DIAGNOSTIC METHODS IN THE INTERNAL MEDICINE

WORKBOOK

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Minsk BSMU 2025

МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ
БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ
КАФЕДРА ПРОПЕДЕВТИКИ ВНУТРЕННИХ БОЛЕЗНЕЙ

ДОПОЛНИТЕЛЬНЫЕ МЕТОДЫ ИССЛЕДОВАНИЯ В КЛИНИКЕ ВНУТРЕННИХ БОЛЕЗНЕЙ ПРАКТИКУМ

DIAGNOSTIC METHODS IN THE INTERNAL MEDICINE WORKBOOK

Рекомендовано Учебно-методическим объединением по высшему медицинскому, фармацевтическому образованию Республики Беларусь в качестве учебно-методического пособия для студентов учреждений высшего образования, обучающихся по специальности 1-79 01 01 «Лечебное дело»

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А в т о р ы: д-р мед. наук, проф. Э. А. Доценко; канд. мед. наук М. В. Шолкова; ассист. А. Г. Захарова; ассист. Ю. В. Репина; канд. мед. наук, доц. М. Н. Антонович; канд. мед. наук, доц. Г. М. Хващевская; канд. мед. наук, доц. И. Л. Арсентьева; канд. мед. наук, доц. В. Я. Бобков; ассист. Е. О. Полякова

Р е ц е н з е н т ы: д-р мед. наук, проф., зав. каф. кардиологии и ревматологии Белорусской медицинской академии последипломного образования А. М. Пристром; каф. пропедевтики внутренних болезней Витебского государственного ордена Дружбы народов медицинского университета

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CHAPTER 1.
LABORATORY DIAGNOSTISTICS

In the modern world in the process of treatment, patients meet with a variety of diagnostic examinations, among which an important place is occupied by clinical laboratory tests.

Laboratory tests are performed using biological material that is taken from the patient. Doctors carry out necessary laboratory tests and check their results. Nurses ensure the interaction between the laboratory, the patient and the doctor: is responsible for the proper preparation for the test, taking and collecting of biological material, the correct and timely delivery of it to the laboratory. The most popular tests doctors use in therapeutic practice are as follows:

– Complete blood count (CBC);
– Urinalysis;
– Sputum tests;
– Biochemical blood analysis;
– Examination of pleural fluid and other biological fluids;
– Stool tests.

It should be noted that the "normal values" of laboratory parameters are the values found in a carefully examined group of people without objective signs of pathology. Since the term "normal values" is difficult to interpret, it was proposed to replace it with the concept of "reference values", that is, the values given for comparison. The reference interval usually includes the central 95 % of the values, i. e. 2.5 % of the minimum and maximum values are discarded. Currently, due to the significant diversification of laboratory research methods, it is impossible for all indicators to provide unified reference values. In each laboratory, the reference interval may differ slightly (and sometimes significantly). Therefore, when interpreting the results of laboratory studies, it is necessary to rely not on abstract "normal" values, but on the reference values of the particular laboratory that performed the analysis.

When interpreting the results of laboratory and instrumental studies, it should be remembered that there are no absolute methods. This means that even with the error-free execution of the preanalytical and analytical steps, there are a small number of patients in whom this method does not confirm the existing disease (or indicates the disease in its absence). For example, in case of a bacterial infection, an increased level of leukocytes (leukocytosis) in the peripheral blood occurs in 90 % of patients; however, some patients have a decrease in the number of leukocytes (leukopenia) or their normal level. These patients will have false negative test results in relation to the underlying disease, which may lead to the false conclusion that there is no bacterial infection.

On the other hand, leukocytosis can occur in patients with leukemia, and our conclusion about the presence of a bacterial infection in this patient will be false in relation to the patient's disease (false positive result).

Therefore, when we interpret the results of laboratory and instrumental examinations, especially if these are new or rarely used methods, we must know the characteristics of the method: sensitivity and specificity.

Sensitivity measures the proportion of truly positive results that correctly indicate an underlying disease (the proportion of those who do have a disease who are correctly identified by the method as suffering from that disease).

Specificity measures the proportion of truly negative outcomes (the proportion of those who do not have the disease who are correctly identified as not having the disease).

Thus, if the sensitivity of the test is 98 % and its specificity is 92 %, the false-negative rate is 2 %, and the false-positive rate is 8%.

Complete Blood Count (CBC)

An important condition for ensuring the quality of laboratory blood tests is taking the material on an empty stomach in the morning. 12 hours before examination patient should exclude alcohol, smoking, eating, and should limit physical activity. It's necessary not to eat after dinner, go to bed the night before at the usual time for the patient and get up no later than 1 hour before the blood sampling. Blood tests are taken before radiological, endoscopic examinations or physiotherapy (if they are performed in one day). Patients should postpone medication intake (if it's impossible to stop taking the medication, it's necessary to inform the laboratory about it). Right before taking blood tests, patient should reduce physical activity and emotional stress and have a rest 10–15 minutes before the procedure and calm down.

Complete blood count (CBC) is one of the main tests in Internal Medicine, it is used for diagnosis of various hematological and non-hematological pathologies. The purpose of this blood test is a quantitative and qualitative analysis of blood cells (erythrocytes, leukocytes, platelets), determination of hemoglobin and erythrocyte sedimentation rate (ESR). Currently, most indicators are performed on automatic hematology analyzers, which are able to simultaneously determine from 5 to 24 parameters of blood. The main ones are the number of leukocytes (white blood cells), hemoglobin concentration, hematocrit, erythrocytes (red blood cell), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), mean corpuscular volume (MCV), platelets, mean platelet volume (MPV), etc.

ESR is determined by the Panchenkov's method (in the Panchenkov's capillary) or by the Westergren's method (in a test tube). ESR count in mm for 1 hour and it depends on the age. The normal rate of ESR for male is 2–10 mm/hour, for female — 2–15 mm/hour. The Westergren's method is an international method for determining ESR. It differs from the Panchenkov's method by the characteristics of the tubes used and the calibration of the result scale. But the Westergren's method is more sensitive to increased ESR, and the results in the zone of elevated ESR values will be more accurate than the results obtained by the Panchenkov's method. In many diseases, the ESR is increased, especially for those that are accompanied by changes in the protein fractions of the blood. This is explained by the fact that the greatest influence on the ESR is caused by the violation of the ratio of different fractions of blood proteins. Albumins prevent erythrocyte sedimentation, and globulins, on the contrary, accelerate it. Especially great influence on the erythrocyte sedimentation has fibrinogen. The increase in ESR is observed in various inflammatory processes and infectious diseases, in case of rheumatic and oncological diseases, tuberculosis, myocardial infarction. ESR decreases in case of diseases accomplained by blood clots (polycythemia, food toxicoinfection, cholera).

Hemoglobin is the red blood cell pigment. It's a carrier of oxygen from the lungs to the tissues and carbon dioxide from the tissues to the lungs. Currently, hemoglobin is determined automatically using the photometric method. The amount of hemoglobin is significantly reduced with anemia, other blood diseases, malignant tumors.

Erythrocytes (red blood cells, RBC) are the most numerous blood cells that don't contain nuclei and are the most special cells in the body, the main function of RBC is oxygen transport from the lungs to the tissues and transfer carbon dioxide from the tissues to the lungs. This process is carried out with the help of hemoglobin. The red blood cells shape (a biconcave disc) gives the optimum ratio of volume to surface for the gases exchange, and provides RBC with the ability to deform during microcirculation. The red blood cells count underlies the assessment of erythropoiesis.

Erythrocytes are the subject of further tests to determine the hemoglobin concentration and hematocrit value (the ratio of the erythrocytes volume to the total blood volume). Following erythrocyte indices characterize RBC quality: MCH — mean corpuscular hemoglobin, MCHC — mean corpuscular hemoglobin concentration, MCV — mean corpuscular volume. Low level of red blood cells indicates the presence of anemia. RBC number below than $1*10^{12}$ /l is a life-threatening condition. In patients with erythremia, the number of erythrocytes increased to $8–12*10^{12}$ /l.

Platelets (thrombocytes) come from giant bone marrow cells-megakaryocytes. Platelets are round or oval in shape. They take part in a blood clot formation. The number of platelets (thrombocytosis) increases in case of bleeding, surgery, cancer. Thrombocytopenia occurs with Verlgof's disease, leukemia, and infectious diseases.

Leukocytes (white blood cells, WBC) are divided into groups: granulocytes and agranulocytes. The name of granulocytes is associated with the presence of specific granules in the cytoplasm. Three types of granulocytes are identified, depending on their color in blood smear: neutrophils, eosinophils, and basophils. Agranulocytes consist of lymphocytes and monocytes, they don't contain specific cytoplasmic granules, their nucleus is non-segmented. In healthy individuals, the number of leukocytes is $4–9*10^9$ /liter. When the number of leukocytes exceeds $9*10^9$ /l, we are talking about leukocytosis; the number of white blood cells below $4*10^9$ /l is called leukopenia. Leukocytosis is observed in many diseases of the blood system (leukemia, Hodgkin's disease), in purulent inflammation (abscess, appendicitis, cholangitis), pneumonia and myocardial infarction. Leukopenia is present in case of blood diseases, liver cirrhosis, drug poisoning, radiation sickness, as well as with some infectious diseases (viral hepatitis, brucellosis, influenza, typhoid fever). The leukocyte count is the ratio between the various forms of white blood cells. It is counted in blood smear.

To determine the leukocyte count, the coloring according to Romanovsky–Giemsa is used. The colorant is a mixture of acid and alkaline paints. Acidic substances are painted in blue color, alkaline substances are red color, while neutral get both colors and turn in purple color.

Neutrophils amount is 50–70 % of leukocytes. Their cytoplasm is colored in light pink, granules are purple. Neutrophils are divided into band and segmented. Eosinophils have a characteristic bright red grain and a segmented core. Basophils are the smallest granulocytes. The nucleus of their irregular shape occupies almost the entire cell.

Lymphocytes are non-granular cells. The nucleus is located centrally, has a round or bean-shaped form, is painted in blue-violet color.

Monocytes are the largest blood cells. Their horseshoe-shaped or irregular shaped core are colored purple-red. Cytoplasm has a purple-blue color with a delicate reddish grain.

Neutrophils perform a protective function in the body. They fight against microbes and toxins. During infections, intoxication, their number increases significantly. At the same time, immature forms appear: the number of band is increased, young neutrophils appear, even myelocytes can occur in the smear. This neutrophilic rejuvenation is called shift to the left. Eosinophils are very active in allergic diseases and collagen diseases. Their number increases with parasitic diseases, scarlet fever, Hodgkin's disease. In some diseases their number, on the contrary, decreases (miliary tuberculosis, typhoid fever). Basophils are involved in immune response. Basophil number increases with myeloid leukemia. An increase in the number of lymphocytes (lymphocytosis) is observed in tuberculosis, thyrotoxicosis, and especially in lymphocytic leukemia. Lymphopenia occurs in case of Hodgkin's disease, viral infections, autoimmune diseases. Monocytes are cells of the innate immune response, after entering the blood they are in the bloodstream for 1–2 days, then they settle down in the tissues. Monocytosis is observed in malaria, tuberculosis. Monocytopenia occurs in case of severe sepsis, typhoid fever.

Biochemical Blood Analysis

A biochemical blood analysis includes a long list of indicators. The number of these indicators depends on the capacity of the clinical laboratory. In the practice of the hospital, there is an order that defines the minimum number of biochemical tests. This minimum volume usually includes:

1. Renal function parameters (urea and creatinine). In addition, the doctor needs to calculate the glomerular filtration rate (GFR) based on creatinine. This is a very important indicator that allows you to individualize the functional state of the kidneys. Several formulas can be used: Cockcroft-Gault formula, MDRD formula, CKD-EPI formula, and others. To calculate GFR, in addition to the creatinine level, it is necessary to know the patient's gender, age, height and weight. In some laboratories, GFR is calculated automatically, but usually the doctor does it on his own by a special calculator program.

2. Liver function parametres: total bilirubin, direct and indirect bilirubin, alanine transaminase (alanine aminotransferase, ALT), aspartate transaminase (aspartate aminotransferase, AST), total protein, albumin. The activity of gamma-glutamyltransferase (GGTP), alkaline phosphatase (ALP) is also evaluated.

3. Peripheral blood glucose level.

4. Electrolytes: sodium, potassium, chlorides, calcium.

5. C-reactive protein (CRP) level is used to assess inflammatory changes.

6. Cardiovascular system state is estimated by different groups of parameters as follows:

6.1. Lipid metabolism parameters: total cholesterol, high density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), triglycerides.

6.2. Myocardial damage parameters: troponin, myoglobin, creatine kinase (creatine phosphokinase, CK) and its MB fraction (CK-MB).

When making a diagnosis, we have wide variety of parameters in bochemical blood analysis: for example, the pancreas disorders can be diagnosed by the high activity of amylase; in case of anemia, it is useful to determine serum iron level, transferrin, ferritin, etc.

Urinalysis

Urinalysis is an important diagnostic test not only for kidney and cardiovascular diseases, but also for diseases of other organs and systems. Various pathological processes affect the urine test.

The results of urine tests allow us to assess the disease course and effectiveness of treatment.

For urinalysis, it's necessary to collect strictly morning urine collected immediately after awakening. Patient shouldn't take diuretics, alcohol, spicy and salty meal, products that change the color of urine (beets, carrots) on the day before of urine collection. Before urine collection, patient should do genital hygiene without antiseptics. Women are not recommended to take a urine test in menses. In case of urgency, urine is taken with the catheter. Urine is collected in a sterile disposable container. The container after collecting is tightly closed, placed in a clean disposable bag and delivered to the laboratory. Nurse should fill direction for urinalysis, write patient's surname, name, patronymic, age, department, diagnosis.

For Urinalysis, the middle portion of morning urine is collected (at least 50 ml). Urinalysis includes determination of physical properties, chemical analysis and microscopic examination of the sediment.

Physical properties of urine. The color of urine is normally depending on its concentration and ranges from dark-yellow to slightly-yellow. Colorless urine is observed in case of polyuria (after taking diuretics, in case of diabetes). Dark-yellow urine color, like beer color, occurs in case of jaundice due to presence of bile pigments. The urine of the color of meat slop is observed in case of hematuria, for example in glomerulonephritis.

Normal urine is clear. Turbidity of the urine can be caused by the presence of salts, cells, mucus, fat, bacteria.

Smell: fresh urine of a healthy person has no smell. If the urine was in a warm room for a long time, it gets an ammonia smell. Acetone in the urine (in case of diabetes) provides fruity odor.

Reaction of urine: normal urine in case of mixed diet is acidic or neutral; in case of acidosis, it becomes more acidic, in case of alkalosis it becomes more alkaline. In case of diseases accompanied by the appearance of acidic metabolic products in the blood (uremia, diabetes, heart failure), urine becomes very acidic. The pH of urine is determined by titration, using a pH meter and litmus paper.

The density of urine ranges from 1001 to 1040. The density of the primary urine is 1010–1012, i. e. it is equal to the plasma density. The excretion of urine with a density of 1010–1012 is called isostenuria, the excretion of urine with a lower density of hyposthenuria. Pro-longed hypostenuria is a poor prognostic sign. The amount of urine depends on the amount of fluid intake. A healthy person produces 1000–2000 ml of urine per 24 hours. In case of diabetes, the amount of urine can be 8 liters or more per 24 hours. Normally, most urine is excreted during the day. Excretion of urine mainly at night (nicturia) is observed in chronic kidney failure and in chronic heart failure.

