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MINISTRY OF HEALTH OF UKRAINE
SUMY STATE UNIVERSITY
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"Approved"
**at a meeting of the Department of General
Surgery, Radiation Medicine and Phthisiology**

Protocol № _____

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**METHODOLOGICAL RECOMMENDATIONS FOR TEACHERS
FOR THE PRACTICAL STUDIES OF PREPARATION FOR
PHTHISIOLOGY GENERAL PRACTITIONERS**

<i>Academic discipline</i>	Phthisiology
<i>Subject lesson number 2</i>	Common approaches to the diagnosis of tuberculosis. Special methods of detection and diagnosis of TB (microbiological, radiological diagnosis, tuberculin diagnosis).
<i>Course</i>	4

Topic № 2: Common approaches to the diagnosis of tuberculosis. Special methods of detection and diagnosis of TB (microbiological, radiological diagnosis, tuberculin diagnosis).

1. Currency of the topic

In all sorts of diagnosis methods, applied to reveal TB cases, the most important ones are as follows: microbiology diagnostics, X-Ray inspection, laboratory methods, tuberculin test. Tuberculin test is a key method to timely reveal TB cases among children and youngsters, giving an opportunity -1) to find out a fact of being infected and 2) define a probability of being infected. X-Ray investigation is a key method to timely reveal TB cases among adults, making it possible for a doctor to get to knowing of clinical cases different implications as well as their morphological essence. Laboratory methods to analyze sputum or some other material, as far as mycobacterium (MTB) presence is concerned, allow a doctor to finally confirm a TB diagnosis. They are as follows: simple microscopy, culture method, biological test (guinea pig inoculation), amplification methods (polymerase chain reaction). Histological analysis is a procedure meant to reveal cheesy or caseous necrosis of epithelioid-cellular granulomas with Pirogov-Langhans' cells. It can morphologically define if a specific TB inflammation in an affected organ is taking place. These instructions to follow are intended to help a student systemize his/her knowledge, having got in the course of self preparatory work, as well as apply it in practice (practical studies).

TUBERCULIN TEST

2. General goal is 1) to have learned indications for tuberculin test to be proceeded; 2) to appreciate tuberculin tests clinic and epidemiological values.

3. Basic knowledge and skills are necessary for topic studying (interdisciplinary integration) The title of preliminary discipline The skills which were obtained

1. Department of pathological physiology To be able to understand essence of allergic response of time-lagged kind (that's cell-mediated immunology reactions of the IV sort: hypersensitivity of time-lagged kind)

2. Department of microbiology To know biological properties of BCG, dates of vaccination and revaccination to be made. To know all sorts of tuberculin and tuberculin tests.

4. The concrete aims:

- To explain essence of the tuberculin reaction.
- To define objective and indications for mass / individual tuberculin test.
- To be able to get through with Mantoux reaction as well as with that of Koch. One should also be able to interpret and evaluate these reaction results.
- To carry out comparative diagnosis of the results of two different tuberculin reactions, which are defined as 1) tuberculin infectious one and 2) tuberculin posvaccinal one.
- To make use of tuberculin test results so as 1) to define the groups of ones susceptible to get TB infected, 2) to be able to reveal TB cases in time.

5 The tasks for student's independent work during the preparation for the class.

5.1. The list of the main terms, parameters and characteristics which a student has to master during the preparation for the class.

Tuberculin is a product of MTB metabolism, incomplete glycolipoprotein complex (hapten), which elicits its antigen activity only in sensitized (an infected or BCG vaccinated) body. 1IU (1international unit of tuberculin) of PPD-L is tuberculin quantity, containing in 0.00006 mg of a dry substance, capable to elicit positive reaction in previously sensitized body.

Tuberculin test "conversion" is either -1) the 1st appearance of positive tuberculin test comparing with the last year detected as negative one or -2) just positive tuberculin test amplification over, at least, 6 mm for a year term among those vaccinated by BCG.

Anergia is the case of getting no reaction at injected tuberculin.

Positive anergia is the case of getting no reaction at tuberculin injected into a healthy (uninfected) human being. **Negative anergia** is the case of getting no reaction at tuberculin injected into a TB-infected patient.

