Ministry of Health of the Republic of Belarus

Educational Establishment

«Vitebsk State Order of Peoples` Friendship Medical University»

Chair of Propedeutics of Internal Diseases

 It predicated on methodical

 meeting of the chair from

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 The report № \_\_\_\_\_\_

**METHODOLOGICAL GUIDELINES FOR STUDENTS N 8**

for the practical training

on Propaedeutic of Internal Diseases

for specialty 1-79 01 01 "General medicine"

2 course of medical faculty

full-time form of higher education

 **THEME:** **Auscultation of lungs (main breath sounds) , examination of bronchophony.**

Vitebsk, 2023

 **THEME:** Auscultation of lungs (main breath sounds) , examination of bronchophony.

**Time:** 3 academic hours.

**Purpose of the lesson**

1. To acquaint students with the physical bases and rules of the lung auscultation.

**Objectives of the lesson**

1. To study the mechanism of formation of the basic respiratory sounds, interpretation of the obtained results.

2 To teach students the rules and methods of auscultation of lungs, determination of bronchophony, interpretation of the obtained results.

3. To teach students to differentiate qualitative and quantitative changes of the basic respiratory sounds in patients with respiratory diseases.

4. Repeat with students the technique of questioning, general examination of the patient, and percussion in respiratory diseases.

 **Motivational characteristics of the need to study the topic of the class.**

Lung auscultation is one of the most important methods of respiratory investigation. It allows you to determine the quantitative and qualitative changes in vesicular breathing, identify pathological types of bronchial breathing in patients with lung diseases. It also allows, using the bronchophony study, to make a more accurate diagnosis.

 **Questions for classroom knowledge control**

1. Auscultation of lungs. Technique and rules of lung auscultation. Concept of main and adventitious respiratory sounds.
2. Vesicular (alveolar) breathing: the mechanism of their genesis, auscultator features. Points of auscultation. Qualitative and quantitative changes in vesicular breathing. Diagnostic value.
3. Bronchial (laryngotracheal) breathing: the mechanism of their genesis, auscultatory features. Auscultation points of bronchial breathing. Conditions of occurrence of bronchial breathing over the lungs. Types of pathological bronchial breathing. Diagnostic value of appearance of pathological bronchial breathing.,
4. Bronchophony. Technique and rules of carrying out. Diagnostic value.

**Information block of the topic**

**Method of Auscultation**

Auscultation (Latin *auscultare* listen) is a method of examination based on listening to the sounds inside the body.

*Auscultation method is differentiated in:*

*direct auscultation* - produced by applying the ear to the patient's body,

*mediated auscultation* - made with a special tube - stethophonendoscope (from the Greek words stethos – chest, phone - sound, scopeo – look).

*Stethophonendoscope* is a device that intensifies auscultatory sounds. It consists of a bell (*stethoscope*) and a flat chamber closed at its contact with the skin by a thin plastic diaphragm (*phonendoscope*).

***Auscultation rules***

Special rules should be followed during auscultation:

1. The room should be quiet and warm.
2. The skin at places of auscultation should be hairless, or hairs on the chest should be moistened by a cotton with warm water, because hairs produce additional friction sounds that interferes with differentiation and interpretation of the sounds.
3. The lungs are listened to in a vertical position of the patient (standing or sitting), in a serious condition the patient can be listened to in a supine position.

Auscultation of the lungs, as well as percussion should be comparative. *The sequence of lungs auscultation* is the same as in the comparative percussion . (parasternalis dextra et sinistra, medioclavicularis dextra et sinistra, axillaris anterior dextra et sinistra, axillaris media dextra et sinistra, axillaris posterior dextra et sinistra, vertebralis dextra et sinistra, paravertebralis dextra et sinistra, scapularis dextra et sinistra).

