPARATIVE PERCUSSION OF THE LUNGS

- The air-containing lung tissue will give a clear pulmonary sound (resonance) in percussion.
- Comparative percussion helps to determine whether the underlying tissues are air-filled, fluid-filled, or solid. The common cause of percussion notes changes include:

The common cause of percussion notes changes include:

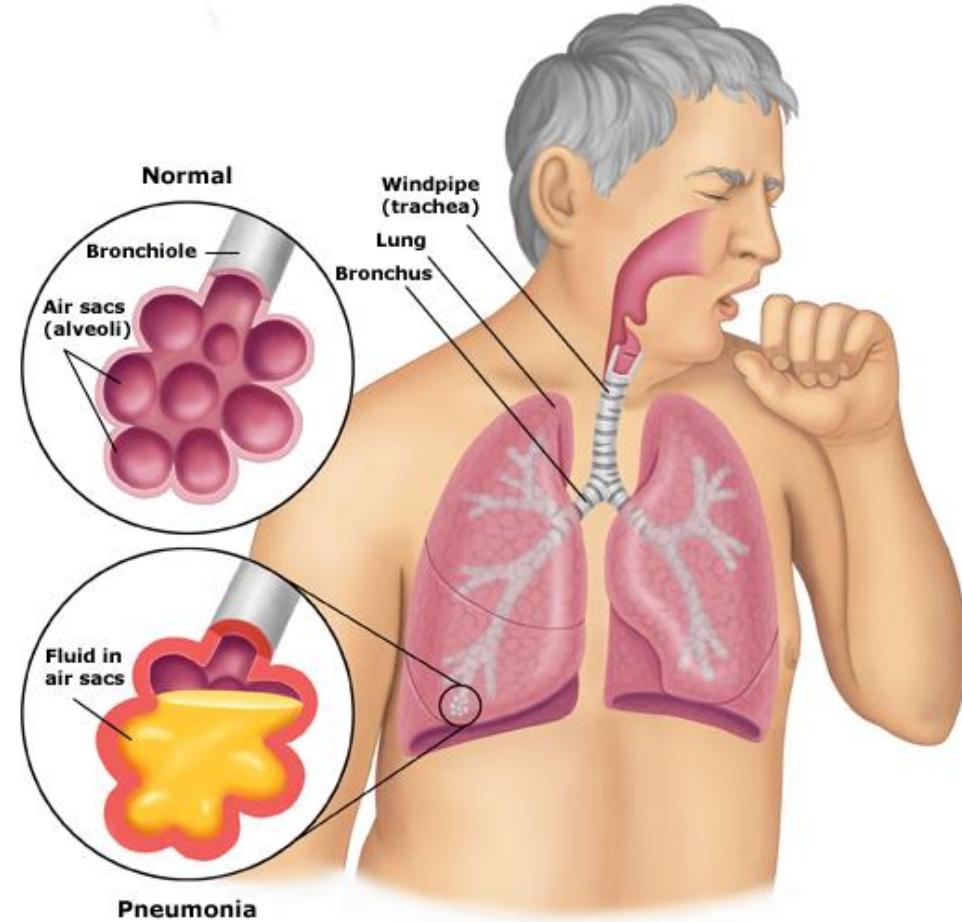
- decreased airiness of the pulmonary tissue or full absence of air in a part of the lung;
- increased airiness of the pulmonary tissue;
- pleural accumulation of fluid;
- pleural accumulation of air.

COMPARATIVE PERCUSSION OF THE LUNGS

Sound	Relative intensity	Relative pitch	Relative duration	Example location	Pathological examples
Clear pulmonary (resonance)	Loud	Low	Long	Normal lungs	---
Intermediate	Softer	Higher	Shorter	Heart covered by the lungs	Decreased airness of the pulmonary tissue
Bandbox (hyper-resonance)	Very loud	Lower	Longer	None normally	Increased airness of the pulmonary tissue
Dullness	Soft	High	Short	Liver (airless organs)	Consolidation of the pulmonary tissue, fluid
Tympany	Loud	High (with music tembre)	Long	Airless organs	Large pneumothorax, cavity filled with air
Metallic	Soft			None normally	Large cavity
Cracked-pot				None normally	Superficial cavity

COMPARATIVE PERCUSSION OF THE LUNGS

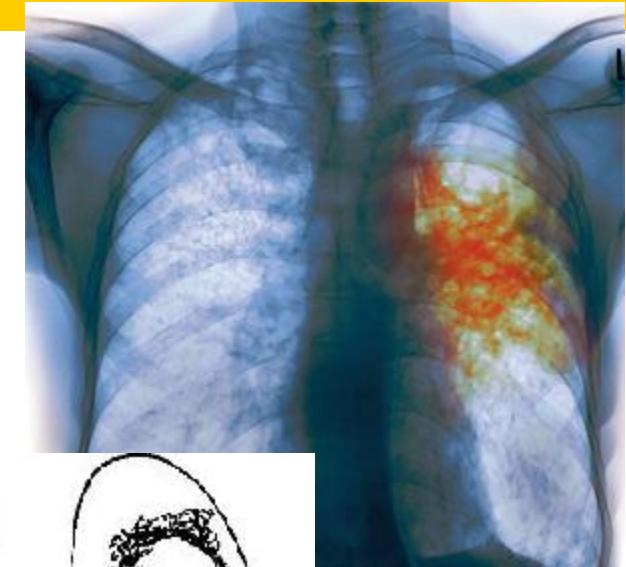
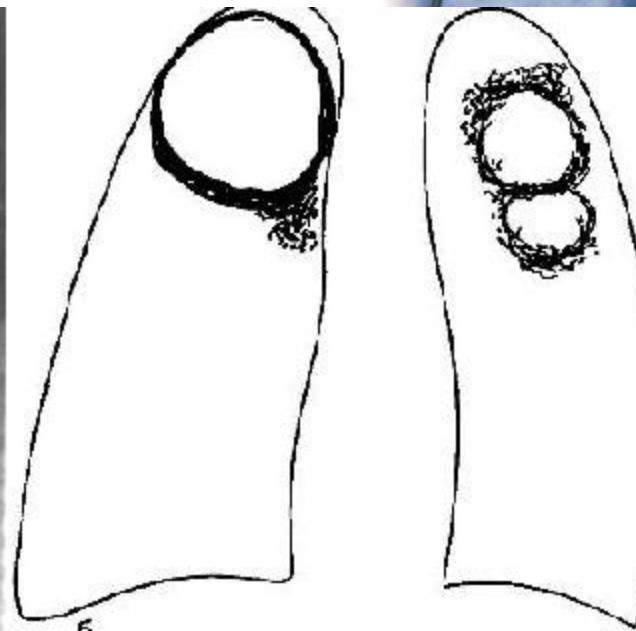
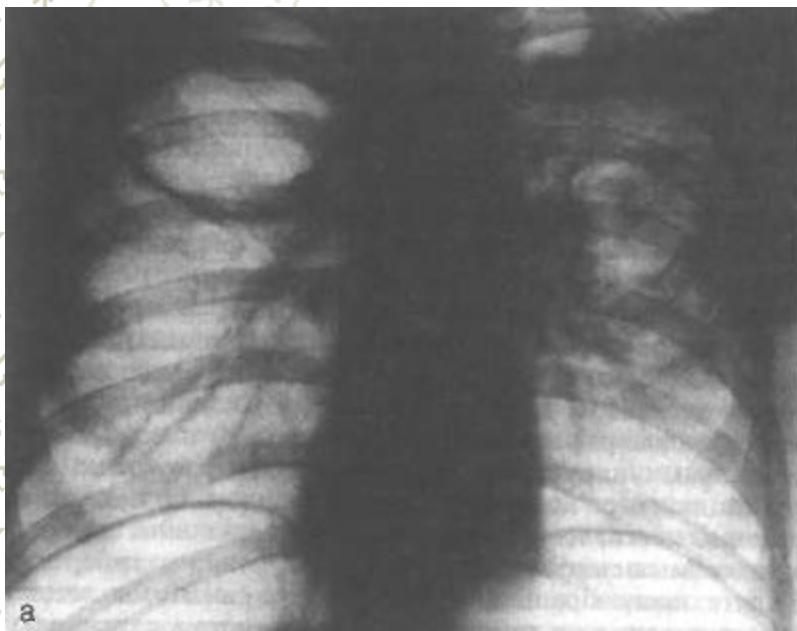
- In decreased amount of air in the lungs clear pulmonary sound becomes duller, that is **intermediate**. Causes include:
- lobar pneumonia initial stage, when alveoli in addition to air contain also a small amount of fluid, or when air-containing tissue alternates with consolidations;