Vaccine BCG is alive but attenuated vaccine, having got brisk immunifacient qualities of a bull kind MBT. It was received by Nocard in 1902 year from a TB infected cow udder. Being recultivated 230 times for 13-year season on potato-glycerin growth medium, containing 5% of bull gall, it had lost its virulence. Vaccine BCG developers, a French microbiologist A.L.Ch.Calmette and a child Doctor C.Guerin, have finished their work in 1919.

PPD purified protein derivative

5.2. Theoretical questions for the class:

1. What is the idea of tuberculin test? What is its essence or the key idea in? Mechanism and time necessary for tuberculin allergy to be developed.

2. What is tuberculin in itself? What sorts of tuberculin are there?

3. What is the objective to make use of tuberculin?

4. Kinds of tuberculin tests.

5. Local reactions on tuberculin injections. 4 types of Mantoux test reactions.

6. General reaction at tuberculin injection, its clinic implications.

7. Indications for a Mantoux test being in need. Tuberculin doses necessary. What should be a correct procedure of getting a testing result. Its registration and clinic interpretation.

8. What is a tuberculin test "conversion"? What could be told when the range was revealed? What are posvaccinal and infectious allergy differential diagnostics?

9. What local reaction on tuberculin should be named as hyperergic one? What information can we get from its taking place?

10. Who of tuberculin -positive patients are considered as dangerous in view of becoming a source of contagious TB infection, thus to be in need of additional medical survey?

11. Indications to Koch test carrying out. What are proper procedure, registration and clinic evaluation?

12. What are positive/negative anergia? What factors might increase or decrease tuberculin tests?

X-RAY INVESTIGATIONS

1. General goal is 1) to have learned radiology changes, typical for pulmonary TB; 2) find out TB location, main radiology syndrome and his elements.

2. Concrete aims:

1. To recognize various pathologic changes seen in the X-ray picture, unite them into some radiological syndromes; define their locality by naming the lung sides, lobes, segments.

2. To recognize main radiology implications of pulmonary TB cases different forms and make use them (implications) to prove TB process clinic forms and phases.

3. Basic knowledge and skills are necessary for topic studying (interdisciplinary integration)

Radiology Department To evaluate an X-ray picture of thorax organs seen in various projections. To know- 1) lung segment constitution and 2) lobe/segment projections, seen in direct and side roentgenograms. To know main lung illnesses radiology syndromes. To find out, draw and describe pathology changes in a thorax roentgenogram. To make out protocol describing a roentgenogram.

4. Practical work (tasks) which are doing within the class:

1. Having received 3 roentgenograms one should -1) find out the main radiology syndromes (locus, focal, coil shadows), 2) describe roentgenograms and, making use of instruction- 3) formulate one's own conclusions about syndromes in question and proper phase of TB processes presented in the pictures.

A student should be able to:

- diagnose focal shadowing syndrome;
- define a syndrome of focal shadow and differentiate limited, widespread, oval blackouts without affected lung volume alteration;
- allocate a syndrome of lung dissemination;
- characterize a coil shadow syndrome.

2. Amidst few roentgenograms, one should -1)choose pictures with a syndrome of local focal shadowing that may show at a TB-like disease (upper lobe location, locus polymorphism, signs of lung tissue fibrosis, pleural reactions, lung roots calcinations'); 2)describe roentgenograms.

3. Amidst few roentgenograms, one should- -1) choose the pictures of patients having syndrome of localized, widespread and oval shadowing; 2) note indications that indirectly specify nature of a disease (upper lobe location, inhomogeneous structure, lung tissue cavitation, lung hilum calcification); 3)describe roentgenograms.

4. Having got few roentgenograms, one should -1) choose the pictures of patients having syndrome of lung dissemination; -2) find out symptoms indicating

a TB case (a tendency to upper lobe location, locuses cortical displacement, forming of focus, infiltration, destruction); -3) describe roentgenograms.

5. One has to -1) analyze roentgenograms, -2) choose pictures with an annular shadow syndrome, -3) describe roentgenograms, -4) notice signs indicating at the cavities tubercular origin (upper lobe location, dissemination, a path to a root, old calcification).

LABORATORY METHODS OF TB DIAGNOSIS (microbiological, cytological, biochemical, functional ones)

1. The concrete aims:

1. To define indications for laboratory and functional survey of pulmonary TB patients.

2. To be able to evaluate results of microbiological survey procedures such as direct and luminescent bacterioscopy, floatation, pathologic material sowing into nutrient liquor, defining of tubercular mycobacterium (MTB) drug resistance. It is necessary to make use of the results to - 1) establish and formulate a diagnosis, -2) proceed with proper treatment.

