

Federal State Budgetary Educational Institution of Higher Education "North Ossetian State Medical Academy" of the Ministry of Health of the Russian Federation

BRONCHOBSTRUCTIVE SYNDROME

(a methodological manual for students of the V-VI courses of the Faculty of Medicine, residents and graduate students)

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Broncho-obstructive syndrome (BOS) is one of the urgent problems of modern clinical medicine. This is due to the wide spread, progressive course, insufficient effectiveness of drug therapy, high disability and mortality of the working population.

Broncho-obstructive syndrome, or bronchial obstruction syndrome, is a symptom complex caused by a violation of bronchial patency (due to persistent or transient narrowing of the airways) with a subsequent increase in air flow resistance during ventilation.



BOS is not an independent nosological unit, but is a collective concept and can be observed in many respiratory and even non-respiratory diseases.

Broncho-obstructive syndrome can cause:

- Diseases of the cardiovascular system (heart defects, arterial hypertension, cardiac arrhythmia and conduction disturbances);
- Diseases of the respiratory system;
- helminthiasis; pathology of the gastrointestinal tract (hernia of the esophagus, ulcers, etc.);
- psychological disorders (stress, overwork, etc.);
- entry into the respiratory tract of foreign bodies, chemicals, household chemicals, etc.);
- medicines (side effects of some groups of medicines)

The most common source of broncho-obstructive syndrome are the following pathological processes:

- Bronchial asthma
- Exacerbation of chronic obstructive pulmonary disease (COPD)
- Gastroesophageal reflux

The occurrence of biofeedback, especially under the condition of its untimely or inadequate therapy, negatively affects the clinical course and prognosis of the diseases that led to its development. In this regard, in practice, it is necessary to pay special attention to its timely diagnosis, interpretation of pathogenesis, diagnostic criteria, clinic and treatment.

The development of biofeedback is based on functional (reversible) and organic (irreversible) changes.

The mechanism of occurrence of BOS can be conditionally divided into:

1. The functional mechanisms of bronchial obstruction include bronchospasm, inflammatory infiltration, edema and hyperplasia of the mucous membrane, mucociliary insufficiency, hypersecretion of viscous mucus. Smooth muscle spasm and mucus hypersecretion occur as a result of exposure to trigger factors such as allergens, pollutants, infection, etc. on the respiratory mucosa. The response to such exposure is the release of inflammatory mediators that irritate the endings of n. vagus and promote the release of acetylcholine, which activates muscarinic cholinergic receptors. Activation of these receptors causes

cholinergic bronchoconstriction and hypersecretion of bronchial mucus. At the same time, there is also a sharp plethora of vessels of the microcirculatory bed in the wall of the bronchi and an increase in their permeability is noted. All this leads to swelling of the mucous membrane and submucosal layer of the bronchi, their infiltration with mast cells, basophils, eosinophils, lymphocytes and plasma cells.

2. Organic (irreversible, dominant in chronic BOS) mechanisms of bronchial obstruction include peribronchial fibrosis, cicatricial stenosis of the bronchus, compression of the bronchus by a volumetric process from the outside, compression of the bronchus by emphysematous tissue, volumetric formations in the lumen of the bronchi.

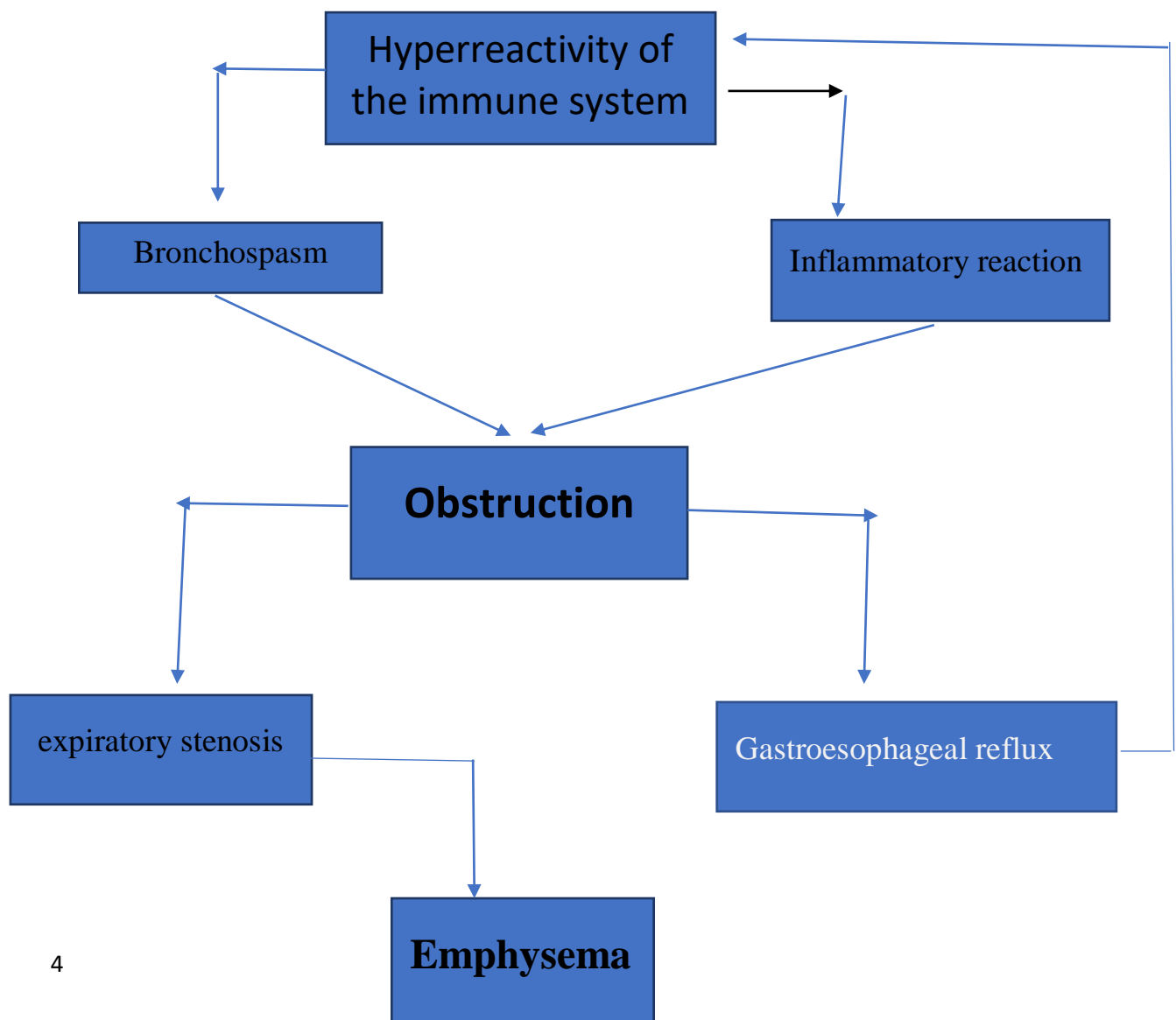
Thus, the irreversible component of bronchial obstruction is mainly determined by emphysema and peribronchial fibrosis.