COMPARATIVE PERCUSSION OF THE LUNGS

intermediate sound

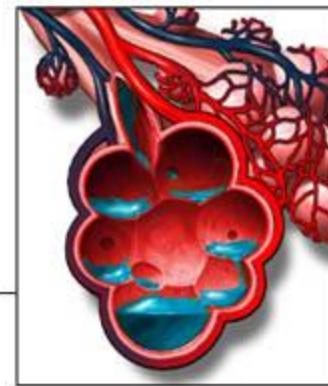
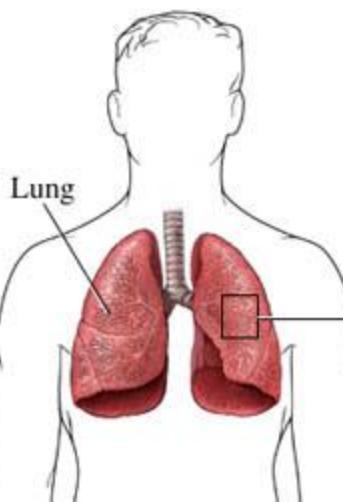
- pneumosclerosis,
fibrous-focal
tuberculosis;



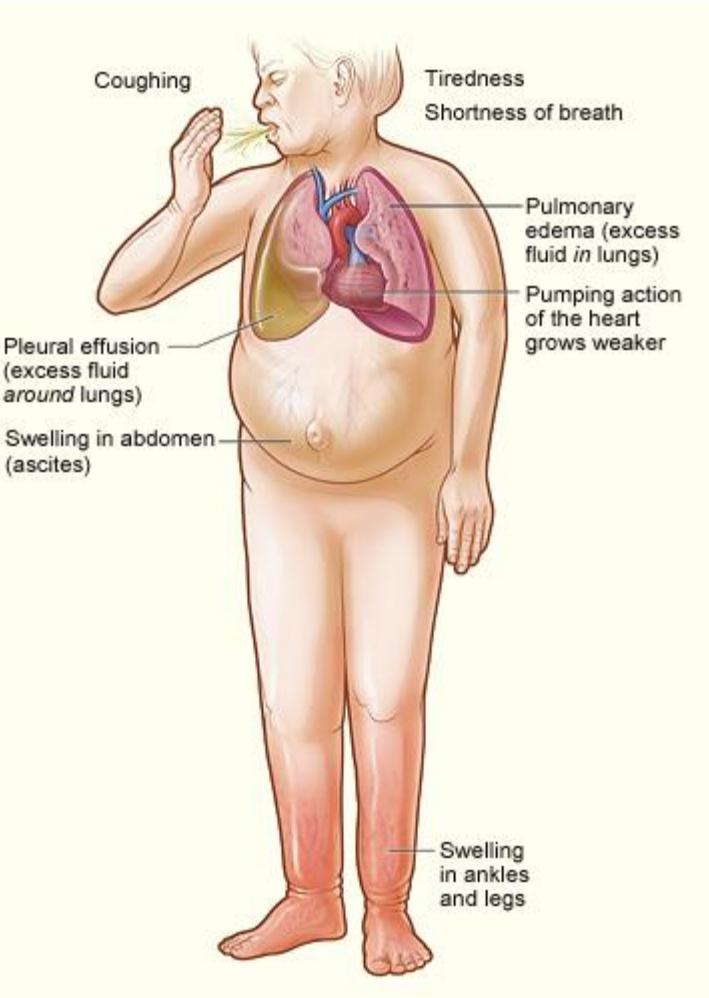
COMPARATIVE PERCUSSION OF THE LUNGS

intermediate sound

- pulmonary edema due to the left ventricular failure;



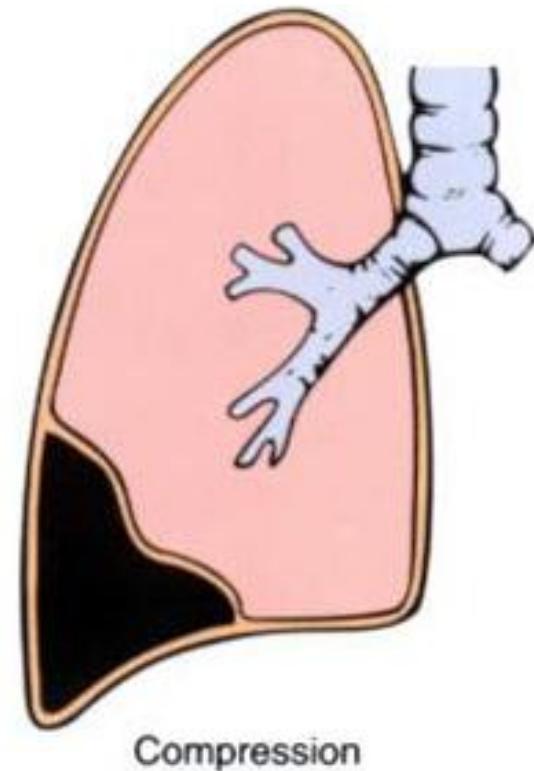
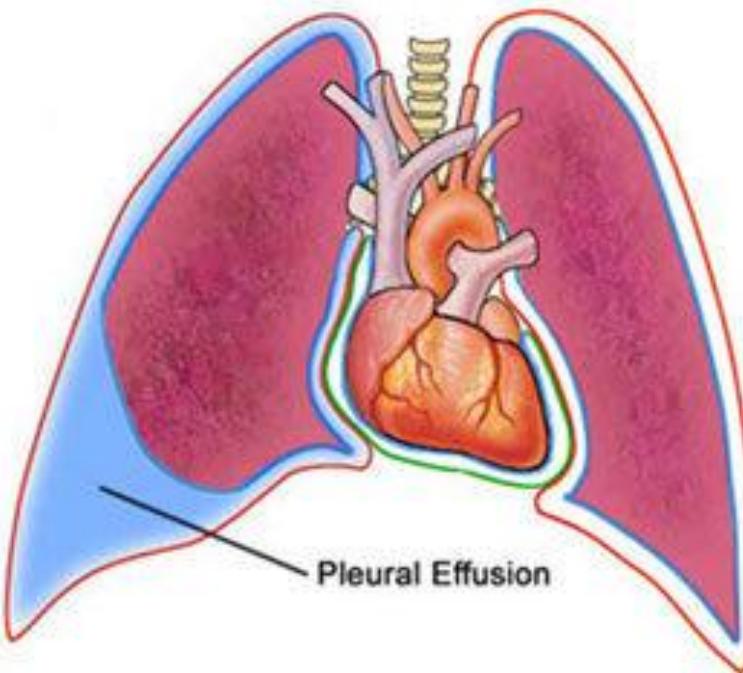
Accumulation of fluid in the air sacs (alveoli) in the lungs