Chemical examination of urine. The presence of protein, urobilin, glucose, acetone, salts is determined in the urine. Concentration of enzymes, hormones, metabolites of drugs, alcohol can be found by a special test. Protein: urine of a healthy person contains a trace amount of protein (0.03 g/l). Urinary protein excretion is called proteinuria. Proteinuria can be renal and extrarenal. In renal proteinuria, protein enters the urine from the blood plasma through nephron in case of damage (glomerulonephritis, nephrotic syndrome) or increased permeability due to external stimulus (cold, physical stress). Extrarenal proteinuria can have prerenal causes (associated with an excessive concentration of protein in the blood plasma, for example, in

multiple myeloma) and postrenal causes (associated with diseases of the urinary tract).

Glucose: urine of a healthy person doesn't contain glucose. Glucosuria occurs in case of diabetes, hypophysis and adrenal gland diseases. Ketone bodies include acetone, acetoacetic acid and beta — oxybutyric acid. They appear in the urine in case of diabetic ketoacidosis, acute liver or kidney damage, intoxication.

Microscopic urine examination is done for estimation of the elements such as red blood cells, leukocytes, casts, epithelial cells. Red blood cells may be unchanged (isomorphic, contain hemoglobin), having a greenish-yellow color, and changed (dysmorphic, free from hemoglobin) — color-less. The presence of red blood cells in the urine is called hematuria. There is a macrohematuria, when the blood in the urine is so pronounced that the urine becomes the reddish color, and microhematuria, in which red blood cells are detected only in microscopy. Unchanged erythrocytes (isomorphic) indicate non-glomerular hematuria, they are found in kidney infarction, kidney stones, cancer, kidney tuberculosis, injuries, as well as in cystitis and urethritis. Dysmorphic (changed) erythrocytes indicate glomerular hematuria, they are detected when RBC enter the urine directly through the nephron (with glomerulonephritis). Leukocytes in the urine of healthy individuals are 3–5 cells per high-powered field (HPF) microscopy. If leukocytes cover the entire field of view, it called pyuria. It occurs in case of pyelonephritis, cystitis, and urinary tract infection.

Casts are protein structeres are formed mainly from blood plasma globulins in the renal tubules. The appearance of casts in the urine (cylindruria) indicates the damage of the tubular kidney epithelium.

Epithelial cells in urine can be squamous, transitional and renal cuboidal epithelium. Cells of the squamous epithelium have a round or polygonal shape with a small nucleus. They enter the urine from the external genitalia or urethra. The cells of the transitional epithelium cover the mucous membrane of the urinary tract. The presence of a large number of these cells in the urine indicates an inflammatory process in the pelvis or bladder. Renal cuboidal epithelial cells have an irregular shape, yellowish color. Their appearance is a sign of acute and chronic kidney damage. They are also found in infectious diseases and intoxications.

Nechiporenko's urine test is usually prescribed after a urinalysis and collected separately from it (on another day). Purpose of the test: to estimate the number of cells (leukocytes, erythrocytes) and casts per unit of urine volume. According to the results of Nechiporenko urine test in healthy people, the number of leukocytes in urine is $0–4*10^6$ /l, erythrocytes — $0–2*10^6$ /l, casts — $0–0.25*10^6$ /l. The method of Nechiporenko urine test collecting is the same as for urinalysis.

Zimnitsky's urine test is done for evaluation of kidney function. For this test, 8 containers for urine collection are needed. The patient collects urine for 24 hours, every three hours in one container. Labels are stuck on the container with the indication of the number and time when this portion is received. Urine collection begins after 6.00 in the morning, held every three hours, the last portion at 6.00 the next day. Containers with urine must be stored in a cool place, for example, in a refrigerator on the lower shelf at t = +4–8 °C, without allowing freezing. Every container must be tightly closed with a cover, placed in clean disposable bags and delivered to the laboratory.

Rehberg's test is carried out to determine the filtration capacity of the kidneys (determination of the glomerular filtration rate (GFR) by the clearance of endogenous creatinine). This sample requires two samples: a urine sample and a blood sample for biochemical analysis. Urine is collected for a certain time (from 2 hours to a day), then about 100 ml is taken into a container and delivered to the laboratory with an indication of the collected total volume and time during which the collection was carried out. A biochemical blood test is taken at the end of the urine collection. It is necessary to check the height, weight, age of the patient, the amount of urine collected (ml) and the indication of the time it was collected.

Sputum examination

Sputum is collected in the morning before meals and drugs, by coughing. Before sputum discharge, the patient should thoroughly rinse his mouth and throat with boiled water to prevent saliva collection. The patient needs to take two deep breaths, holding the breath for a few seconds after each inhalation and exhaling slowly. After the third breath, he should cough up well, collect the secreted sputum in a container and immediately close the lid.

A macroscopic examination determines the amount of sputum, smell, consistency, color, the presence of pathological substances. In bronchitis, bronchial asthma, lobar pneumonia, patients cough out sputum in a little portion. In the presence of bronchiectasis, the amount of sputum can be 0.5 liters or more per day.

The consistency of spupum can be liquid, viscous and thick sputum. With bronchitis and bronchopneumonia, sputum is liquid or moderately viscous, and with lobar pneumonia it's thick, poorly coughed out. By the sputum character it can be mucous, mucous-purulent in case of bronchitis and bronchial asthma. In case of pulmonary edema, sputum is serous; it is purulent in case of bronchiectasis, lung abscess.

Bloody sputum contains blood in various quantities. In case of pulmonary bleeding, it consists of almost one blood, in case of tuberculosis, abscess, lung cancer, spupum contains some blood portions. The color of sputum depends on the disease: in case of lung cancer the color is a crimson, in case of lobar pneumonia — broun. Purulent sputum usually has a yellowish color, asthma patients have clear or white sputum. The smell of sputum is often absent. Offensive odor arises from the purulent destruction of lung tissue (lung gangrene, lung cancer), as well as protein decomposition during sputum retention in the cavities (bronchiectasis, lung abscess).

Sputum can include fibrin in case of lobar pneumonia, Kurschman spirals and Charcot–Leyden crystals in case of asthma.

Microscopic examination of sputum is carried out in both native (unstained) and stained smears. In the first case, a portion of sputum is applied to a glass slide, covered with a cover glass and then examined under a microscope under different magnifications.

In the native smears are detected epithelial cells, leukocytes, erythrocytes, actinomycetes, hematoidin crystals and fatty acids. Eosinophils are a rounded cells of light gray color. Charcot crystals are crystals that are formed when eosinophils are destroyed. Spiral Kurshman represents the casts of transparent mucus, occurring in case of bronchial asthma. Elastic fibers are double-lumen shiny formations, they are formed in case of lung tissue breakdown and are found in tuberculosis and lung abscess. Hematoidin crystals have the rhomboid or star form, golden color and are found in case of hemorrhages in lung tissue. The cells of malignant tumors enter the sputum due to their disintegration.

These cells are large, have a different shape, a large nucleus, and sometimes several nuclei. Actinomycetes consist of a central part, which is a plexus of mycelium, and a radiantly located flask-shaped formations surrounding it.

Pleural fluid examination

Fluid obtained by puncture of serous cavities (pleural, abdominal, pericardial) can be defined as exudates or transudates.

Depending on the type and properties of the accumulated fluid, as well as the nature of the pathological process in the pleural cavity, there are:

– hydrothorax is transudate accumulation; it is non-inflammatory fluid;

– exudative pleurisy is an inflammatory process of the pleura, accompanied by the exudate accumulation (an inflammatory fluid);

– empyema (pyothorax) is a purulent inflammation of the pleura, accompanied by the accumulation of pus;

– hemothorax — accumulation of blood in the pleural cavity; most common in case of chest injury;

– chylothorax — accumulation of lymph in the pleural cavity, most often found in case of the thoracic lymphatic duct injury or mediastinal tumors. Differential diagnosis of the exudates and transudates is presented in the Table 1

Note!

The reference values given in the workbook are not universal and may vary at different laboratories.

Table 1

Differential diagnosis of the exudates and transudates

Characteristics	Transsudat	Exsudat
Color	pale yellow	dark yellow, orange, green
Transparency	transparent	transparent or cloudy
Density	less than 1.015	more than 1.015
Protein concentration	less than 20 g/l	more than 30 g/l
The ratio of protein content effusion/serum*	less than 0.5	0.5 and more
LDH activity *	less than 200 u/l (less than $^2/_3$ upper reference limit for blood)	more than 200 u/l (more than $^2/_3$ upper reference limit for blood)
The ratio of the activity of LDH effusion / serum *	below 0.6	over 0.6
Rivalt test	negative	positive
Glucose concentration	more than 3.33 mmol/l	less than 3.33 mmol/l
Causes	heart failure (cardiogenic hydrothorax), liver cirrhosis, nephrotic syndrome, severe hypothyroidism	pneumonia (para- and metapneumonic pleurisy), infectious destruction of the lungs, tuberculosis (tuberculous pleurisy), metastatic damage to the pleura, pleural mesothelioma, systemic vasculitis, sarcoidosis, pneumoconiosis

Parameters marked with * are called “Light’s criteria” and allow to differentiate exudate with a sensitivity of 100 % and a specificity of 80 %.

COMPLETE BLOOD COUNT (CBC)

Note!

The reference values given in the workbook are not universal and may vary at different laboratories.

1. CBC				
Parameter	**Reference values**		**Unit**	**Note**
	male	**female**		
RBC	3.8–5.7	3.5–5.1	10^{12} /l	
Hemoglobin	130–160	120–150	g/l	
Hematocrit	40–52	36–42	%	
MCV	80–95		fl.	
MCH	27–33.3		pg	
MCHC	300–370		g/l	
Reticulocytes	0.5–1.5		%	
WBC	4–9		10^9 /l	
Platelets	150–450		10^9 /l	
ESR Panchen-kov's method	2–10		mm/h	male
	2–15		mm/h	female
ESR Westergren's method	1–15		mm/h	before 50 y.o.
	1–20		mm/h	after 50 y.o.

Leukocyte count			
Parameter	**%**	**10^9/l**	**Note**
Basophils	0.5–1	0.01–0.065	
Eosinophils	1–5	0.02–0.5	from 5 y.o.
Neutrophils: band	1–6	0.04–0.57	from 14 y.o.
segmented	47–72	1.8–6.5	from 5 y.o.
Lymphocytes	19–39	1.5–4	from 5 y.o.
Monocytes	2–11	0.05–0.8	from 14 y.o.

Conclusion:

2.
CBC

PATIENT'S NAME: IVANOV II		
AGE: 67 y.o.	Sex: man	
Parameter	Result	Note
RBC	3.0 * 10^{12} /l	
Hemoglobin	98 g/l	
Hematocrit	40 %	
MCV	80 fl.	
MCH	27 pg	
MCHC	310 g/l	
Reticulocytes	1 %	
WBC	6.8 * 10^{9} /l	
Platelets	357 * 10^{9} /l	
ESR	12 mm/h	
Leukocyte count		
Basophils	1 %	
Eosinophils	1 %	
Neutrophils: band	3 %	
segmented	52 %	
Lymphocytes	37 %	
Monocytes	6 %	
Conclusion:		

3.
CBC

PATIENT'S NAME: IVANOVA II		
AGE: 78 y.o.	Sex: female	
Parameter	Result	Note
RBC	2.5 * 10^{12} /l	
Hemoglobin	77 g/l	
Hematocrit	37.5 %	
MCV	68 fl.	
MCH	25 pg	
MCHC	250 g/l	
Reticulocytes	0.5 %	
WBC	4.7 * 10^{9} /l	
Platelets	345 * 10^{9} /l	
ESR Westergren's method	55 mm/h	
Leukocyte count		
Basophils	1 %	
Eosinophils	2 %	
Neutrophils: band	5 %	
segmented	49 %	
Lymphocytes	37 %	
Monocytes	6 %	
Morphology:	Poikilocytosis+ Microanisocytosis ++	
Conclusion:		

4.
CBC

PATIENT'S NAME: IVANOVA II		
AGE: 62 y.o.	Sex: female	
Parameter	Result	Note
RBC	3.03×10^{12}/l	
Hemoglobin	43 g/l	
Hematocrit	18.2 %	
MCV	60.1 fl.	
MCH	14.2 pg	
MCHC	236 g/l	
Reticulocytes	0.9 %	
WBC	$5.8 * 10^9$ /l	
Platelets	$369 * 10^9$ /l	
ESR	27 mm/h	
Leukocyte count		
Basophils	0 %	
Eosinophils	1 %	
Neutrophils: band	7 %	
segmented	59 %	
Lymphocytes	23 %	
Monocytes	10 %	
Morphology:	Pronounced anisocytosis (microcytes), poikilocytosis	
Conclusion:		

5.
CBC

PATIENT'S NAME: IVANOV II		
AGE: 37 y.o.	Sex: male	
Parameter	Result	Note
RBC	$1.3 * 10^{12}$ /l	
Hemoglobin	60 g/l	
Hematocrit	25.3 %	
MCV	108 fl.	
MCH	39 pg	
MCHC	390 g/l	
Reticulocytes	0.1 %	
WBC	$3.5 * 10^9$ /l	
Platelets	$259 * 10^9$ /l	
ESR Westergren's method	45 mm/h	
Leukocyte count		
Basophils	0 %	
Eosinophils	0 %	
Neutrophils: band	6%	
segmented	46 %	
Lymphocytes	42 %	
Monocytes	6 %	
Morphology:	Anisocytosis++ (macrocytes)	
Conclusion:		

6.
CBC

PATIENT'S NAME: IVANOVA II		
AGE: 69 y.o.	Sex: female	
Parameter	Result	Note
RBC	2.9 * 10^{12} /l	
Hemoglobin	70 g/l	
Hematocrit	23.6 %	
MCV	93 fl.	
MCH	33 pg	
MCHC	360 g/l	
Reticulocytes	10 %	
WBC	12.0 * 10^{9} /l	
Platelets	480 * 10^{9} /l	
ESR	17 mm/h	
Leukocyte count		
Basophils	0 %	
Eosinophils	2 %	
Neutrophils: Myelocytes Metamyelocytes band	 0 % 6 % 12 %	
segmented	60 %	
Lymphocytes	15 %	
Monocytes	6 %	
Normoblasts, polychromatophiles		
Conclusion:		

7.
CBC

PATIENT'S NAME: IVANOV II		
AGE: 35 y.o.	Sex: male	
Parameter	Result	Note
RBC	6.0 * 10^{12} /l	
Hemoglobin	180 g/l	
Hematocrit	58.9 %	
MCV	90.6 fl.	
MCH	30.5 pg	
MCHC	336 g/l	
Reticulocytes	2.0 %	
WBC	4.8 * 10^{9} /l	
Platelets	307 * 10^{9} /l	
ESR	8 mm/h	
Leukocyte count		
Basophils	0 %	
Eosinophils	2 %	
Neutrophils: band	 1 %	
segmented	68 %	
Lymphocytes	28 %	
Monocytes	1 %	
Conclusion:		

8.

CBC

PATIENT'S NAME: IVANOV II		
AGE: 20 y.o.	Sex: male	
Parameter	Result	Note
RBC	4.6 * 10^{12}/l	
Hemoglobin	143 g/l	
Hematocrit	37 %	
MCV	85 fl.	
MCH	28 pg	
MCHC	300 g/l	
Reticulocytes	0.8 %	
WBC	16.5 * 10^{9}/l	
Platelets	200 * 10^{9}/l	
ESR Westergren's method	40 mm/h	
Leukocyte count		
Basophils	1 %	
Eosinophils	2 %	
Neutrophils: band	12 %	
segmented	64 %	
Lymphocytes	20 %	
Monocytes	1 %	
Conclusion:		

9.