Emphysema is usually formed as a result of depletion of local protease inhibitors due to oxidative stress and under the influence of neutrophilic proteases that destroy the elastic stroma of the alveoli. As a result, the elastic properties of the lungs are violated, the mechanics of respiration changes and an expiratory collapse of the airways is formed, which is an important reason for the irreversibility of bronchial obstruction. Slower emptying of the lungs leads to the formation of dynamic hyperinflation (swelling) of the lungs, and the increase in the functional residual volume disrupts the functioning and coordination of the respiratory muscles, leads to its fatigue, which in turn exacerbates ventilation disorders.

In order to diagnose a disease that occurs with biofeedback, it is necessary to study in detail the clinical and anamnestic data, paying special attention to the presence of atopy in the family, previous diseases, and the presence of relapses of bronchial obstruction.

Scheme 1

The general scheme of the pathogenesis of BOS is as follows (according to A.P. Zilber, 1996):

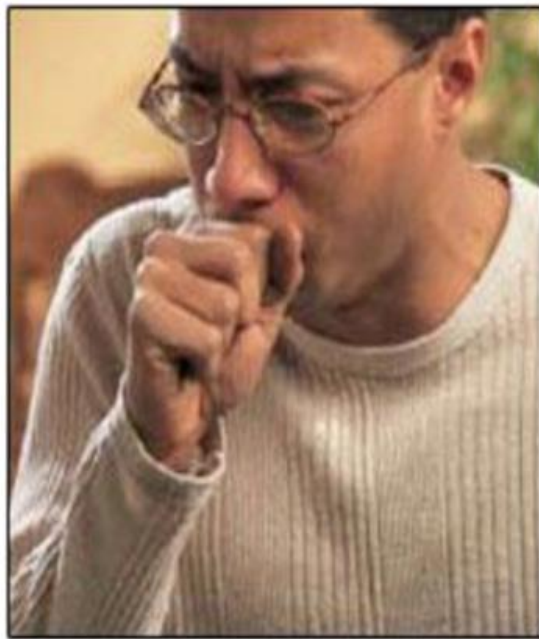


Clinical manifestations of BOS:

- shortness of breath, usually of an expiratory nature
- asthma attacks
- dry paroxysmal or unproductive cough
- participation of auxiliary muscles in breathing
- tympanic shade of percussion sound
- prolongation of the expiratory phase
- the appearance of expiratory noises in the form of wheezing, noisy breathing during auscultation or audible at a distance, scattered dry rales

The clinical course of the disease will depend on the type of obstruction.

Бронхообструктивный синдром



According to the Federal Program for COPD, bronchitis and emphysematous-sclerotic forms of obstruction are distinguished.

Bronchial type of obstruction - thickening of the mucous membrane and submucosal layer due to hyperplasia of the epithelium and inflammatory edema, impaired bronchial patency due to blockage with a viscous secretion and bronchospasm, can be reversible, eventually leading to hypoventilation.

Patients are often obese, they are primarily concerned about coughing with copious sputum, and then shortness of breath and cyanosis join, cor pulmonale and its decompensation rapidly develop. This is facilitated by persistent pulmonary hypertension, significant hypoxemia, erythrocytosis and constant intoxication due to a pronounced inflammatory process in the bronchi. Such patients are figuratively called "blue puffiness".

The emphysematous-sclerotic type of obstruction is a pathological expansion of the air spaces located distal to the bronchioles, resulting from pulmonary emphysema and expiratory collapse of the small bronchi, always irreversible. Patients are usually thin, their cough is often dry or with a small amount of viscous sputum, their complexion is pink, since sufficient oxygenation of the blood is maintained by the maximum possible increase in ventilation.

Patients often exhale with closed lips and “puff” at the same time, for which they are called “pink puffers”. Heart failure (HF) has been compensated for a long time (Federal Program for COPD, group of experts - chairman, Academician of the Russian Academy of Medical Sciences, Professor A.G. Chuchalin).

It should be emphasized that the development of clinical manifestations of BOS, regardless of its etiology, requires the doctor to take urgent measures to eliminate bronchial obstruction precisely by influencing its reversible component, since it is extremely problematic to effectively influence the irreversible component of bronchial obstruction.

In practice, it is customary to subdivide BOS as follows: the causes of development, the duration of the course, and the severity of obstruction.

For reasons of development:

- infectious (ARVI, bronchitis, bronchiolitis, chronic obstructive pulmonary disease, pneumonia, tuberculosis, etc.);
- allergic (bronchial asthma, exogenous allergic alveolitis, bronchopulmonary aspergillosis);
- obstructive (foreign bodies of the respiratory tract);
- hemodynamic (diseases of the cardiovascular system with the development of heart failure).

According to the duration of the flow:

- acute (up to 10 days);
- protracted (more than 10 days);
- recurrent;
- continuously relapsing.

According to the severity of obstruction (based on spirometry data):

- mild degree;
- moderate;
- heavy;
- hidden bronchial obstruction.

In addition, it is possible to single out a group of diseases (and there are more than 100 of them in total), accompanied by the obligatory development of bronchial obstruction (for example, chronic obstructive pulmonary disease, bronchial asthma, pulmonary emphysema) and its optional formation (for example, acute bronchitis, pulmonary tuberculosis, sarcoidosis of the lungs, pneumoconiosis, fibrosing alveolitis, parasitic lesions of the lungs, lung tumors, diseases of the cardiovascular system with the development of left ventricular failure, etc.)

For the diagnosis of broncho-obstructive syndrome, in addition to clinical signs, functional research methods are of great importance, which are widely used in the diagnosis of pathology of the respiratory organs, without them it is impossible not only to treat, but also to diagnose this pathology.

