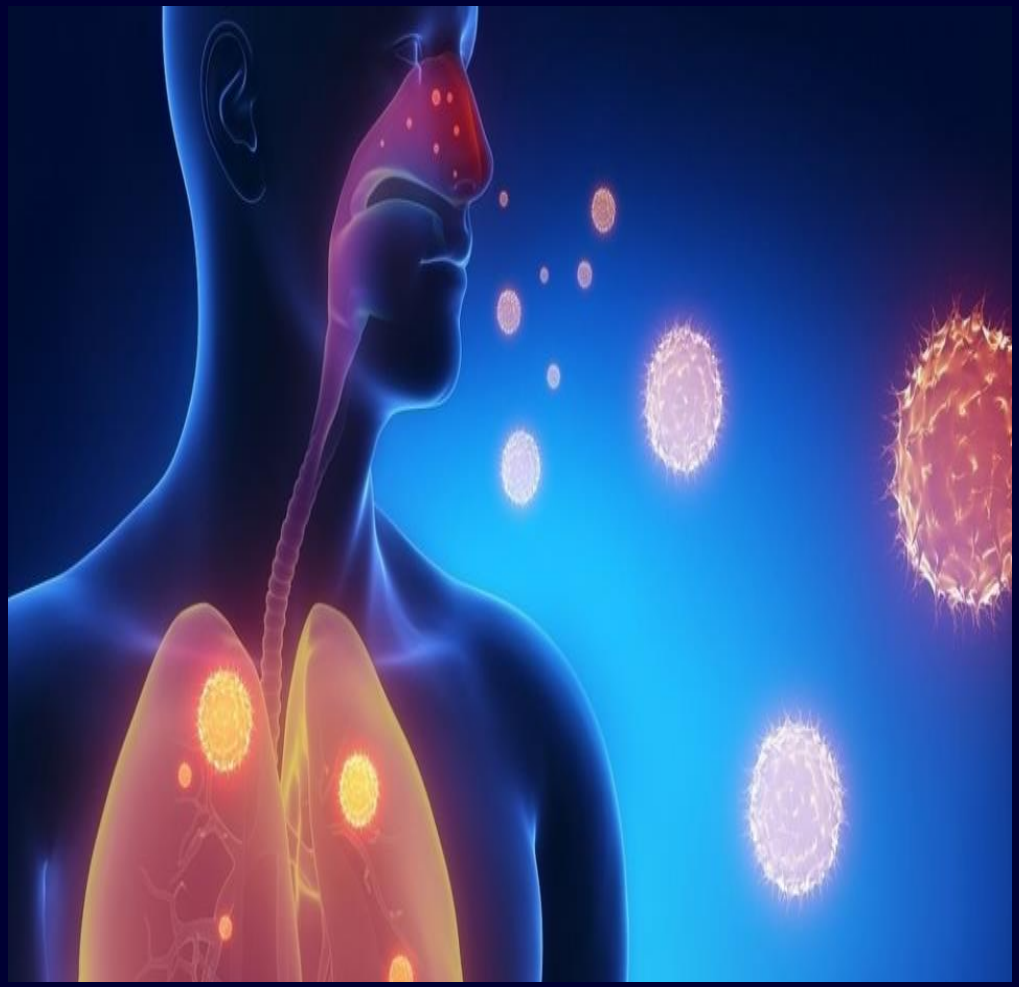
Azerbaijan Medical University

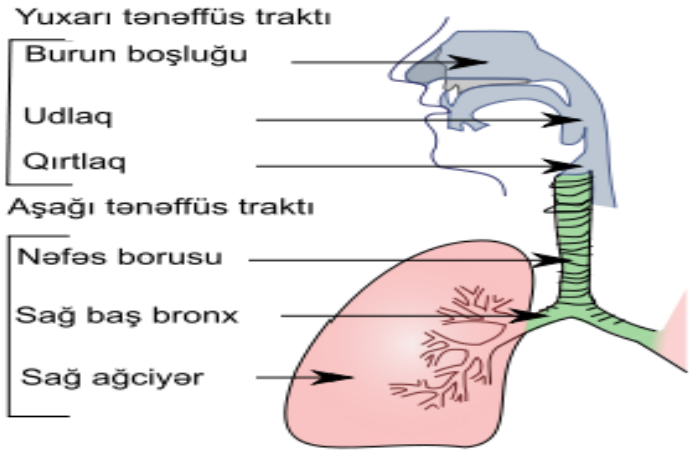


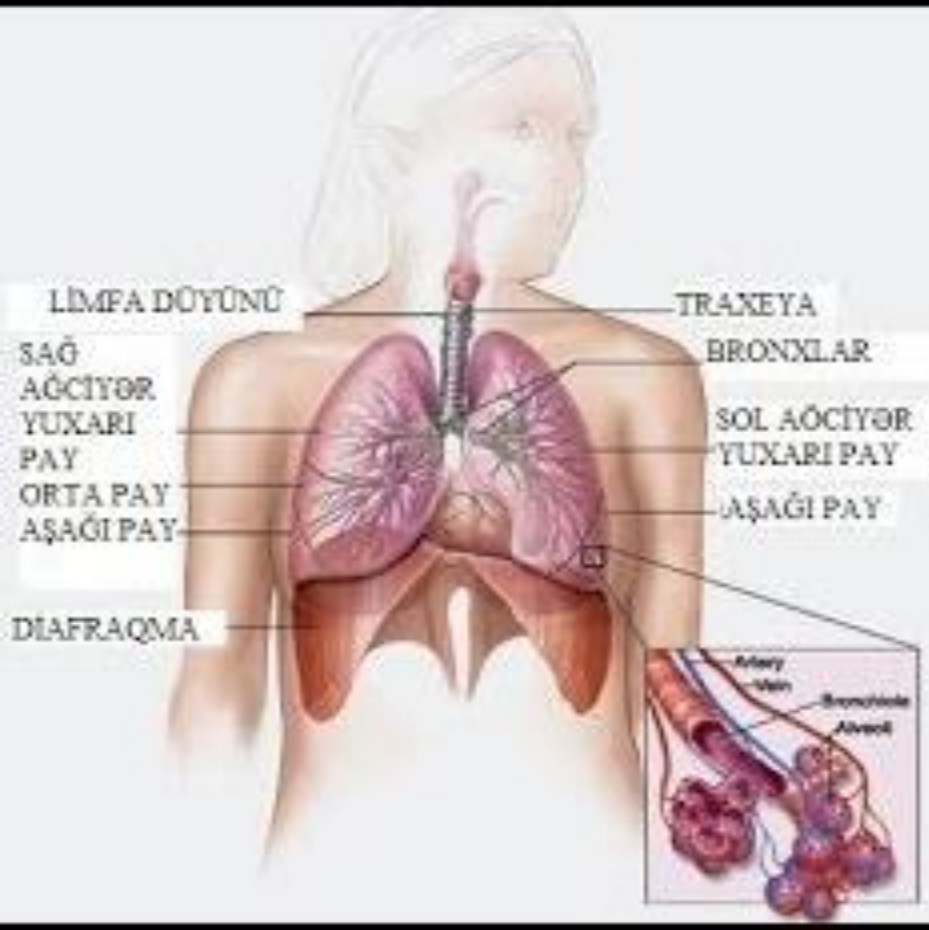
LABORATORY DIAGNOSIS OF RESPIRATORY DISEASES.

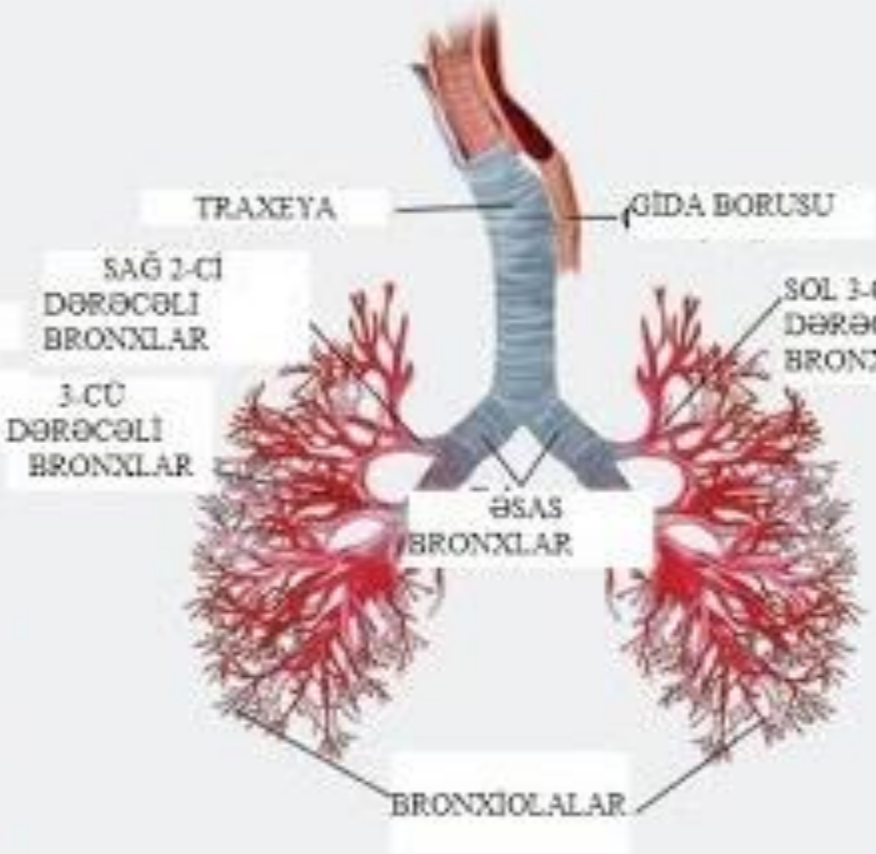
Department of Pathological Physiology

RESPIRATORY DISEASES

Gas exchange between living organisms and the environment is called respiration







The number of respiratory movements in adults at rest is 16-20 per minute.

For women, this number is 18-22

When stretched - 14 in 1 min

When standing up- 1 min. 18-20

In an emotional state-
deep breathing

Classification of respiratory system diseases

Classification:

Distribution -diffuse/local

Due to ventilation problems:

Obstructive:

- Chronic obstructive bronchitis (COB)
- Bronchiectasis
- Chronic obstructive pulmonary emphysema
- Chronic bronchiolitis
- Bronchial asthma

Restrictive:

- Pneumoconiosis
- Interstitial pneumonia, including exogenous allergic alveolitis
- Idiopathic fibrosing alveolitis
- Goodpasture's syndrome
- Sarcoidosis
- Idiopathic pulmonary hemosiderosis

Mixed : (almost all terminal chronic diseases)

EVALUATION OF EXTERNAL RESPIRATORY FUNCTION OF THE BODY

lung volume

reflects the elastic properties of the lungs and chest..

dynamic indicators of lung volume characterize airway permeability

Expiratory flow rate-The rate of airflow depends on the volume of the lungs and the force of exhalation. Air flow begins to increase with increasing exhalation force

Diffusion capacity of the lungs (DC) is the most effective indicator of the transfer of gases from the air of the alveoli to the blood of the pulmonary capillary.

