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 9**

for the practical training

on Propaedeutics 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 the Lungs (adventitious (additional) breath sounds)**

Vitebsk, 2023

**THEME:** Auscultation of the Lungs **(**adventitious (additional) breath sounds)

**Time:** 3 academic hours.

**Purpose of the lesson**

To familiarize students with the types of additional respiratory sounds and their differential diagnosis.

**Objectives of the lesson**

1. To study the mechanism of formation of additional respiratory sounds, interpretation of the received results.

2. To teach students to differentiate additional respiratory sounds in patients with respiratory diseases.

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

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

Lung auscultation is one of the most important methods of investigation of respiratory organs. It allows to determine quantitative and qualitative changes of the main respiratory sounds (vesicular and bronchial breathing), to reveal additional respiratory sounds connected with pathological changes of bronchial tree and lungs.

**Questions for classroom knowledge control.**

1 Additional respiratory sounds: classification.

Rales: mechanism of formation of dry and wet rales, peculiarities of auscultatory picture. Diagnostic value.

3. Crepitation: the mechanism of formation, features of the auscultatory picture. Diagnostic value.

4. Pleural rub: the mechanism of formation, features of auscultatory picture. The diagnostic value.

5. Auscultatory distinction of collateral respiratory noises from each other.

**Information block of the topic**

**Adventitious breath sounds *Adventitious sounds are rhonchi, wheezes, coarse crackles, fine crackles, and pleural rub*** (Table).

**Rhonchi and wheezes *Rhonchi and wheezes*** *are adventitious breath sounds formed in the bronchi. The late medical term for them is “dry rales” (the literal translation from Russian “сухие хрипы”).* *They are a continuous sound (≥250 msec), musical, prolonged, heard in the inspiration and the expiration, but not necessarily persisting throughout the respiratory cycle, like dashes in time.*

***Rhonchi and wheezes*** result from uneven swelling of mucosa in bronchial inflammation and narrowing of the bronchial lumen, with vibrations of viscous sputum in the flowing air in the lumen of the bronchi.

***Rhonchi*** *(late term - dry buzzing rales)*occur in the large and medium bronchi. Rhonchi are buzzing, low-pitched sounds with a snoring quality. The mechanism of their formation is similar to the appearance of harsh vesicular breathing. Their formation is due to the oscillation of sputum, located in the bronchial lumen. They are heard on the background of harsh vesicular breathing (in non-obstructive bronchitis).

**Table.** Adventitious breath sounds and differences between them

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Characteris- tics | Rhonchi | Wheezes | Coarse crackles | Fine crackles | Pleural rub |
| Late term | Dry buzzing rales | Dry whis- tling rales | Wet (moist) small- bubbling rales | Сrepitation | Pleural rub friction murmur |
| Medical terms in Russian | Cухие басовые (жужжащие) хрипы | Сухие свистящие хрипы | Влажные мелкопузырчатые хрипы | Крепита-ция | Шум трения плевры |
| Place of formation | large and medium bronchi | Small bronchi | bronchi | alveoli | pleural membranes |
| Condition of formation | viscid secret in bronchial lumen, edema of bronchial mucosa, bronchospasm | | liquid secret in bronchial lumen | liquid secret and air in alveoli lumen | fibrin secret on surface of pleural membranes, and pleural adhesions |
| Sounds | continuous, buzzing, low-pitched with snoring quality | continuous, wheezing, high-pitched with hissing or shrill quality | somewhat louder, low- er in pitch, brief crackles | soft, high- pitched, very brief crackles | crackles |
| Relation to breathing phases | at inspira- tion and ex- piration | at inspira- tion and ex- piration | at inspira- tion (better) and expira- tion | at inspira- tion | at inspira- tion and ex- piration |
| After coughing | change of the character | change of the character | change of the character | without change of the character | without change of the character |
| Acoustic characteris- tics | frequently variated sounds | frequently variated sounds | frequently variated sounds | uniform sounds | variated sounds |
| Under ste- thoscope pressing | no acoustic enhance- ment | no acoustic enhance- ment | no acoustic enhance- ment | no acoustic enhance- ment | acoustic en- hancement |

***Wheezes*** *(late term - dry whistling rales)* occur in the small bronchi due to the increase in the air velocity when their lumen is narrowed. The increase in air friction leads to the appearance of an additional sound – wheezes. *They are continuous, wheezing, whistling sounds, high-pitched with a hissing or shrill quality*. *Wheezes* are heard against the background of vesicular breathing with an elongated expiration in COPD, obstructive bronchitis, bronchial asthma.