1. Auscultation is performed in both phases of breathing (inspiration and expiration) on strictly symmetric parts of the chest, with a uniform depth of breathing.
2. Listening to the lungs, unlike percussion, is carried out not along topographic lines, but on the areas starting with the supraclavicular areas (the area of the tops of the lungs), then the area of the pectoralis major muscles and the lower lateral parts of the anterior surface of the chest. When listening to the axillary areas the patient rises hands behind his/her head, then the physician listens to the side surfaces of the chest. On the back surface of the chest, auscultation of the lungs begins with suprascapular regions (the projection of the tops of the lungs behind it) then to the interscapular region, for this the patient should cross his/her arms. Then the physician listens to the area below the corners of the scapular bones and lower lateral sections.
3. The auscultation is carried out at least 2-3 points in every area, so as to assess an auscultation picture at one point is impossible, then just hold on auscultation symmetrical area of the opposite side.
4. At first, the main breath sounds are analyzed, while the patient's breathing should be through a half-opened mouth and a medium depth.
5. Then ask the patient to breathe deeply and through the mouth, with a better identified side of the breath sounds. For the same purpose, if necessary, ask the patient to cough, exhale quickly and sharply.

***All auscultative phenomena on the part of the respiratory organs can be divided into main (basic) and adventitious (additional) breath sounds***.

***Main breath sounds:***

• *vesicular breathing;*

*• bronchial breathing.*

***Adventitious (additional) breath sounds:***

* *rhonchi;*
* *wheezes;*
* *coarse crackles;*
* *fine crackles;*
* *pleural rub.*

In auscultation, it is necessary to first pay attention to the main breath sounds, determine the type of breathing, its intensity, and then proceed to the analysis of adventitious (additional) breath sounds.

Main breath sounds in norm

Table 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type of sound | Mechanism of genesis | Sound characteristics | Duration of sound | Place of auscultation |
| Vesicular (alveolar) breathing | vibration of alveolar walls during their filling with air in inspiration | simulate the sound *“F”*  | entire inspiration and first third of expiration | over pulmonary tissue  |
| Bronchial(laryngotracheal) breathing | arise in the larynx and the trachea as air passes through the vocal slits | resembles the sound of Russian letter *"X*" | length and intensity of inspiration and expiration are the same | over the larynx, the trachea, and at points of projection of the tracheal bifurcation |

**Vesicular (alveolar) breathing**

***Vesicular breathing*** is normally heard above the entire surface of the lungs during inspiration and in the first third of the expiration. It is a result of the alveolar walls vibration at the time of inspiration when filling alveoli with air and alveoli emptying at the beginning of expiration. When a human person expires, these oscillations rapidly decay, as the tension of the alveolar walls decreases. Vesicular breathing is perceived as a soft, blowing noise, like the sound "F".

*The strength of vesicular breathing depends on*:

* the elastic properties of the lung tissue (the walls of the alveoli);
* a number of alveoli involved in breathing per unit volume;
* a rate of filling of the alveoli with the air;
* duration of inhalation and discharge;
* changes in the chest wall, pleural leaves and pleural cavity;
* patency of the bronchi.

In healthy lungs, physiological vesicular breathing as a rule is changed symmetrically in all places of auscultation.

In pathological conditions, vesicular breathing can change simultaneously in both lungs, in one of them or in a limited area of the lung.

***Alterations of vesicular breathing****:*

* + *quantitative - increasing and weakening breathing;*
	+ *qualitative - harsh, prolonged expiration, saccadic breathing*.

*Physiological increase of vesicular breathing* is observed in heavy physical load, and in children (*puerile breathing*) (Table 2).

Increased vesicular breathing is heard over healthy areas of the lungs, located next to the pathologically altered. The gain is determined over a healthy lung when you turn off from the breathing of the other half.

*Physiological weakening of vesicular breathing* is observed in obesity, and in well-developed chest muscles.

*Pathological weakened vesicular breathing* presents due to a loss of elasticity and alveoli wall destruction (in emphysema of the lungs), a decreased number of ventilating alveoli when they are filled with exudate (in focal pneumonia, initial and final stages of lobar pneumonia), alveoli collapse (compression atelectasis), filling the pleural cavity with liquid, air (hydrothorax, pneumothorax), in decreased depth of breathing due to the pain (fractures of ribs, intercostal neuralgia).