Indicators of pulmonary ventilation

- Respiratory volume (RV).
- Vital capacity of the lungs (VCL).
- Increased vital capacity of the lungs (IVCL).
- Forced expiratory volume in 1 second (FEV-1s).
- FEV-1s / IVCL -The ratio of FEV-1c to IVCL (Tiffno index)
- Total lung volume (TLV)
- Functional residual lung capacity (FRLC)

DIAGNOSTIC METHODS

Laboratory

Screening tests:

- General blood analysis
- General analysis of urine
- Biochemical analysis of blood

Special analyses:

- General analysis of sputum
- Sputum for tuberculosis mycobacteria
- Sputum for atypical cells
- Sputum for culture of bacteria
- Examination of pleural fluid

İnstrumental

Functional diagnostic methods

- X-ray, as well as x-ray contrast
- Ultrasound
- Radioisotope
- Endoscopic

Screening methods of laboratory diagnostics are carried out in clinical and biochemical laboratories

General analysis of blood from the finger blood sampling, counting of blood form elements and analysis:

-1. Leukocytosis, toxic granularity of neutrophils, ESR ↑: signs of microbial inflammation
-2. Eosinophilia, ESR ↑: signs of allergic inflammation, parasitic diseases
-3. Anemia, ESR ↑: signs of tumor processes, bleeding and chronic intoxication
-4. Erythrocytosis, hematocrit (HTC) number ↑, ESR ↓,: signs of chronic respiratory failure

Screening methods of laboratory diagnostics

General analysis of urine - to determine the physical, chemical properties and microscopy of urine sediment:

- Oliguria,
- Saturated yellow color of urine,hypersthenuria,
- Low or moderate proteinuria:
- High fever, signs of intoxication

Biochemical analysis of blood - taking a blood sample from a vein and analyzing a number of parameters

Dysproteinemia, α2 and γ globulins, sialic acids, seromucoid, fibrinogen, C-reactive protein ↑: nonspecific signs of immune inflammation

Special laboratory research methods

- General analysis of sputum
- Sputum for tuberculosis mycobacteria
- Sputum for atypical (tumor) cells
- Sputum for culture of bacteria
- Examination of pleural fluid

Sputum is a pathological discharge that comes out with cough during lung diseases, it is released during coughing, it is formed when the mucous membrane of the trachea and bronchi is damaged by infectious, physical or chemical substances.

1. Physical properties of sputum

2. Microscopic determination of sputum

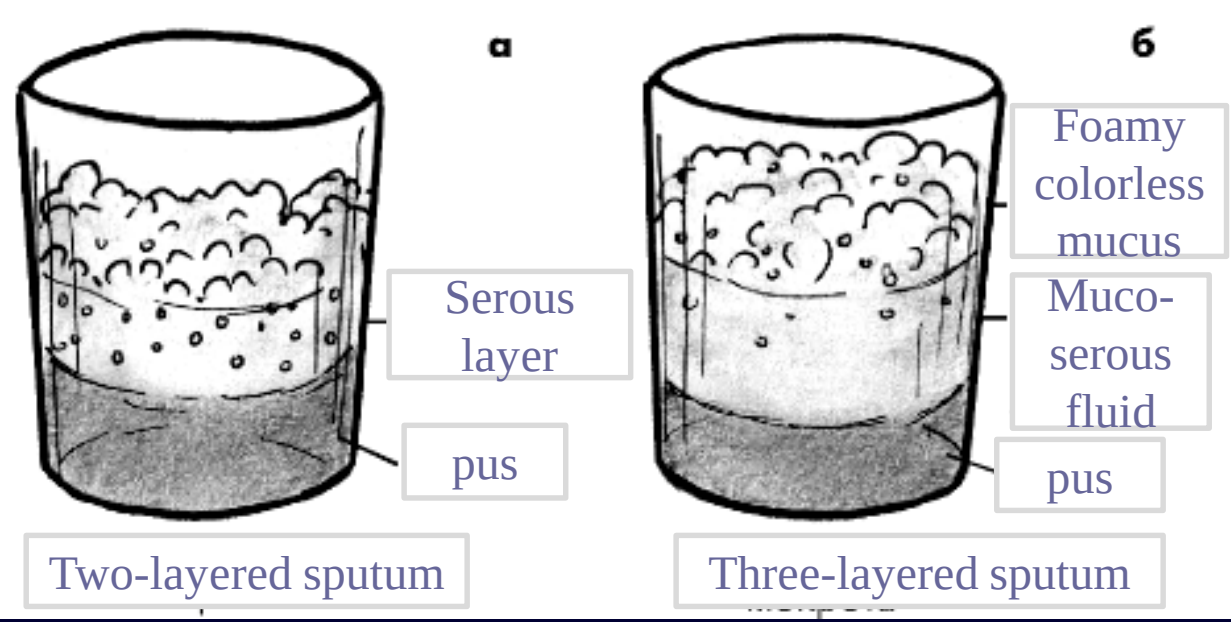
Taking sputum for research

- Cough cabin (sputum collection cabin). A distinctive feature of the cabin is its low weight (120 kg).
- Sterile container – individual polypropylene container for collecting liquid biomaterial. Volume - 150ml.

Characteristics of sputum in various pathological conditions

Disease	The nature of sputum
Bronchitis	Mucopurulent or purulent-mucous. There are few leukocytes, few erythrocytes, and enough epithelial cells.
Bronchial asthma	A small amount, slimy, solid, colorless. Many eosinophils, single erythrocytes, epithelial cells, different numbers of leukocytes, Charcot-Leiden crystals, Kurshman spirals
Lung abscess	Lots of sputum. Microscopically, leukocytes, erythrocytes, fibrin, elastic fibers (a sign of lung tissue destruction), hematoid crystals, microbial flora
Pulmonary gangrene	Lots of putrid-smeling sputum. Microscopy reveals a large number of leukocytes in the stage of degradation, elastic fibers, and hematoid crystals.
Bronchiectasis	Profuse sputum secretion early in the morning (when moving from a lying position to a standing position), more often purulent, sometimes with a bad smell. There are few leukocytes, single erythrocytes, Dietrich's plugs, and no elastic fibers.
Tuberculosis	At the initial stage, there is little sputum -mucous, thick, mixed with various purulent nodules. Leukocytes and alveolar epithelium are not numerous. Mycobacteria may be absent. In the late stage - calcified elastic fibers, signs of caseous decay, cholesterol crystals, mycobacteria
Lungs' cancer	The most common is squamous (45-60%), undifferentiated (20-40%), and adenocarcinomas (9-12%). In the sputum - mucous, purulent, bloody cellular elements, atypical cellular complexes with signs of malignant tumors.

Separation of sputum into layers



Two-layered sputum is more common in lung abscess. The upper layer consists of serous foamy liquid, and the lower layer consists of greenish-yellow, opaque pus.

Three-layered sputum -. characteristic of pulmonary gangrene, can sometimes be seen in bronchiectasis, even in patients with bronchitis.

The upper layer consists of colorless, foamy mucus with many air bubbles.

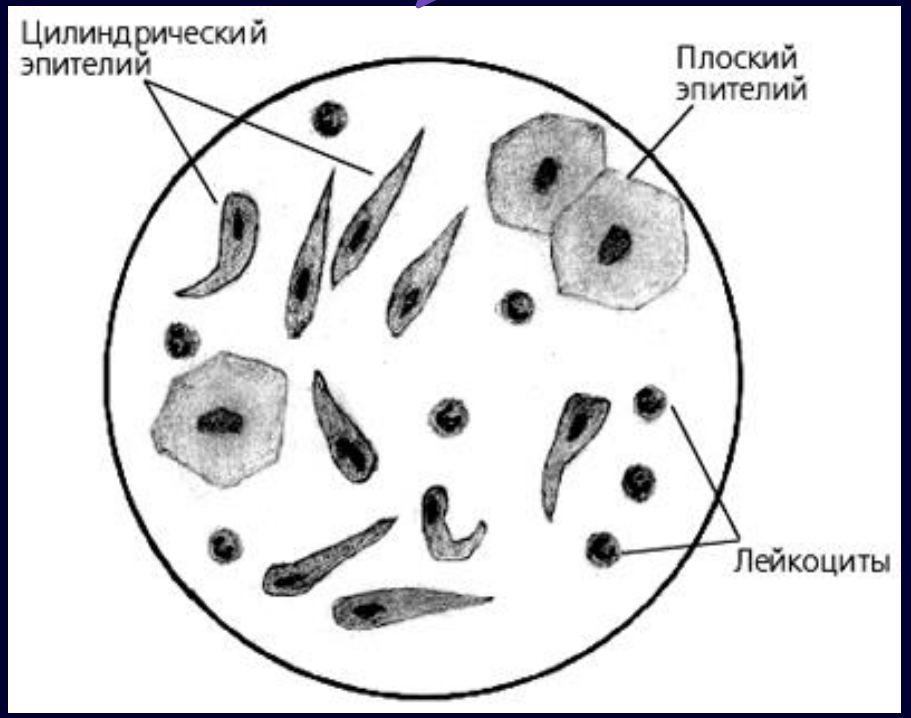
medium — from cloudy muco-serous liquid of yellowish-green color

lower — consists of yellow or greenish opaque pus.

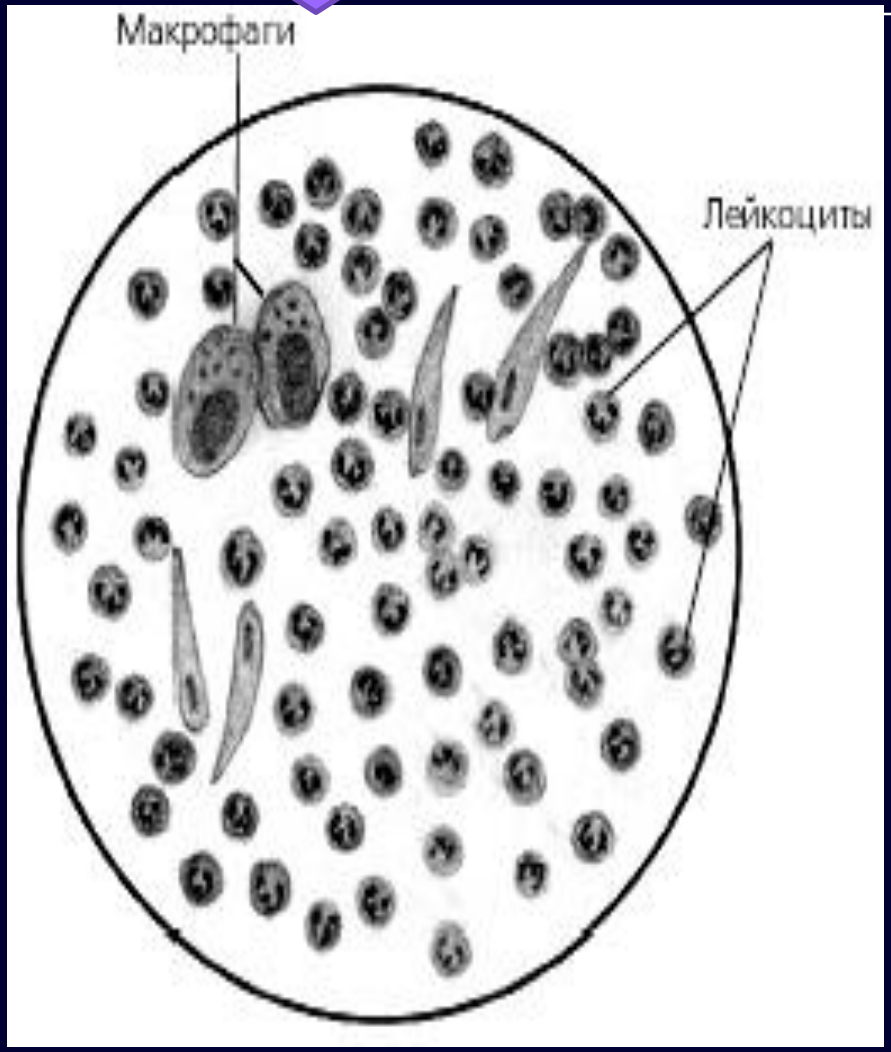
Microscopic examination of sputum

Microscopic examination of sputum preparations allows to determine the nature of the pathological process in the lungs and bronchi, the cell composition that reflects to a certain extent, the activity of the pathological process, various fibrous and crystalline formations, and to assess the state of the microbial flora of the respiratory tract (bacterioscopy).