3. To evaluate the results of - (1) cytological study of sputum, (2) study of pleural exudate (3) peripheral lymphatic nodes punctuate study - needed for differential diagnostics of TB and some other illnesses.

4. To evaluate the results of clinical analyzing of -1) blood test, 2) sputum [its quantity, color, smell, microscopy, etc], 3) urine – to define: pathologic changes taking place in organism, TB process gravity, its difference from other lung illnesses.

5. To evaluate the results of biochemical analyzing of blood indexes [meaning bilirubin, transaminase, other hepatic tests] as to define contra-indications to implement hepatotoxic drugs, reveal their toxic action and the treatment proper correction.

6. To evaluate results of spirometry, plain X-ray picture and ECG to find out a patient state gravity, making up expertise of work capacity and indication to a surgical lung intervention.

2. Basic knowledge and skills are necessary for topic studying (interdisciplinary integration)

The Department of introduction into internal diseases To know methods of laboratory and functional investigation and be able to evaluate minimal amount of methods needed for a concrete patient

Microbiology Department To master methods intended to reveal TB mycobacterium presented in pathological tissue. To be able to make up a negative dab, paint it by Zheel-Nilsen and find out TB mycobacterium in it. To make sowing of a pathological material sample into dense nutrient medium

Department of histology To master methods of histological and cytological investigations. To be able to make up a dab of pathologic material, to proceed with its microscopy and differentiate cell structure typical for various diseases

Department of normal and pathology physiology and Department of introduction into internal diseases To master investigation methods of such materials as blood, urine, excretion. To be able to differentiate pathological changes in samples from

normal ones Department of To master methods of blood biochemical analysis and reveal pathological changes in proper samples

Department of normal/pathological physiology, Department of propedeutics
To master methods of lung and heart disease functional diagnostics. To be capable to differentiate pathological indexes from normal ones

3. Practical work (tasks) which are doing within the class:

1. To examine a newly coming patient and prescribe all needed sorts of laboratory survey. Justify an objective for every survey to be prescribed.

2. Making use of results (1), one has to formulate and justify one's clinic diagnosis. Role of the laboratory survey should be pointed out.

3. Making use of a TB patient's case history, one should complete the table of disease laboratory signs, having evaluated diagnostic importance of every sign.

4. To have analyzed data of three kinds of probing (X-ray picture, laboratory, clinical) related to a patient, pointing out the significance of laboratory data.

5. A 63-year-old patient (K) entered a hospital, having complains of dry cough, common weakness, poor appetite, dyspnea, with diagnosis: infiltrative pulmonary TB of the right lung upper lobe, being in the phase of decay.

1) Make a plan of the patient survey in order to specify the diagnosis and prescribe a complex treatment.

2) What should be waiting periods for getting 3 kinds of the patient excretion MBT testing results – direct bacterioscopy, flotation, sowing into a dense nutrient medium ?

6. A 55-year-old patient (N) entered a hospital after a regular professional survey, having no complains. His roentgenogram shows oval shadow with clear contour, size 3*4 cm, placed at the level of III rib. There is no excretion.

1) Make a plan of the patient survey in order to specify the diagnosis and prescribe a complex treatment.

2) What additional survey (instrumental one, in particular) might be recommended to N, should laboratory and radiological ones don't bring up correct diagnosis?

7. A 27-year-old patient (P) has got infiltrative pulmonary TB of the right lung upper lobe, being in the phase of decay, MBT (+). What of two analyses, presented below, may most likely belong to P:

-A. erythrocytes-4,5. 1012/l; HB-150 g/l; leucocytes-10,5. 109/l; eosinophils-1%, band neutrophils-4%, segmented neutrophils-73%. Lymphocytes-15%, monocytes.-7%, ESR – 25 MM/h

-B. erythrocytes -4,0. 1012/l; HB-136; leucocytes -23,5. 109/l; eosinophils.-2%. band neutrophils -9%, segmented neutrophils -75%. Lymphocytes-8%, monocytes.-6%, ESR – 50 MM/h.