CBC

PATIENT'S NAME: IVANOV II		
AGE: 55 y.o.	Sex: male	
Parameter	Result	Note
RBC	4.4 * 10^{12}/l	
Hemoglobin	136 g/l	
Hematocrit	39 %	
MCV	86 fl.	
MCH	28 pg	
MCHC	300 g/l	
Reticulocytes	0.6 %	
WBC	5.8 * 10^{9}/l	
Platelets	322 * 10^{9}/l	
ESR	39 mm/h	
Leukocyte count		
Basophils	0 %	
Eosinophils	15 %	
Neutrophils: band	4 %	
segmented	49 %	
Lymphocytes	29 %	
Monocytes	3 %	
Conclusion:		

10.
CBC

PATIENT'S NAME: IVANOVA II		
AGE: 57 y.o.	Sex: female	
Parameter	Result	Note
RBC	4.76 * 10^{12} /l	
Hemoglobin	125 g/l	
Hematocrit	41 %	
MCV	87 fl.	
MCH	31 pg	
MCHC	336 g/l	
Reticulocytes	0.9 %	
WBC	2.2 * 10^{9} /l	
Platelets	290 * 10^{9} /l	
ESR	18 mm/h	
Leukocyte count		
Basophils	1 %	
Eosinophils	1 %	
Neutrophils: band	3 %	
segmented	80 %	
Lymphocytes	10 %	
Monocytes	5 %	
Conclusion:		

11.
CBC

PATIENT'S NAME: IVANOVA II		
AGE: 28 y.o.	Sex: female	
Parameter	Result	Note
RBC	3.6 * 10^{12} /l	
Hemoglobin	100 g/l	
Hematocrit	41 %	
MCV	89 fl.	
MCH	31 pg	
MCHC	330 g/l	
Reticulocytes	0.6 %	
WBC	16.3 * 10^{9} /l	
Platelets	298 * 10^{9} /l	
ESR	37 mm/h	
Leukocyte count		
Basophils	1 %	
Eosinophils	2 %	
Neutrophils: band	12 %	
segmented	43 %	
Lymphocytes	32 %	
Monocytes	10 %	
Morphology	Toxic granularity of neutrophils+	
Conclusion:		

12.
CBC

PATIENT'S NAME: IVANOV II		
AGE: 42 y.o.	Sex: male	
Parameter	Result	Note
RBC	4.5 * 10^{12} /l	
Hemoglobin	146 g/l	
Hematocrit	42 %	
MCV	88 fl.	
MCH	30 pg	
MCHC	320 g/l	
Reticulocytes	0.7 %	
WBC	6.8 * 10^{9} /l	
Platelets	355 * 10^{9} /l	
ESR	10 mm/h	
Leukocyte count		
Basophils	1 %	
Eosinophils	12 %	
Neutrophils: band	4 %	
segmented	35 %	
Lymphocytes	30 %	
Monocytes	8 %	
Conclusion:		

13.
CBC

PATIENT'S NAME: IVANOVA II		
AGE: 72 y.o.	Sex: female	
Parameter	Result	Note
RBC	1.1 * 10^{12} /l	
Hemoglobin	30 g/l	
Hematocrit	16 %	
MCV	71 fl.	
MCH	22 pg	
MCHC	280 g/l	
Reticulocytes	0 %	
WBC	1 * 10^{9} /l	
Platelets	34 * 10^{9} /l	
ESR Westergren's method	72 mm/h	
Leukocyte count		
Basophils	0 %	
Eosinophils	1 %	
Neutrophils: band	7 %	
segmented	56 %	
Lymphocytes	32 %	
Monocytes	4 %	
Conclusion:		

14.
CBC

PATIENT'S NAME: IVANOV II		
AGE: 69 y.o.	Sex: male	
Parameter	Result	Note
RBC	5.2 * 10^{12} /l	
Hemoglobin	148 g/l	
Hematocrit	41 %	
MCV	87 fl.	
MCH	29 pg	
MCHC	310 g/l	
Reticulocytes	0.7 %	
WBC	4.8 * 10^{9} /l	
Platelets	75 * 10^{9} /l	
ESR Westergren's method	12 mm/h	
Leukocyte count		
Basophils	1 %	
Eosinophils	1 %	
Neutrophils: band	5 %	
segmented	45 %	
Lymphocytes	45 %	
Monocytes	3 %	
Conclusion:		

15.
CBC

PATIENT'S NAME: IVANOVA II		
AGE: 65 y.o.	Sex: female	
Parameter	Result	Note
RBC	3.35 * 10^{12} /l	
Hemoglobin	105 g/l	
Hematocrit	33 %	
MCV	78 fl.	
MCH	25.7 pg	
MCHC	289 g/l	
Reticulocytes	0.5 %	
WBC	72 * 10^{9} /l	
Platelets	256 * 10^{9} /l	
ESR Westergren's method	48 mm/h	
Leukocyte count		
Basophils	0 %	
Eosinophils	1 %	
Neutrophils: band	1 %	
segmented	5 %	
Lymphocytes	93 %	
Monocytes	0 %	
Morphology	Shadow cells of Botkin–Gumprecht +	
Conclusion:		

16.
CBC

PATIENT'S NAME: IVANOV II		
AGE: 19 y.o.	Sex: male	
Parameter	Result	Note
RBC	1.88 * 10^{12} /l	
Hemoglobin	69 g/l	
Hematocrit	36 %	
MCV	80 fl.	
MCH	25 pg	
MCHC	290 g/l	
Reticulocytes	1 %	
WBC	2.0 * 10^{9} /l	
Platelets	80 * 10^{9} /l	
ESR	45 mm/h	
Leukocyte count		
Basophils	0 %	
Eosinophils	0 %	
Blasts	10 %	
Neutrophils: band	2 %	
segmented	16 %	
Lymphocytes	72 %	
Monocytes	0 %	
Morphology	Pronounced anisocytosis, poikilocytosis	
Conclusion:		

17.
CBC

PATIENT'S NAME: IVANOVA II		
AGE: 68 y.o.	Sex: female	
Parameter	Result	Note
RBC	3.3 * 10^{12} /l	
Hemoglobin	102 g/l	
Hematocrit	33 %	
MCV	78 fl.	
MCH	25.7 pg	
MCHC	289 g/l	
Reticulocytes	0.5 %	
WBC	133 * 10^{9} /l	
Platelets	145 * 10^{9} /l	
ESR	43 mm/h	
Leukocyte count		
Basophils	7 %	
Eosinophils	9 %	
Promyelocytes	3 %	
Myelocytes	4 %	
Young neutrophils	13 %	
Neutrophils: band	15 %	
segmented	40 %	
Lymphocytes	3 %	
Monocytes	0 %	
Conclusion:		

FOR NOTES

Note!

The reference values given in the workbook are not universal and may vary at different laboratories.

URINALYSIS

18. URINALYSIS	
PATIENT'S NAME: I. II	
AGE: 50 y.o.	Sex:
Parameter	Reference values
Physical properties	
Amount	100 ml
Color	pale yellow to deep amber
Transparency	Transparent
Ph	Acidic
Relative density	1012–1025
Chemical properties	
Protein	less 0.033 g/l
Glucose	Absent
Ketone bodies	Absent
Bilirubin	Absent
Urobilin	Absent
Microscopic examination	
Epithelium:	
squamous	0–5 per high-powered field
transitional	Absent
renal	Absent
RBC	0–5 per high-powered field — female 0–2 per high-powered field — male
WBC	0–6 per high-powered field — female 0–3 per high-powered field — male
Casts (hyaline)	0–1 per high-powered field
Casts (other types)	Absent
Salts	Absent
Bacteria	Absent
Mucus	Absent

19.
URINALYSIS

PATIENT'S NAME: IVANOV II		
AGE: 30 y.o.	Sex: male	
Parameter	Result	Note
Physical properties		
Amount	150.0	
Color	Straw-yellow	
Transparency	Cloudy	
Ph	Acidic	
Relative density	1035	
Chemical properties		
Protein	Absent	
Glucose	++	
Ketone bodies	++	
Bilirubin	Absent	
Urobilin	Absent	
Microscopic examination		
Epithelium:		
squamous	1–2 per high-powered field	
transitional	Absent	
renal	Absent	
RBC	0–1 per high-powered field	
WBC	0–2 per high-powered field	
Casts	Absent	
Salts	Absent	
Bacteria	Absent	
Mucus	Absent	
Conclusion:		

20.
URINALYSIS

PATIENT'S NAME: IVANOV II		
AGE: 50 y.o.	Sex: male	
Parameter	Result	Note
Physical properties		
Amount	200.0	
Color	Straw-yellow	
Transparency	Cloudy	
Ph	Alkaline	
Relative density	1020	
Chemical properties		
Protein	0.033 g/l	
Glucose	Absent	
Ketone bodies	Absent	
Bilirubin	Absent	
Urobilin	Absent	
Microscopic examination		
Epithelium:		
squamous	Considerable amount	
transitional	–	
renal	–	
RBC	6–7 per high-powered field	
WBC	20–30 per high-powered field	
Casts	Absent	
Salts	Absent	
Bacteria	Absent	
Mucus	Absent	
Conclusion:		

21. URINALYSIS		
PATIENT'S NAME: IVANOVA II		
AGE: 36 y.o.	Sex: female	
Parameter	Result	Note
Physical properties		
Amount	170.0	
Color	Straw-yellow	
Transparency	Transparent	
Ph	Acidic	
Relative density	1018	
Chemical properties		
Protein	Absent	
Glucose	Absent	
Ketone bodies	+++	
Bilirubin	Absent	
Urobilin	Absent	
Microscopic examination		
Epithelium:		
squamous	8–10 per high-powered field	
transitional	Absent	
renal	Absent	
RBC	0–3 per high-powered field	
WBC	2–4 per high-powered field	
Casts	Absent	
Salts	Absent	
Bacteria	Absent	
Mucus	Absent	
Conclusion:		

22. URINALYSIS		
PATIENT'S NAME: IVANOVA II		
AGE: 24 y.o.	Sex: female	
Parameter	Result	Note
Physical properties		
Amount	200.0	
Color	Straw-yellow	
Transparency	cloudy	
Ph	Alkaline	
Relative density	1016	
Chemical properties		
Protein	0.066 g/l	
Glucose	Absent	
Ketone bodies	Absent	
Bilirubin	Absent	
Urobilin	Absent	
Microscopic examination		
Epithelium:		
squamous	2–3 per high-powered field	
transitional	Absent	
renal	Absent	
RBC	1–3 per high-powered field	
WBC	20–30 per high-powered field	
Casts	Absent	
Salts	Absent	
Bacteria	++	
Mucus	Considerable amount	
Conclusion:		

23. URINALYSIS		
PATIENT'S NAME: IVANOVA II		
AGE: 68 y.o.	Sex: female	
Parameter	Result	Note
Physical properties		
Amount	220.0	
Color	Straw-yellow	
Transparency	cloudy	
Ph	Alkaline	
Relative density	1017	
Chemical properties		
Protein	0.087 g/l	
Glucose	Absent	
Ketone bodies	Absent	
Bilirubin	Absent	
Urobilin	Absent	
Microscopic examination		
Epithelium:		
squamous	3–4 per high-powered field	
transitional	Absent	
renal	Absent	
RBC	0–3 per high-powered field	
WBC	30–40 per high-powered field, aggregation till 50	
Casts	hyaline 0–2 per high-powered field	
Bacteria	+++	
Mucus	Considerable amount	
Conclusion:		

24. URINALYSIS		
PATIENT'S NAME: IVANOV II		
AGE: 42 y.o.	Sex: male	
Parameter	Result	Note
Physical properties		
Amount	230.0	
Color	Straw-yellow	
Transparency	cloudy	
Ph	Acidic	
Relative density	1007	
Chemical properties		
Protein	1.66 g/l	
Glucose	Absent	
Ketone bodies	Absent	
Bilirubin	Absent	
Urobilin	Absent	
Microscopic examination		
Epithelium:		
squamous	3–4 per high-powered field	
transitional		
renal	0–1 per high-powered field	
RBC	Changed 10–15 в per high-powered field	
WBC	2–3 per high-powered field	
Casts	Hyaline: 2–3 per high-powered field Granular: 2–3 per high-powered field	
Conclusion:		

25. URINALYSIS		
PATIENT'S NAME: IVANOVA II		
AGE: 20 y.o.	Sex: female	
Parameter	Result	Note
Physical properties		
Amount	150.0	
Color	yellow	
Transparency	Transparent	
Ph	Faintly acidic	
Relative density	1022	
Chemical properties		
Protein	Absent	
Glucose	Absent	
Ketone bodies	Absent	
Bilirubin	Absent	
Urobilin	+++	
Microscopic examination		
Epithelium:		
squamous	1–2 per high-powered field	
transitional	Absent	
renal	Absent	
RBC	0–1 per high-powered field	
WBC	0–2 per high-powered field	
Casts	Absent	
Salts	Absent	
Bacteria	Absent	
Mucus	Absent	
Conclusion:		

26. URINALYSIS		
PATIENT'S NAME: IVANOV II		
AGE: 46 y.o.	Sex: male	
Parameter	Result	Note
Physical properties		
Amount	150.0	
Color	Bloody	
Transparency	Transparent	
Ph	Acidic	
Relative density	1020	
Chemical properties		
Protein	0.056 g/l	
Glucose	Absent	
Ketone bodies	Absent	
Bilirubin	Absent	
Urobilin	Absent	
Microscopic examination		
Epithelium:		
squamous	10–15 per high-powered field	
transitional		
renal		
RBC	Considerable amount, fresh	
WBC	10–20 per high-powered field	
Casts		
Salts	Oxalates+++	
Bacteria	Absent	
Mucus	Absent	
Conclusion:		

27.
URINALYSIS

PATIENT'S NAME: IVANOV II		
AGE: 53 y.o.	Sex: male	
Parameter	Result	Note
Physical properties		
Amount	100.0	
Color	Bear color	
Transparency	Transparent	
Ph	Acidic	
Relative density	1018	
Chemical properties		
Protein	Absent	
Glucose	Absent	
Ketone bodies	Absent	
Bilirubin	+++	
Urobilin	absent	
Microscopic examination		
Epithelium:		
squamous	1–2 per high-powered field	
transitional	Absent	
renal	Absent	
RBC	0–1 per high-powered field	
WBC	0–2 per high-powered field	
Casts	Absent	
Salts	Absent	
Bacteria	Absent	
Mucus	Absent	
Conclusion:		

28.
URINALYSIS

PATIENT'S NAME: IVANOVA II		
AGE: 60 y.o.	Sex: female	
Parameter	Result	Note
Physical properties		
Amount	180.0	
Color	Bright yellow	
Transparency	Transparent	
Ph	Faintly acidic	
Relative density	1020	
Chemical properties		
Protein	Absent	
Glucose	Absent	
Ketone bodies	Absent	
Bilirubin	++	
Urobilin	++	
Microscopic examination		
Epithelium:		
squamous	1–2 per high-powered field	
transitional	Absent	
renal	Absent	
RBC	0–1 per high-powered field	
WBC	0–2 per high-powered field	
Casts	Absent	
Salts	Absent	
Conclusion:		

29. URINALYSIS		
PATIENT'S NAME: IVANOV II		
AGE: 63 y.o.	Sex: male	
Parameter	Result	Note
Physical properties		
Amount	180.0	
Color	Bloody	
Transparency	Cloudy	
Ph	Acidic	
Relative density	1020	
Chemical properties		
Protein	0.15 g/l	
Glucose	Absent	
Ketone bodies	Absent	
Bilirubin	Absent	
Urobilin	Absent	
Microscopic examination		
Epithelium:		
squamous	2–3 per high-powered field	
transitional	0–1 per high-powered field	
renal		
RBC	Considerable amount, fresh	
WBC	2–3 per high-powered field	
Casts	Absent	
Salts	Absent	
Mucus	Absent	
Conclusion:		

30. URINALYSIS		
PATIENT'S NAME: IVANOV II		
AGE: 25 y.o.	Sex: male	
Parameter	Result	Note
Physical properties		
Amount	190.0	
Color	Meat slops	
Transparency	Cloudy	
Ph	Acidic	
Relative density	1024	
Chemical properties		
Protein	2.3 g/l	
Glucose	Absent	
Ketone bodies	Absent	
Bilirubin	Absent	
Urobilin	Absent	
Microscopic examination		
Epithelium:		
squamous	2–3 per high-powered field	
transitional	Absent	
renal	Absent	
RBC	Considerable amount, changed	
WBC	5–10 per high-powered field	
Casts	Hyaline 1–2 per high-powered field	
Salts	Absent	
Bacteria	Absent	
Conclusion:		

NECHIPORENKO'S URINE TEST

31. NECHIPORENKO'S URINE TEST	
PATIENT'S NAME: I. II	
AGE: 63 y.o.	Sex:
Parameter	**Reference values**
RBC	Less $2 * 10^6$ /l
WBC	Less $4 * 10^6$ /l
Casts	Less $0.25 * 10^6$ /l
Conclusion:	

32. NECHIPORENKO'S URINE TEST		
PATIENT'S NAME: IVANOV II		
AGE: 45 y.o.	Sex: male	
Parameter	Result	Notes
RBC	$12 * 10^6$ /l	
WBC	$3 * 10^6$ /l	
Casts	$0.32 * 10^6$ /l	
Conclusion:		

33. NECHIPORENKO'S URINE TEST		
PATIENT'S NAME: IVANOVA II		
AGE: 38 y.o.	Sex: female	
Parameter	Result	Notes
RBC	$1 * 10^6$ /l	
WBC	$22.5 * 10^6$ /l	
Casts	$0.8 * 10^6$ /l	
Conclusion:		

34. NECHIPORENKO'S URINE TEST		
PATIENT'S NAME: IVANOV II		
AGE: 68 y.o.	Sex: male	
Parameter	Result	Notes
RBC	$21 * 10^6$ /l	
WBC	$8.75 * 10^6$ /l	
Casts	$0.20 * 10^6$ /l	
Conclusion:		

ZIMNITSKY'S URINE TEST
(24-HOUR URINE TEST)

35.