COMPARATIVE PERCUSSION OF THE LUNGS

intermediate sound

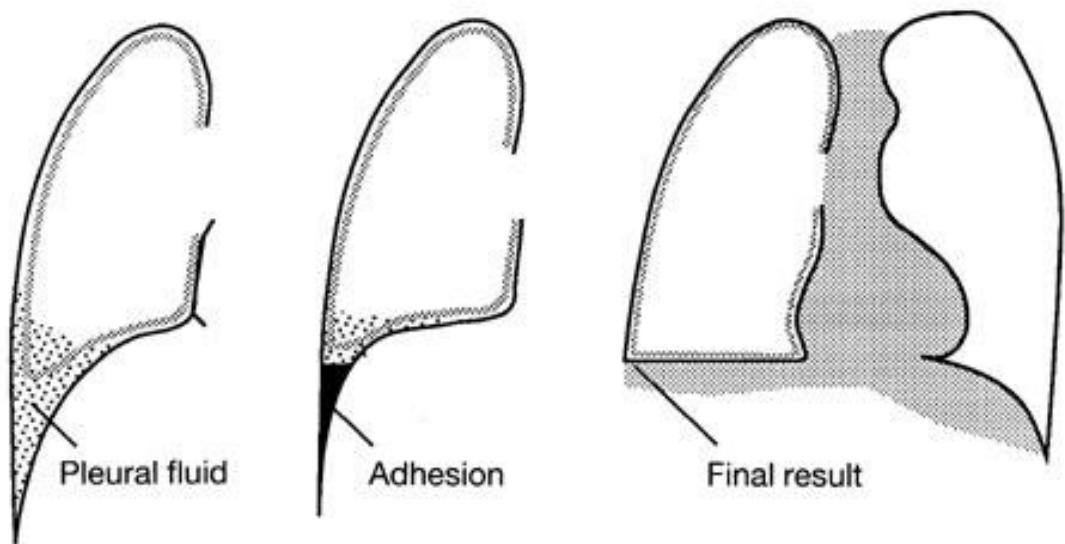
- compressive atelectasis
(above fluid level);



COMPARATIVE PERCUSSION OF THE LUNGS

intermediate sound

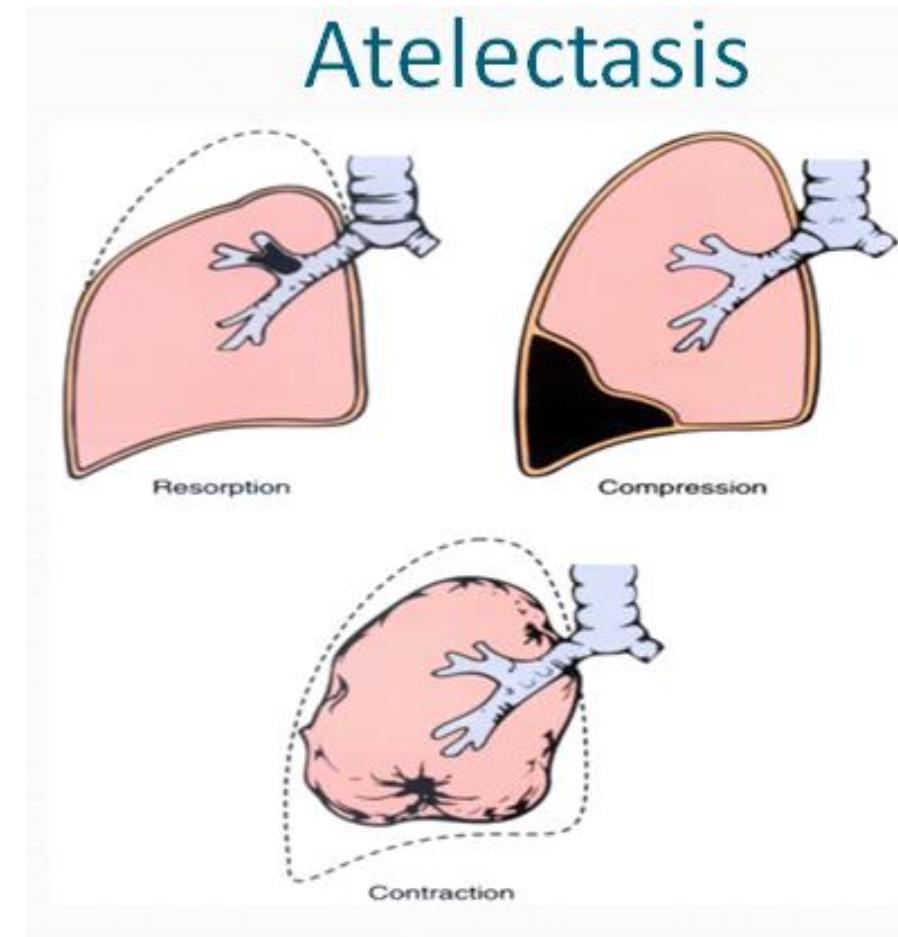
- pleural adhesion or obliteration, which interferes with normal distension of the lungs during inspiration;