The diagnostic algorithm for biofeedback involves:

- establishing the presence of bronchial obstruction (a combination of clinical and functional disorders characteristic of this syndrome);
- establishment of the etiology of the disease that caused the development of biofeedback;
- carrying out in each specific case of differential diagnosis with other possible causes of biofeedback;
- exclusion of the causes of syndr laboratory "noisy breathing", not related to biofeedback.

The first detected BOS of a mild course, which developed against the background of a respiratory infection, does not require additional research methods.

In case of recurrent course of biofeedback, a set of examination methods should include laboratory and instrumental diagnostics:

- General blood analysis
- Biochemical research
- Serological tests (specific IgM and IgG are required, IgA testing is desirable) for the presence of chlamydial, mycoplasmal, cytomegalovirus and herpetic infections; in the absence of IgM and the presence of diagnostic IgG titers, it is necessary to repeat the study after 2-3 weeks (paired sera).
- Serological tests for the presence of helminthiasis (toxocariasis, ascariasis).

- Allergological examination (level of total IgE, specific IgE, skin prick tests); other immunological examinations are carried out after consultation with an immunologist.

The main indicators of functional diagnostics of the pathology of the respiratory organs include, first of all, spirometry.

Spirometry is a method of graphic registration of changes in lung volumes during the performance of natural respiratory movements and volitional forced respiratory maneuvers, which makes it possible to obtain a number of indicators characterizing lung ventilation. First of all, these are static volumes and capacities that characterize the elastic properties of the lungs and chest wall, as well as dynamic indicators that determine the amount of air ventilated through the respiratory tract during inhalation and exhalation per unit time.



Indications for spirometry:

- determination of the type and degree of pulmonary insufficiency;
- monitoring of pulmonary ventilation indicators in order to determine the degree and speed of disease progression;
- evaluation of the effectiveness of course treatment of diseases with bronchial obstruction;
- differential diagnosis between pulmonary and heart failure;
- identifying early signs of ventilation failure in individuals at risk of lung disease;
- identification of initial signs of ventilation insufficiency in persons working under the influence of harmful production factors;
- examination of working capacity and military examination based on the assessment of the function of pulmonary ventilation;
- bronchodilatory tests to determine the reversibility of bronchial obstruction;
- provocative inhalation tests to detect bronchial hyperreactivity.

Contraindications for spirometry:

- Severe general condition of the patient, not giving the opportunity to carry out study;
- Severe pulmonary insufficiency that does not allow breathing maneuvers;
- progressive angina;
- acute myocardial infarction;
- acute violation of cerebral circulation;
- malignant arterial hypertension;
- hypertensive crisis;
- toxicosis of pregnancy;
- second half of pregnancy;
- insufficiency of blood circulation of the III stage.

It is known that there are 4 levels that occupy the lungs when performing respiratory excursions:

- level of quiet exhalation
- level of quiet inspiration
- maximum expiratory level
- maximum inspiratory level

The main indicators of spirometry:

Total lung capacity (TLC) is the volume of air that the lungs can hold at the maximum inspiratory level.

As part of the OEL, 4 volumes are distinguished - simple structural units enclosed between adjacent levels and 3 containers, including several volumes.

Inspiratory reserve volume (RIV) - between the levels of a quiet inspiration and maximum exhalation. This is the maximum amount of air that can be inhaled after a normal normal breath.

Tidal volume (TO) - between the levels of a calm breath and a calm exhalation. Corresponds to the depth of quiet breathing, or the average volume of the respiratory cycle

Expiratory reserve volume (ERV) - between the levels of calm expiration and maximum exhalation. It is equal to the maximum volume of air that can be exhaled after a quiet exhalation.

Residual lung volume (RLV) - between the level of maximum exhalation and the position of complete collapse of the lungs, i.e. volume of air left after maximum exhalation

Vital capacity (VC) - between the levels of maximum inhalation and maximum exhalation, the maximum amount of air that can be exhaled after an extremely deep breath

Inspiratory capacity (Evd) - between the levels of a quiet exhalation and maximum inspiration. Corresponds to the maximum amount of air that can be inhaled after a quiet exhalation.

Functional residual capacity (FRC) - between the level of a quiet exhalation and the position of the full collapse of the lungs. Corresponds to the volume of air remaining after a quiet exhalation.

The relationship of the volumes presented can be expressed by the following simple formulas:

$OEL = VC + OOL = EVD + FOE$

$ZEL = ROVD + TO + ROVD$

$FOE = ROVD + OOL$

$EVD = ROVD + TO$

Of these indicators, TRL, VC, TOL, and FFU are of the greatest interest for diagnosis.

The ratio of volumes and capacities that make up the TEL is called the "structure of the total lung capacity."

Interpretation of the main indicators of spirometry:

- Forced expiratory volume in the first second (FEV₁, FEV₁) —

is the amount of air exhaled from the lungs by the patient in the first second of exhalation. The normal value is not less than 80% of the proper value.

- Forced vital capacity (FVC) is

the amount of air exhaled from the lungs at maximum speed (forced exhalation) after the deepest possible inhalation. Normally, it is more than 80% of the proper value. With bronchial asthma, COPD and some other diseases, it decreases.

- Modified Tiffno Index (FEV₁/FVC) is the ratio

the two previous indicators. Normally, its value exceeds 75%. The Tiffno index significantly decreases with obstruction of the upper respiratory tract, which is the main criterion for diagnosing bronchial asthma, COPD and some other diseases.

- Average forced expiratory flow rate of 25–75%

from FVC (SOS_{25–75%}, FEV_{25–75%}). Normally, its value exceeds 75% of the proper value. It is the earliest and most sensitive marker of upper airway obstruction.

- Peak volumetric forced expiratory flow rate (PEF, PEF) —

this is the main indicator of self-control in obstructive pulmonary diseases and bronchial asthma. It represents the maximum volume of air exhaled from the lungs in 1 s during a forced (forced) exhalation after the deepest possible inspiration. Normally, its value exceeds 80% of the proper value.



The main indicators of spirometry (norms)

- Forced expiratory volume in the first second (FEV₁, FEV₁) > 80%
- Forced vital capacity (FVC) > 80%
- Modified Tiffno Index (FEV₁/FVC) > 75%
- Average forced expiratory flow rate of 25–75% from FVC (SOS25–75%, FEV25–75%) > 75%
- Peak forced expiratory flow rate (PEF) > 80%

In addition to spirometry, the determination of a complete blood count, blood gases and acid-base balance, biochemical studies are widely used - lipid spectrum, enzymes (LDH, ACE, etc.), calcium, sputum examination, bacteriological, radiological research methods, ergospirometry, provocative tests, peak flowmetry.