ZIMNITSKY'S URINE TEST (24-HOUR URINE TEST)

PATIENT'S NAME IVANOV II AGE: 40 y.o.

DEPARTMENT UROLOGICAL

Amount of fluid intake: 2000 ml

№ of portion	Hours	Relative density	Amount of urine
1	9.00	1018	200.0
2	12.00	1010	300.0
3	15.00	1020	300.0
4	18.00	1029	200.0
5	21.00	1017	100.0
6	24.00	1018	200.0
7	3.00	1018	100.0
8	6.00	1020	100.0

Day diuresis 1000 ml
Night diuresis 560 ml
Total diuresis 1560 ml

Conclusion:

36.

ZIMNITSKY'S URINE TEST (24-HOUR URINE TEST)

PATIENT'S NAME IVANOV II AGE: 55 y.o.

DEPARTMENT UROLOGICAL

Amount of fluid intake: 1000 ml

№ of portion	Hours	Relative density	Amount of urine
1	9.00	1014	40
2	12.00	1012	50
3	15.00	1016	30
4	18.00	1013	30
5	21.00	1010	90
6	24.00	1015	90
7	3.00	1013	70
8	6.00	1013	50

Day diuresis 150 ml
Night diuresis 300 ml
Total diuresis 450 ml

Conclusion:

37.

ZIMNITSKY'S URINE TEST (24-HOUR URINE TEST)

PATIENT'S NAME IVANOV II AGE: 66 y.o.

DEPARTMENT UROLOGICAL

Amount of fluid intake: 1450 ml

№ of portion	Hours	Relative density	Amount of urine
1	9.00	1006	230
2	12.00	1007	210
3	15.00	1009	250
4	18.00	1008	200
5	21.00	1007	490
6	24.00	1008	380
7	3.00	1007	350
8	6.00	1005	400

Day diuresis 890 ml
Night diuresis 1620 ml
Total diuresis 2510 ml

Conclusion:

38.

ZIMNITSKY'S URINE TEST (24-HOUR URINE TEST)

PATIENT'S NAME IVANOV II AGE: 35 y.o.

DEPARTMENT UROLOGICAL

Amount of fluid intake: 650 ml

№ of portion	Hours	Relative density	Amount of urine
1	9.00	1.010	30
2	12.00	–	–
3	15.00	1.008	20
4	18.00	1.012	20
5	21.00	1.012	30
6	24.00	1.009	20
7	3.00	1.010	20
8	6.00	1.012	10

Day diuresis 120 ml
Night diuresis 50 ml
Total diuresis 170 ml

Conclusion:

39.

ZIMNITSKY'S URINE TEST (24-HOUR URINE TEST)

PATIENT'S NAME IVANOV II AGE: 70 y.o.

DEPARTMENT UROLOGICAL

Amount of fluid intake: 1600 ml

№ of portion	Hours	Relative density	Amount of urine
1	9.00	1006	230
2	12.00	1007	210
3	15.00	1009	250
4	18.00	1008	200
5	21.00	1007	490
6	24.00	1008	380
7	3.00	1007	340
8	6.00	1005	400

Day diuresis 900 ml
Night diuresis 1650 ml
Total diuresis 2650 ml

Conclusion:

FOR NOTES

SPUTUM TEST

40. SPUTUM TEST	
PATIENT'S NAME: IVANOVA II	
Sex: female	Age: 36 y.o.
DEPARTMENT pulmonology	
Macroscopic examination	
Amount: 30 ml	Consistence: fluid
Odor: odorless	Color: grayish-yellow
Character: mucous	Admixture: absent
Microscopic examination	
Native preparation	
WBC	18–20 per high-powered field
RBC	absent
Epithelium squamous	0–1 per high-powered field
Epithelium cylindrical	1–2 per high-powered field
Alveovar macrophage	absent
Elastic fibers	absent
Spirals of Kurshman	absent
Crystals of Charcot–Leyden	absent
Special stain	
Neutrophils	90 %
Lymphocytes	10 %
Eosinophils	absent
Alveovar macrophage	absent
Fungi	absent
Acid Resistant Bacteria	absent
Conclusion:	

41. SPUTUM TEST	
PATIENT'S NAME: IVANOVA II	
Sex: female	Age: 79 y.o.
DEPARTMENT pulmonology	
Macroscopic examination	
Amount: 20 ml	Consistence: viscous
Odor: odorless	Color: grayish
Character: mucous	Admixture: absent
Microscopic examination	
Native preparation	
WBC	20–25 per high-powered field
RBC	absent
Epithelium squamous	2–3 per high-powered field
Epithelium cylindrical	3–4 per high-powered field
Alveovar macrophage	absent
Elastic fibers	absent
Spirals of Kurshman	absent
Crystals of Charcot–Leyden	absent
Special stain	
Neutrophils	20 %
Lymphocytes	80 %
Eosinophils	0–1 per high-powered field
Alveovar macrophage	absent
Fungi	absent
Acid Resistant Bacteria	absent
Conclusion:	

42. SPUTUM TEST	
PATIENT’S NAME: IVANOVA II	
Sex: female	Age: 58 y.o.
DEPARTMENTpulmonology	
Macroscopic examination	
Amount: 15 ml	Consistence: viscous
Odor: odorless	Color: rusty
Character: hemorrhagic	Admixture: absent
Microscopic examination	
Native preparation	
WBC	10–15 per high-powered field
RBC	20–30 per high-powered field
Epithelium squamous	0–1 per high-powered field
Epithelium cylindrical	0–1 per high-powered field
Alveovar macrophage	7–8 per high-powered field
Fibrous tissues	1–2 per high-powered field
Spirals of Kurshman	absent
Crystals of Charcot–Leyden	absent
Special stain	
Neutrophils	60 %
Lymphocytes	30 %
Eosinophils	single
Alveovar macrophage	7–10 per high-powered field
Fungi	absent
Acid Resistant Bacteria	absent
Conclusion:	

43. SPUTUM TEST	
PATIENT’S NAME: IVANOV II	
Sex: male	Age: 49 y.o.
DEPARTMENTpulmonology	
Macroscopic examination	
Amount: 315 ml	Consistence: viscous
Odor: stinking	Color: grayish-yellow-green
Character: serous-purulent	Admixture: 3 layers
Microscopic examination	
Native preparation	
WBC	cover all sight
RBC	absent
Epithelium squamous	0–1 per high-powered field
Epithelium cylindrical	5–8 per high-powered field
Alveovar macrophage	absent
Elastic fibers	considerable amount
Spirals of Kurshman	absent
Crystals of Charcot–Leyden	absent
Special stain	
Neutrophils	98 %
Lymphocytes	2 %
Eosinophils	absent
Alveovar macrophage	absent
Fungi	absent
Acid Resistant Bacteria	absent
Staphylococci	present
Conclusion:	

44. SPUTUM TEST	
PATIENT’S NAME: IVANOVA II	
Sex: male	Age: 85 y.o.
DEPARTMENTpulmonology	
Macroscopic examination	
Amount: 15 ml	Consistence: fluid
Odor: odorless	Color: pink
Character: mucous	Foammy, gummous
Microscopic examination	
WBC	1–2 per high-powered field
RBC	8–12 per high-powered field
Epithelium squamous	1–2 per high-powered field
Epithelium cylindrical	absent
Alveovar macrophage	absent
Elastic fibers	absent
Spirals of Kurshman	absent
Crystals of Charcot–Leyden	absent
Special stain	
Neutrophils	single
Lymphocytes	single
Eosinophils	absent
RBC	considerable amount
Alveovar macrophage	absent
Fungi	absent
Acid Resistant Bacteria	absent
Conclusion:	

45. SPUTUM TEST	
PATIENT’S NAME: IVANOV II	
Sex: male	Age: 34 y.o.
DEPARTMENTpulmonology	
Macroscopic examination	
Amount: 200 ml	Consistence: viscous
Odor: odorless	Color: grayish-yellow
Character: bloody	Admixture: absent
Microscopic examination	
WBC	5–6 per high-powered field
RBC	1–2 per high-powered field
Epithelium squamous	2–4 per high-powered field
Epithelium cylindrical	absent
Alveovar macrophage	absent
Elastic fibers	1–2 per high-powered field
Spirals of Kurshman	absent
Crystals of Charcot–Leyden	absent
Special stain	
Neutrophils	20 %
Lymphocytes	80 %
Eosinophils	absent
Alveovar macrophage	absent
Fungi	absent
Acid Resistant Bacteria	3–4 in 100 sights
Conclusion:	

46. SPUTUM TEST	
PATIENT’S NAME: IVANOV II	
Sex: male	Age: 74 y.o.
DEPARTMENTpulmonology	
Macroscopic examination	
Amount: 25 ml	Consistence: fluid
Odor: odorless	Color: reddish-yellow
Character: mucous-bloody	Admixture: absent
Microscopic examination	
WBC	20–30 per high-powered field
RBC	considerable amount
Epithelium squamous	0–1 per high-powered field
Epithelium cylindrical	absent
Alveovar macrophage	1–2 per high-powered field
Elastic fibers	absent
Spirals of Kurshman	absent
Crystals of Charcot–Leyden	absent
Crystals of hematoidin	considerable amount
Special stain	
Neutrophils	50 %
Lymphocytes	50 %
RBC	considerable amount
Alveovar macrophage	absent
Fungi	absent
Acid Resistant Bacteria	absent
Conclusion:	

47. SPUTUM TEST	
PATIENT’S NAME: IVANOV II	
Sex: male	Age: 43 y.o.
DEPARTMENTpulmonology	
Macroscopic examination	
Amount: 350 ml	Consistence: semifluid
Odor: stinking	Color: yellow-green
Character: purulent	Creamy
Microscopic examination	
WBC	40–50 per high-powered field
RBC	2–3 per high-powered field
Epithelium squamous	absent
Epithelium cylindrical	absent
Alveovar macrophage	absent
Elastic fibers	absent
Spirals of Kurshman	absent
Crystals of Charcot–Leyden	absent
Crystals of hematoidin	considerable amount
Special stain	
Neutrophils	99 %
Lymphocytes	1 %
RBC	2–3 per high-powered field
Alveovar macrophage	absent
Fungi	absent
Acid Resistant Bacteria	absent
Conclusion:	

48. SPUTUM TEST	
PATIENT'S NAME: IVANOVA II	
Sex: female	Age: 50 y.o.
DEPARTMENTpulmonology	
Macroscopic examination	
Amount: 20 ml	Consistence: viscous
Odor: odorless	Color: grayish-white
Character: mucous	Admixture: absent
Microscopic examination	
WBC	5–10 per high-powered field
RBC	absent
Epithelium squamous	0–1 per high-powered field
Epithelium cylindrical	0–1 per high-powered field
Alveovar macrophage	absent
Elastic fibers	absent
Spirals of Kurshman	0–1 per high-powered field
Crystals of Charcot–Leyden	2–3 per high-powered field
Special stain	
Neutrophils	absent
Lymphocytes	absent
Eosinophils	5–10 per high-powered field
Alveovar macrophage	absent
Fungi	absent
Acid Resistant Bacteria	absent
Conclusion:	

FOR NOTES

EXAMINATION OF PLEURAL FLUID

49. EXAMINATION OF PLEURAL FLUID	
PATIENT'S NAME: IVANOVA II	
Sex: female	Age: 63 y.o.
DEPARTMENT pulmonology	
Amount	200.0
Transparency	cloudy
Color	yellow-green
Rivalta's test	positive
Protein	40 g/l
LDH	720 u/l
Microscopy	
WBC	40–50 per high-powered field
RBC	7–8 per high-powered field
Cellular count	
Neutrophils	97 %
Lymphocytes	2 %
Macrophage	1 %
Eosinophils	absent
Conclusion:	

50. EXAMINATION OF PLEURAL FLUID	
PATIENT'S NAME: IVANOVA II	
Sex: female	Age: 82 y.o.
DEPARTMENT pulmonology	
Amount	300.0
Transparency	cloudy
Color	pink
Rivalta's test	positive
Protein	32 g/l
LDH	542 u/l
Microscopy	
WBC	3–4 per high-powered field
RBC	50–60 per high-powered field
Cellular count	
RBC	99 %
Neutrophils	solitary
Lymphocytes	solitary
Macrophage	absent
Eosinophils	absent
Conclusion:	

51. EXAMINATION OF PLEURAL FLUID	
PATIENT’S NAME: IVANOV II	
Sex: male	Age: 27 y.o.
DEPARTMENTpulmonology	
Amount	400.0
Transparency	cloudy
Color	Gold-yellow
Rivalta’s test	positive
Protein	52 g/l
Microscopy	
WBC	30–35 per high-powered field
RBC	3–8 per high-powered field
Detritus	++
Cellular count	
RBC	3–8 per high-powered field
Neutrophils	80 %
Lymphocytes	15 %
Macrophage	5 %
Eosinophils	absent
Conclusion:	

52. EXAMINATION OF PLEURAL FLUID	
PATIENT’S NAME: IVANOV II	
Sex: male	Age: 37 y.o.
DEPARTMENTpulmonology	
Amount	250.0
Transparency	cloudy
Color	milky
Rivalta’s test	positive
Protein	35 g/l
Microscopy	
WBC	10–15 per high-powered field
RBC	15–20 per high-powered field
Fat drops	++
Cellular count	
Neutrophils	8 %
Lymphocytes	89 %
Macrophage	3 %
Eosinophils	absent
Conclusion:	

53. EXAMINATION OF PLEURAL FLUID	
PATIENT’S NAME: IVANOVA II	
Sex: female	Age: 75 y.o.
DEPARTMENTpulmonology	
Amount	280.0
Transparency	cloudy
Color	brown
Odor	stinking
Rivalta’s test	positive
Protein	44 g/l
LDH	612 u/l
Microscopy	
WBC	60–70 per high-powered field
RBC	20–30 per high-powered field
Cellular count	
Neutrophils	85 %
Lymphocytes	7 %
Macrophage	8 %
Eosinophils	absent
Conclusion:	