COMPARATIVE PERCUSSION OF THE LUNGS

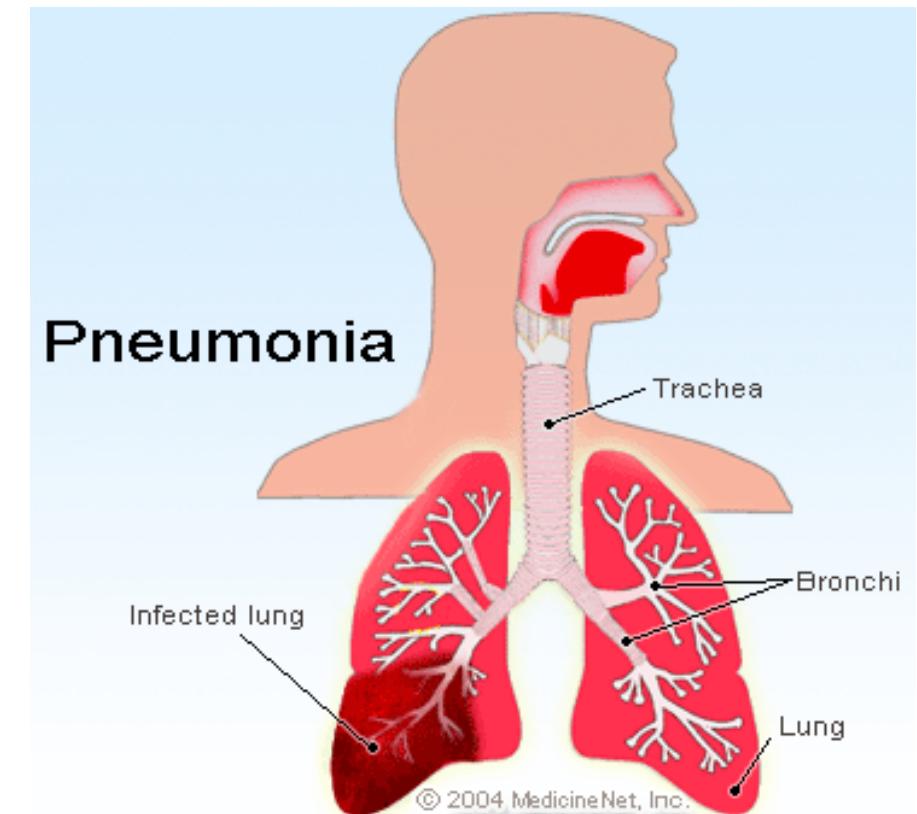
intermediate sound

- obstructive atelectasis due to gradual resorption of air from the lungs below obstruction.



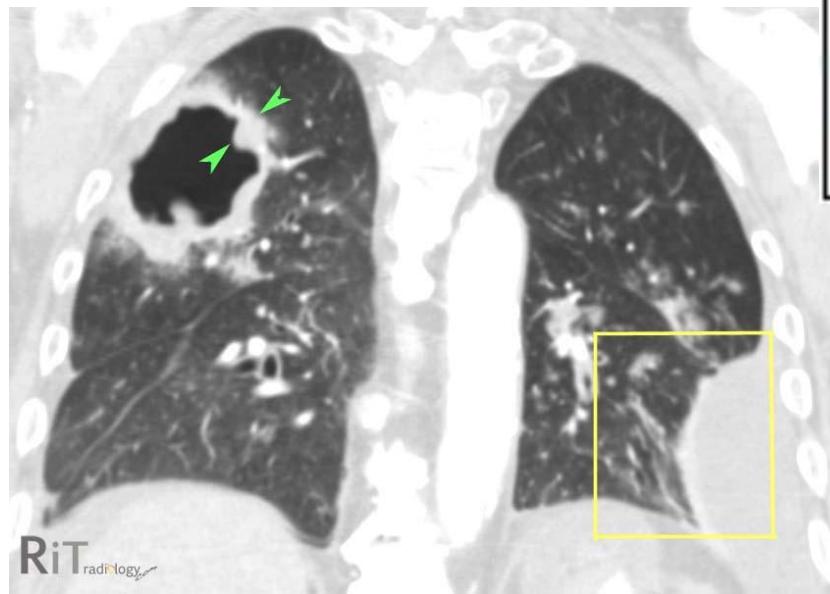
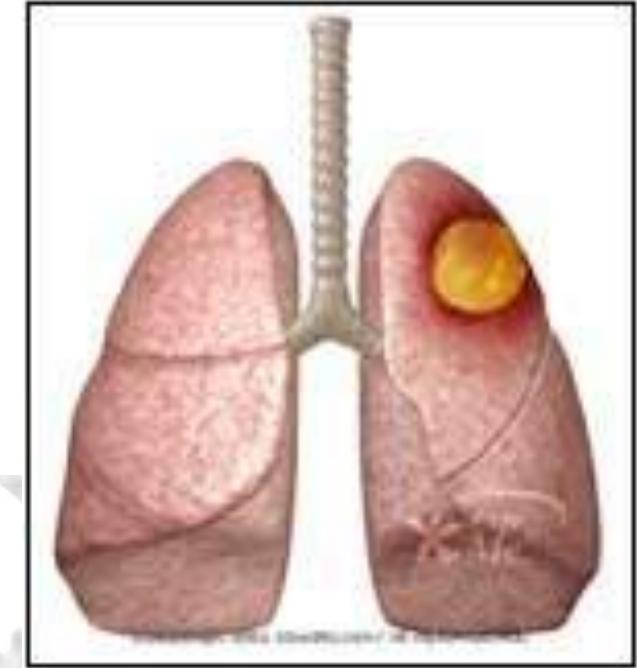
COMPARATIVE PERCUSSION OF THE LUNGS

- Dullness replaces resonance when solid tissue replaces air-containing lungs in such conditions as:
- acute lobar pneumonia (consolidation stage), when the alveoli are filled with the exudates;