Of great diagnostic importance is the definition of sputum.

Sputum analysis begins with its external examination in a Petri dish, which is placed alternately on a black and white background.

Sputum color:

General rule:

- clear mucus is the usual protective sputum;
- cloudy sputum - there is an inflammatory process.

Mucous sputum is colorless (transparent), viscous, practically does not contain cellular elements. It occurs in many acute and chronic diseases of the upper and lower respiratory tract.

Serous sputum is colorless, liquid, frothy. Excreted in pulmonary edema.

Purulent (or putrid) sputum contains pus. The color of sputum is yellow or green. Purely purulent sputum occurs, for example, when a lung abscess ruptures into a bronchus; mixed - mucopurulent sputum is more often observed.

Green sputum is generally any pathology associated with delayed outflow (sinusitis, bronchiectasis, post-tuberculosis disorders, etc.) In adolescents with green sputum, ENT pathology should first be ruled out, and not chronic bronchitis should be assumed.

Amber-orange sputum reflects an eosinophilic reaction and is indicative of an allergy.

Bloody - sputum with an admixture of blood. It can be purely bloody against the background of pulmonary bleeding, or mixed, for example, mucopurulent with streaks of blood in bronchiectasis. If blood is retained in the airways, hemoglobin is converted to hemosiderin, and the color of the sputum becomes rusty (rusty sputum). Blood in the sputum (even single streaks) is always a warning sign that requires careful examination.

Pearly sputum contains round, opalescent inclusions consisting of atypical cells and detritus. Pearly sputum is observed in squamous cell carcinoma of the bronchi.

When settling, sputum can exfoliate:

Three-layer sputum is profuse, purulent sputum, which, when settling, is divided into three layers:

upper - serous, frothy;

medium - slimy, colorless, transparent;

the lower one is dirty gray-green in color, containing pus and remnants of necrotic tissues.

Seen in gangrene of the lung.

Table 1
Sputum analysis

Components of sputum	Deciphering the analysis
Kurshman spirals	Bronchospasm syndrome, the most likely diagnosis is asthma.
Charcot Leiden Crystals	Allergic processes, bronchial asthma.
Eosinophils, up to 50-90% of all leukocytes	Allergic processes, bronchial asthma, eosinophilic infiltrates, helminthic invasion of the lungs.
Neutrophils, more than 25 per field of view	infectious process. It is impossible to judge the localization of the inflammatory process.
Squamous epithelium, more than 25 cells per field of view .	Admixture of discharge from the oral cavity
Alveolar macrophages	The sputum sample comes from the lower respiratory tract.
Elastic fibers	Destruction of lung tissue, abscess pneumonia.

bacteriological research.

Bacteriological examination methods and PCR diagnostics are highly informative when taking material during bronchoscopy and deep expectoration of sputum from the lower respiratory tract, the study of smears characterizes mainly the flora of the upper respiratory tract.

Sputum culture is carried out no later than 2 hours after collection. If tuberculosis is suspected, then sputum collection is carried out for 3 consecutive days.

Bacteriological research allows to identify the type of microbes and determine their antibiotic sensitivity.

Usually in healthy individuals, sputum culture reveals alpha-hemolytic streptococcus, Neisseria spp., diphtheroids.

Detection of only normal microflora does not mean the absence of infection. The culture result should be interpreted taking into account the clinical picture and the general condition of the patient.

The criterion for the etiological significance of the pathogen will be the detection of a microbe at a concentration of 10^6 in 1 ml and above. But the detection of Mycobacterium tuberculosis in any quantity should be taken seriously.

Bronchoscopic examination is indicated if it is necessary to conduct a differential diagnosis of chronic obstructive bronchitis with other diseases (bronchiectasis, cancer, bronchial tuberculosis, etc.), as well as

to assess the condition of the bronchial mucosa and cultural study of bronchial contents.



The gas composition of the blood

With an increase in the feeling of shortness of breath, in patients with clinical signs of respiratory failure, with a decrease in FEV1 values <50% of the due values, it becomes necessary to study blood gases and acid-base balance to decide whether long-term oxygen therapy is appropriate

Taking into account the fact that disturbances in the diffusion ability and gas composition of blood at rest in the initial stages of the disease may be absent and manifest only during physical activity, it is recommended to conduct and evaluate a test with physical activity in order to objectify and document the degree of their violations. Preference is given to a walking test - a test with a 6-minute walk. It is usually used to select patients for rehabilitation programs and is used in cases where the severity of dyspnea does not correspond to a decrease in FEV1.

The 6-minute walk test is performed according to the standard protocol (Enright & Sherill, 1998) [4]. Patients are instructed about the purpose of the test. They are asked to walk along the measured corridor at their own pace, trying to cover the maximum distance within 6 minutes. Patients are allowed to stop and rest during the test, but must resume walking when they feel it is possible. While walking, it is allowed to encourage patients with the phrases: "Everything is going well", "Keep going at the same pace." Before and at the end of the test, dyspnea is assessed on the Borg scale (0-10 points: 0 - no dyspnea, 10 - maximum dyspnea) [5], SatO2 and pulse. Patients stop walking when the following symptoms occur: severe dyspnea, chest pain, dizziness, pain in the legs and when SatO2 drops to 86%.

In diseases of the respiratory organs, such a large amount of acids or bases can accumulate in the blood that the regulatory mechanisms (blood buffer systems, respiratory and excretory systems) can no longer maintain the pH at a constant level, and acidosis or alkalosis develops. These indicators are determined in the study of blood by the method of determining the acid-base balance.

Classification of disorders of acid-base balance

GFR disorders are classified according to several criteria.

table 2

Types of violations of acid-base balance

Criteria	Types of violations of the ASC

Direction of changes in $[H^+]$ and pH	Acidosis, alkalosis
Causes that caused violations of the ASC	Endogenous, exogenous
The degree of compensation for violations of the ASC	Compensated, subcompensated, uncompensated
Causes and mechanisms of development of violations of the ASC	Gas Non-gas metabolic excretory (renal, gastric, intestinal) exogenous Mixed (combined)

Acidosis and alkalosis

Acidosis is a typical form of acid-base balance disorder, characterized by a relative or absolute excess of acids in the body.

In the blood with acidosis, there is an absolute or relative increase in $[H^+]$ and a decrease in pH below the norm (conditionally - below the average pH, taken as 7.39).

Alkalosis is a typical form of violation of the acid-base balance, characterized by a relative or absolute excess of bases in the body.