54. EXAMINATION OF PLEURAL FLUID	
PATIENT’S NAME IVANOV II	
Sex: male	Age: 58 y.o.
DEPARTMENTpulmonology	
Amount	500.0
Transparency	Transparent
Color	Slightly yellow
Rivalta’s test	negative
Protein	12 g/l
LDH	180 u/l
Microscopy	
WBC	6–7 per high-powered field
RBC	2–3 per high-powered field
Cellular count	
Neutrophils	6 %
Lymphocytes	94 %
Macrophage	absent
Eosinophils	absent
Conclusion:	

BIOCHEMICAL BLOOD ANALYSIS

55. BIOCHEMICAL BLOOD ANALYSIS		
Parameter	**Reference values**	**Units**
Urea	2.5–8.3	mmol/l
Creatinine	0.044–0.12	mmol/l
Total protein	60–87 (after 65 y.o.) 65–87 (3–65 y.o.)	g/l
Albumen	35–55	g/l
Glucose	3.9–6.4	mmol/l
Bilirubin total	5–21	mcmol/l
Bilirubin direct	0.5–5.1	mcmol/l
Bilirubin indirect	6.4–15.4	mcmol/l
ALT	5–45	u/l
AST	Less 45	u/l
GGTP	Female: 4–38 Male: 2–55	u/l
LDH	Less 248	u/l
Alkaline phosphatase	Female: less 240 Male: less 270	u/l
Amylase	22–120	u/l
CRP	0–6	mg/l
Rheumatoid factor	Less 15	IU/ml
ASL-O	Less 200	IU/ml
Uric acid	Female: 0.24–0.36 Male: 0.3–0.42	mmol/l
Creatine kinase	20–174	u/l
Creatine kinase-MB	Less 24	u/l
Troponine	Less 0.05	ng/ml

Parameter	**Reference values**	**Units**
Total cholesterol	2.82–5.2	mmol/l
LDL	Less 3.36	mmol/l
HDL	0.78–1.63	mmol/l
Triglycerids	0.42–1.67	mmol/l
Atherogenic index	2–3	
Potassium	3–5.4	mmol/l
Calcium	2–2.75	mmol/l
Sodium	130–150	mmol/l
Chloride	95–110	mmol/l

56.

BIOCHEMICAL BLOOD ANALYSIS

PATIENT'S NAME: IVANOVA II			
Sex: female	Age: 37 y.o.		
Height 168 sm	Weight 72 kg		
Parameter	Result	Units	Note
Urea	16.4	mmol/l	
Creatinine	0.189	mmol/l	
Total protein	56	g/l	
Albumen	23	g/l	
Glucose	5.6	mmol/l	
Bilirubin total	10	mcmol/l	
ALT	13	u/l	
AST	16	u/l	
CRP	6	mg/l	
Potassium	5.7	mmol/l	
Calcium	2.25	mmol/l	
Sodium	131	mmol/l	
Chloride	100	mmol/l	

Calculation of glomerular filtration rate (GFR)

Conclusion:

57.

BIOCHEMICAL BLOOD ANALYSIS

PATIENT'S NAME: IVANOV II			
Sex: male	Age: 45 y.o.		
Height 182 sm	Weight 94 kg		
Parameter	Result	Units	Note
Urea	4.2	mmol/l	
Creatinine	0.087	mmol/l	
Total protein	73	g/l	
Albumen	38	g/l	
Glucose	4.8	mmol/l	
Bilirubin total	20.5	mcmol/l	
Bilirubin direct	4.5	mcmol/l	
Bilirubin indirect	16	mcmol/l	
ALT	278	u/l	
AST	156	u/l	
LDH	460	u/	
GGTP	378	u/l	
Potassium	4.7	mmol/l	
Calcium	2.23	mmol/l	

Calculation of glomerular filtration rate (GFR)

Conclusion:

58.

BIOCHEMICAL BLOOD ANALYSIS

PATIENT'S NAME: IVANOVA II			
Sex: female	Age: 48 y.o.		
Height 178 sm	Weight 75 kg		
Parameter	Result	Units	Note
Urea	6.5	mmol/l	
Creatinine	0.098	mmol/l	
Total protein	69	g/l	
Albumen	38	g/l	
Glucose	4.0	mmol/l	
Bilirubin total	48.5	mcmol/l	
Bilirubin direct	27.5	mcmol/l	
Bilirubin indirect	21	mcmol/l	
ALT	43	u/l	
AST	42	u/l	
GGTP	478	u/l	
Alkaline phosphatase	575	u/l	
Potassium	4.4	mmol/l	
Calcium	2.2	mmol/l	
Sodium	134	mmol/l	
Chloride	107	mmol/l	
Total cholesterol	8.2	mmol/l	
Calculation of glomerular filtration rate (GFR)			
Conclusion:			

59.

BIOCHEMICAL BLOOD ANALYSIS

PATIENT'S NAME: IVANOV II			
Sex: male	Age: 69 y.o.		
Height 174 sm	Weight 88 kg		
Parameter	Result	Units	Note
Urea	3.9	mmol/l	
Creatinine	0.098	mmol/l	
Total protein	56	g/l	
Albumen	23	g/l	
Glucose	5.6	mmol/l	
Bilirubin total	28.6	mcmol/l	
Bilirubin direct	14	mcmol/l	
Bilirubin indirect	14.6	mcmol/l	
ALT	68	u/l	
AST	73	u/l	
LDH	315	u/l	
GGTP	278	u/l	
Alkaline phosphatase	297	u/l	
Potassium	4.4	mmol/l	
Calcium	2.26	mmol/l	
Sodium	130	mmol/l	
Chloride	103	mmol/l	
Total cholesterol	2.3	mmol/l	
Calculation of glomerular filtration rate (GFR)			
Conclusion:			

60.

BIOCHEMICAL BLOOD ANALYSIS

PATIENT'S NAME: IVANOVA II			
Sex: female	Age: 72 y.o.		
Height 164 sm	Weight 78 kg		
Parameter	Result	Units	Note
Urea	7.6	mmol/l	
Creatinine	0.077	mmol/l	
Total protein	62	g/l	
Uric acid	0.655	mmol/l	
Glucose	7.5	mmol/l	
Bilirubin total	14.3	mcmol/l	
Bilirubin direct	3.3	mcmol/l	
Bilirubin indirect	11.0	mcmol/l	
ALT	12	u/l	
AST	20	u/l	
GGTP	48	u/l	
Alkaline phosphatase	148	u/l	
Potassium	4.2	mmol/l	
Calcium	2.2	mmol/l	
Sodium	140	mmol/l	
Chloride	102	mmol/l	
Total cholesterol	8.3	mmol/l	
LDL	5.78	mmol/l	
HDL	0.62	mmol/l	
Triglycerids	4.9	mmol/l	
Aterogenic index	12.4		

Calculation of glomerular filtration rate (GFR)

Conclusion:

61.

BIOCHEMICAL BLOOD ANALYSIS

PATIENT'S NAME: IVANOV II			
Sex: male	Age: 54 y.o.		
Height 174 sm	Weight 109 kg		
Parameter	Result	Units	Note
Urea	5.4	mmol/l	
Creatinine	0.1	mmol/l	
Total protein	66	g/l	
Albumen	30	g/l	
Uric acid	0.59	mmol/l	
Glucose	6.8	mmol/l	
Bilirubin total	20.0	mcmol/l	
ALT	82	u/l	
AST	112	u/l	
LDH	448	u/l	
Potassium	4.8	mmol/l	
Calcium	2.15	mmol/l	
Sodium	142	mmol/l	
Chloride	104	mmol/l	
Troponin	1.25	нg/ml	
Creatine kinase	980	u/l	
Creatine kinase-MB	594	u/l	
Total cholesterol	5.9	mmol/l	
LDL	3.38	mmol/l	
HDL	1.1	mmol/l	
Triglycerids	2.5	mmol/l	

Calculation of glomerular filtration rate (GFR)

Conclusion:

62.

BIOCHEMICAL BLOOD ANALYSIS

PATIENT'S NAME: IVANOVA II			
Sex: female	Age: 25 y.o.		
Height 158 sm	Weight 69 kg		
Parameter	Result	Units	Note
Urea	6.6	mmol/l	
Creatinine	0.068	mmol/l	
Total protein	55	g/l	
Uric acid	0.34	mmol/l	
Glucose	5.9	mmol/l	
Bilirubin total	19.5	mcmol/l	
CRP	22.4	mg/l	
Rheumatoid factor	48	IU/ml	
ASL-O	350	IU/ml	
ALT	18	u/l	
AST	22	u/l	
GGTP	50	u/l	
Potassium	4.0	mmol/l	
Calcium	2.2	mmol/l	
Sodium	142	mmol/l	
Chloride	103	mmol/l	
Total cholesterol	4.6	mmol/l	
Triglycerids	2.8	mmol/l	

Calculation of glomerular filtration rate (GFR)

Conclusion:

63.

BIOCHEMICAL BLOOD ANALYSIS

PATIENT'S NAME: IVANOV II			
Sex: male	Age: 50 y.o.		
Height 181 sm	Weight 134 kg		
Parameter	Result	Units	Note
Urea	18.2	mmol/l	
Creatinine	0.38	mmol/l	
Total protein	50	g/l	
Albumen	24	g/l	
Uric acid	0.49	mmol/l	
Glucose	14.9	mmol/l	
Bilirubin total	23.0	mcmol/l	
ALT	48	u/l	
AST	40	u/l	
Potassium	5.8	mmol/l	
Calcium	2.1	mmol/l	
Sodium	140	mmol/l	
Chloride	101	mmol/l	
Creatine kinase	172	u/l	
Creatine kinase-MB	12	u/l	
Total cholesterol	6.9	mmol/l	
Triglycerids	4.5	mmol/l	

Calculation of glomerular filtration rate (GFR)

Conclusion:

CLINICAL VARIANTS OF LABORATORY TESTS

64. ОБЩИЙ АНАЛИЗ КРОВИ			
ФИО ПАЦИЕНТА: ИВАНОВ ИИ			
ВОЗРАСТ: 66 лет	Пол: муж		
Показатель	Результат	Примечание	
Эритроциты	2.67 * 10^{12} /л		
Гемоглобин	68 г/л		
Гематокрит	24 %		
MCV	89.9 фл.		
MCH	25.5 пг		
MCHC	283 г/л		
Лейкоциты	85 * 10^{9} /л		
Тромбоциты	230 * 10^{9} /л		
СОЭ по Панченкову	6 мм/ч		
Лейкоцитарная формула			
Показатель	%	10^{9} /л	Примечание
Базофилы	0	0.001	
Эозинофилы	1	0.852	
Нейтрофилы: палочкоядерные	9	7.669	
сегментоядерные	49	41.753	
юные	5	4.26	
миелоциты	10	8.521	
промиелоциты	2	1.702	
бласты	8	6.817	
Лимфоциты	14	11.929	
Моноциты	2	1.704	
Заключение:			

64. CBC			
PATIENT'S NAME: IVANOV II			
AGE: 66 y.o.	Sex: male		
Parameter	Result	Note	
RBC	2.67 * 10^{12} /l		
Hemoglobin	68 g/l		
Hematocrit	24 %		
MCV	89.9 fl.		
MCH	25.5 pg		
MCHC	283 g/l		
WBC	85 * 10^{9} /l		
Platelets	230 * 10^{9} /l		
ESR Westergren's method	6 mm/h		
Leukocyte count			
Parameter	%	10^{9} /l	Note
Basophils	0	0.001	
Eosinophils	1	0.852	
Neutrophils: band	9	7.669	
segmented	49	41.753	
young	5	4.26	
myelocytes	10	8.521	
promyelocytes	2	1.702	
blasts	8	6.817	
Lymphocytes	14	11.929	
Monocytes	2	1.704	
Conclusion:			

65. ОБЩИЙ АНАЛИЗ КРОВИ			
ФИО ПАЦИЕНТА: ИВАНОВ ИИ			
ВОЗРАСТ: 83 года	Пол: муж		
Показатель	Результат	Примечание	
Эритроциты	3.05 * 10^{12} /л		
Гемоглобин	78 г/л		
Гематокрит	23.8 %		
MCV	78 фл.		
MCH	24.6 пг		
MCHC	315 г/л		
Лейкоциты	13.6 * 10^{9} /л		
Тромбоциты	159 * 10^{9} /л		
СОЭ по Вестергрену	60 мм/ч		
Лейкоцитарная формула			
Показатель	%	10^{9} /л	Примечание
Нейтрофилы: палочкоядерные	14	1.904	
сегментоядерные	71	9.656	
миелоциты	1	0.136	
Лимфоциты	14	1.904	
Моноциты	0	0	
Морфология			
Анизоцитоз (микро)	+		
Гипохромия	+		
Токс. зернистость нейтрофилов	++		
Заключение:			

65. CBC			
PATIENT'S NAME: IVANOV II			
AGE: 83 y.o.	Sex: male		
Parameter	Result	Note	
RBC	3.05 * 10^{12} /l		
Hemoglobin	78 g/l		
Hematocrit	23.8 %		
MCV	78 fl.		
MCH	24.6 pg		
MCHC	315 g/l		
WBC	13.6 * 10^{9} /l		
Platelets	159 * 10^{9} /l		
ESR Westergren's method	60 mm/h		
Leukocyte count			
Parameter	%	10^{9} /l	Note
Neutrophils: band	14	1.904	
segmented	71	9.656	
myelocytes	1	0.136	
Lymphocytes	14	1.904	
Monocytes	0	0	
Morphology			
Anisocytosis	+		
Hypochromia	+		
Toxic granularity of neutrophils	++		
Conclusion:			

66. ОБЩИЙ АНАЛИЗ КРОВИ			
ФИО ПАЦИЕНТА: ИВАНОВ ИИ			
ВОЗРАСТ: 88 лет	Пол: муж		
Показатель	Результат	Примечание	
Эритроциты	3.37 * 10^{12} /л		
Гемоглобин	108 г/л		
Гематокрит	37.3 %		
MCV	111 фл.		
MCH	34 пг		
MCHC	290 г/л		
Лейкоциты	177 * 10^{9} /л		
Тромбоциты	68 * 10^{9} /л		
СОЭ по Вестергрену	82 мм/ч		
Лейкоцитарная формула			
Показатель	%	10^{9} /л	Примечание
Базофилы	0	0	
Эозинофилы	0	0	
Нейтрофилы: сегментоядерные	3	5.31	
Лимфоциты	96	169.92	
Морфология			
Анизоцитоз (макро)	+		
Тени Боткина–Гумпрехта	++		
Заключение:			

66. CBC			
PATIENT'S NAME: IVANOV II			
AGE: 88 y.o.	Sex: male		
Parameter	Result	Note	
RBC	3.37 * 10^{12} /l		
Hemoglobin	108 g/l		
Hematocrit	37.3 %		
MCV	111 fl.		
MCH	34 pg		
MCHC	290 g/l		
WBC	177 * 10^{9} /l		
Platelets	68 * 10^{9} /l		
ESR Westergren's method	82 mm/h		
Leukocyte count			
Parameter	%	10^{9} /l	Note
Basophils	0	0	
Eosinophils	0	0	
Neutrophils: segmented	3	5.31	
Lymphocytes	96	169.92	
Morphology			
Anisocytosis (macro)	+		
Shadow cells of Botkin-Gumprecht	++		
Conclusion:			