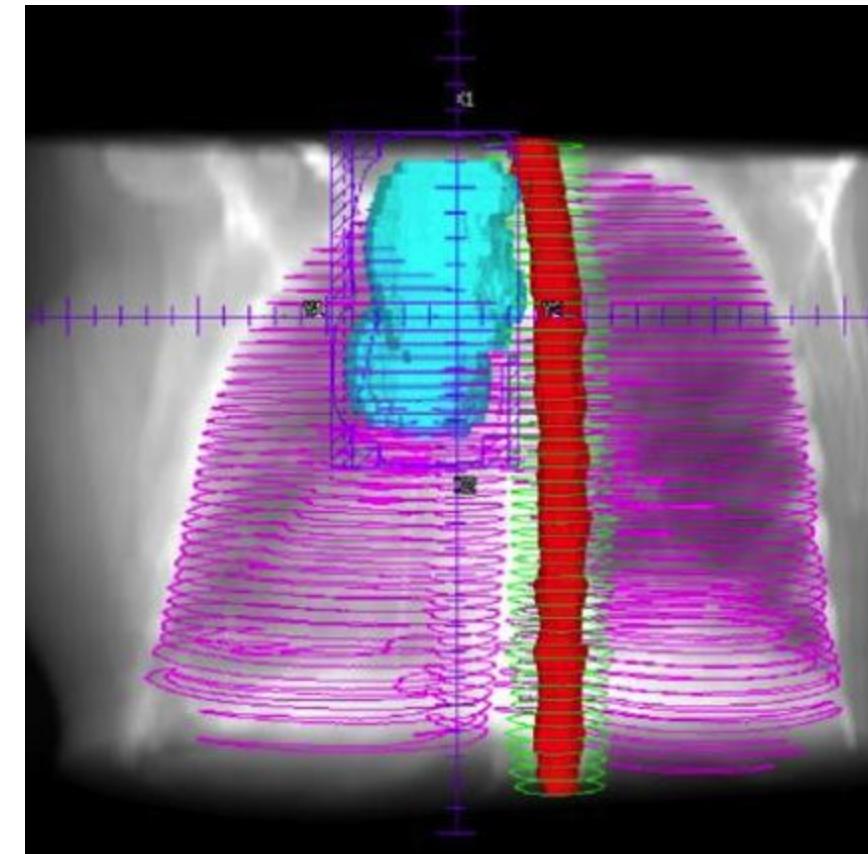
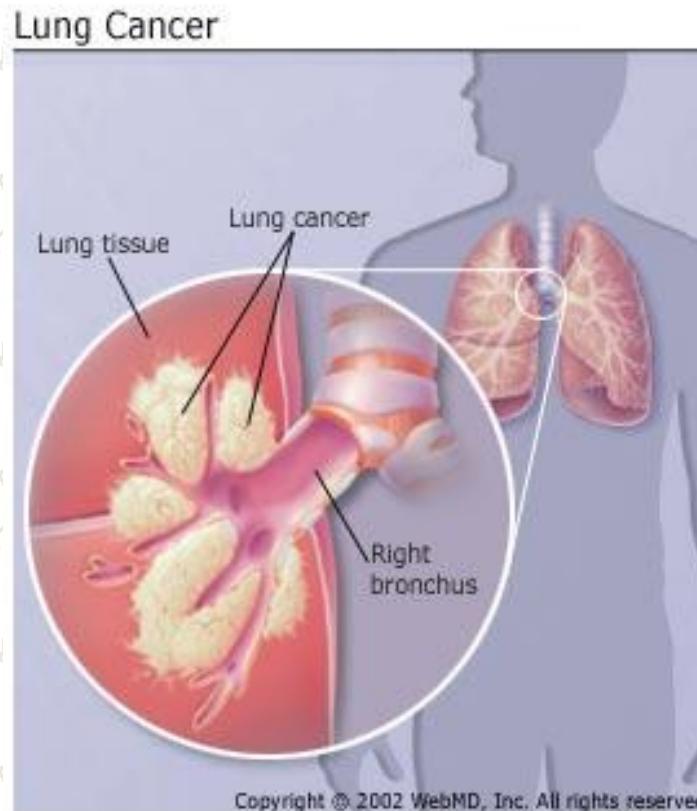
COMPARATIVE PERCUSSION OF THE LUNGS Dullness

- formation in the lung of a large cavity, which is filled with inflammatory fluid (sputum, pus, etc);



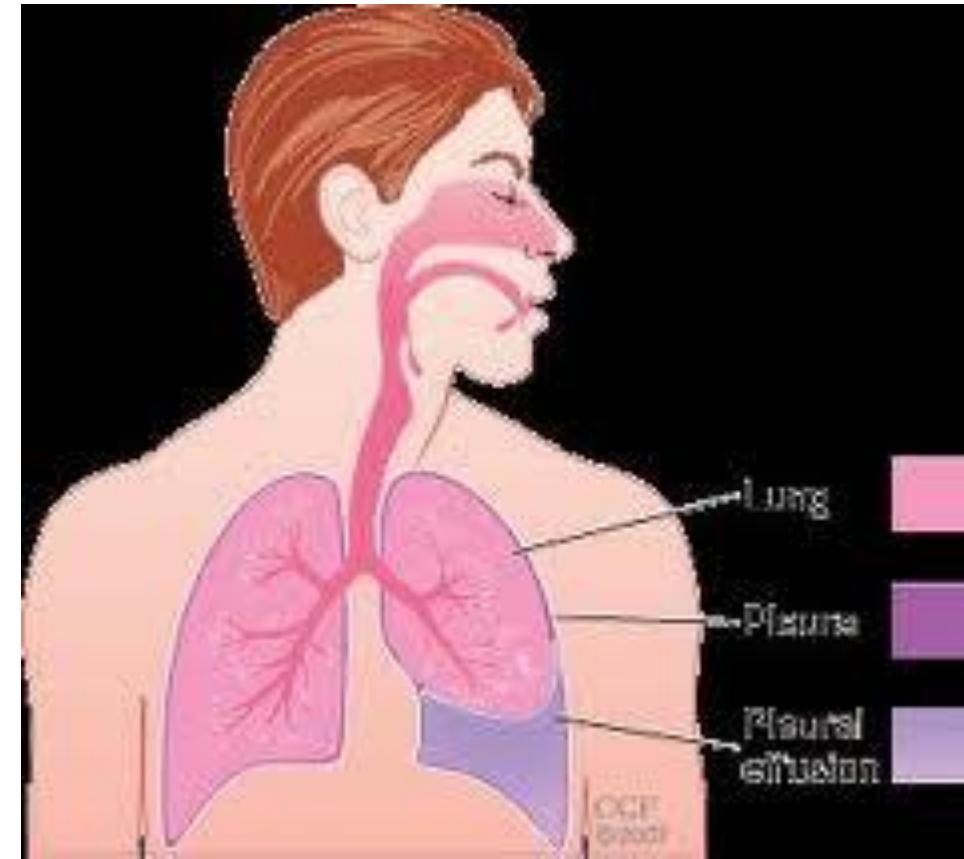
COMPARATIVE PERCUSSION OF THE LUNGS Dullness

- pulmonary tumor (airless tissue);



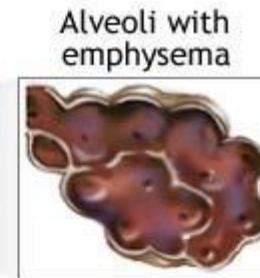
COMPARATIVE PERCUSSION OF THE LUNGS Dullness

- dullness also heard when fluid occupies the pleural space (over fluid): pleural accumulation of serous fluid (pleural effusion), blood (hemothorax), or pus (empyema).

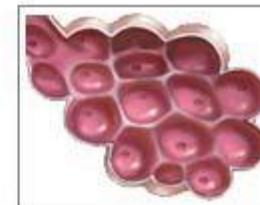


COMPARATIVE PERCUSSION OF THE LUNGS

Generalized hyperresonance (bandbox sound) may be heard over the hyper inflated lungs of emphysema.