In the blood with alkalosis, there is an absolute or relative decrease in $[H^+]$ or an increase in pH (conditionally - above the average pH, taken as 7.39).

Endo- and exogenous acidosis and alkalosis

- Endogenous causes of ASC shifts are the most frequent and significant in clinical practice. This is explained by the fact that in many disorders of the vital activity of various organs and tissues, the functions of both chemical buffer systems and physiological mechanisms for maintaining optimal ASC in the body are disrupted.

- Exogenous causes of violations of the acid-base balance: excessive intake of acidic or alkaline substances into the body.

† Drugs used in violation of the dosage and / or treatment regimen (for example, salicylates; solutions for artificial nutrition, including proteins containing acidic substances: NH_4Cl , arginine • HCl , lysine • HCl , histidine. H^+ is formed during their catabolism).

† Inadvertently or knowingly toxic substances (eg, methanol, ethylene glycol, paraldehyde, hydrochloric acid).

† Food. Acidosis often develops in people using synthetic diets (contain amino acids with acidic properties). Consumption of large quantities of alkaline mineral waters and milk can lead to the development of alkalosis.

Compensated and uncompensated violations of the ASC

The determining parameter of the degree of compensation for violations of the ASC is the pH value.

- Compensated shifts of the acid-base balance are those at which the blood pH does not deviate beyond the normal range: 7.35–7.45. 7.39 is conditionally taken as a “neutral” value. pH deviations in the ranges: 7.38–7.35 - compensated acidosis, 7.40–7.45 — compensated alkalosis.

In the case of compensated forms of ABA disturbances, changes in the absolute concentration of the components of the hydrocarbonate buffer system (H_2CO_3 and NaHCO_3) are possible. However, the $[\text{H}_2\text{CO}_3]/[\text{NaHCO}_3]$ ratio remains in the normal range (i.e. 20/1).

- Uncompensated violations of the acid-base balance are those in which the pH of the blood goes beyond the normal range:

At pH 7.34 and below - uncompensated acidosis.

At pH 7.46 and above - uncompensated alkalosis.

Uncompensated acidosis and alkalosis are characterized by significant deviations in both the absolute concentration of H_2CO_3 and NaHCO_3 , and their ratio.

Some authors distinguish the so-called subcompensated acidosis and alkalosis.

pH 7.29 - subcompensated acidosis (below 7.29 - uncompensated acidosis).

pH 7.56 - subcompensated alkalosis (above 7.56 - uncompensated alkalosis).

Gas and non-gas disorders

According to the criterion of "causes and mechanisms of development," ASC disorders are divided into gas, non-gas and mixed (combined).

Gas disorders

Gas (respiratory) disorders of the ASC (regardless of the mechanism of development) are characterized by a primary change in the content of CO_2 in the body and, as a result, the concentration of carbonic acid in the ratio:

$[\text{HCO}_3^-]/[\text{H}_2\text{CO}_3]$.

With gaseous acidosis, the denominator of the ratio (i.e., the concentration of carbonic acid) increases, with gaseous alkalosis, it decreases.

- Gas acidosis and alkalosis, as a rule, remain compensated for a long time. This is due both to the activation of physiological compensation mechanisms (mainly due to a mobile decrease in the volume of alveolar ventilation - an increase in gaseous acidosis and a decrease in gaseous alkalosis), and the effects of buffer systems.

- Reasons for the development of gas disorders of the ASC: violations of alveolar ventilation. As a result, the volume of lung ventilation ceases to meet the needs (it is higher or lower) of the body's gas exchange for a certain time.

X-ray methods.

X-ray examination is carried out in the following situations:

- suspicion of a complicated course of biofeedback (atelectasis, etc.);
- exclusion of pneumonia;
- suspicion of a foreign body;
- recurrent course of biofeedback (if no radiography has been performed previously).

According to the indications, bronchoscopy, scintigraphy, computed tomography of the lungs, sweat test, etc. are performed.

The scope of the examination is determined individually for each patient.

Severe cases of bronchial obstruction and recurrence of BOS require mandatory hospitalization to clarify the genesis and differential diagnosis of BOS.



When making a diagnosis, the epidemiological history, the presence of symptoms of intoxication against the background of elevated body temperature, and inflammatory processes in the nasopharynx are important. Laboratory studies make it possible to identify the pathogen by ELISA from swabs of nasopharyngeal mucus.

During the initial X-ray examination, it is possible to exclude other diseases accompanied by clinical symptoms similar to those of COPD, in particular, neoplastic processes and tuberculosis. In mild COPD, significant x-ray changes are usually not detected. In the bronchitis variant of COPD, X-ray data provide important diagnostic information about the state of the bronchial tree: an increased density of bronchial walls and their deformation are detected.

X-ray diagnostics is especially informative for the detection and evaluation of pulmonary emphysema. Detection of increased transparency of the lung fields, low standing of the dome of the diaphragm, limitation of its mobility are signs of emphysema. A more in-depth method of X-ray diagnostics, which increases the level of detection of various forms of emphysema, is computed tomography, especially high resolution. Chronic bronchitis is outside the limits of the X-ray method. In case of exacerbation of bronchitis, fluorograms and radiographs make it possible to exclude pneumonia, lung cancer, tuberculosis, etc. The presence of focal-infiltrative changes in the lungs on chest X-ray, in combination with the corresponding symptoms of lower respiratory tract infection, makes it possible to verify the diagnosis of pneumonia.

The radiological sign of pneumonia is an infiltrative, usually unilateral darkening of the lung tissue.

Pleural effusion (usually limited) complicates the course of community-acquired pneumonia in 10-25% of cases.

The formation of destruction cavities in the lungs testifies in favor of staphylococcal infection, aerobic gram-negative pathogens of the intestinal group and anaerobes.

ECG data in most cases allow us to exclude the cardiac genesis of respiratory symptoms. ECG analysis in severe COPD may reveal signs of right heart hypertrophy, indicating the development of stable pulmonary hypertension.

Ergospirometry is a non-invasive method for assessing the reactions and interactions of the cardiovascular and respiratory systems, as well as metabolic processes in the body during exercise.

The study is a stress test, during which the patient's gas exchange is continuously monitored and all indicators of heart function, ECG and blood pressure are simultaneously evaluated.

Peakflowmetry is a diagnostic method in which the peak velocity of exhaled air is measured using a special device - a peakflowmeter.