Table 2. Alterations of vesicular breathing

|  |  |  |
| --- | --- | --- |
| Alterations | Characteristics | Causes |
| Physiological weakening | sound volume reduction | thick chest wall (excessively developed muscles or obesity) |
| Physiological intensification | sound volume increase | thin chest wall, good elasticity of the alveoli, children *“puerile breathing”*, physical exercise, hyperthermia |
| Pathologicalweakening | sound volume reduction | diminished ventilation of alveoli (atrophy of alveoli, inflammation, degradation of elastic fibers, swelling, external compression of alveoli); bronchial obstruction of sound conduction |
| Abnormally increased | expiration becomes louder and longer  | obstruction of small bronchi (inflammatory edema of the mucosa, bronchospasm, hypersecretion of viscid mucus)  |
| Harsh (coarse)breathing | increase during both breathing phases | narrowing small bronchi and bronchioles (inflammatory edema of the mucosa, bronchospasm)  |
| Interrupted (saccadic) breathing | inspiration is interrupted by short pauses  | in a cold room, nervous trembling patients, or diseases of the respiratory muscles, traumas of the chest wall; locally – in pathology of small bronchi  |

*Pathological increased vesicular breathing* can be observed on the healthy side when the affected lung is switched off from breathing.

*Increased vesicular breathing with prolonged expiration* is heard in the unexpressed narrowing of the lumen of small bronchi, with edema of their mucosa or bronchospasm.

*Harsh (coarse) breathing* is observed with uneven narrowing of the bronchial lumen in bronchitis and focal pneumonia. In tone, it is a sharp and coarse, wheezing and with increased duration of expiration.

Another type of vesicular breathing is *saccadic breathing*. This is intermittent breathing (2-3 intermittent sounds on the inspiration), and the expiration is not changed. It occurs in healthy people with uneven contraction of the respiratory muscles (hypothermia, nervous tremor). With focal pulmonary tuberculosis, it can occur in a limited area of the lung due to the difficulty of passing air through the small bronchi and bronchioles and non-simultaneous expansion of the pulmonary tissue.

**5.3. Bronchial (laryngotracheal) breathing**

***Physiological bronchial breathing***

*Breath sounds known as bronchial (laryngotracheal) breathing* arise in the larynx and trachea when air passes through the vocal slits. In this case, turbulent air flows (swirls). This breathing is heard normally above the larynx and trachea on anterior surface of the neck and lower to the manubrium sterni and posteriorly from C7 to interscapular space at the level of III and IV thoracic vertebrae (Fig. 1 Table 1). Bronchial breathing is loud, and its expiration length is equal to expiration, and there is a characteristic pause between them its sound resembles the sound of the Russian letter "X". Normally, bronchial breathing is not carried on lung fields, as healthy lung tissue suppresses these fluctuations. If this breathing is carried out on the chest wall, it is called *pathological bronchial breathing*.

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1 2

Fig. 1.Places of listening to bronchial breathing:

1. anterior side; 2) posterior side.

***Pathological bronchial breathing***

Depending the origin there are ***three* *types of pathological bronchial breathing:***

1)***Infiltrative type*** arises in consolidation of a pulmonary tissue [(II and III stages (the “red and grey hepatization” stages) of lobar pneumonia, infarction of lungs, tuberculosis];

2*)* ***Atelectatic type*** - it is observed in compression atelectasis (if exudative pleurisy of 1.5-3 liters), and is auscultated at the vertebral column on a superior border of a dullness where there is a compressed lung; it rarely passes for *lin. axillaries anterior.* It presents at the *Garland triangle* (See Chapter 4. Fig. 4-10);

3) ***Cavitary type***is auscultated above superficially posed smoothbore lumen of the big diameter connected with a bronchus (an abscess, a tubercular cavern, bronchiectasias with an appreciable distention of bronchi).