67. АНАЛИЗ МОЧИ ОБЩИЙ		
ФИО ПАЦИЕНТА: ИВАНОВ ИИ		
ВОЗРАСТ: 67 лет	Пол: муж	
Показатель	Результат	Примечание
Физические свойства		
Количество	180.0	
Цвет	Насыщ.желтый	
Прозрачность	Слабо-мутная	
Реакция	Кислая	
Относит. плотность	1022	
Химические свойства		
Белок	положит.	
Белок	0.34 г/л	
Глюкоза	отсут.	
Билирубин	++	
Микроскопическое исследование		
Эпителий:		
плоский	6–8 в поле зрения	
переходный	Нет	
почечный	Нет	
Эритроциты	1–2 в поле зрения	
Лейкоциты	2–4 в поле зрения	
Цилиндры зернистые	1–2 в поле зрения	
Цилиндры гиалиновые	0–1 в поле зрения	
Бактерии	+	
Заключение:		

67. URINALYSIS		
PATIENT’S NAME: IVANOV II		
AGE: 67 y.o.	Sex: male	
Parameter	Result	Note
Physical properties		
Amount	180.0	
Color	Bright yellow	
Transparency	Slightly cloudy	
Ph	Acidic	
Density	1022	
Chemical properties		
Protein	positive	
Protein	0.34 g/l	
Glucose	absent	
Bilirubin	++	
Microscopic examination		
Epithelium:		
squamous	6–8 per high-powered field	
transitional	Absent	
renal	Absent	
RBC	1–2 per high-powered field	
WBC	2–4 per high-powered field	
Casts granular	1–2 per high-powered field	
Casts hyaline	0–1 per high-powered field	
Bacteria	+	
Conclusion:		

68. АНАЛИЗ МОЧИ ОБЩИЙ		
ФИО ПАЦИЕНТА: ИВАНОВА ИИ		
ВОЗРАСТ: 85 лет	Пол: жен	
Показатель	Результат	Примечание
Физические свойства		
Количество	200.0	
Цвет	Соломенно-желтый	
Прозрачность	Слабо-мутная	
Реакция	Кислая	
Относит. плотность	1025	
Химические свойства		
Белок	положит.	
Белок	0.28 г/л	
Глюкоза	отсут.	
Билирубин	++	
Нитриты	положит.	
Микроскопическое исследование		
Эпителий:		
плоский	6–10 в поле зрения	
Эритроциты	20–30 в поле зрения	
Лейкоциты	40–50 в поле зрения	
Бактерии	+++	
Заключение:		

68. URINALYSIS		
PATIENT’S NAME: IVANOVA II		
AGE: 85 y.o.	Sex: female	
Parameter	Result	Note
Physical properties		
Amount	200.0	
Color	Straw-yellow	
Transparency	Slightly cloudy	
Ph	Acidic	
Density	1025	
Chemical properties		
Protein	positive	
Protein	0.28 g/l	
Glucose	absent	
Bilirubin	++	
Nitrites	positive	
Microscopic examination		
Epithelium:		
squamous	6–10 per high-powered field	
RBC	20–30 per high-powered field	
WBC	40–50 per high-powered field	
Bacteria	+++	
Conclusion:		

69. БИОХИМИЧЕСКИЙ АНАЛИЗ КРОВИ			
ФИО: ИВАНОВА ИИ			
Пол: жен	Возраст: 70 лет		
Рост 166 см	Вес 48 кг		
Наименование	Результат	Ед. измерения	Примечание
Мочевина	8	ммоль/л	
Креатинин	0.061	ммоль/л	
Общий белок	64	г/л	
Альбумин	16.8	г/л	
СРБ	37.4	мг/л	
Глюкоза	4.9	ммоль/л	
Билирубин общий	202.6	мкмоль/л	
Билирубин прямой	92.7	мкмоль/л	
Билирубин непрямой	109.9	мкмоль/л	
АЛТ	67	ед/л	
АСТ	177	ед/л	
Амилаза	гемолиз+	ед/л	
Калий	3.8	ммоль/л	
Кальций	2.2	ммоль/л	
Натрий	126	ммоль/л	
Хлориды	105	ммоль/л	
Расчет СКФ: Заключение:			

69. BIOCHEMICAL BLOOD ANALYSIS			
PATIENT'S NAME: IVANOVA II			
Sex: female	Age: 70 y.o.		
Height 166 sm	Weight 48 kg		
Parameter	Result	Units	Note
Urea	8	mmol/l	
Creatinine	0.061	mmol/l	
Total protein	64	g/l	
Albumen	16.8	g/l	
CRP	37.4	mg/l	
Glucose	4.9	mmol/l	
Bilirubin total	202.6	mcmol/l	
Bilirubin direct	92.7	mcmol/l	
Bilirubin indirect	109.9	mcmol/l	
ALT	67	u/l	
AST	177	u/l	
Amylase	hemolysis+	u/l	
Potassium	3.8	mmol/l	
Calcium	2.2	mmol/l	
Sodium	126	mmol/l	
Chloride	105	mmol/l	
Calculation of glomerular filtration rate (GFR) Conclusion:			

70.
БИОХИМИЧЕСКИЙ АНАЛИЗ КРОВИ

ФИО: ИВАНОВ ИИ			
Пол: муж	Возраст: 62 года		
Рост 170 см	Вес 65 кг		
Наименование	Результат	Ед. измерения	Примечание
Мочевина	39.3	ммоль/л	
Креатинин	0.34	ммоль/л	
Общий белок	52	г/л	
Альбумин	22	г/л	
СРБ	216	мг/л	
Глюкоза	6.8	ммоль/л	
Билирубин общий	31.2	мкмоль/л	
АЛТ	192	ед/л	
АСТ	274	ед/л	
Калий	4.6	ммоль/л	
Кальций	2.15	ммоль/л	
Натрий	131	ммоль/л	
Хлориды	99	ммоль/л	

Расчет СКФ:

Заключение:

70.
BIOCHEMICAL BLOOD ANALYSIS

PATIENT'S NAME: IVANOV II			
Sex: male	Age: 62 y.o.		
Height 170 sm	Weight 65 kg		
Parameter	Result	Units	Note
Urea	39.3	mmol/l	
Creatinine	0.34	mmol/l	
Total protein	52	g/l	
Albumen	22	g/l	
CRP	216	mg/l	
Glucose	6.8	mmol/l	
Bilirubin total	31.2	mcmol/l	
ALT	192	u/l	
AST	274	u/l	
LDH	565	u/l	
Potassium	4.6	mmol/l	
Calcium	2.15	mmol/l	
Sodium	131	mmol/l	
Chloride	99	mmol/l	

Calculation of glomerular filtration rate (GFR)

Conclusion:

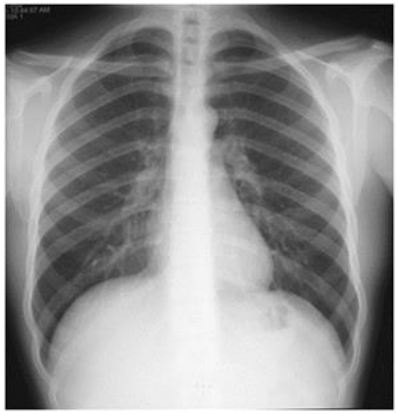
CHAPTER 2. CHEST X-RAY

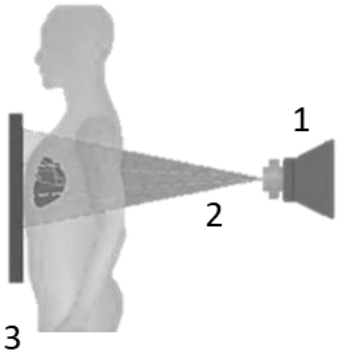
X-RAY INTERPRETATION

X-ray imaging	Plain, tomography		
Image quality (contrast, penetration)	Low contrast, high contrast		Well penetrated, soft penetrated
Examination area	Chest		
X-ray projection	Direct (standart posteroanterior, frontal), lateral		
Assessment of the chest shape, walls, diaphragm	Norm		Patology
Chest shape	Normosthenic (mesomorph), asthenic (ectomorph), hypersthenic (endomorph)		Barrel chest, deformed (indicate the deformation character and localization)
Mediastinum position	Normal		Shifted to the left/right
Position of the hemidiaphragm	Normal (the right is 1.5–2 sm higher than the left one)		Diaphragm elevation (right, left) Flat diaphragm
Costophrenic angles	Sharp		Costophrenic angle blunting
Lung fields and lung roots (hila) assessment	Norm		Patology (indicate localization)
Sizes of lung fields	Normal		Increased/decreased
Density of lung fields	Normal		Increased/decreased
Condition of lung roots (hila)	Structural, not enlarged		Unstructured, enlarged
Shadow characteristics	Physiological — pectoralis major muscle, mammary gland		Amount, localization, shape, size, intensity of pathological structures
Heart size and contours	Norm		Patology
Cardio-Thoracic Ratio (CTR) CTR = Cardiac Width / Thoracic Width	Size	CTR is less than 50 %	CTR is more than 50 %
	Contours (silhouette)	Normal	Mitral, aortic, trapezoidal
Clinical syndrome at presented X-ray image	Bronchial obstruction, consolidation of the lung tissue, atelectasis, cavity in the lung, fluid accumulation in pleural cavity, air accumulation in pleural cavity		
Conclusion			

Write the most common X-ray imaging:

1 _____ 2 _____



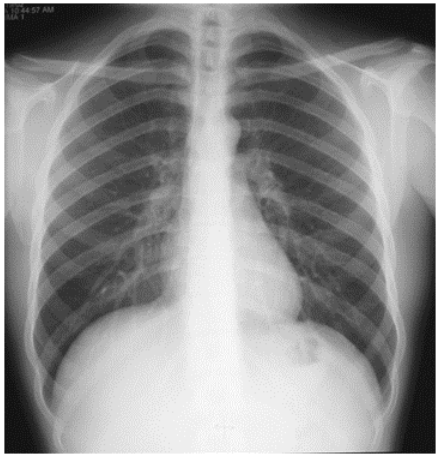


Write the numbered objects:

1 _____

2 _____

3 _____



Write possible X-ray projections:

1 _____

2 _____

3 _____

What anatomical structures do form an x-ray image of the chest?

1 _____

2 _____

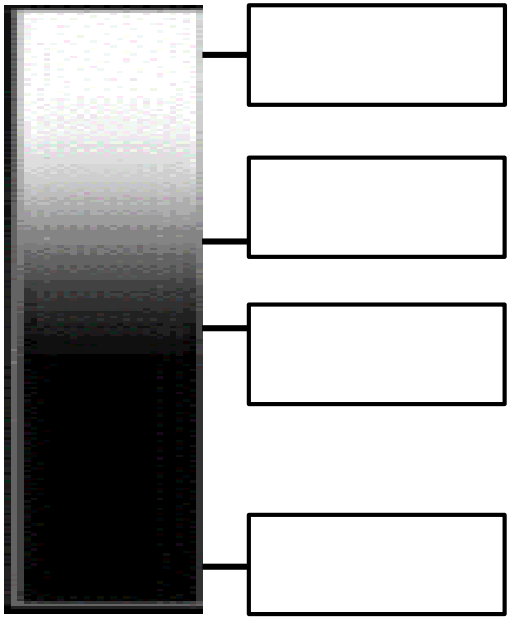
3 _____

4 _____

5 _____

Tissues permeability for x-rays

Match the color of X-ray image with the type of tissue



Determine on this x-ray image:

– X-ray imaging _____

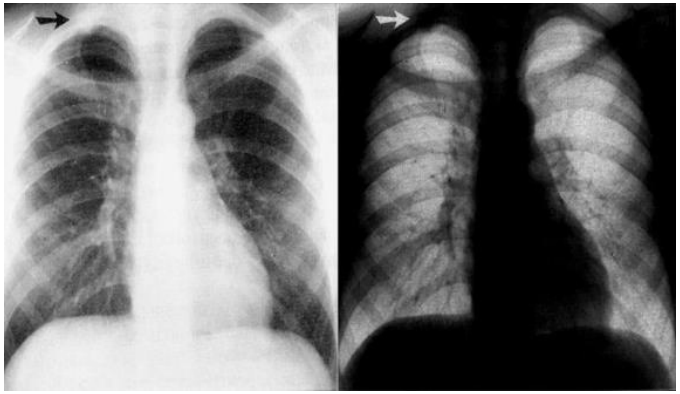
– examined area _____

– X-ray projection _____

FEATURES OF THE X-RAY IMAGE

Evaluate the type of X-ray image:

Positive X-ray _____ Negative X-ray _____



1 **2**

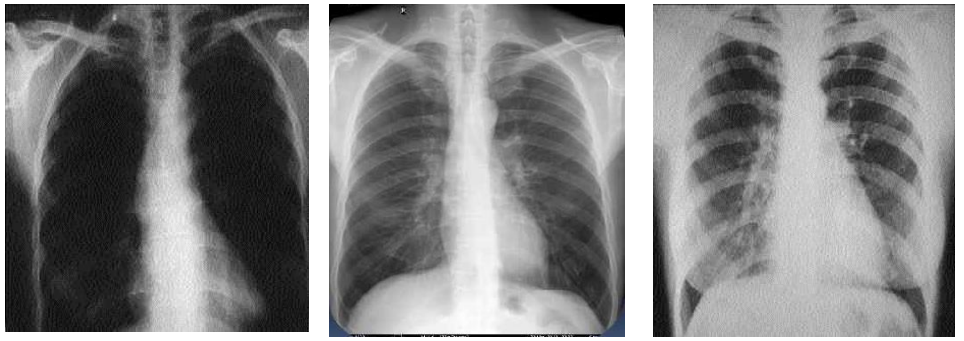
What tissue colors are in case of different X-ray images?

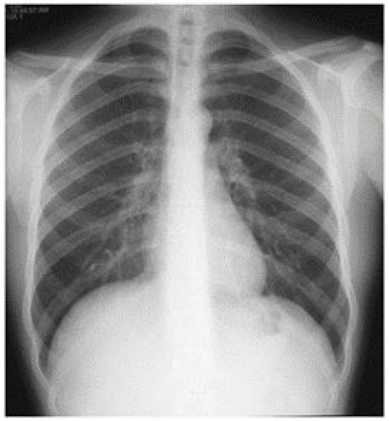
Tissue (structure)	Positive	Negative
Mediastinum		
Ribs		
Lung fields		

X-ray image penetration assessment

With optimal penetration in the upper part of the thoracic spine, 3–4 intervertebral discs are visible, the shadows of the ribs do not overlap the pulmonary pattern.

Write the penetration of the imagings on the pictures (soft penetrated, optimum penetrated, well penetrated).