Peakflowmetry is prescribed for patients with bronchial asthma, chronic bronchitis and other diseases that require constant monitoring of the state of airway patency. Since allergy sufferers with sensitive nasal and bronchial mucosa are often predisposed to bronchial asthma, peak flow measurements will be useful for them too.

Indications for peak flowmetry

- it is necessary to distinguish bronchial asthma from chronic obstructive pulmonary disease (COPD).
- Control of bronchial asthma.
- Prognosis of exacerbation of the disease.
- Determine the feasibility of changing the treatment strategy.
- Assess the patient's response to new drugs.
- Prevent drug addiction.

Examination of a patient with broncho-obstructive syndrome is carried out depending on the disease that causes the clinic of this syndrome.

Thus, a patient with acute bronchitis lasting no more than 3 weeks does not require any examination, including sputum cultures (level of evidence C) and x-ray methods of examination (level of evidence B), unless, of course, the doctor suspects the development of pneumonia, which should appear if the clinical picture of acute bronchitis is accompanied by tachycardia >100 beats per minute, dyspnea at rest with a respiratory rate >24 beats per minute, high fever >38°C, and auscultatory signs of pneumonia. If cough and other symptoms of BOS persist for more than 3 weeks, the causes of such a course of the disease should be clarified. In this situation, the examination of the patient begins with a fluorography or radiography of the lungs, a clinical blood test and spirometry with a bronchodilation test. The results of these studies, together with clinical and anamnestic data, will determine further diagnostic search. If bronchiectasis, bronchiolitis obliterans or other diffuse parenchymal lung diseases, including sarcoidosis, are suspected, plain lung radiography does not always provide sufficient information and often there is a need for computed tomography of the lungs and complex functional studies (body plethysmography, lung diffusion capacity study). To confirm the diagnosis of asthma, bronchoprovocation tests are often used, and in the absence of such an opportunity, peak flowmetry for 2-3 weeks. The diagnosis of COPD is made in the presence of relevant risk factors, primarily smoking, and the exclusion of other causes of BOS.

Treatment of bronchial obstructive syndrome.

The tactics of managing people suffering from broncho-obstructive syndrome can differ significantly depending on its cause. Each nosological form has its own treatment features. Thus, anti-inflammatory therapy is recommended for bronchial asthma, antibacterial therapy for pneumonia, a combination of chemotherapy and surgical treatment for tumors, and sedatives and psychotherapy for psychogenic disorders.

However, to alleviate their condition, eliminate unpleasant symptoms and prevent complications, all patients are prescribed bronchodilator therapy according to general principles. For this are used:

- β_2 -agonists;
- anticholinergics;
- methylxanthines.

The expediency of such treatment is determined by the severity and duration of the violation of bronchial patency.

The main provisions of the treatment of broncho-obstructive syndrome

- Should be aimed at eliminating the cause of the disease that led to the development of bronchial obstruction
- Improving the drainage function of the bronchi
- Carrying out bronchodilator therapy
- Carrying out anti-inflammatory therapy
- The severe course of an attack of bronchial obstruction requires oxygenation of the inhaled air, up to mechanical ventilation.

Principles of treatment of broncho-obstructive syndrome

- Elimination of allergies
- To give up smoking
- Oxygen therapy
- Short-acting beta-agonists (salbutamol, fenoterol)
- Ipratropium bromide
- Inhaled corticosteroids
- GCS systems (prednisolone)
- Methylxanthines (aminophylline, theophylline)
- Leukotriene antagonists

Groups of drugs that are used to treat bronchial obstruction syndrome

1. Bronchodilators:

- adrenomimetics
- anticholinergics
- xanthines

2. Expectorants:

- drugs that stimulate expectoration (secretory) - (reflex action, resorptive action)
- mucolytic drugs (bronchosecretolytic) - (proteolytic enzymes, acetylcysteine, ambroxol and bromhexine).

3. Drugs that eliminate swelling of the bronchial mucosa:

- glucocorticosteroids;
- mast cell membrane stabilizers.

One of the most significant diseases characterized by biofeedback is bronchial asthma (BA).

Asthma is a multifactorial disease in which a chronic inflammatory process in the airways and bronchial hyperreactivity is formed, and a characteristic symptom is transient bronchial obstruction (local or generalized); The clinical symptoms of AD may include paroxysms of coughing, wheezing, and suffocation.

Key provisions of the mechanisms of development of bronchial asthma

1. Bronchial asthma is a chronic persistent inflammatory disease of the respiratory tract, regardless of the severity of the course.

2. The inflammatory process leads to bronchial hyperreactivity, obstruction and respiratory symptoms.

3. Airway obstruction comes in four forms:

- acute bronchoconstriction due to spasm of smooth muscles;
- subacute - due to edema of the mucous membrane of the respiratory tract;
- obstructive - due to the formation of mucous plugs;
- sclerotic - sclerosis of the bronchial wall with a long and severe course of the disease.

4. There is atopy - a genetic predisposition to the production of immunoglobulins of the E (IgE) class.

Bronchial asthma should be suspected in the following cases:

Repeated episodes (two or more per year) of coughing and wheezing with or without shortness of breath in the absence of symptoms of an acute respiratory viral infection - catarrhal and intoxication syndromes, in particular, fever;

The same signs on the background of a respiratory viral infection, but quickly reversible when using adrenomimetics;

Repeated attacks of coughing without wheezing and shortness of breath, stopped by bronchospasmolytics.

At the same time, it is necessary to exclude other diseases with similar clinical manifestations - pulmonary embolism, aspiration of gastric contents in case of gastroesophageal reflux, etc.

The diagnosis of asthma becomes more likely in the presence of risk factors for its development (family and personal history of allergic diseases, etc.), characteristic situational aspects of the onset of symptoms (at night or in the early morning hours, during exercise, etc.), a clear relief and preventive effect of bronchospasmolytics, and sometimes, in the early stages of the disease, antihistamines. To confirm the diagnosis, it is necessary to monitor the functional parameters of breathing, study the reactivity of the respiratory tract, conduct an allergological examination, etc.

Overestimate the importance of early diagnosis of asthma and identification of its causes, since etiotropic treatment is most effective in the early stages of the disease.

There are 4 phases during bronchial asthma.

The exacerbation phase is the resumption, frequency and intensification of seizures, coughing, shortness of breath, distant wheezing, a decrease in the effectiveness of bronchodilators. An increase in signs of respiratory discomfort may be accompanied by clinical (fever, chills, sweating) and laboratory (leukocytosis, eosinophilia, etc.) signs of inflammation.