8. A 19-year-old patient (H) has complaints of aches in the field of her right lung, related with breathing. Objectively: right part of her thorax lags behind the right one while breathing. Voice vibration is weakened. There is some sound dullness, taking place in the low part of her right lung, where breathing is sharply

weakened under auscultation. 1) What sort of illness is it? Make a plan of the patient survey in order to specify the diagnosis and prescribe a complex treatment.

9. A 4-year-old child has got enlarged neck lymphonoduses with fistula in one of them. Roentgenogram shows a black-out placed at the level of the right side IV rib, related to the lung root enlargement.

1) Set up preliminary diagnosis.

2) Make up a plan of the patient clinic-laboratory observation intended at the diagnosis correction.

10. In order to reveal MBT a patient has been gotten through procedure of sowing into dense nutrient medium by Lovenshtein-Yensen.

1) What are minimal/maximal seasons for the MTB to commence growing?

2) Since what time can laboratory bring its resume, should there is no growing?

4. Materials for self - control

TUBERCULINODIAGNOSTICS

1. What test is used under massive surveys of children/youngsters in Ukraine to reveal TB positive ones?

A. Koch test.

B. Mantoux reaction with 2 IU of PPD-L.

C. Mantoux reaction with 100 IU of PPD-L .

D. Eosinophyl – tuberculin test.

E. Graduated skin test.

E. since 1 hour.

2. Which contingent remains out of phthisiology control, in regard with results of screening tuberculin diagnostics?

A. Children and youngsters, who were infected a long ago.

B. Youngsters with tuberculin test “conversion”.

C. Persons, who have been infected long ago, having hyperergic sensibility towards Mantoux reaction with 2 IU of PPD-L.

D. Persons with enlarging of [previously] doubtful or positive reaction towards tuberculin with 6 mm or more.

E. Children and youngsters, which were infected long ago, regardless of a papule diameter by Mantoux reaction with 2 TU PPD-L, should there is information about their getting in touch with a TB infected patient.

3. A 5-year-old child was infected by BCG vaccine at a maternity home. Since being vaccinated has index of 5 mm. Tuberculin sensibility dynamics is as follows: 1-year-old - infiltrate of 8 mm in diameter; 2 years – 5 mm, 3 years – 3 mm, 4 years – hyperemia, 5 years – 10 mm.

What conclusion has to be made according to these data?

A. The child is quite healthy, no TB case.

B. The child has got after-vaccination allergy.

C. There is a “conversion” of a TB reaction.

D. The child is ailing with TB.

E. The child is TB-infected with allergic response at Mantoux reaction.

4. A 11-year-old child, being vaccinated by BCG-M at the age of 7, has a scar of 6 mm. As a result of tuberculin test one could reveal hyperemia without a papule. Previous reaction (response) was positive.

What conclusion about the child shall be right?

- A. A TB positive patient, which is in need of phthisiologist' consulting.
- B. This is posvaccinal allergy.
- C. This is a tuberculin reaction "conversion". Phthisiologist consultation is necessary.
- D. This is a healthy non-infected child.
- E. This long ago TB infected patient needs no specified consultation.

5. What is objective to make hypodermic test by Koch?

- A. To investigate a specific process activity.
- B. To find out people who are risky to get TB infected.
- C. To study percentage of TB infected ones, being [amidst population], as an epidemiology index.
- D. To determine TB infected ones as early as possible.
- E. To study a limit of sensibility against tuberculin.

6. What is the waiting period /term since various sorts of vaccinations, which "allows" to get Mantoux test with 2 TU of PPD-L.

- A. Since a year
- B. Since 6 months.
- C. Since 2 weeks.
- D. Since 3 days.
- E. Since 1 month.

7. What is the right place to inject tuberculin for getting a Mantoux probe with 2 TU PPD-L?

- A. Inner surface of a forearm middle third part.
- B. Border between upper and low thirds of the outer middle of a forearm.
- C. Over a blade.
- D. Under a blade.
- E. Upper third of the inner part of a forearm.

8. A child is vaccinated by BCG in a maternity home. His father suffers with TB in its active form. How often should a Doc make survey of the child by Mantoux reaction?

9. A 5-year-old child was intradermally vaccinated by BCG-1 at a maternity home. Tuberculin test was carried out yearly. Size of Mantoux test papule is of 14 mm in diameter. Last year it was 3 mm. Vaccinating sign is 3 mm. No complaints. There is no pathology. Radiology method shows no pathology in lungs.