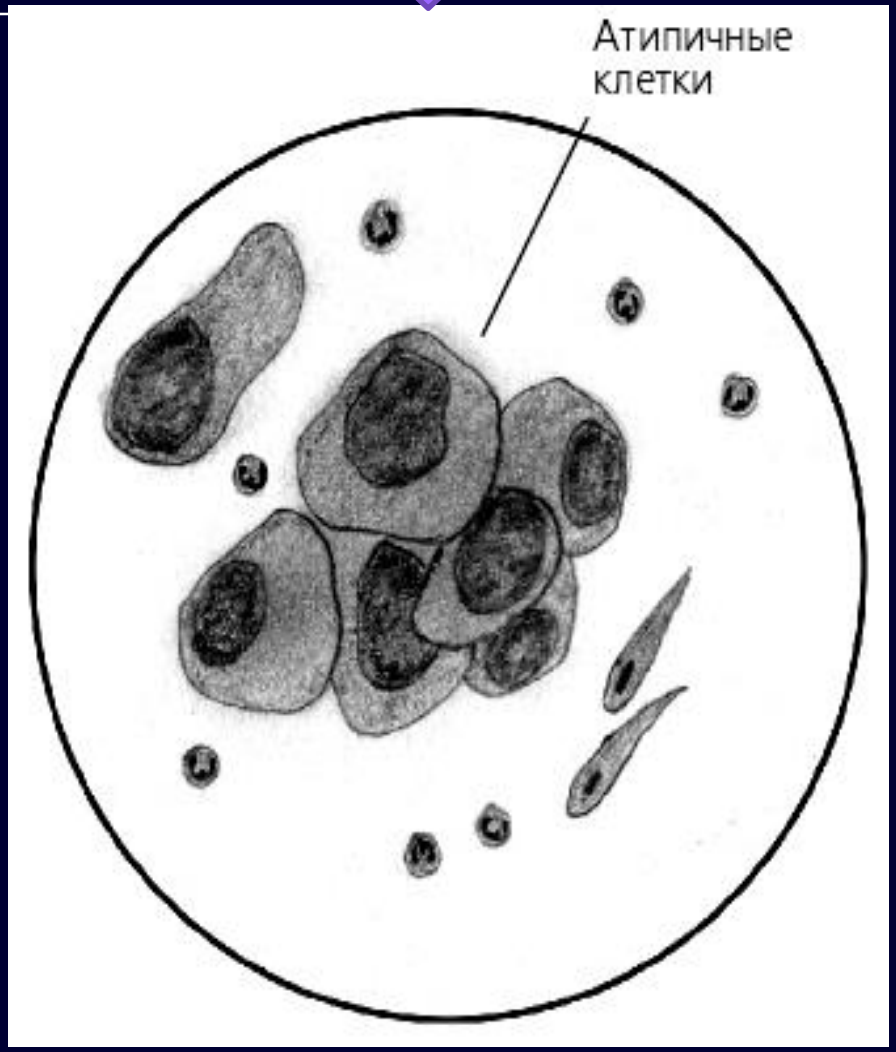
SQUARE AND CYLINDRICAL EPITHELIUM



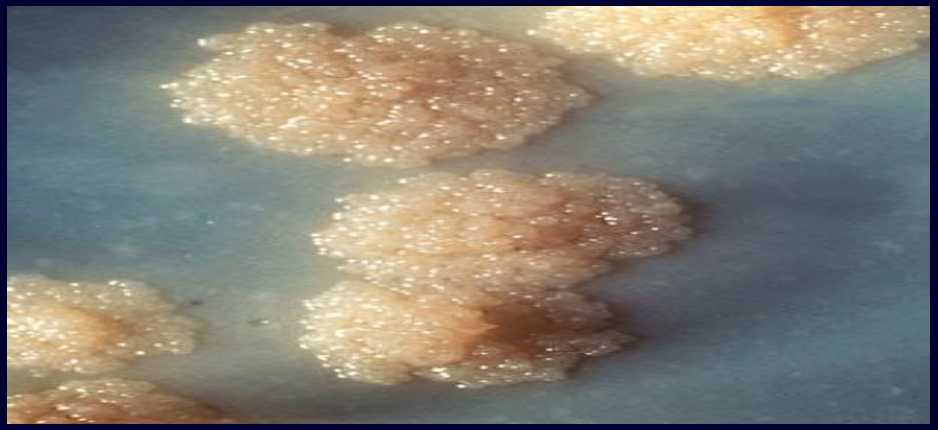
PURULOUS SPUTUM WITH MANY LEUKOCYTES

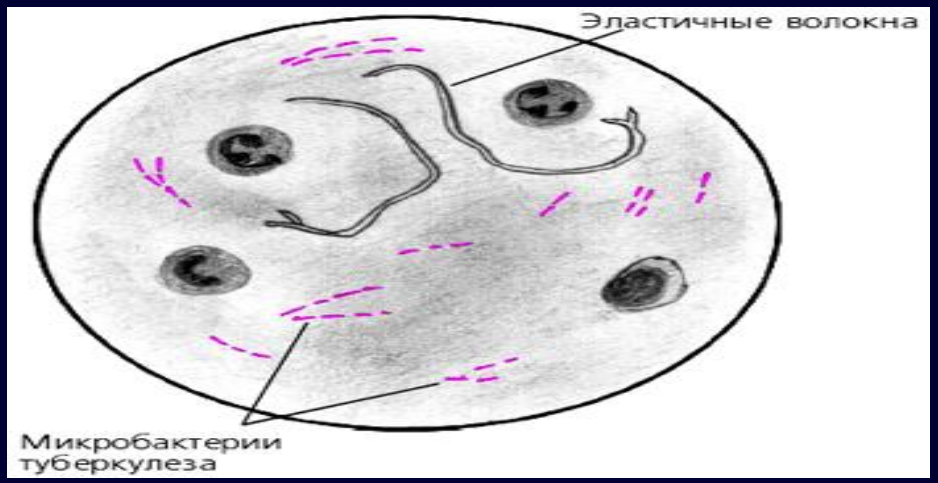


ATYPICAL CELLS



Cultivation of biological fluids against tuberculosis mycobacteria





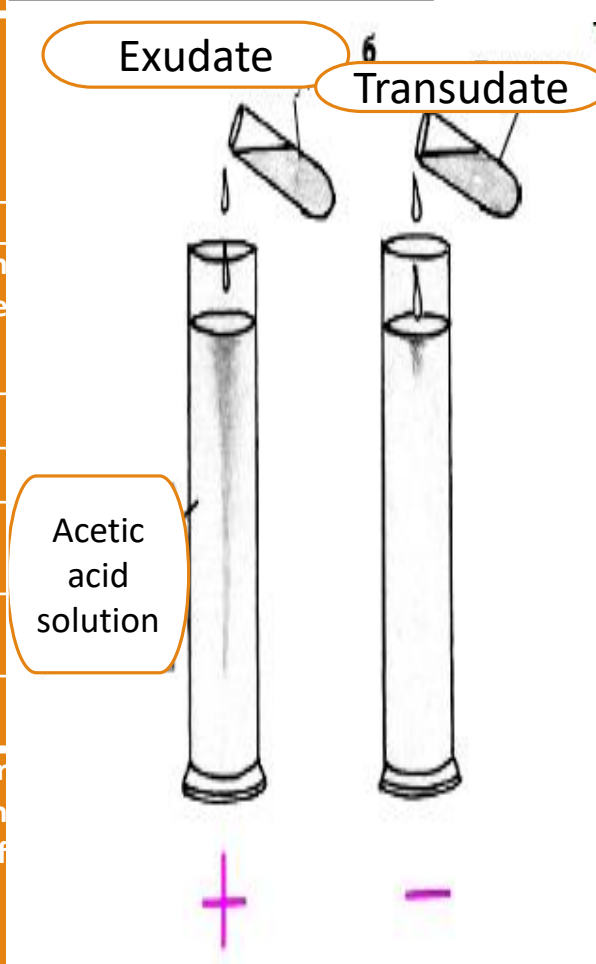
- Figure 1 shows the morphology of a colony of Mycobacterium tuberculosis.
- Colonies of tuberculosis mycobacteria differ from other microorganisms by their colorless, indented-protruding surface.

Microscopy of sputum: Tuberculosis mycobacteria (Sil-Nielsen staining)

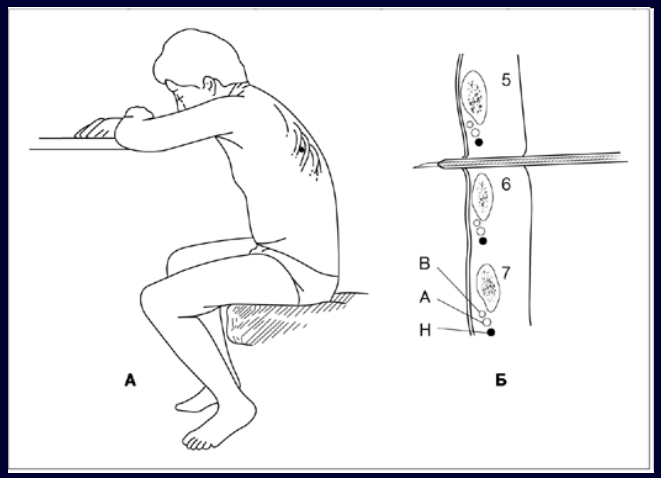
Examination of the pleural fluid

Pleural fluid is sent to the clinical laboratory for studying the physical and chemical properties of the fluid, microscopy of the fluid, determination of tuberculosis mycobacteria, atypical cells, bacterial culture of the pleural fluid.

Research	transudate	Exudate
Relative density	Usually below 1.015; in rare cases (compression of large vessels by a tumor), above 1.013–1.025	Not less than 1.015 Usually 1018
Coagulation	It does not clot	Clot
Color and transparency	Transparent, lemon yellow, or light yellow	Serous exudate does not differ from transudate; other types of exudate are cloudy and differ in color.
Opponent's reaction	Negative	Positive
Protein content, g/l	5–25	30–50 (up to 80 g/l with pus)
Protein concentration ratio	Less than 0.5	More than 0.5
LDH (lactate dehydrogenase)	Less than 200 IU/l	More than 200 IU/l
LDH ratio	Less than 0.6	More than 0.6
Cytological examination	Cellular elements are few, usually mesothelial cells, erythrocytes, sometimes lymphocytes, and eosinophils after a repeated puncture.	Lots of cells. The number of cellular elements, their types, and their condition depends on the etiology and stage of inflammation.



EXAMINATION OF PLEURAL FLUID



- In the treatment room, a pleural puncture is performed to collect pleural fluid

FUNCTIONAL RESEARCH METHODS

Spirometry

Spirography

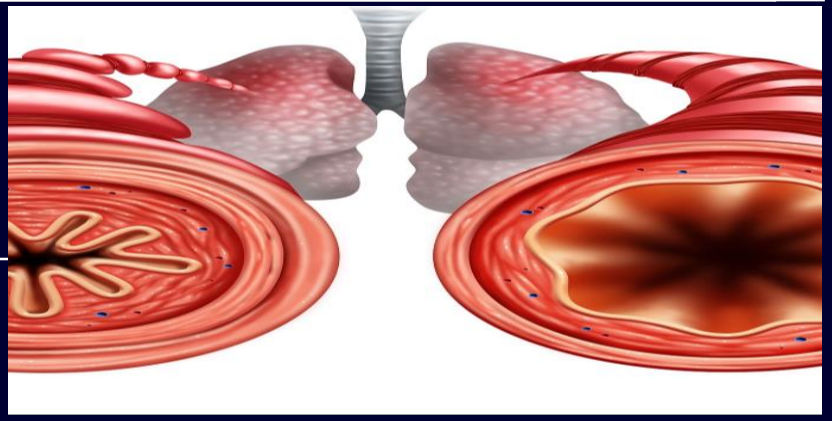
Peak flowmetry

Ergospirometry

Indications for spirometry:

- Bronchial asthma, chronic obstructive pulmonary disease, sarcoidosis, etc. in the diagnosis and severity of lung diseases
- Evaluation of treatment effectiveness, selection of further treatment tactics
- Evaluation of disease prognosis
- Assessment of lung function in smokers
- Assessment of respiratory functions in patients before surgery and after differentiation
- Differentiation of obstructive, restrictive diseases

Bronchial asthma is a disease characterized by chronic inflammation of the respiratory tract, manifested by symptoms such as expiratory shortness of breath, heaviness in the chest, cough, wheezing, and suffocation, observed with airway obstruction.



- **ETIOLOGY**
- **External factors:** allergens (house dust mites, pet allergens, cockroaches, mold, fungal allergens, plant pollens, etc.), infectious agents (mainly viruses), occupational factors, ozone, sulfur and nitrogen dioxides, diesel fuel combustion products, tobacco smoke (active and passive smoking), food, etc.
- **Internal factors**: Hereditary tendency to atopy, hereditary tendency to bronchial hyperreactivity, gender, obesity

Types: - Atopic asthma.