The phase of unstable remission is a condition in which signs of respiratory discomfort have become less pronounced, but stable remission has not yet been achieved.

Remission of bronchial asthma - diagnosed in cases where attacks of respiratory discomfort are stopped, single attacks of suffocation or other signs of respiratory discomfort may occur in accordance with the severity of bronchial asthma,

Persistent remission can be diagnosed in those patients who have no signs of exacerbation of the disease for more than 2 years.

Treatment.

The course of BA consists of 2 moments - from the interictal period and attacks of bronchial asthma, and often in the interictal period there may be no clinical signs of BA, which makes it extremely difficult to diagnose the disease.

To prescribe adequate therapy, it is necessary to take into account the severity of the course of asthma, the phase of the course, the severity of exacerbation (if the disease is in the acute stage), the clinical and pathogenetic variant of bronchial asthma.

In this regard, it is necessary to treat bronchial asthma not in general, but taking into account one of the specific situations, distinguishing between:

- 1) treatment of an asthma attack (or an early asthmatic reaction) aimed at eliminating paroxysmal spasm of the smooth muscles of the bronchi and bronchioles;
- 2) treatment of exacerbation of BA and a late asthmatic reaction pathogenetically close to it, aimed at suppressing inflammatory reactions occurring in the bronchial tree;
- 3) treatment of asthmatic status, including urgent measures to combat allergic inflammation of the bronchi, bronchospasm, acute respiratory failure, rebound syndrome, hypovolemia and blood hypercoagulation.

In the phase of stable remission of asthma, no treatment is required.

Let's start with organizational events. Elimination therapy is carried out in order to remove from the environment of the patient allergens that cause allergic reactions.

It is an important and mandatory type of treatment that can reduce the frequency of asthma exacerbations and the severity of clinical symptoms, and reduce the need for drugs in patients. This treatment should be used in all patients and has no contraindications or side effects.

Household sensitization is most associated with: allergy to mites.

To decartelize the dwelling, the following measures are taken: removal of upholstered furniture and carpets from the room; the use of special flare-proof covers for pillows, mattresses and blankets; cleaning bedding with a vacuum cleaner at least once a week, and washing bed linen every 1-2 weeks; replacement of down and feather beds and pillows with synthetic winterizers; use of vacuum cleaners equipped with filters or water reservations.

It is necessary to carry out daily wet cleaning of the premises (there is evidence that mopping with 10-20% saline solution reduces the number of mites); store books in glass cabinets; maintain a relative humidity of no higher than 50%, which adversely affects the growth and reproduction of mites.

It is necessary to regularly ventilate the premises; It is recommended to use an air cleaner with filters.

Elimination measures in case of sensitization to animal allergens: remove pets from the apartments and carefully clean the premises after that; you can not get new animals; if it is not possible to eliminate the animal, it must be kept out of the bedroom.

Use clothes made of synthetic fabrics instead of wool and fur products; patients with epidermal sensitization should not be administered heterologous sera (anti-tetanus, anti-diphtheria, anti-botulinum, anti-rabies, etc.) because of the cross-reaction between antigens of dandruff and animal serum.

In case of pollen allergy, the following elimination measures are recommended: departure of patients to another area where there are no plants whose pollen causes the development of the disease; a ban on patients leaving the city during pollination of plants and walking in dry windy weather; close windows and vents with a cloth or film that does not let pollen into the home.

When returning home from the street, you need to rinse the throat, take a shower and change clothes; wear glasses on the street; on days when the concentration of pollen in the air is especially high, patients should not go out; it is recommended to use filters to clean pollen from the air entering the living quarters; in case of cross-allergy, it is necessary to follow an elimination diet (it is forbidden to eat apples if you are allergic to birch dust, etc.).

With insect allergies, measures are taken to combat cockroaches. The use of organophosphorus insecticides is permissible only with a long absence of a patient in this room.

In case of allergic reactions to insect bites, it is recommended: do not walk barefoot on the grass; wear closed clothes and a hat; do not use deodorants and perfumes that attract insects; when insects appear, do not make sudden movements, do not wave your arms; cover windows and doors with insect screens; have an anti-shock kit (tourniquet, 2 ampoules with adrenaline, prednisolone, tavegil, alcohol, cotton wool).

With fungal sensitization, the following preventive measures are necessary: in the premises where the patient lives, there should be no mold; timely treat fungal diseases of nails and skin; prohibit the use of yeast-containing products (beer, kvass, cheese, dry wines, yeast dough, etc.); antibiotics from the penicillin group should not be used.

Elimination therapy for food allergies includes the following:

- with an obvious intolerance to any products, their use is prohibited for life;
- in the absence of convincing data on the intolerance of certain products, the patient is prescribed a hypoallergenic diet with the exclusion of "obligate" allergens: citrus fruits, fish, eggs, chocolate, nuts, strawberries, strawberries, red varieties of apples, pineapples, smoked meats, caviar, canned food, purchased culinary products, alcoholic beverages, carbonated beverages; salt is limited;
- patients are allowed lean meats (boiled beef and chicken), butter (butter, sunflower, corn, olive), lactic acid products (cottage cheese, kefir, yogurt), cereals (buckwheat, oatmeal, rice), vegetables and fruits (boiled potatoes, rutabaga, cabbage, cucumbers, green varieties of apples, watermelon, melon, etc.), berries (currants, gooseberries, cherries, plums, etc.), compotes, tea, lean bread;
- if certain allergens are identified, then all food products in which they are included are excluded from the patient's diet. For example, in case of intolerance to chicken eggs, confectionery products containing eggs (cakes, pastries, cookies, muffins, ice cream, etc.), mayonnaise, pasta, chicken meat, as well as vaccines against influenza, mumps, measles, rubella, are excluded. respiratory organs of typhus, which are made using chicken embryos;
- the development of food allergies is promoted by various diseases of the digestive system (chronic cholecystitis, pancreatitis, intestinal dysbacteriosis, etc.).

For drug allergies, information about which drugs cause an allergic reaction is placed on the front side of the medical history or outpatient card.

Elimination measures are as follows:

- it is forbidden to use both the medicinal product itself and the combined preparations in which it is included. For example, in case of allergy to pyrazolone derivatives, the use of theofedrine, baralgin, pentalgin, spasmalgon, etc. is prohibited;
- the use of drugs that have common antigenic determinants with intolerable drugs is prohibited. For example, with allergic reactions to penicillin, cephalosporins should not be used, with allergies to sulfonamides, local anesthetics.