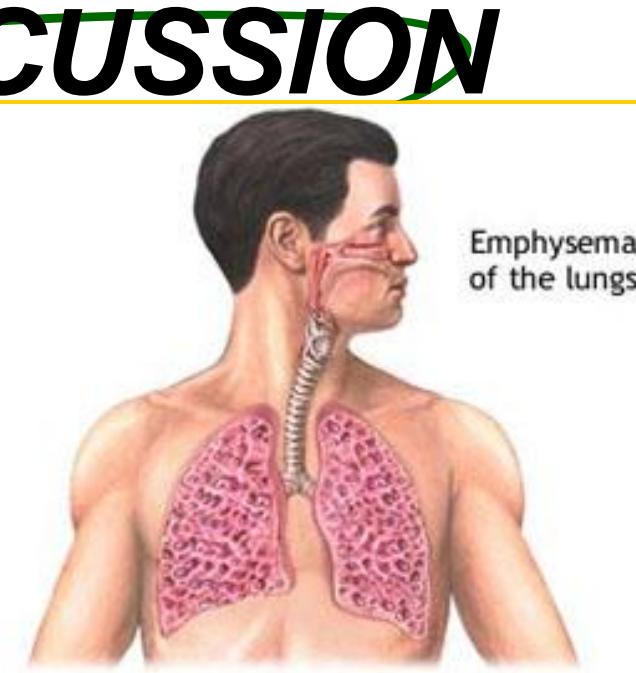


Alveoli with emphysema



Microscopic view of normal alveoli

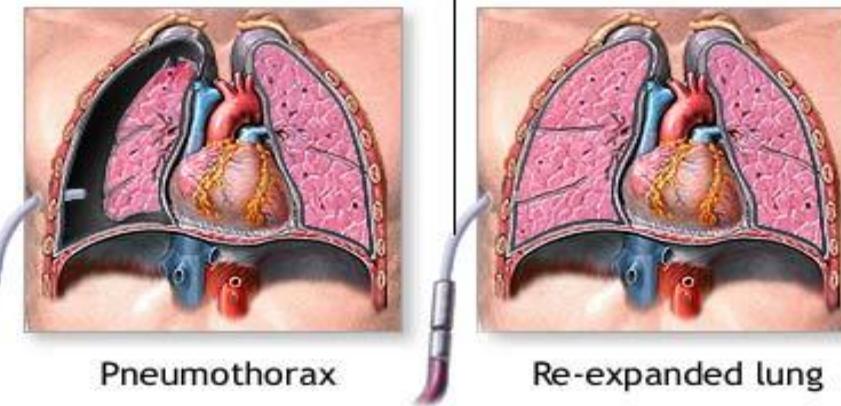
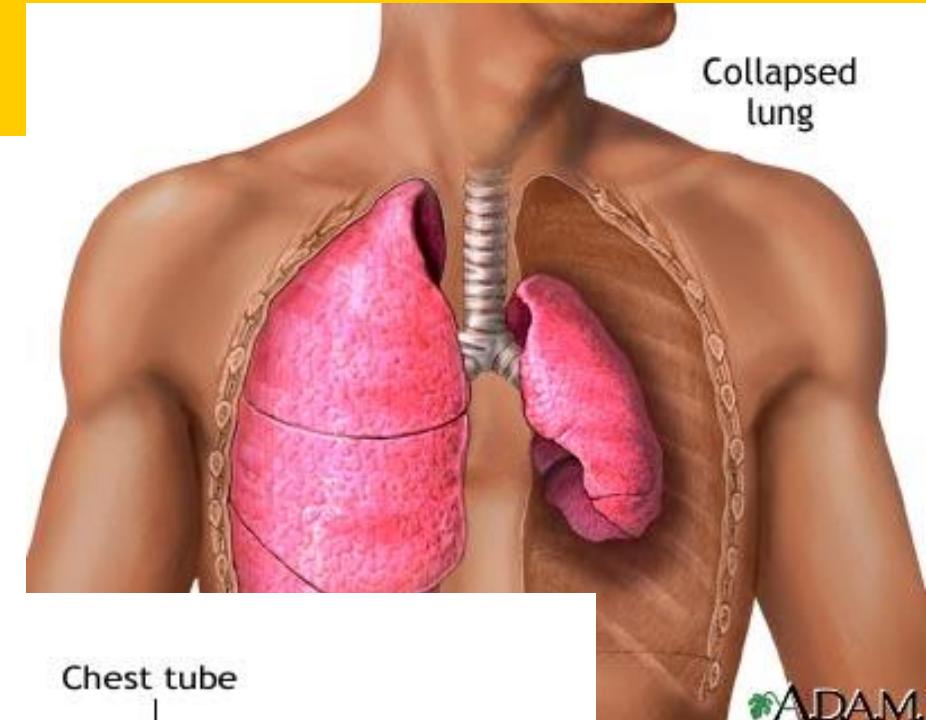
ADAM.



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COMPARATIVE PERCUSSION OF THE LUNGS

- Unilateral tympany suggests a large pneumothorax or possibly a large smooth-wall air-filled cavity (bulla) communicated with bronchus (pulmonary abscess, tubercular cavern).



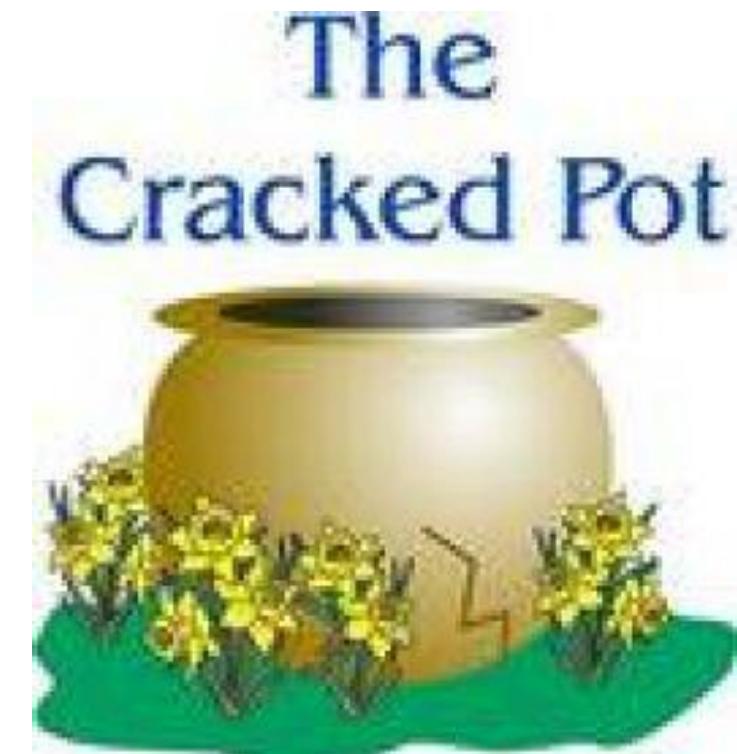
COMPARATIVE PERCUSSION OF THE LUNGS

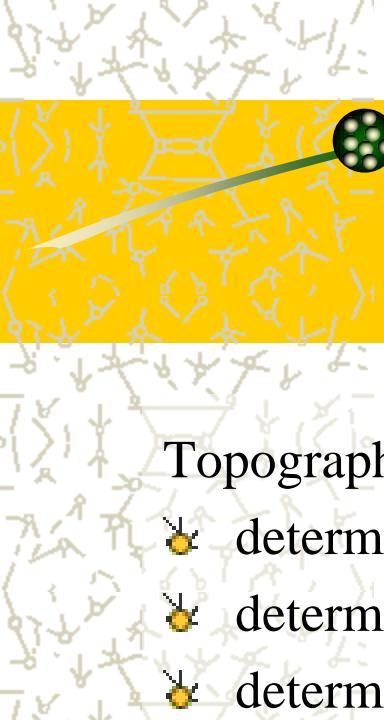
- 💡 *Metallic percussion sound*: tympanic sound resembling a stroke on a metal may be heard over a large (6-8 cm in diameter) air-filled bulla in the lungs.