- This is the most common type of asthma
- It occurs in patients who are sensitive to allergens
- There is a family history
- Positive skin tests
- IgE is a classic example

Non-atopic asthma

- Lack of sensitivity to allergens
- Skin test results are negative
- A family history of asthma is rare
- Triggers of non-atopic asthma are respiratory infections
- The disease is based on high reactivity
- Inflammation of the mucous membrane of the respiratory tract caused by the virus lowers the threshold of sensitivity

CLINICAL PHENOTYPES

ALLERGIC ASTHMA eosinophilic inflammation of the respiratory tract in sputum examination

NON-ALLERGIC ASTHMA Sputum examination with neutrophil, eosinophil, macrogranulocytic or mixed cells

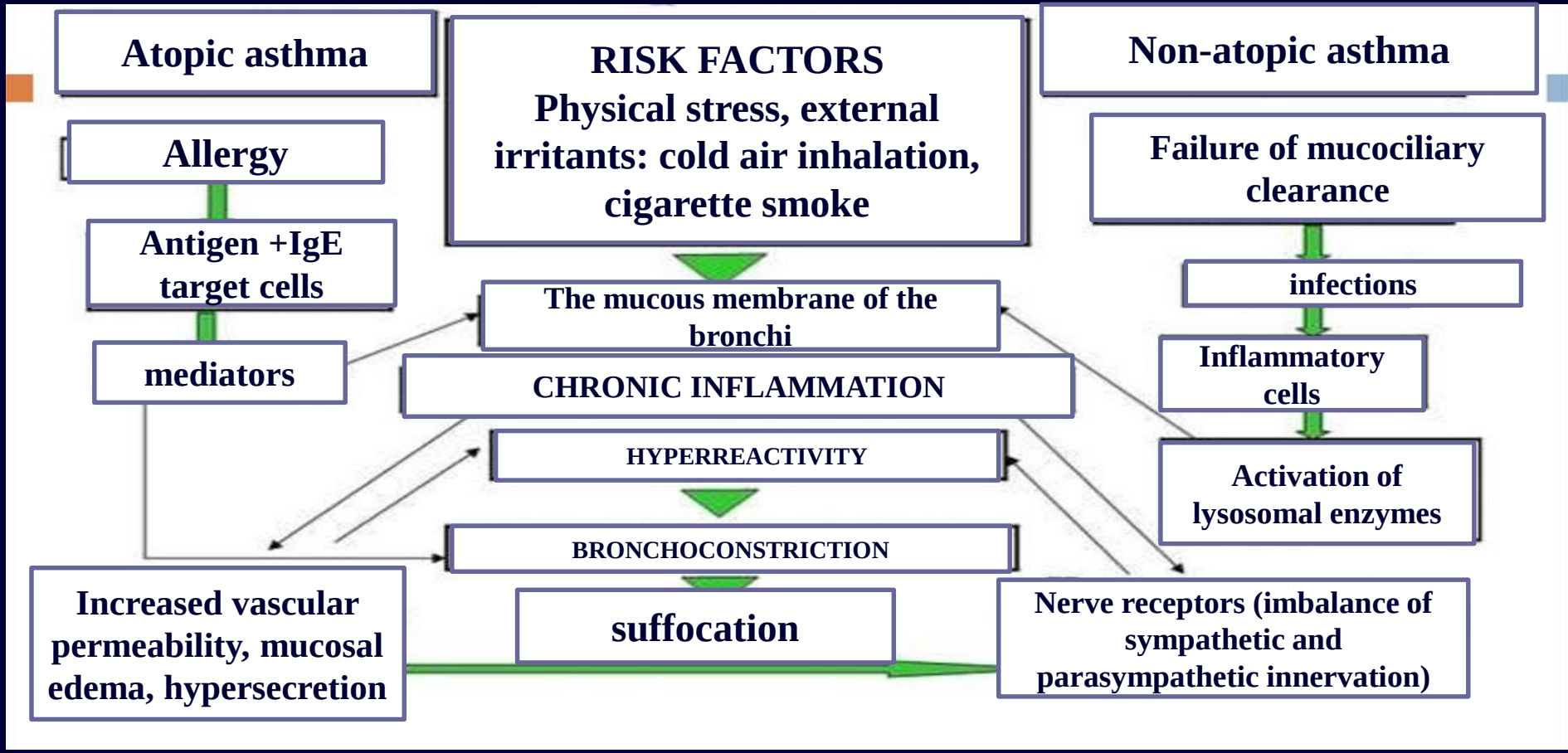
LATE ONSET ASTHMA non-allergic in nature

ASTHMA WITH PERSISTENT AIRWAY OBSTRUCTION persistent or irreversible obstruction

ASTHMA Eosinophilic inflammation is less important in obese individuals

Typical asthma symptoms: ***wheezing, shortness of breath, chest tightness, choking, coughing***

PATHOGENESİS



List of diagnostic methods of bronchial asthma

- General blood analysis (clinical blood test - possibility of eosinophilia)
- General and cytological examination of sputum
- Scarification, subcutaneous and needle (prick test) tests.
- Allergotest (determination of specific Ig E-antibodies in serum).

External respiratory function assessment methods:

- Spirometry (AHT, Tiffno index, etc.).
- Peak flowmetry (PFM). (test against the speed of the air flow during breathing)

For differential diagnosis:

- Irritation test with methacholine.
- X-ray of the lungs.
- ECG.
- CT (if indicated)

CLINICAL AND LABORATORY DIAGNOSTIC METHODS OF BRONCHIAL ASTHMA

General analysis of blood - eosinophilia, leukocytosis, ESR increase,

Biochemical analysis - increase of alpha and gamma globulin fractions, increase of activity of acid phosphatase, increase of C-reactive protein, increase of fibrinogen; increase of procalcitonin, increase of natriuretic peptide, increase of eosymophilic cationic protein

Detection of specific IgE in blood serum (characteristic of allergic BA).

Bronchoscopy is the study of the bronchi. A flexible endoscope equipped with a video camera and lighting system is inserted through the mouth. The image of the inner surface of the bronchial passages is shown on the screen.

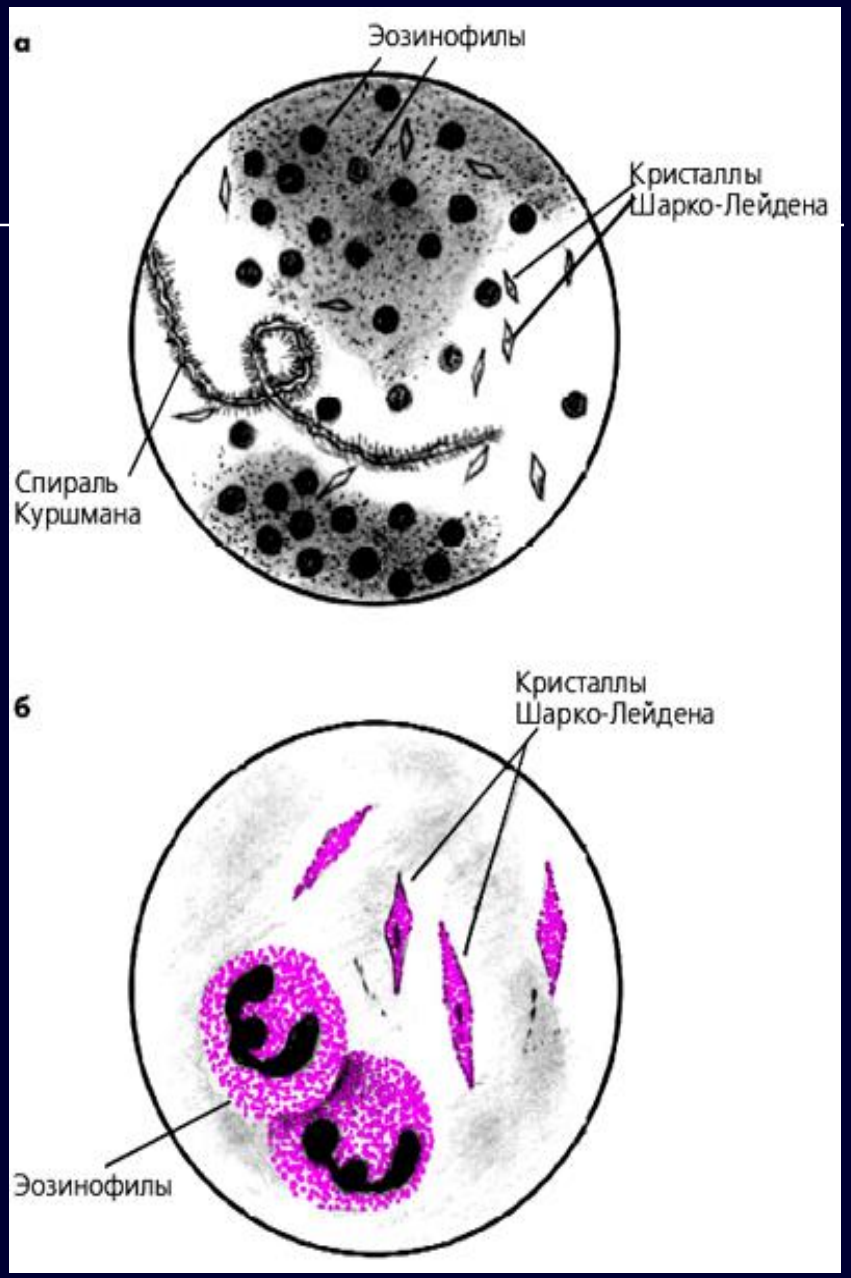
To assess the functional capacity and strength of the heart: electrocardiography (ECG).

Chest X-ray or CT to evaluate the condition of the respiratory system

LABORATORY EXAMINATION:

Sputum examination: Kurshman spirals, Charcot-Leyden crystals, eosinophils.

№	Характер	слизистый
1	Цвет	белесоватый
2	Консистенция	вязкая
3	Альвеолярные клетки	4-7-18
4	Лейкоциты	-
5	Нейтрофилы	-
6	Эозинофилы	+
7	Кристаллы Шарко-Лейдена	+
8	Спирали Куршмана	+
9	Микобактерии туберкулеза	-



PEAKFLOWMETRY

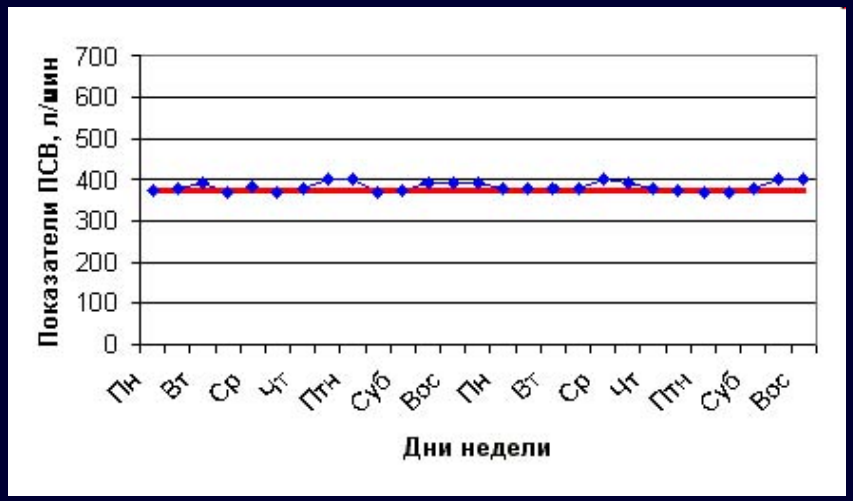
-Peakflowmetry is one of the most important methods for diagnosing and monitoring bronchial asthma. Why is the examination carried out:

- to determine the irreversibility of bronchial obstruction (respiratory tract narrowing);
- assess the severity of the course of the disease;
- evaluate bronchial hyperreactivity (bronchial narrowing due to muscle spasm).
- to predict exacerbation of asthma;

-occupational asthma determination;

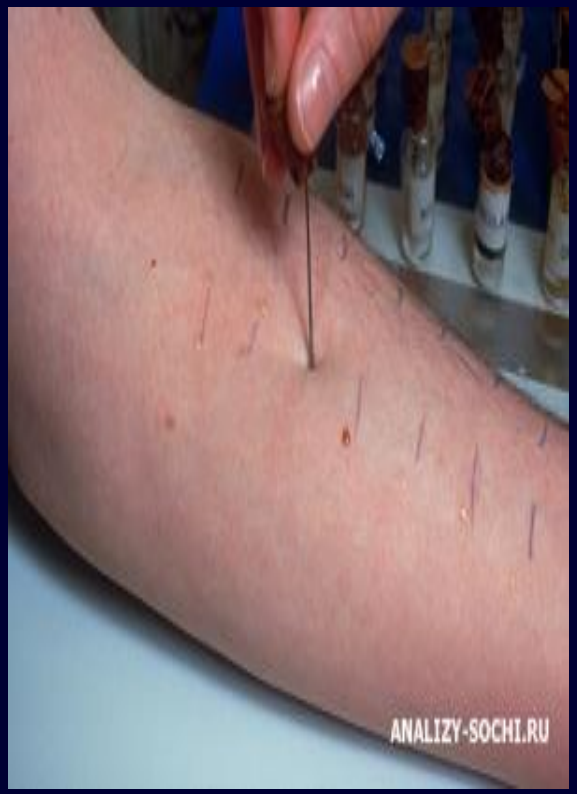
therapeutic efficacy to evaluate.