Intensity of wheezes can be different: with a slight narrowing of the bronchial lumen, they are heard in the form of a gentle quiet whistle, which is only at the end of inspiration and expiration. With a diffuse bronchial spasm, wheezes are heard at a distance from the patient (bronchial asthma).

Depending on the degree of inflammatory changes and the nature of the main process, *rhonchi and wheezes can be detected in a limited area of the lung (pneumonia) or diffusely over its entire surface (bronchitis).*

The number of rhonchi and wheezes can change dramatically (increase or decrease, or disappear) under the influence of cough, repeated deep breaths.

To identify the constancy of rhonchi and wheezes, ask the patient to cough after a deep breath. Rhonchi after coughing changes and may disappear due to the movement of sputum when coughing into the larger bronchus. Wheezes are more constant: when coughing, they may even increase due to an increase in air velocity during a coughing jolt and increased friction against the wall of the bronchus.

**Crackles (coarse crackles, fine crackles, and pleural rub)**

**Crackles *are discontinuous, intermittent, nonmusical, brief sounds, like dots in time. According to mechanisms of origin, basic types of crackles include coarse crackles, fine crackles, and pleural rub.***

**Coarse crackles**

**Coarse crackles (***the**late term – small-bubbling wet rales,**the**literal translation from Russian “влажные мелкопузырчатые хрипы”)*occurs when air passes through the liquid sputum or other liquid secret, which accumulates in the lumen of small caliber bronchi. This creates sound like somewhat louder, lower in pitch, brief crackles (20–30 msec). The coarse crackles are better heard in the inspiration phase, because the speed of air movement in the bronchi will be greater. A cough changes coarse crackles. They can increase or disappear.

***The coarse crackles present in bronchitis, and if the bronchi are surrounded by a dense tissue (in pneumosclerosis, focal pneumonia).***

Russian-language medical literature uses also terms “влажные средне- и крупнопузырчатые хрипы” (the literal translation *- medium- and large bubbling wet rales),* and terms “звучные и незвучные влажные хрипы” *(the literal translation - consonating and non-consonating wet rales).*

*Medium-bubbling wet rales occur in the* medium caliber bronchi, and the *large-bubbling wet rales* occur in large bronchi and cavities, when air passes through the liquid in their lumen.

*The consonating moist rales* are very loud crackles if the bronchi are surrounded by a dense tissue (in pneumosclerosis, focal pneumonia). In addition, they can occur in cavities.

*Non-consonating moist rales* are heard worse, they are deaf and quiet, and resembles a rupture of the soup bubbles. The most often non-consonating rales are a direct sign of bronchitis.

**Fine crackles**

***Fine crackles*** (*the* *late term - crepitation*) is the sound that occurs when a large number of alveoli are sticking out, it is heard only at inspiration. The condition for occurrence of the fine crackles is the presence of a small amount of exudate or other liquid in the alveoli lumen, and reducing amount of surfactant. In this case, at expiration alveoli walls stick together, and on inspiration - they stick out. The sounds of the fine crackles are similar to the coarse craclkes, but they are heard only on inspiration. A cough does not change the fine crackles (see Table).

There are the *inflammatory fine crackles* due to the accumulation of exudate in the alveoli [I and IV stages (the congestion and resolution stages) of lobar pneumonia, focal pneumonia]; and the *long-term fine crackles* due to the congested fluid in the lumen of the alveoli when the left ventricular heart failure; and the *short-time fine crackles* due to a reduction in a tone of the walls of the alveoli and even collapsing them. Short-time fine crackles hap- pens in severe, weakened patients, as well as in the elderly. The peculiarity of this fine crackles that they are not stable, transient: after a few deep breaths alveoli wall are straightened, and fine crackles disappears.

The *loud constant fine crackles* are auscultated in focal pneumosclerosis (passed pneumonia, infiltrative tuberculosis).

**Pleural rub**

The ***pleural rub*** *(the late term - pleural rub friction murmur)* *is heard on the inspiration and expiration.* It is heard close to the ear, it does not dis- appear and does not change its location when coughing, and it increases when pressed by a phonendoscope on the chest. The pleural rub is heard when its membranes become roughened (in deposition of fibrin filaments in dry pleurisy, adhesions between pleural membranes, uremia) (see Table).

*To differentiate it from the other crackles*, the place of the appearance of pleural rub is listened to when imitating respiratory movements (the mouth is closed, and the nose is pressed with fingers, the patient retracts and protrudes the stomach). The pleural rub persists with the disappearance of other breath sounds.

*Pleuropericardial rub (murmur)* is the sound of pleura friction in close proximity to the heart (when involved in inflammation of the pleura directly adjacent to the heart) coincides with the respiratory movements and the heart contractions.

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