➲ Assess this X-ray image:

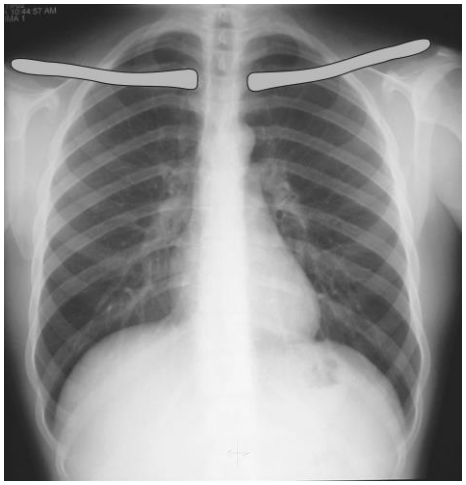
penetration is _____

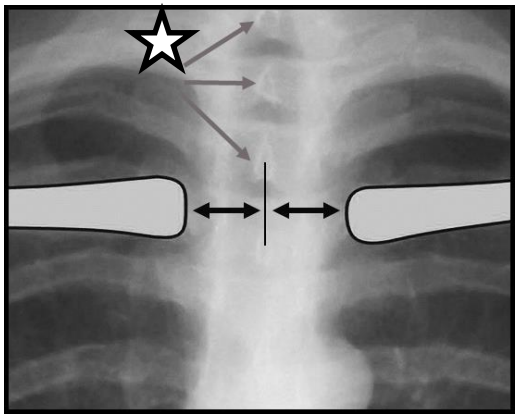
CORRECT POSITIONING OF THE PATIENT

Clavicle

The distance between the spinous process of Th3 and the sternoclavicular joints left and right side should be

_____

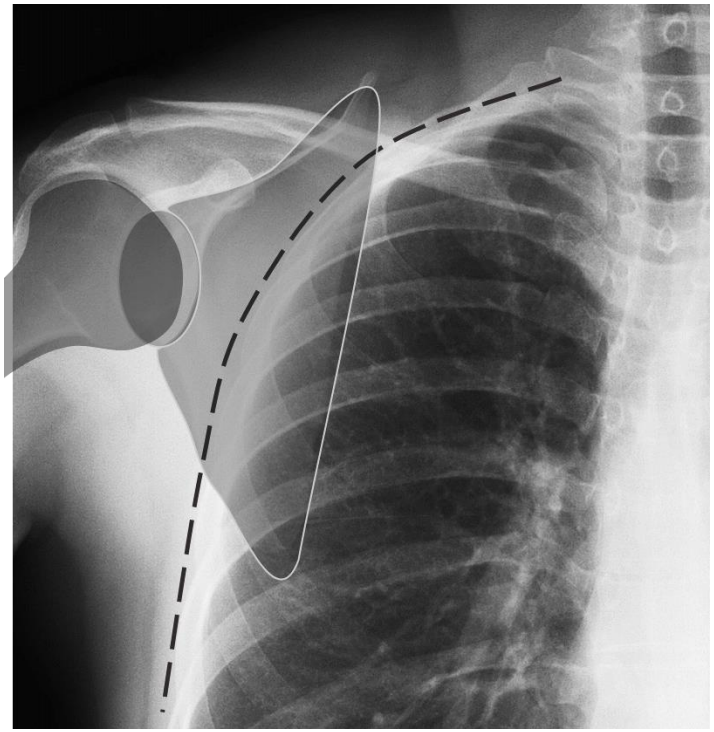




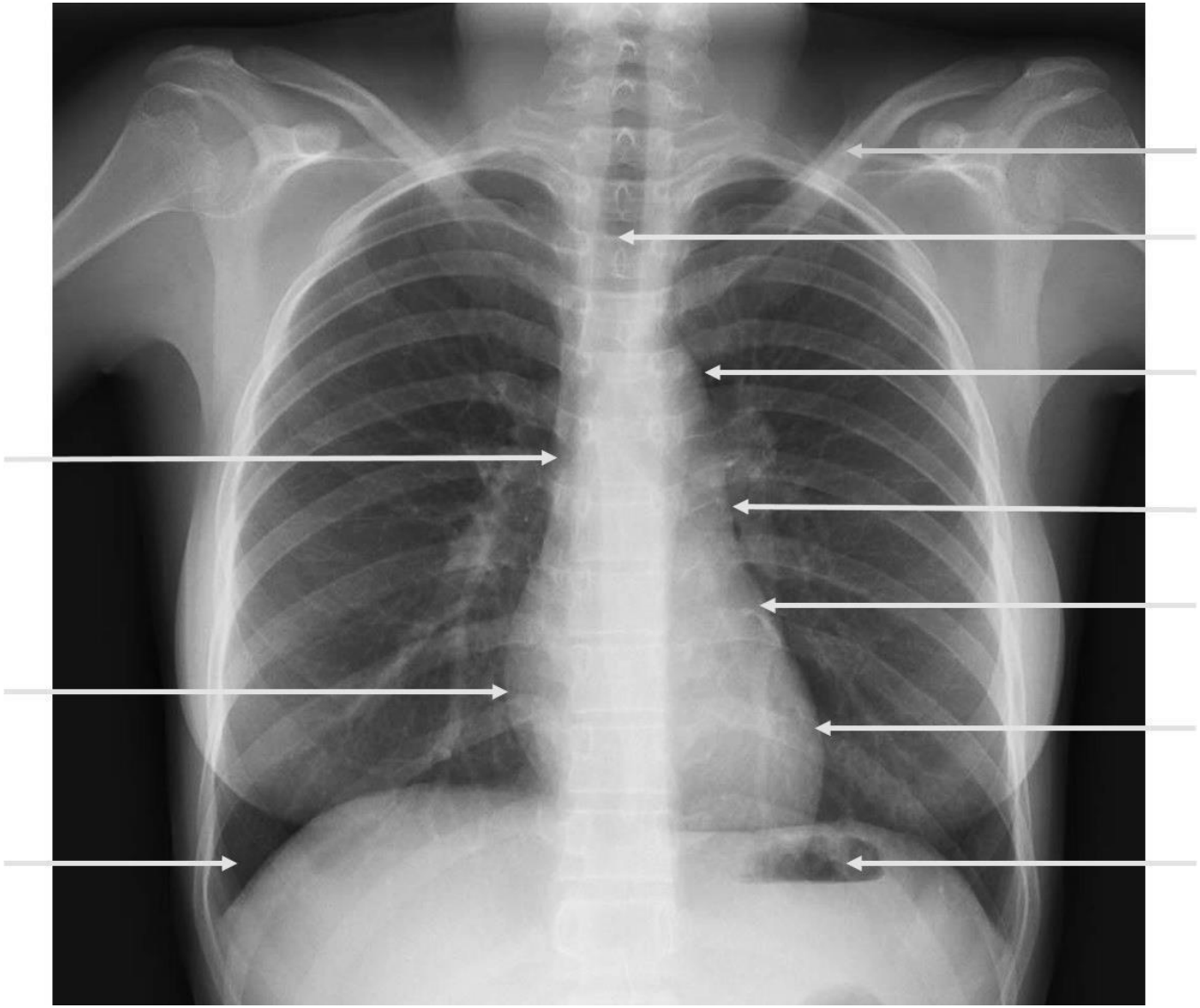
What structures are marked with ✰? _____

Scapulas

Scapulas shoul be _____



WRITE THE NAMES OF STRUCTURES



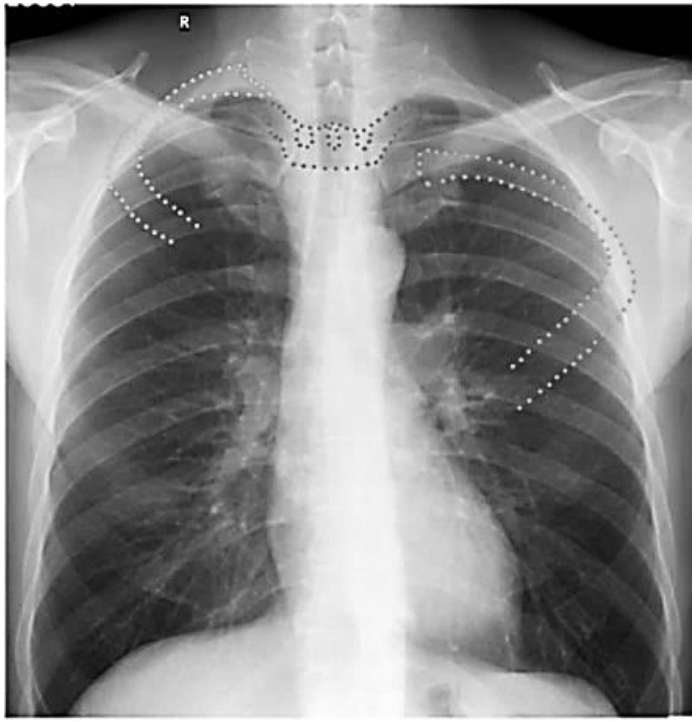
RIBS

1. Write, what is the highlighted rib?

   right _____ left _____

2. What segment of ribs do we use to rib count? _____

3. What type of patients has a clearly visible cartilaginous parts of the ribs? _____



DIAPHRAGM

Location of the right and left hemidiaphragm normally is

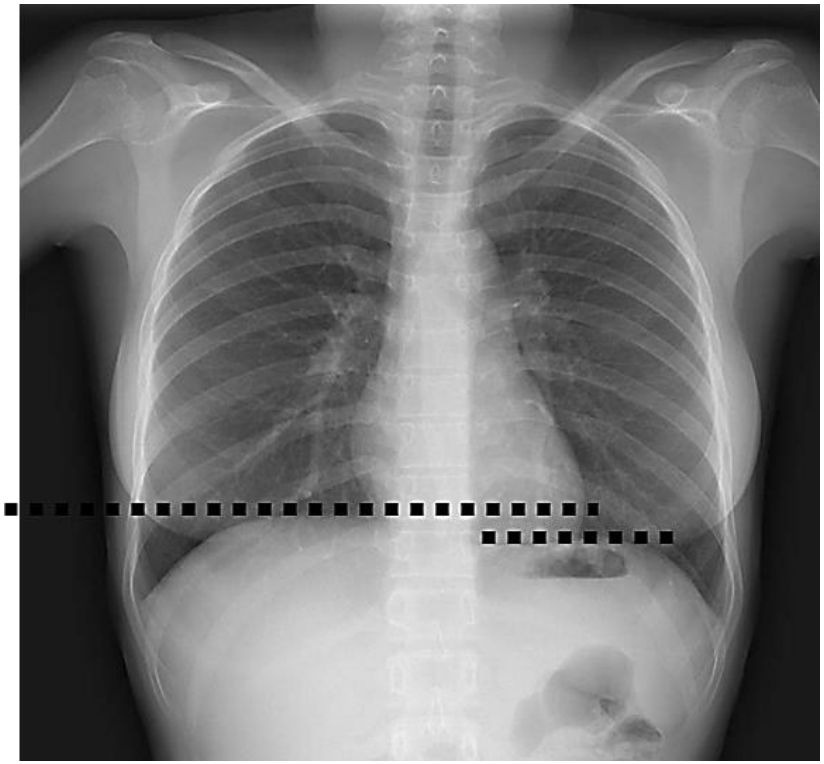
_____

Location of the mediastinum normally is

_____

Location of the gastric gas bubble normally is

_____

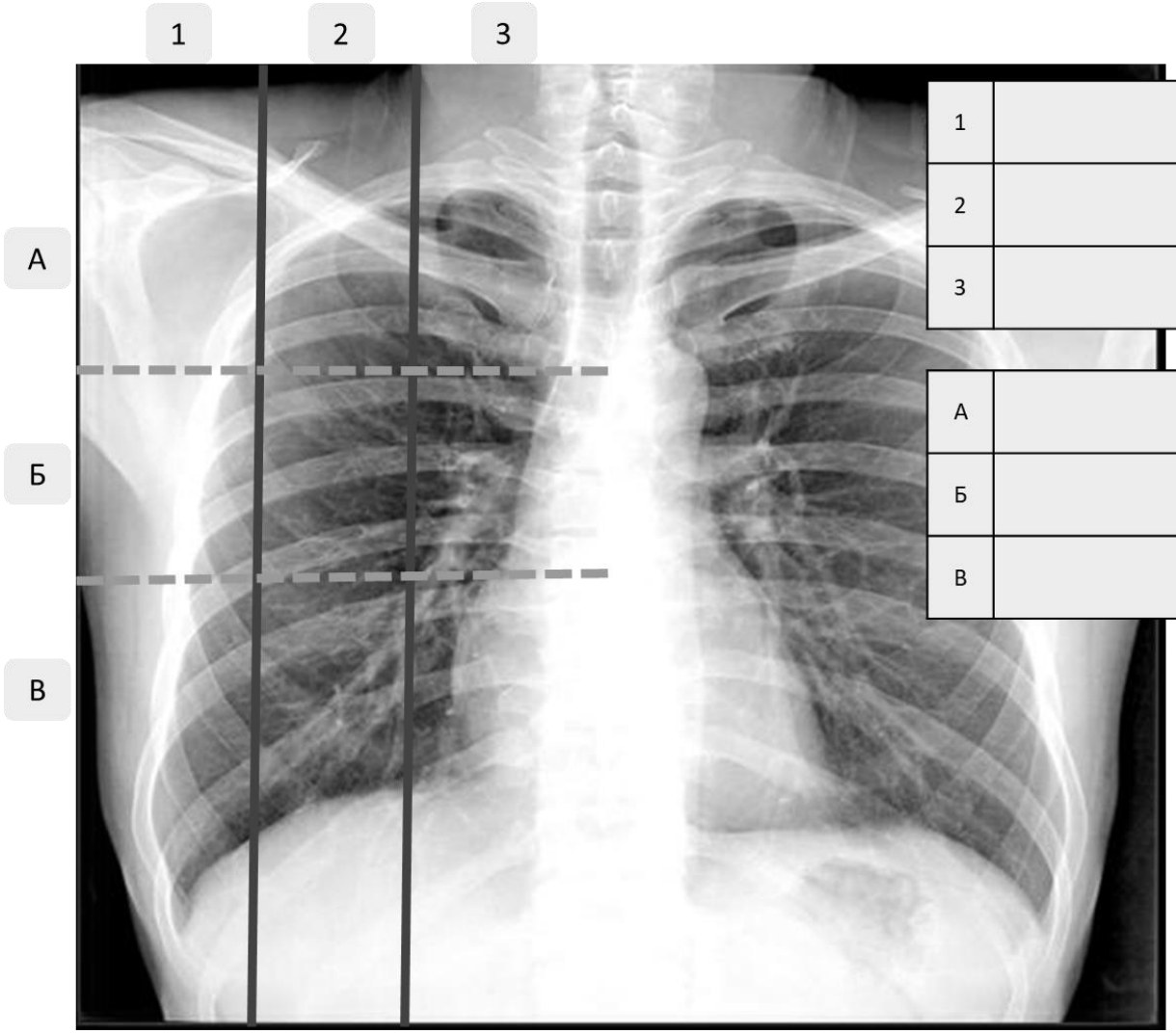


WRITE THE NAMES OF THE LUNG FIELDS

"Lung fields" is a radiological term for the part of a chest x-ray with lung lobes and segments.

Horizontal lines drawn at the level of the anterior segments of the 2nd and 4th ribs divide the lung fields into three sections - the upper (upper lung field), the middle (middle lung field) and the lower (lower lung field).

Vertical lines drawn through the middle of the intrathoracic section of the clavicle and through the point of intersection of the clavicle with the costal arch divide the lung fields into three zones: internal (medial), middle and external (lateral).