How should one interpret this TB - test dynamics?

10. A 5-year-old child was intradermally vaccinated by BCG-1 in a maternity home. Tuberculin test was carried out yearly. Size of Mantoux test papule is of 14 mm in diameter. Last year it was 3 mm. Vaccinating sign is 3 mm. No complaints. There is no pathology. Radiology method shows no pathology in lungs. **What is the reason for the Mantoux reaction to become positive?**

The pattern of answers: 1.B. 2.A. 3.C. 4.B. 5.A. 6.E. 7.A. 8. Once a year.
9. A tuberculin test “conversion”. 10. Getting infected.

X-RAY METHODS OF TB DIAGNOSIS

1. What radiology method is made use of for population screening survey in order to reveal cases of breathing organs TB?

- A. Plain X-ray picture.
- B. Computer tomography
- C. Fluorography
- D. Roentgenphotography
- E. Bronchography

2. What diagnosis method will be the most appropriate one to keep in check dynamics of the pulmonary TB patient’s treatment efficiency?

- A. Roentgenography
- B. Roentgenkymography
- C. Fluorography
- D. Roentgenphotography
- E. Bronchography

3. What method will be the most effective one to localize a shadow, placed somewhere in the lung tissue? What is the shadow’s disposition if to compare it with adjacent tissues such as ribs, spine, etc?

- A. Plain X-ray picture
- B. Computer tomography
- C. Fluorography
- D. Roentgenphotography
- E. Bronchography

4. What method is used to reveal destruction in a lung tissue?

- A. Plain Z-ray picture
- B. Tomography
- C. Side roentgenography
- D. Roentgenphotography
- E. Bronchography

5. What sort of radiology method should be made use of to commence an additional survey, if - under preventive fluorography observation – there were focal shadows in the 1st and 2nd lung segments?

- A. Plain Z-ray picture
- B. Computer tomography
- C. Side roentgenography
- D. Roentgenphotography
- E. Bronchography

6. What is normal shape for a lung root?

- A. Obtuse angle, opened towards a lung field
- B. Triangle top of which is turned towards a middle shadow.
- C. A circumference segment
- D. A Rectangle
- E. A complex polycyclic figure.

7. A 40-year-old patient, under radiological survey, have shown a spherical darkening sized 5 cm in diameter placed in the left lung VI segment.

What radiological syndrome is revealed in this case?

8. A 35-year-old patient, having got through flu-survey, revealed many focal shadows of different intensity, placed along all lung fields. **What radiological syndrome would be correct to register in this case?**

9. A 35-year-old patient, having got through flu-survey, revealed a spherical cavity sized up to 5 cm in diameter with thin walls, placed in the 1st and 2nd left lung segments.

What radiological syndrome would be correct to register in this case?

10. A 50-year-old patient worked as a miner for 25 years. For the last 3 years he registers progressive dyspnea while walking. Hard breathing is been heard. Heart tones are dull. There is 2nd tone accent (increase?) heard over a lung artery. Blood analyzes is normal. X-ray diagram shows small multiple intensive focal shadows, placed in lungs middle and low parts, both having deformed lung drawing.

What radiological syndrome is revealed in this case?

The patterns of answers: 1.C. 2.A. 3.B. 4.B. 5.A. 6.C. 7. A spherical shadow, 8. Dissemination, 9. Ring-shaped shadow syndrome, 10. Syndrome of dissemination.

LABORATORY METHODS OF TB DIAGNOSTICS, methods of revealing of MBT. Atypical MBT and their clinic values.

1. What method of MBT revealing is the most economic?

- A. Direct microscopy
- B. Cultural investigation
- C. Biology testing
- D. Polymerase chain reaction (PCR).
- E. IFA.

2. What method of MBT revealing is the most sensitive and specific?

- A. Direct microscopy
- B. Cultural investigation
- C. Biology testing
- D. Polymerase chain reaction (PCR).
- E. IFA.

3. What coloring is necessary to reveal MBT?

- A. By Gram.
- B. By Zheel-Nilsen.
- C. By Romanovski-Gimza.
- D. Fucine
- E. Methylene blue

4. What changes of leukocyte number, while uncomplicated TB case, are the most typical?

- A. Leucocytosis with much band displacement, leukemic test.
- B. Changes aren't typical.
- C. Moderate Leucocytosis with low band displacement.