Every bronchial asthmatic daily to the patient peak flowmetry It is recommended.

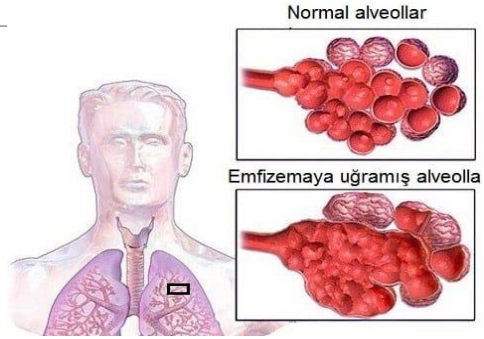


ALLERGY TESTS

- Skin allergic (prick or scarification) tests
- Measurement of specific immunoglobulin E (sIgE) level in blood serum
- Phadiatop ImmunoCAP test



Pulmonary emphysema - The term pulmonary emphysema is a pathological change characterized by an increase in air in one or both lung regions due to excessive expansion of the alveoli and gradual collapse of the partitions between them.



Classification: By distribution:

1. Diffuse emphysema - the entire lung tissue is damaged

• Primary - having an independent nosological form

• Secondary - developing as a result of damage to the bronchi and lungs (COPD, a common form of pulmonary tuberculosis)

• Involutive or senile emphysema- formed as a result of lung aging against the background of general aging of the body

2. Localized (bronchorctasia, pneumosclerosis, tuberculosis, pneumoconiosis).

3. Special forms of pulmonary emphysema: vicar (compensator); McLeod syndrome. (progressive hypoplasia is a chronic pathology accompanied by a decrease in the density of one lung or its share, a decrease in arterioles, obliteration of small bronchi and bullous changes in the alveoli)

ETIOLOGY

• frequent cough (e.g. during chronic bronchitis)

●chronic obstruction of the bronchi (bronchial asthma)

●chronic interstitial inflammation

●genetic factor (α1-antitrypsin deficiency)

●mechanical stretching of the alveoli due to increased tension during breathing

● absorption of some harmful substances and dust

●smoking ●old age

CLINIC

• Shortness of breath, feeling of expiratory shortness of breath

• weakness

• cough and sputum, the nature of sputum is determined by the type of inflammation in the bronchi (catarrhal or purulent).

During the objective examination:

• "pink face", swelling of the face, no cyanosis for a long time;

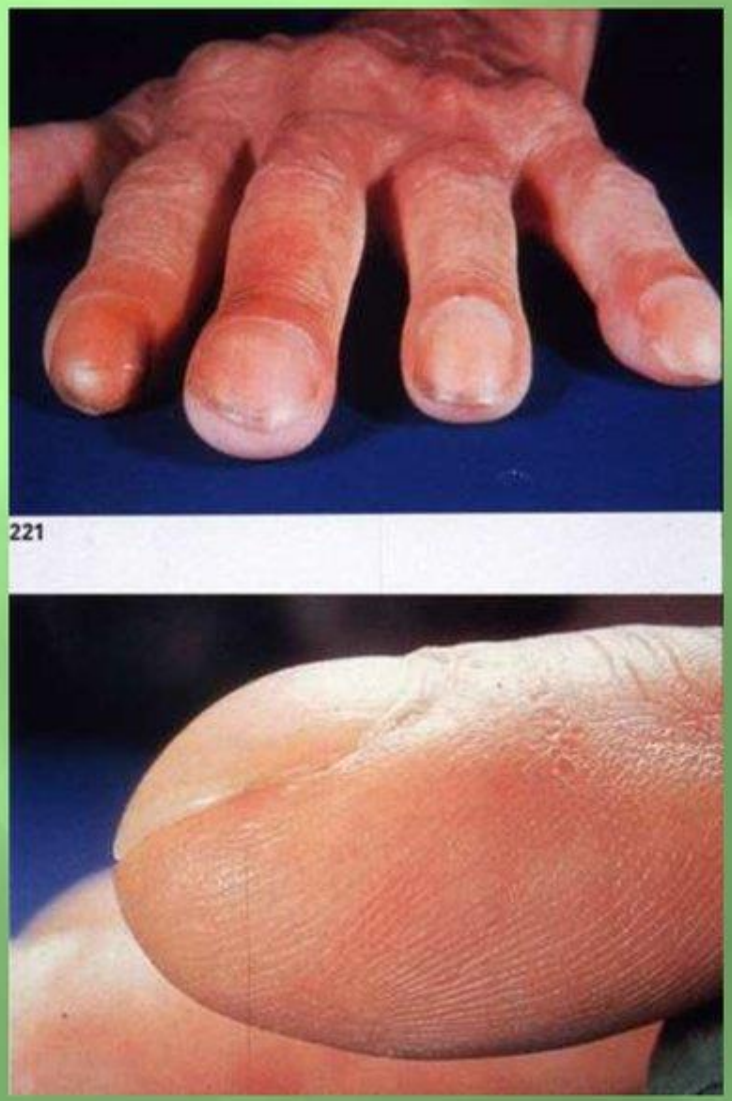
• barrel chest, increasing its volume;

• complete or partial lack of mobility of the lower lung margin

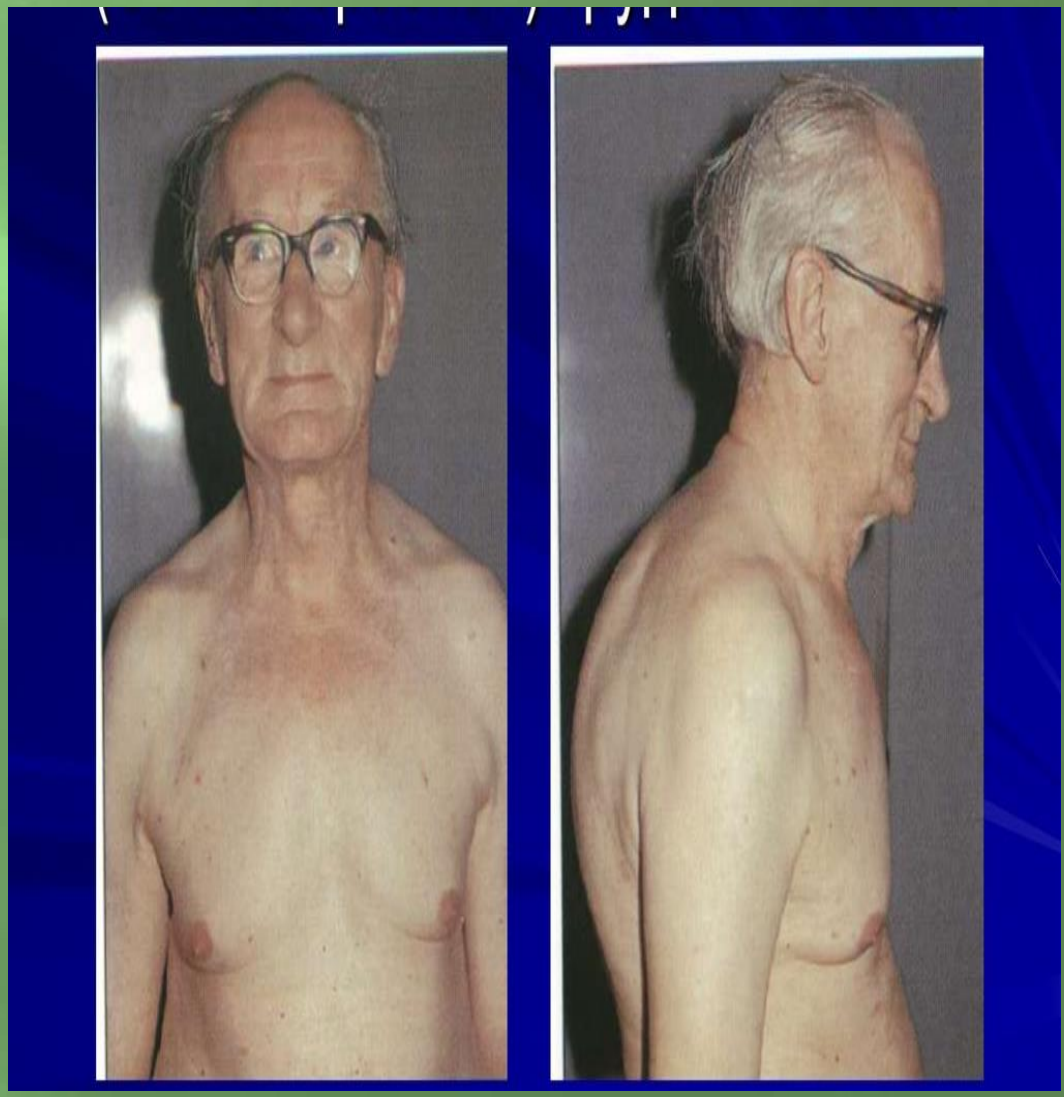
• weakening of voice vibration and bronchophony;

• poor breathing is observed in patients with primary emphysema during auscultation.