COMPARATIVE PERCUSSION OF THE LUNGS

- *Cracked-pot percussion sound* (soft, resembles that of a cracked pot) may be heard over a large superficial cavity communicated with the bronchus through the narrow slit.

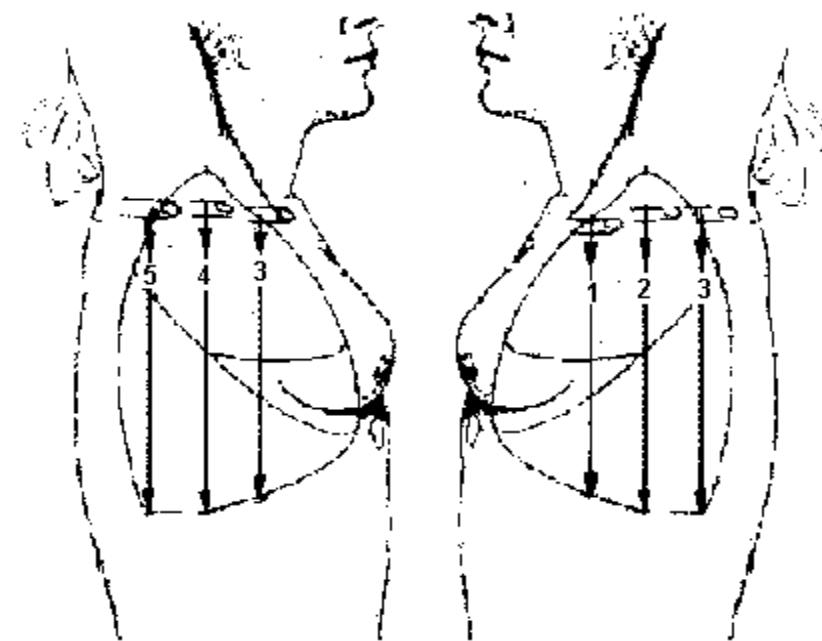
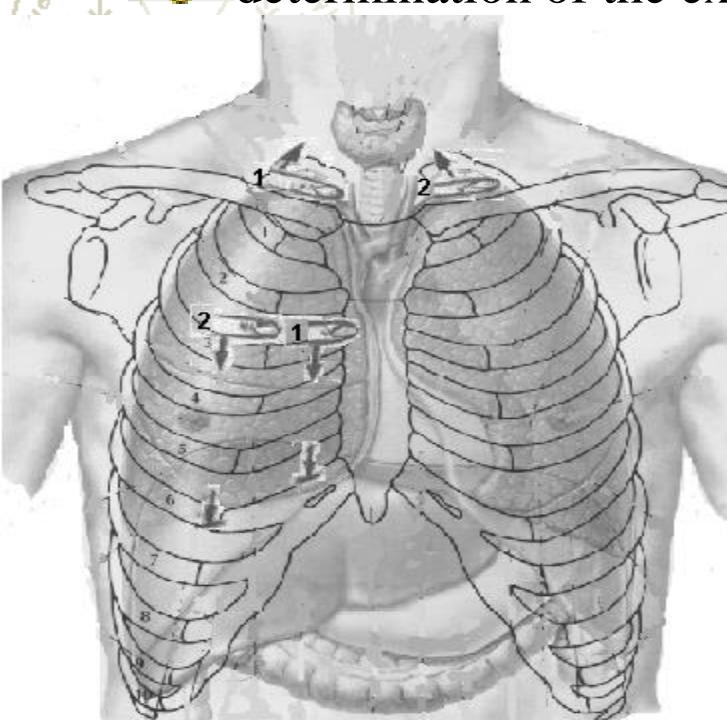




Topographic percussion of the lungs

Topographic percussion has following potential uses:

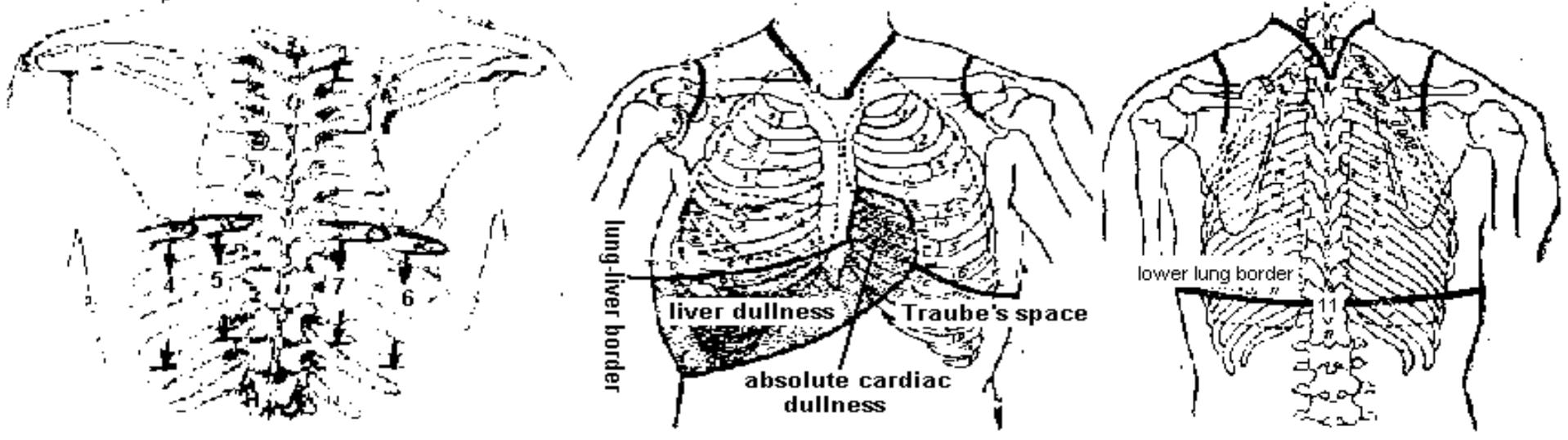
- determination of the upper borders (apices) of the lungs;
- determination of the lower borders of the lungs;
- determination of the excursion of the lower borders of the lungs.



Topographic percussion of the lungs

**Normal lungs
borders of
normosthenic
person**

Topographic lines	Right lung	Left lung
Parasternal	5 th interspace	---
Midclavicular	6 th interspace	---
Anterior axillary	7 th interspace	7 th interspace
Midaxillary	8 th interspace	8 th interspace
Posterior axillary	9 th interspace	9 th interspace
Scapular	10 th interspace	10 th interspace
Paraspinal	Spinous process of T11	Spinous process of T11



Topographic percussion of the lungs

Displacement of the lower border of the lung can be bilateral or unilateral.