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TESTS

No. 1) The clinic of bronchial asthma is characterized by:

- A. cough with rusty sputum
- B. fine bubbling wet rales in the lungs
- C. wheezing in the lungs +
- D. inspiratory dyspnea
- E. percussion dullness in the lower parts of the lungs

№ 2) What groups of drugs have a bronchodilating effect?

- A. b₂-agonists +
- B. M-cholinomimetics
- C. ganglion blockers
- D. B₁-blockers
- E. nitrates

3. Choose the correct procedure for providing emergency care to patients with a moderate attack of bronchial asthma

- A. salbutamol, eufillin, prednisone+
- B. intal, eufillin, prednisolone
- C. pulmicort, oxygen, aminophylline
- D. prednisolone, aminophylline, oxygen
- E. eufillin, prednisolone, zaditen

4. Indications for hospitalization of patients with asthma attacks

- A. moderate asthma attack
- B. no effect of bronchodilator therapy within 1-2 hours +
- C. mild attack of asthma
- D. all patients with hormone-dependent form of asthma
- E. Presence of comorbidities

5. Which of the following drugs is a selective b₂-agonist?

- A. Adrenaline
- B. Prednisolone
- C. Eufillin
- D. Atrovent
- E. Berotek

6. What complication develops with frequent use of inhaled β₂-agonists in a patient with bronchial asthma?

- A. anaphylactic shock
- B. pulmonary edema
- C. sudden death
- D. status asthmaticus +
- E. hypertensive crisis

7. In the emergency treatment of an asthma attack, the drugs of choice are:

- A. b₂ - long-acting agonists
- B. b₂ - short-acting agonists +
- C. b₁ and b₂ agonists
- D. anticholinergic drugs
- E. IGCS

8. Peak expiratory flow (PEV) is determined using:
- A. pulse oximeter
 - B. Spirometer +
 - C. Glucometer
 - D. peak flowmeter
 - E. pneumotachometer
9. Basic drugs for the treatment of patients with chronic obstructive bronchitis are:
- A. anticholinergics (ipratropium bromide, atrovent)*
 - B. beta2 - agonists (salbutamol, fenoterol - berotek, asthmapent) *
 - B. inhaled glucocorticoid drugs
 - G. theophylline derivatives
10. Basic drugs for the treatment of bronchial asthma in conditions of the clinic are:
- A. fenoterol (berotek)
 - B. inhaled glucocorticoid drugs (beclamethasone, budesonide) *
 - C. methylxanthines derivatives (teopec, teotard, theophylline)
 - D. sodium cromoglycate (intal)*
11. Bronchial asthma is characterized by:
- A. nocturnal attacks of suffocation with superficial rapid breathing, may accompanied by frothy sputum
 - B. attacks of suffocation with difficulty exhaling, after the end of the attack glassy viscous sputum is secreted *
 - C. weakened vesicular breathing
 - D. out of an attack in the lower parts of the lungs are heard small bubbling inaudible moist rales
12. The plan for examining a patient with broncho-obstructive syndrome in a polyclinic includes:
- A. complete blood count *
 - B. spirometry *
 - C. general sputum analysis +VK, +AK *
 - D. Chest x-ray *
13. Which cells are mainly involved in the development of inflammation in bronchial asthma:
- A. eosinophils
 - B. mast cells
 - C. neutrophils
 - D. T-lymphocytes
 - E. platelets
 - G. all of the above*
14. Allergic form of bronchial asthma is characterized by reactions:
- A. cytotoxic type
 - B. reaginic type *
 - C. all kinds of allergic reactions
 - D. delayed allergy
 - E. damage by immune complexes
15. The appearance of shortness of breath in chronic obstructive bronchitis

due to loss:

- A. trachea
- B. large bronchi
- C. bronchi of medium caliber
- D. small bronchi
- E. bronchioles*

16. For the treatment of a patient in status asthmaticus, all of the following are used, with the exception of:

- A. oxygen therapy
- V. eufillina
- C. corticosteroids
- D. intala*
- E. vibration massage

17. When examining the function of external respiration by a sign obstruction is:

- A. increase in MVL
- B. decrease in MVL
- C. increased VC
- E. decrease in the Tiffno index*
- E. increase in the Tiffno index

18. Paroxysmal cough with scanty, difficult to separate sputum, breathing with prolonged expiration, dry wheezing, reversible bronchial obstruction, the presence of Curschman spirals in the sputum is typical for:

- A. acute obstructive bronchitis
- B. chronic obstructive bronchitis
- C. chronic non-obstructive bronchitis
- D. bronchial asthma*

19. Most reliably indicates the presence of bronchial obstruction:

- A. diffusion capacity of the lungs (for CO₂)
- B. indicators of maximum ventilation of the lungs (MVL)
- C. Tiffno test *
- D. change in lung capacity

20. Irreversible bronchial obstruction syndrome is typical for:

- A. bronchial asthma
- B. acute bronchitis
- C. chronic obstructive bronchitis*
- D. pneumonia

21. Indications for hospitalization of patients with bronchial asthma:

- A. status asthmaticus
- B. to resolve expert issues
- C. if a disease is suspected
- D. all of the above*

22. Severe bronchial asthma is characterized by:

- A. frequent exacerbations
- B. physical activity is limited due to manifestations of bronchial

asthma

- C. peak expiratory flow less than 60: from due, diurnal fluctuations its more than 30%
- D. all of the above*

23. Basic drugs for the treatment of bronchial asthma in conditions of the clinic are:

- A. fenoterol (berotek)
- B. inhaled glucocorticoid drugs (beclamethasone, budesonide)*
- C. methylxanthines derivatives (teopec, teotard, theophylline)
- D. anaprilin

24. During dispensary observation of a patient suffering from bronchial asthma of moderate severity, examinations are necessary:

- A Allergist
- V. Pulmonologist
- S. Dentist
- D. all of the above*

25. Patients with bronchial asthma, medium-severe persistent course during dispensary observation are examined:

- A. Once a year
- B. 1 time in 2 years
- C. 2 times a year
- D. 3-4 times a year*

ANSWERS TO TESTS

1 - C	14 - B
2 - A	15 - E
3 - A	16 - Д
4 - B	17 - Д
5 - A	18 - Д
6 - Д	19 - C
7 - B	20 - C
8 - B	21 - Д
9 - A, B	22 - Д
10 - Д	23 - B
11 - B	24 - Д
12 - A,B,C,Д	25 - Д
13 - Ж	