The result of chronic hypoxia: Nail changes



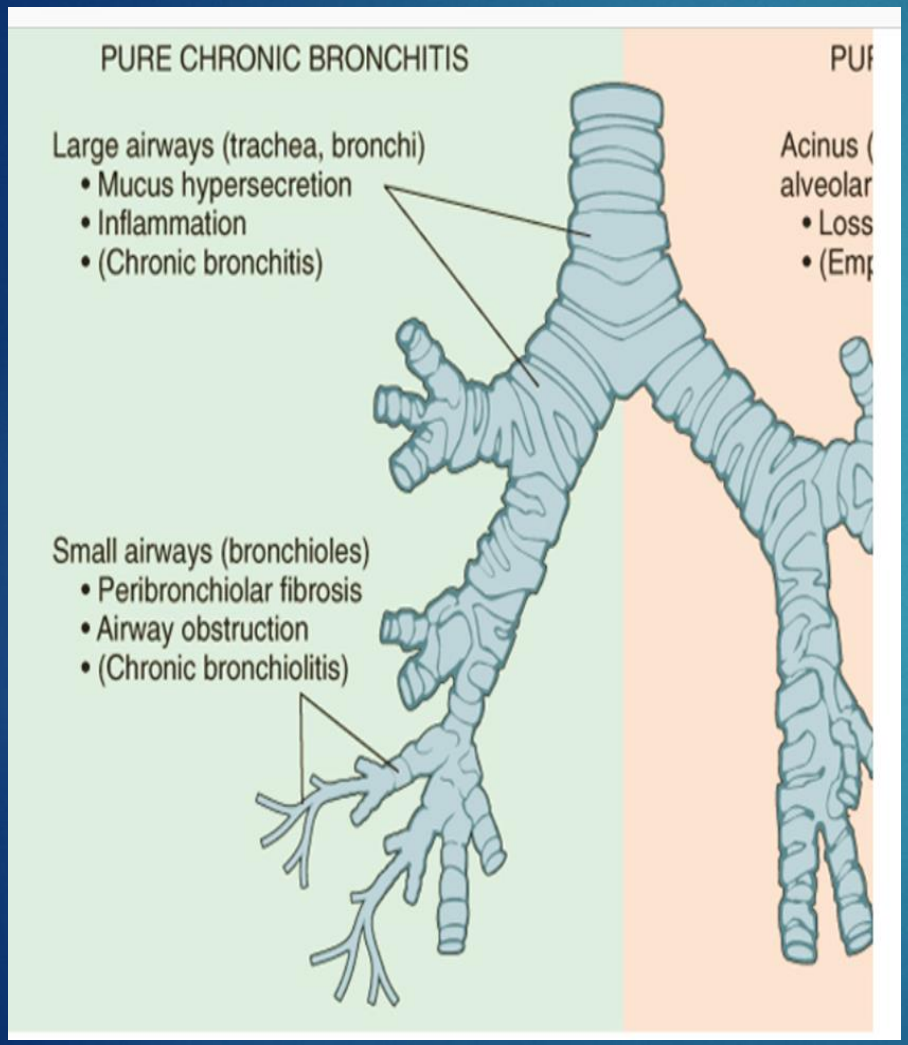
Barrel chest

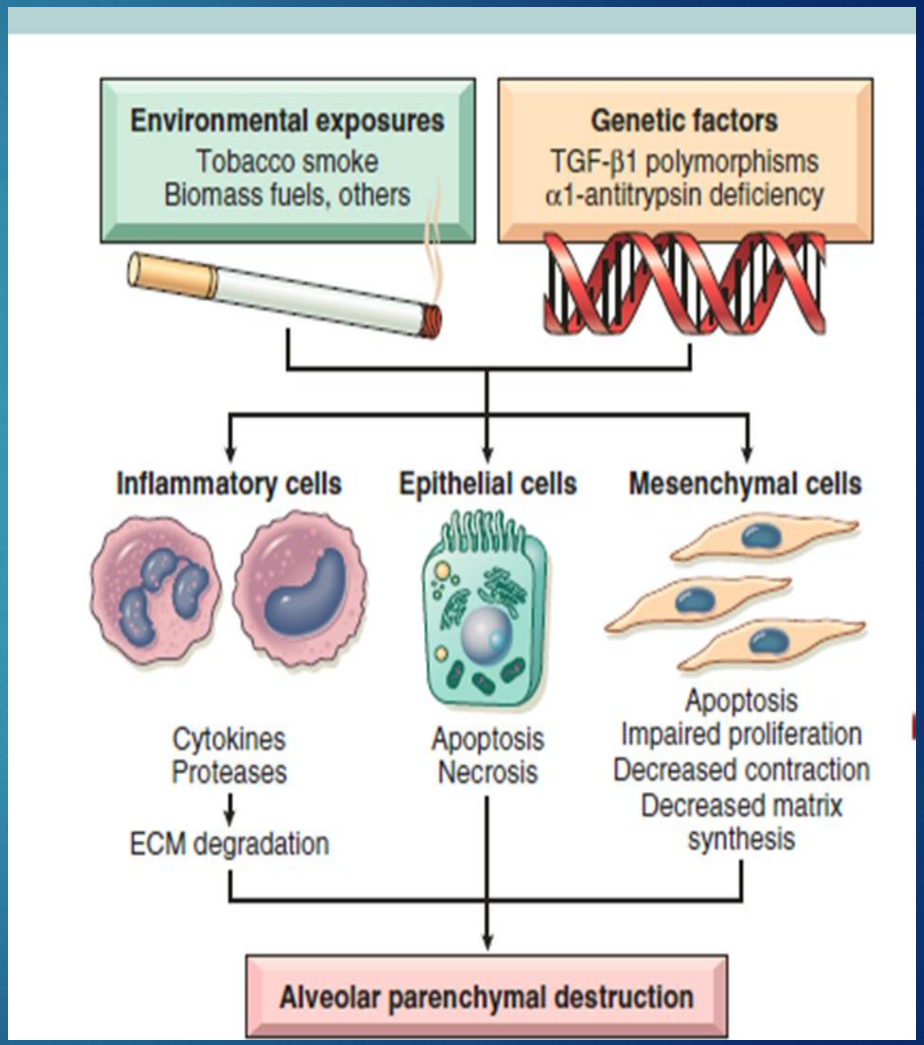


CLINICAL AND LABORATORY SIGNS OF EMPHYSEMA AND CHRONIC BRONCHITIS

	Emphysema	Chronic bronchitis
Age of diagnosis, year	60+	50+
Appearance	Poor nutrition pink skin cold feet	Too much nutrition Diffuse cyanosis Warm feet
First symptoms	Dyspnea	Cough
Sputum	minor, slimy	Lot, purulent
Bronchial infections	Rarely	Often
Pulmonary heart	At the terminal stage	Often
X-rays of light	Hyperinflation, bullous changes, Dropping heart	Strengthening the shape of the lungs, > at the bottom Enlargement of the heart borders
Hematocrit, %	35–45	50–55
PaO2, mm arb. St.	65–75	45–60
PaCO2, mm arb. St.	35–40	50–60
Elastic rejection	Significantly decreased	Norm
Diffusion ability	Decreased	A regular or slight decrease

PATHOGENESIS





RESEARCH METHODS

Laboratory diagnostics:

- General clinical analysis of blood (detailed analysis, erythrocyte sedimentation rate, leukocyte formula (microscopy of blood smear with pathological changes)

- Cytological examination of sputum

- If necessary - biochemical analysis of blood

- Blood examination for C-reactive protein;

- Determination of acid-base composition of blood

Instrumental diagnostics:

- computed tomography of the chest organs with the determination of the optical density of the lung tissue

Functional diagnostics:

- comprehensive study of external respiratory function:

- spirometry;

- test with broncholytic drug (probe) body plesmography;

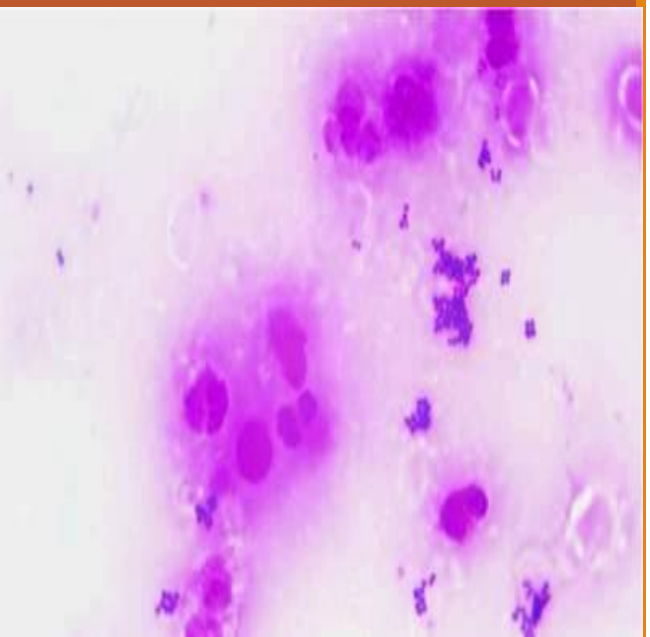
- diffuse test;

- pulse oximetry;

- 6-minute walk test;

RESULTS

GRAM method staining - Gram-positive cocci (hemolytic streptococcus)



CLINICAL BLOOD TEST-neutrophil leukocytosis, ↑ of ESR, polycythemia (↑ of erythrocytes, Hb, blood viscosity)

BLOOD SERUM - α1-antitrypsin deficiency (3-7mmol/l↓)

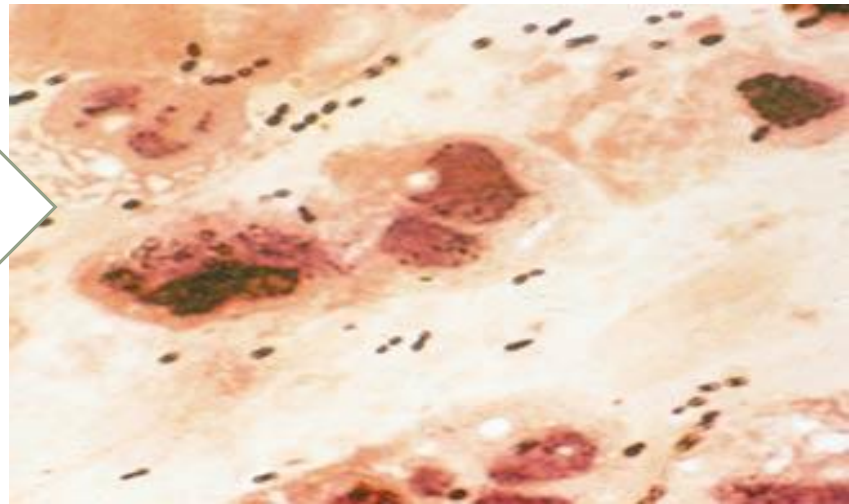
GENETIC TEST-AAT =7-10mmol/l

CYTOLOGICAL EXAMINATION OF SPUTUM - purulent sputum, a large number of neutrophils.

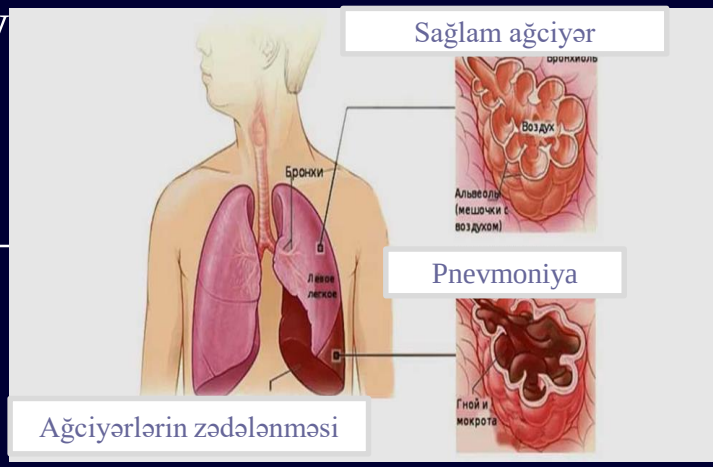
ARTERIAL BLOOD GAS ANALYSIS - progressive hypoxemia - PaO_2 ↓

BICARBONATE- chronic respiratory acidosis → compensatory metabolic alkalosis

Pneumococci in purulent sputum



Pneumonia is an inflammation of the lower respiratory tract of various etiologies, which develops along with intra-alveolar exudation and is accompanied by characteristic clinical and roentgenological symptoms.



CLINICAL CLASSIFICATION

- ► Community-acquired pneumonia (acquired outside a medical facility)
- ► Nosocomial pneumonia (acquired in a hospital)
- ► Pneumonia in immunocompromised patients
- ► Aspiration pneumonia.