- D. Leucopenia
- E. There might be as leucopenia as leukocytosis.

5. What changes of ESR, when uncomplicated TB, are the most typical?

- A. Increase over 60 mm an hour.
- B. There are no changes.
- C. Decrease.
- D. Increase up to 30 mm an hour.
- E. Increase among women.

6. What are the most representative changes in pulmonary TB cases, when those run with expressed intoxication signs?

- A. Moderate proteinuria, Moderate leukocyturia, total gross hematuria.
- B. Moderate leucocyturia, single erythrocytes.
- C. Considerable proteinuria without change in amount of leukocytes.
- D. Pyuria, cylindruria, microhematuria.
- E. Total gross hematuria with pain syndrome.

7. A 28-year-old patient has complaints of high temperature (up to 39°C), weakness, hemorrhage, loss of weight. X-ray picture shows the right lung VI segment' black-out and its (segment) diminishing in size. There also is the right lung root increase on account of enlarged intrathoracic lymphatic nodes.

What additional investigation should be made to specify the diagnosis?

Patterns of answers: 1.A. 2.D. 3.B. 4.C. 5.D.6.B.

7. Excretion analyzes on MBT by bacterioscopic and bacteriological methods, excretion analyzes on cancer cells, overall blood/excretion analyzes, survey and side roentgenogram, the right root tomogram, bronchoscopy.

FUNCTIONAL RESPIRATORY TESTS in pulmonary TB cases 1.

What data can't be received under functional respiratory tests for a TB patient?

- A. Value of work disability
- B. Possibility of surgical intervention
- C. Presence of an bronchial obstruction
- D. Treatment efficiency
- E. Presence of a destructive lung process

2. What bronchial obstruction criterion is used presently?

- A. Decrease of forced expiratory volume₁.
- B. Increase of vital capacity.
- C. Decrease of coefficient of breathing reserve.
- D. Rise of one minute volume of ventilation.
- E. Decrease of maximal lung ventilation.

3. What a lung restriction criterion is used presently?

- A. Decrease of forced expiratory volume₁.
- B. Increase of vital capacity.
- C. Decrease of coefficient of breathing reserve.
- D. Rise of one minute volume of ventilation.
- E. Decrease of maximal lung ventilation.

4. What index is investigated under pneumotachometry?

- A. maximal expiratory flow.
- B. forced expiratory volume per 1s.
- C. vital capacity.
- D. one minute volume of ventilation.
- E. maximal lung ventilation.

5. What can one witness by detecting of vital capacity?

- A. Infringement of small bronchus pass ability.
- B. Having got obstructive type of ventilation insufficiency.
- C. Having got restrictive type of ventilation insufficiency.
- D. Infringement of gas diffusion.
- E. Having got ventilation insufficiency of mixed type.

6. Under what illness should breathing parameters [such as velocity of breath] become the main criteria of that illness complexity?

- A. Pneumonia
- B. Pulmonary TB.
- C. Fibrous alveolitis.
- D. Exudative pleuritis.
- E. Chronic obstructive bronchitis.

7. What clinical sign does help to reveal external breath function infringement?

- A. Coughing.
- B. Dyspnea.
- C. Wet rales in a field of lungs.
- D. Sound under the percussion.
- E. Voice vibration reducing.

8. A 50-year-old patient was originally revealed infiltrative TB of the right lung upper part and the left lung VI segment being in the phase of decay. MBT+, BH of the 2nd degree by obstructive type with damages of possibility of breathing ways middle and upper parts. Indexes of functional of external breathing, afore making a functional test with broncholytic drug, are as follows: forced expiratory volume per 1s -59%, maximal expiratory flow 25-30%, maximal expiratory flow 50-59%, maximal expiratory flow 75-86%. Analogical ones, received 40 minutes after making a functional test with broncholytic, are as follows: forced expiratory volume per 1s -91%, maximal expiratory flow 25-45%, maximal expiratory flow 50-72%, maximal expiratory flow 75-108%.

How can one evaluate broncholytic influence at state of bronchi possibility by means of spirotest?

The pattern of answers: 1.E. 2.A. 3.B. 4.A. 5.C. 6.E. 7.C. 8. Functional test with making use of broncholytic drug is positive.