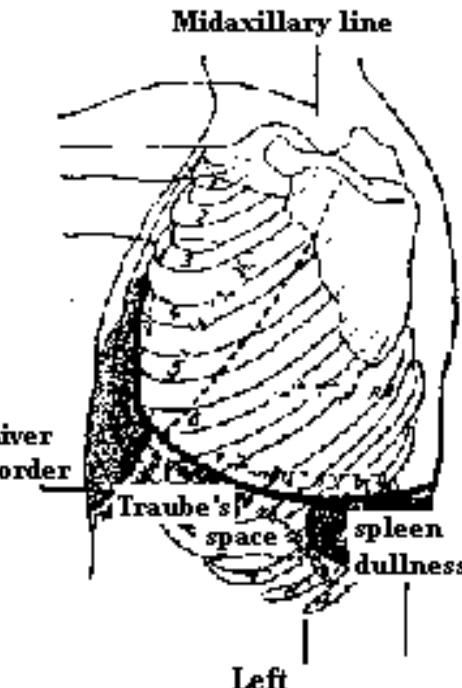
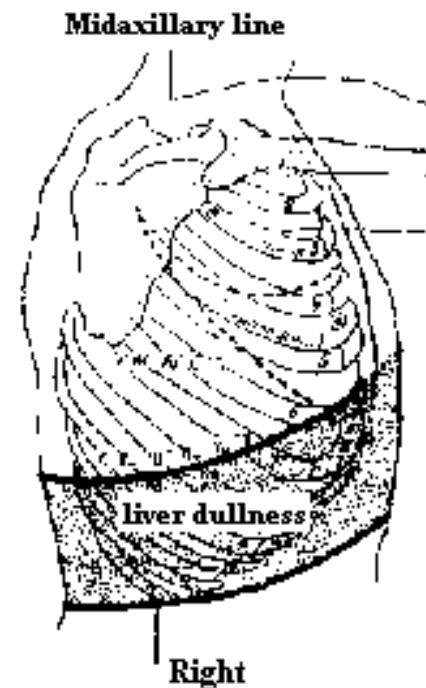
Bilateral lowering of the lower lung edges is observed in: asthenic persons; in acute dilation of the lungs (attack of bronchial asthma); in chronic dilation of the lungs (emphysema).

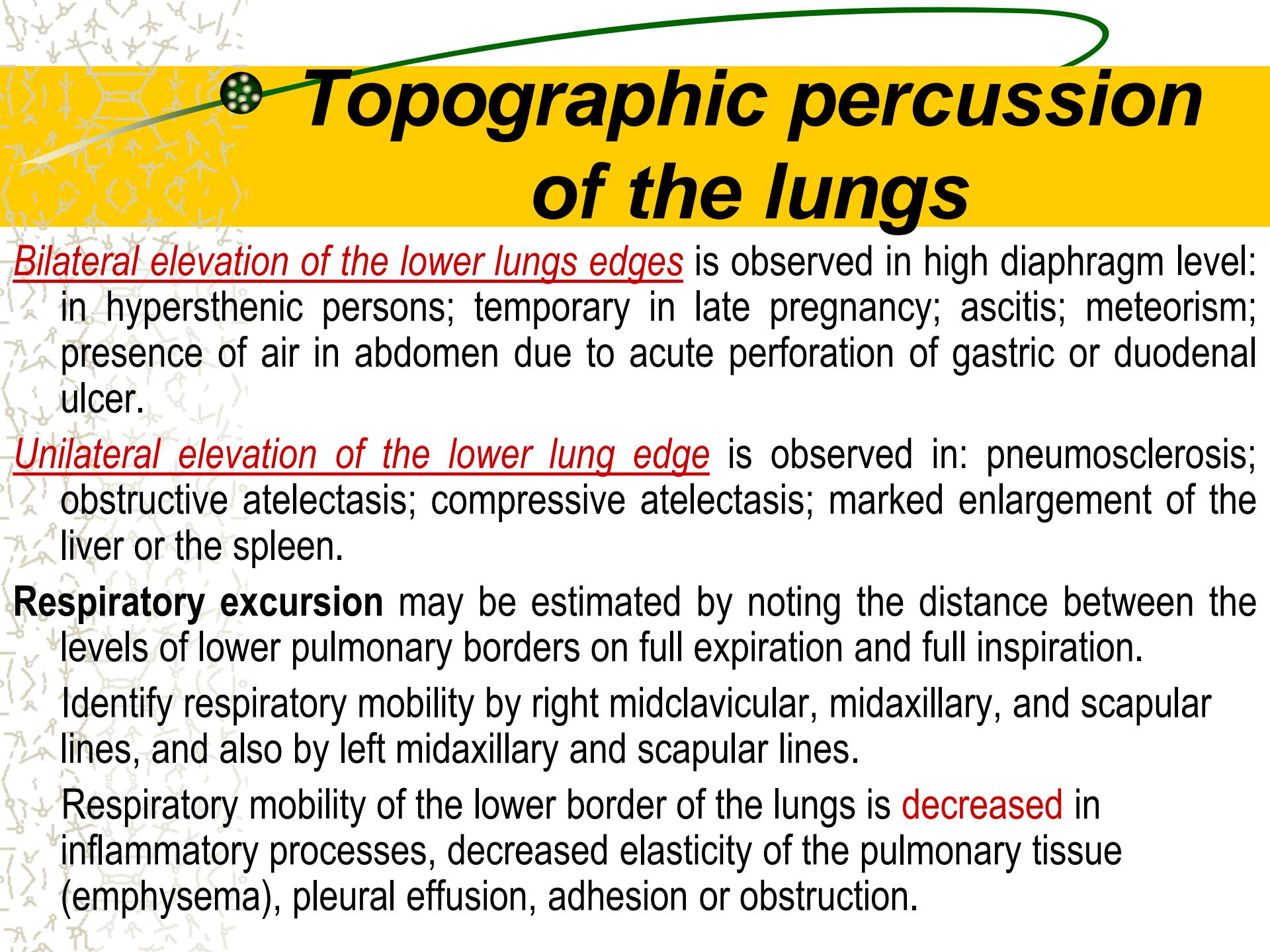
Unilateral lowering

of the lower lung edge is

observed in:

compensatory emphysema of one lung with inactivation of the other (pleural effusion, hydrothorax, pneumothorax, hemiparesis of the diaphragm).





Topographic percussion of the lungs

Bilateral elevation of the lower lungs edges is observed in high diaphragm level: in hypersthenic persons; temporary in late pregnancy; ascitis; meteorism; presence of air in abdomen due to acute perforation of gastric or duodenal ulcer.

Unilateral elevation of the lower lung edge is observed in: pneumosclerosis; obstructive atelectasis; compressive atelectasis; marked enlargement of the liver or the spleen.

Respiratory excursion may be estimated by noting the distance between the levels of lower pulmonary borders on full expiration and full inspiration.

Identify respiratory mobility by right midclavicular, midaxillary, and scapular lines, and also by left midaxillary and scapular lines.

Respiratory mobility of the lower border of the lungs is **decreased** in inflammatory processes, decreased elasticity of the pulmonary tissue (emphysema), pleural effusion, adhesion or obstruction.