According to the etiology:

1. Pneumococcus
2. Haemophilus influenzae
3. Klebsiella
4. Blue-purulent stick
5. Staphylococcus
6. Streptococcus B, etc.
7. Escherichia
8. Mycoplasma
9. Bacteria of known and unknown nature
10. Chlamydia
11. Pneumonia with other agents

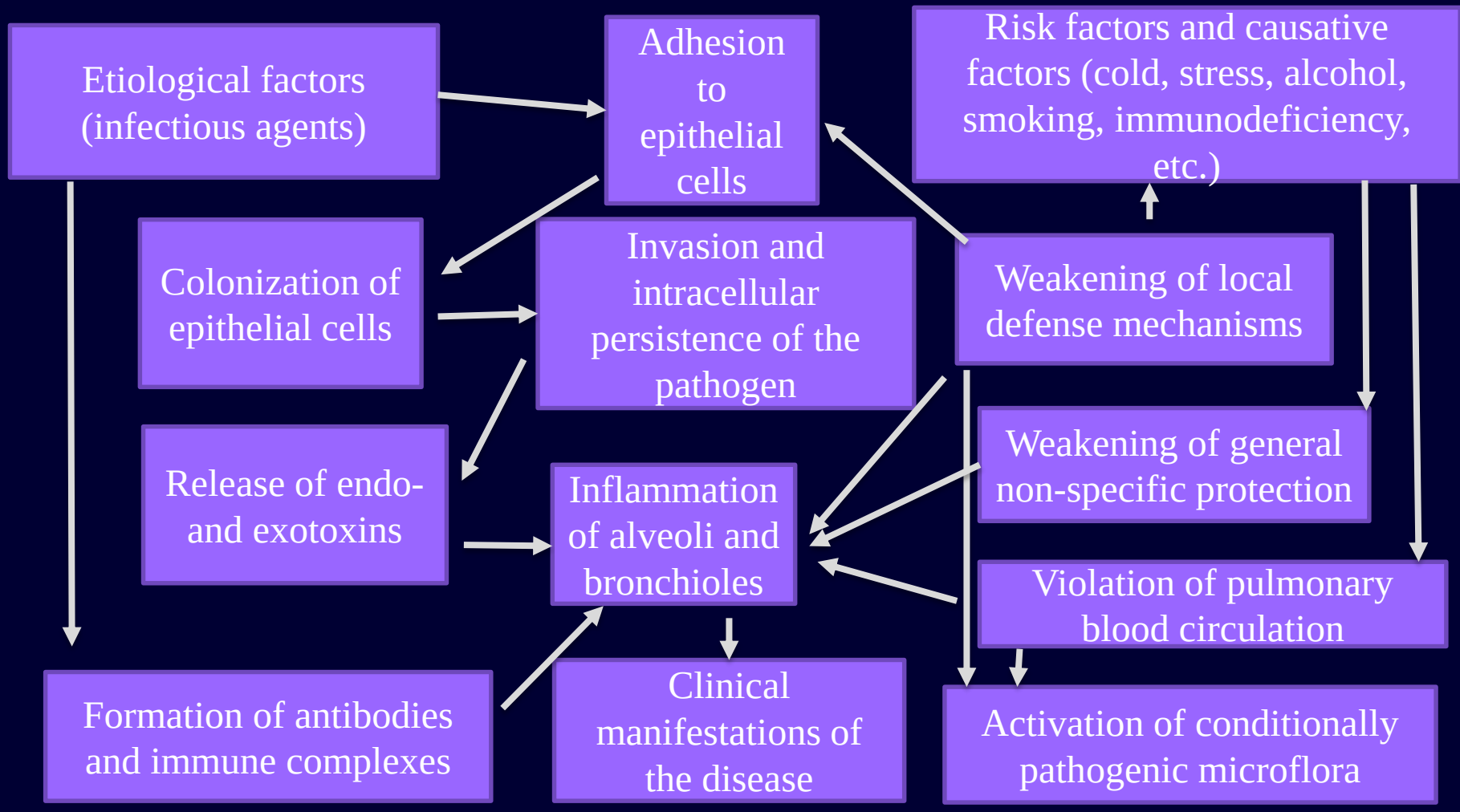
ETIOLOGY

- Streptococcus pneumoniae is one of the most common causes of CPP and accounts for 50% of all cases. Risk factors:
- Alcoholism, smoking
- - Immunosuppressive condition
- - Contact with children's institutions
- Long-term care facilities (nursing homes, etc.)
- Viruses
- - Cooling
- - Stress
- Age (under 5, over 60)
- Concomitant conditions: asthma, lung cancer, obstructive pulmonary disease (COPD), diabetes, alcoholism, liver and kidney failure, congestive heart failure, long-term use of corticosteroids, malnutrition or severe weight loss (>5%), IBD virus infection
- Use of antibiotics recently (for 3 months).

Clinic:

- Anamnesis:
- ► Fever +/- chills
- ► Production of cough
- ► Presence of pleural pains in chest
- ► Fatigue, headache, nausea, abdominal pain, myalgia
- Physical examination
- ► Temperature above 37.8°C
- ► Increased respiratory rate (≥25/minute) (respiration count should be counted in full minutes)
- ► Signs of hardening of the lung parenchyma: decrease in mobility of the chest, increase in voice vibration, muffled percussion sound, decrease in air intake, presence of bronchial breathing, wet crackles with local small bubbles, crepitations, pleural friction murmur

PATHOGENESIS OF PNEUMONIA



LABORATORY DIAGNOSTICS

- Chest x-ray (in both projections)
- General analysis of blood (extensive)
- During productive cough - sputum staining and culture by Gram method
- Blood culture in patients with a history of high fever and chills (recommended before antibiotic treatment)
- Blood biochemical analysis: glucose, electrolytes, creatinine, ALT, C-reactive protein

- Pulse oximetry
- Measurement of gases in arterial blood (PaO2 below 60 mm.cv, hypoxemia)
- Consider thoracentesis in patients with large volumes of pleural exudate
- Serological tests are usually not recommended

RESULTS

General analysis of blood - leukocytosis, (10-15x10 /l), shift of the leukocyte formula to the left, toxic granularity of neutrophils and ↑, lymphocytes, eosinophils ↓ (aneosinophilia), ESR ↑

BIOCHEMICAL ANALYSIS OF BLOOD - CRP., FIBRINOGEN ↑
EXAMINATION OF SPUTUM - INCREASED LEUKOCYTES, YELLOWISH MUCO-PURULENT SPUTUM
EXTERNAL RESPIRATORY - LUNG VOLUME CAPACITY ↓, TIFFNO INDEX +
IGM + INDICATES PRIMARY INFECTION, THE NUMBER OF IG ↑ INDICATES THE PROGRESS OF THE DISEASE;
IGG + INDICATES THAT THE PATHOLOGICAL PROCESS CONTINUES FOR A LONG TIME;
IGG AND IGM - THIS REACTION INDICATES THE ABSENCE OF INFECTION IN THE BODY.

Coronavirus infection - SARS CoV-2 is an acute infectious disease caused by a new strain of the virus of the coronavirus family

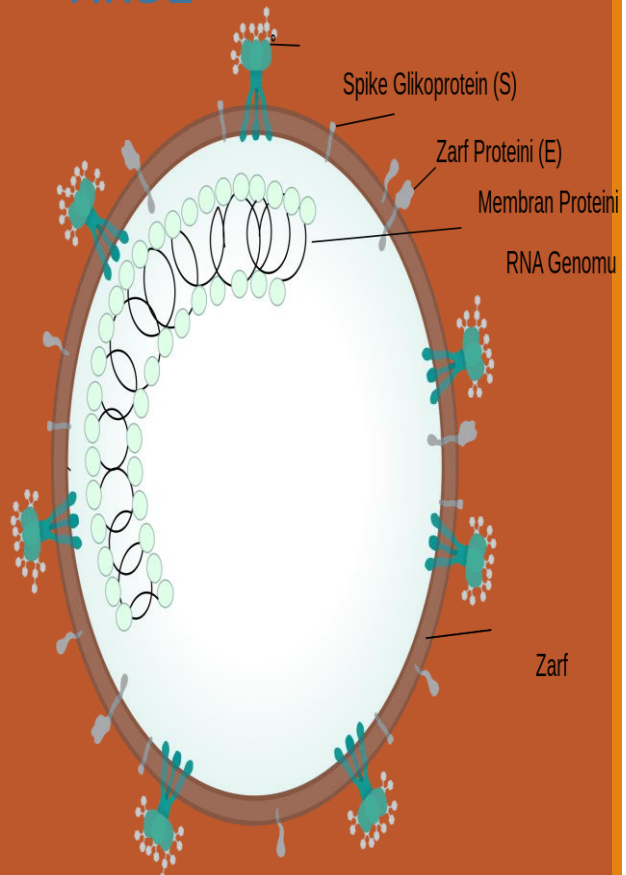
COVİD - 19

Coronaviruses (Coronaviridae) are a large family of RNA-containing viruses with proven pathogenic properties that spread between humans and animals

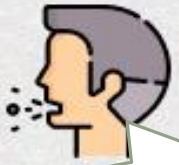
SARS-CoV - SARS-related coronavirus:

- SARS - atypical pneumonia;
- CoV - coronavirus

Currently, 4 coronaviruses are known to circulate among the population: - HCOV-229E
- OC43
- NL63
- HKU1



TRANSMISSION



Air-droplet (cough, sneeze, talk)

Contact-household (hand contact, household items)

Air-dust

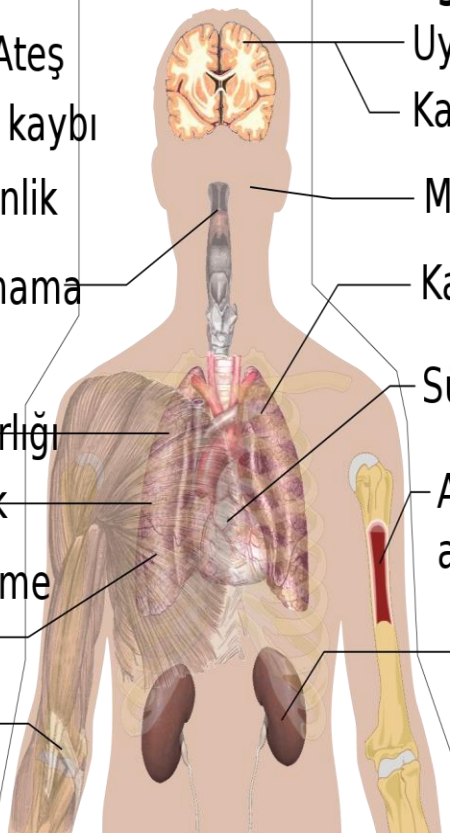
SYMPTOMS

Yaygın belirtiler:

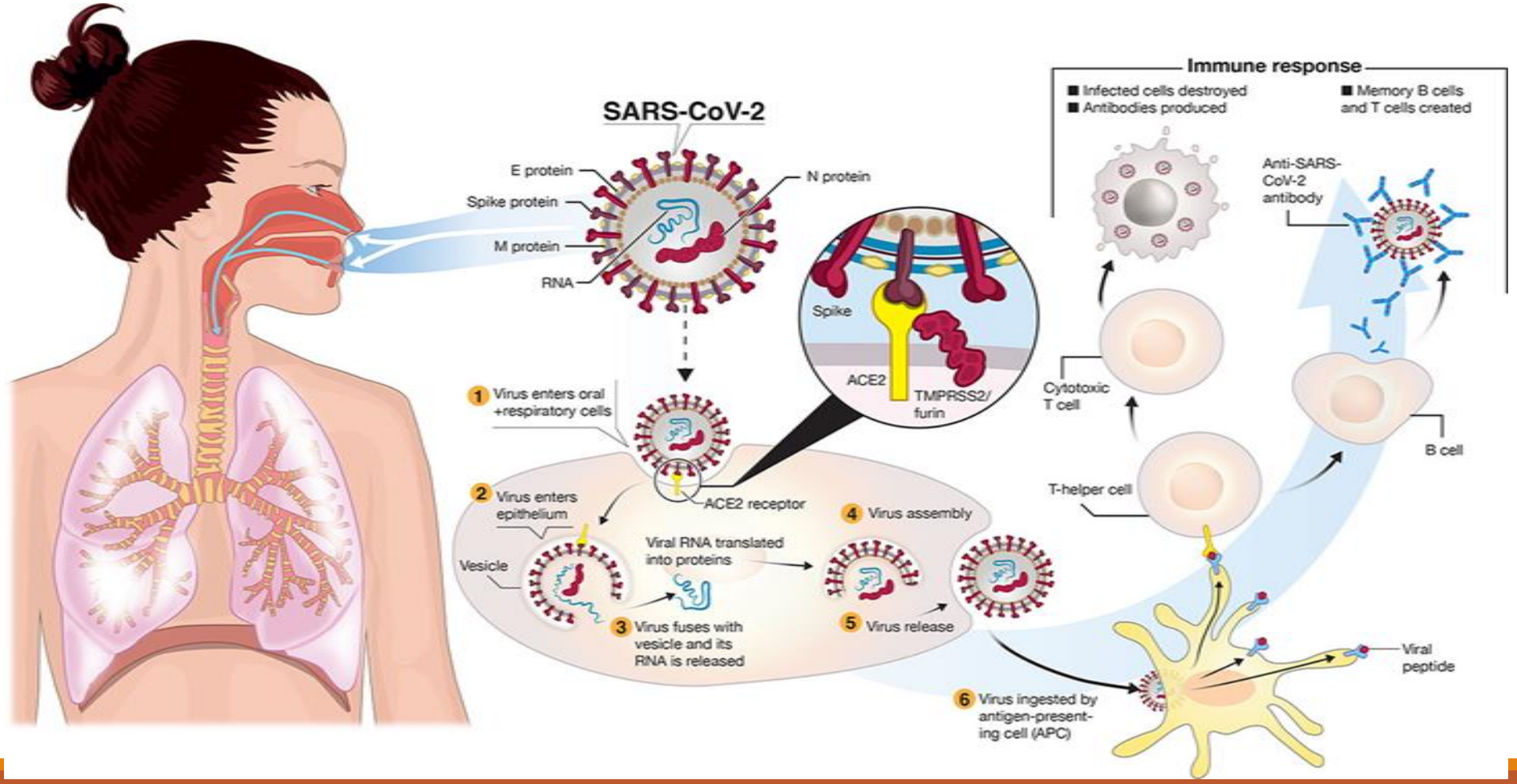
- Ateş
- İştah kaybı
- Bitkinlik
- Koku alamama
- Nefes darlığı
- Öksürük
- Balgam öksürme
- Kas ağrıları