*Amphoric breathing* is a subtype of the pathological cavitary bronchial breathing. It occurs in the presence of a light smooth-walled air-containing cavity (lung abscess after opening, tuberculous cavity), communicating with the bronchus. It is heard in both phases of breathing and resembles a booming sound that occurs when air is blown into an empty vessel. This breathing occurs due to resonance phenomena in the pathological cavity. Note that for the occurrence of amphoric breathing, the diameter of the cavity should be at least 5 *cm.*

*Metallic breathing* is a subtype of the pathological cavitary bronchial breathing, which occurs if an open pneumothorax. It is very loud, high timbre and resembles a sound when struck by a metal. The same breath can be with large, smooth, surface-located cavities in the lungs.

*Stenotic breathing* is observed with narrowing of the larynx or trachea (tumor, foreign body in the larynx, laryngeal edema). It is heard in the place of narrowing, but can be heard without a stethoscope, at a distance from the patient (*stridor breathing*). This is a moaning breath with a sharply elongated inspiration. At the same time, it is shallow because of the small flow of the air into the lungs.

**Bronchophony**

***Bronchophony*** *is the auscultation of the whisper speech transfer to the surface of the chest.*

The sound from the larynx transfers on the chest wall by an air column of the trachea and bronchi through the layer of the alveoli.

To listen to the bronchophony, the patient whispers words containing sizzling sounds (*in Russian, for example, “чашка чая”*). In English, the numbers *"ninety-nine"* or *"sixty-six"* are traditionally mentioned (Table 3). However, the translation "ninety-nine", has fewer vowels and is less effective in evoking the phenomenon. Better phrases in English include "*toy boat*”, "*Scooby Doo*", and “*blue balloons*".

To identify bronchophony, an examiner should listen to the entire surface of the chest by comparing with the sound on the symmetrical areas, as in the auscultation of the breath sounds. In a healthy person, the same quiet rustle is heard at symmetrical points. Normally, the sound of the patient's voice becomes less distinct as the auscultation moves peripherally from projection of the larynx and trachea.

***Intensified bronchophony*** is the phenomenon of the patient's voice remaining loud at the periphery of the lungs or sounding louder than usual over a distinct. Intensified bronchophony (spoken words are heard) is observed in the consolidation of pulmonary tissue, which better conducts acoustic waves (in pneumonia), in the area of compression atelectasis and the cavity in the lung, communicating with bronchus.

Bronchophony reveals even small foci of consolidation of the pulmonary tissue. Bronchophony is already intensified, when other methods of investigation cannot reveal minimal changes (tactile fremitus is not amplified, vesicular breathing is little changed, pathological bronchial breathing and adventitious breath sounds are absent).

***Bronchophony is weakened***in the presence of fluid (hydrothorax, exudative pleurisy) or large amounts of air in pleural cavity (emphysema, pneumothorax).

Other tool used in auscultation includes listening for ***egophony.*** While listening to the lungs with a stethoscope, the patient is asked to pronounce the long-“E” vowel sound. Stethoscopic auscultation of a clear lung field during this articulation will detect a sound matching that received through normal hearing; that is, the sound articulated by the patient will be clearly transmitted through the lung field and heard unchanged by stethoscope. *When the lung field is consolidated, this finding is referred as the "E” to “A” transition."*

Table 3. Bronchophony and egophony

|  |  |  |  |
| --- | --- | --- | --- |
| Technique | Patient says | Auscultation | Diagnostic value |
| normal | abnormal |
| Broncho-phony | whispered speech: in Russian *”чашка чая”,*  or in English *"ninety-nine"* or *"sixty-six"* | muffed, faint, indistinct sounds | clear and distinct sounds | * consolidation of lung tissue (in pneumonia, tuberculosis, pneumo-fibrosis, etc.);
* bronchiectasis;
* compressed atelectasis;
* air cavity in pulmonary tissue
 |
| Egophony | *”eeeeeee”* loudly | clear sounds ”eeeeeee”  | change sounds to ”aaaaaaa”  |

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