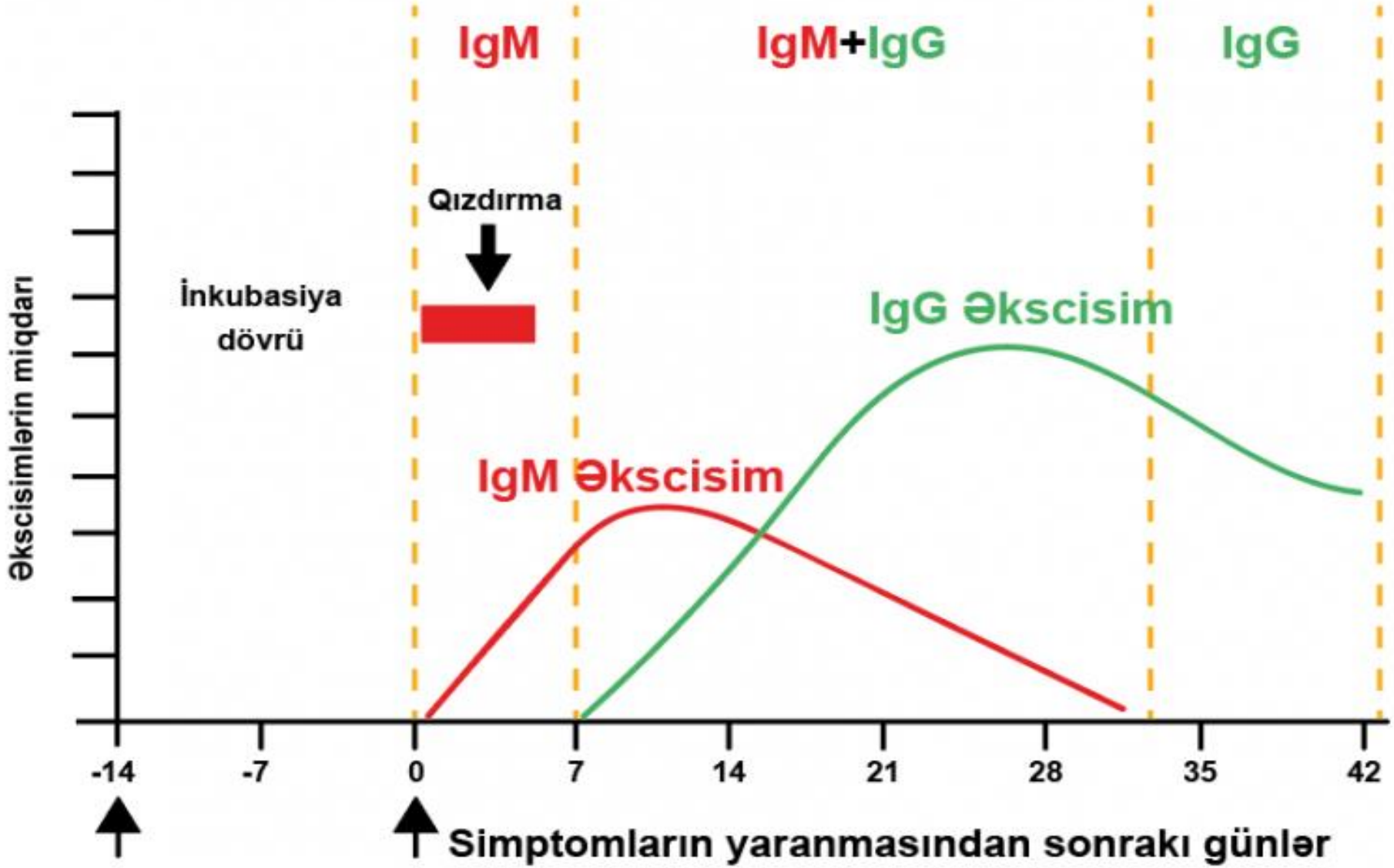
Ağır vakalarda:

- Uyanmada güçlük
- Kafa karışıklığı
- Mavimsi yüz ve dudak
- Kanlı balgam
- Sürekli göğüs ağrısı
- Akyuvar sayısında azalma
- Böbrek yetmezliği
- Yüksek ateş



PATHOGENESİS




IgM
IgM+IgG
IgG
Qızdırma
İnkubasiya dövrü
IgG Əkscisim
IgM Əkscisim
Əkscisimlərin miqdarı
-14
-7
0
7
14
21
28
35
42
Simptomların yaranmasından sonrakı günlər

Laboratory diagnostics

Specific laboratory diagnostics-PCR method

ELISA (enzyme linked immunosorbemt assay) in the diagnosis of coronavirus

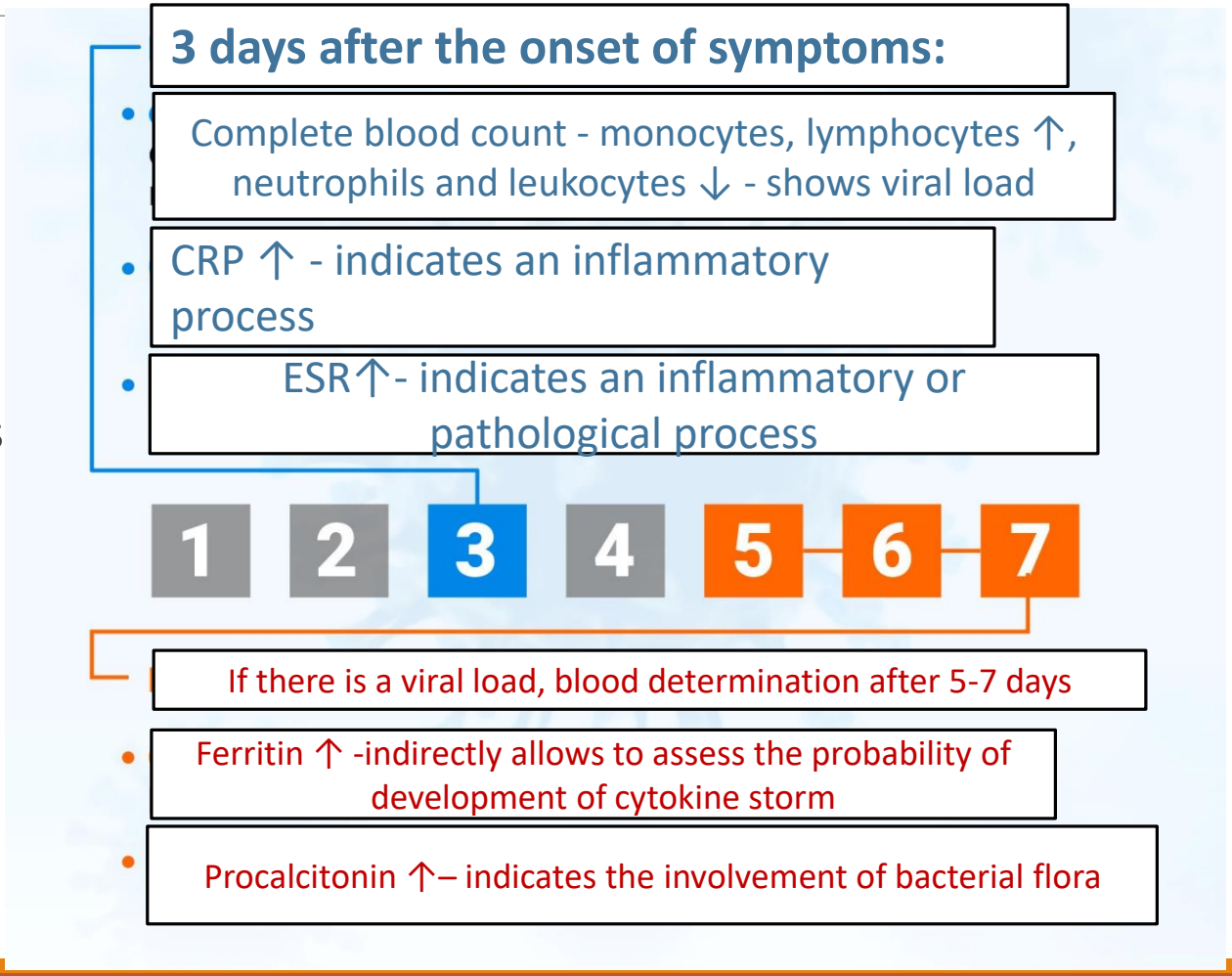
IgM < 1, IgG < 10

IgM from 1 to 2 , IgG < 10

IgM > 2, IgG < 10

IgM > 2, IgG > 10

IgM < 2, IgG > 10



General blood analysis (leukopenia, lymphopenia, thrombocytosis/thrombocytopenia)

Biochemical analysis of blood:

In serum-CRZ (severe cases)

Determination of gas content of blood - PaO_2, $PaCO_2$, pH, bicarbonate, lactate

Ketone bodies in urine (in patients with DM)

Inoculation against sterility and hemoculture of blood (if sepsis is suspected)

Culture of sputum - if bacterial etiology is suspected

Procalcitonin test - for differential diagnosis with bacterial etiology of pneumonia, sepsis (↑). Procalcitonin does not increase with COVID-19, in severe cases ↓

Creatine phosphokinase, troponin - mainly in elderly people, in severe cases ↑

Interleukin 6 is an indicator of the immune response, it increases excessively during the development of a cytokine storm ↑

Ferritin - acute ↑ in severe cases

Laboratory examinations

SATURATION O2 (Sa O2) - the ability of hemoglobin to combine O2 in the lungs and deliver it to the tissues. The oxygen saturation value of hemoglobin characterizes the supply of oxygen to peripheral tissues

PULSE OXIMETRY - a non-invasive method of determining SaO2. Normal SaO2 >90%/ A decrease in this value is associated with the occurrence of hypoxemia and PaO2 below 60 mm.cv.st.

Indicators in the blood during severe COVID-19

indicator	unit	example	Control	severe manifestations	change
leukocytes	10^9 / l	n=187	4.64	7.39	increased
leukocytes	10^9 / l	n=452	4.90	5.60	increased
Monocytes	%	n=452	8.40	6.60	decreased
Eosinophils	%	n=452	0.20	0.00	decreased
Basophils	%	n=452	0.20	0.10	decreased
lymphocytes	10^9 / l	n=5700	1.14	0.74	decreased
lymphocytes	10^9 / l	n=452	1.00	0.80	decreased
Neutrophils	10^9 / l	n=187	3.07	6.01	increased
Neutrophils	10^9 / l	n=452	3.20	4.31	increased

Cytokine markers during severe covid-19

Indicator	Unit	example	Control	severe manifestations	change
B- cell	%	n=44	18.5	21.60	increased
T- cell	%	n=44	63.40	60.00	decreased
NK	%	n=44	17.20	16.90	decreased
Treg- cell	kl/mkl	n=44	4.50	3.70	decreased
İL-2R	Unit /ml	n=452	663.5	757.0	increased
İL-6	pq/ml	n=452	13.30	25.20	increased
İL-8	pq/ml	n=452	13.70	18.40	increased
İL-10	pq/ml	n=452	5.00	6.60	increased
TNF-	pq/ml	n=452	8.40	8.70	increased
LDG	MV/l	n=10	135-225	433-537	increased
D-dimer	mkq/l	n=10	< 0.5	0.6-18.7	increased
Ferritin	mkq/l	n=10	250	1424-2036	increased
CRP	mq/l	n=10	>0.5	8.7-16-5	Increased

Thanks for your attention