1	
2	
3	

А	
Б	
В	

LUNG ROOTS (HILA)

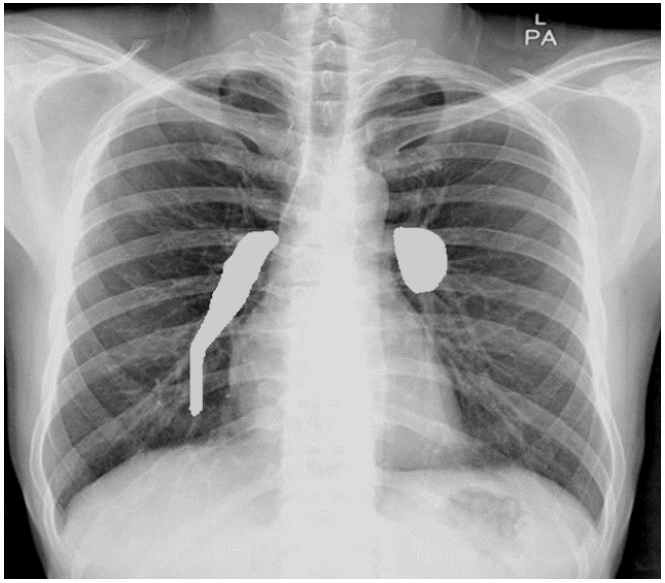
Anatomical substrate of the lung roots:

1 _____

2 _____

3 _____

4 _____

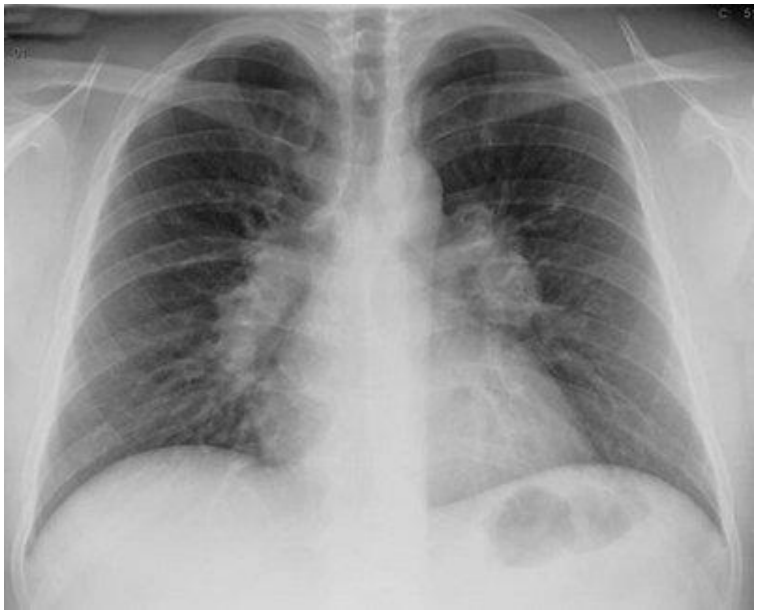


Assessment of the normal lung roots (hila)

Size: does not go beyond the medial third of the clavicle (width 1.5–2 sm)
Shape: left — oval, right — “comma”
Parts: left — head; right — head, body, tail
Contours: smooth

X-ray image of the lung roots is formed by

_____



Assess the condition of the lung roots on the x-ray:

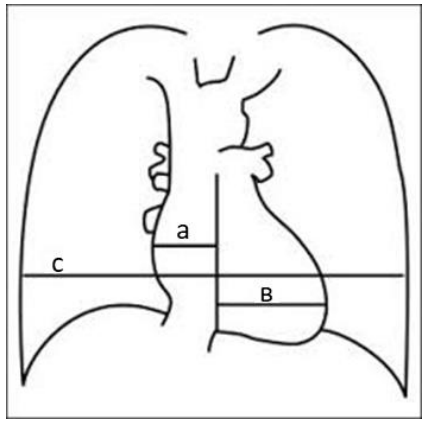
Size _____

Shape: left _____ right _____

Structure: left _____ right _____

Contours _____

CARDIOTHORACIC RATIO ASSESSMENT



CTR = (a + в) / c × 100 %

Normal CTR is less than 50 %

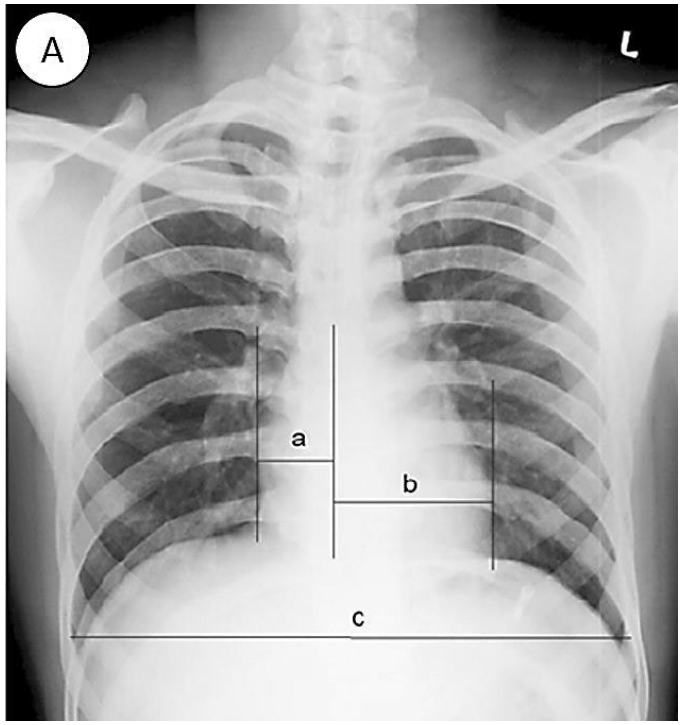
Assess the CTR on the X-ray:

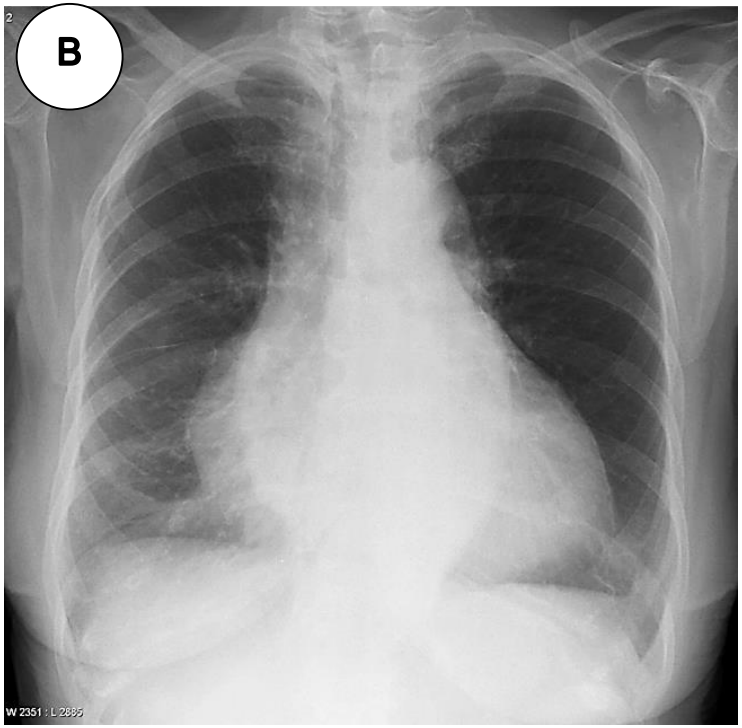
A _____

B _____

Write the reasons for enlarged CTR:

_____

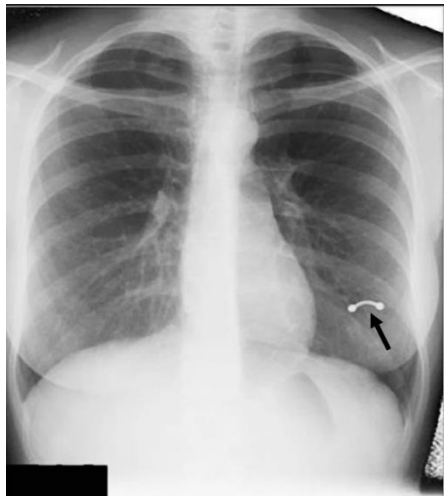




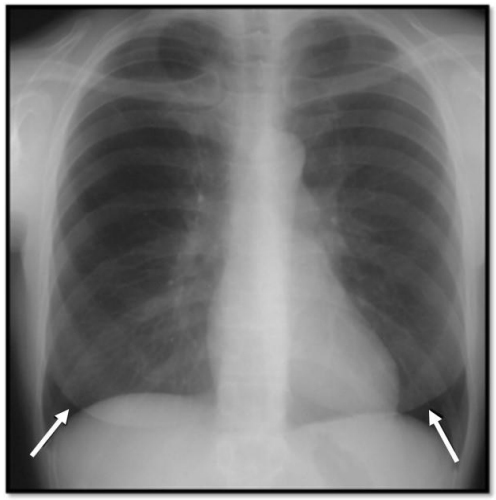
PHYSIOLOGICAL CHEST SHADOW

Write physiological shadows and artifacts, visible on these X-ray images, indicated by arrows.

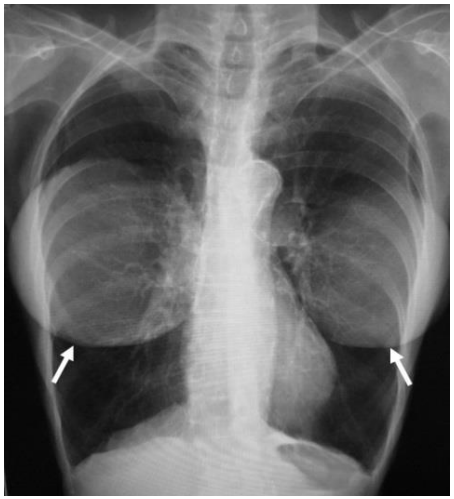
1. _____



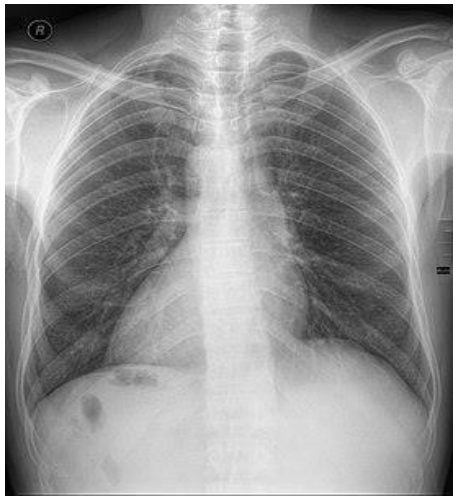
2. _____



3. _____



4. _____



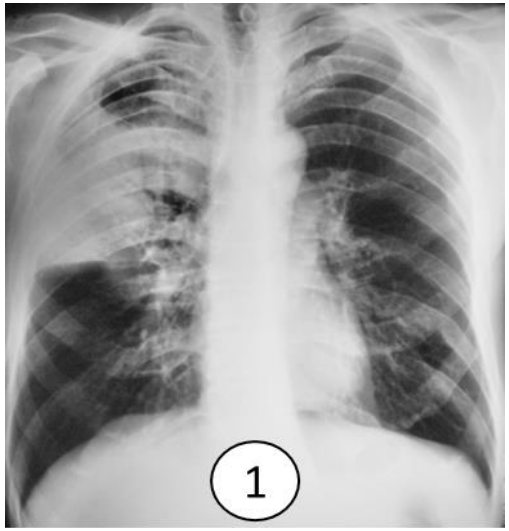
SHADOW'S SIZE

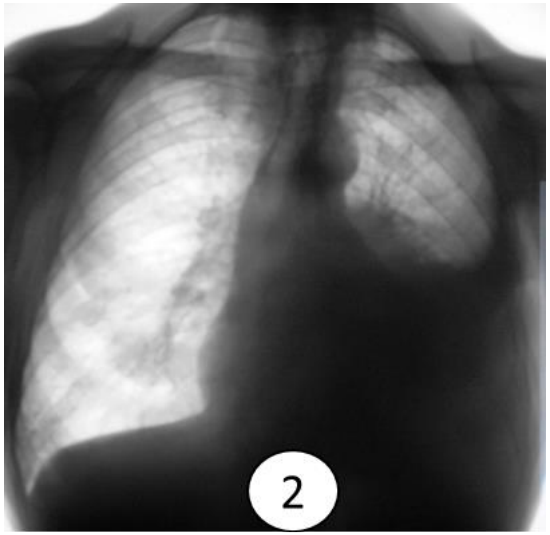
1. Identify the numbers of positive _____ and negative _____ X-ray images
2. Write the differences between positive and negative X-ray images? _____

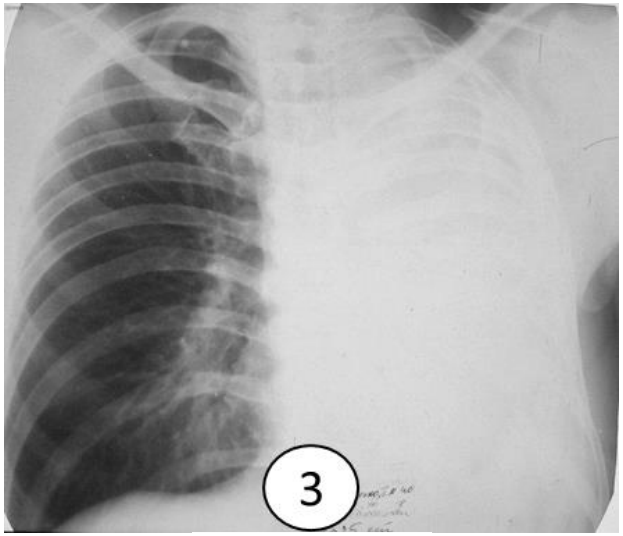
_____

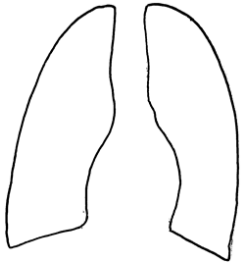
3. Match the size of each shadow (very large, large)
4. Sketch the shadows shown on the X-ray images

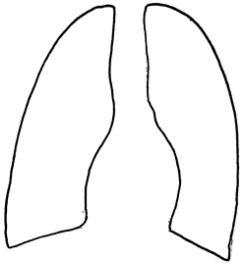
_____ _____ _____

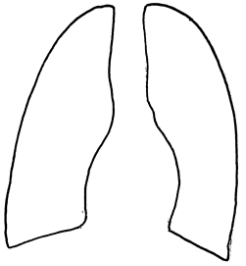






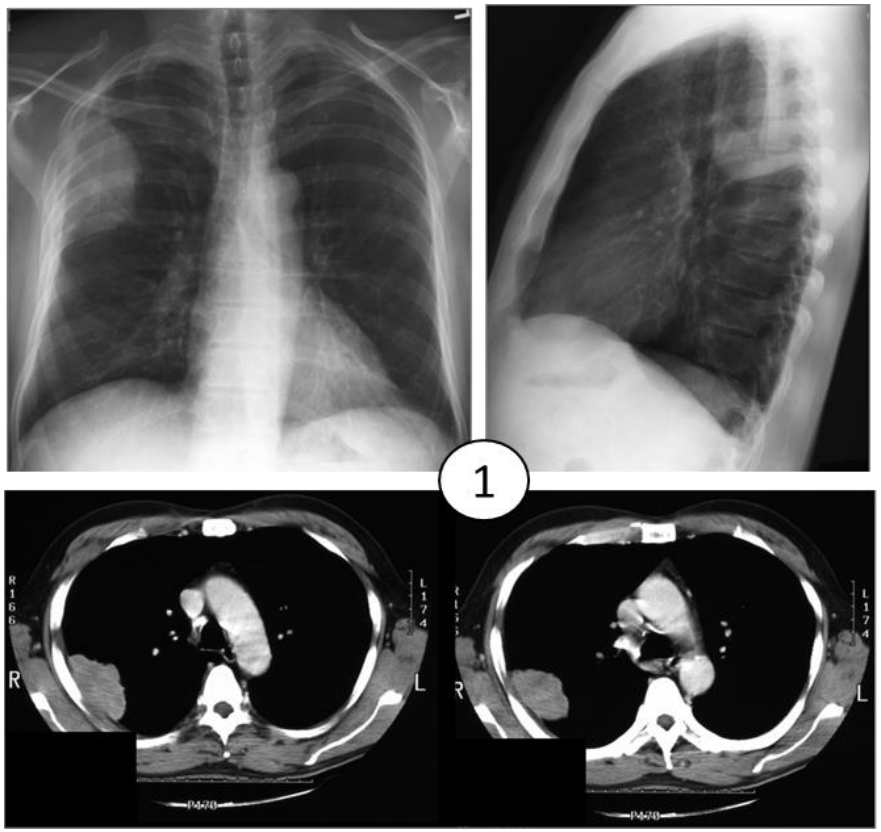






LOCALIZATION OF THE SHADOW

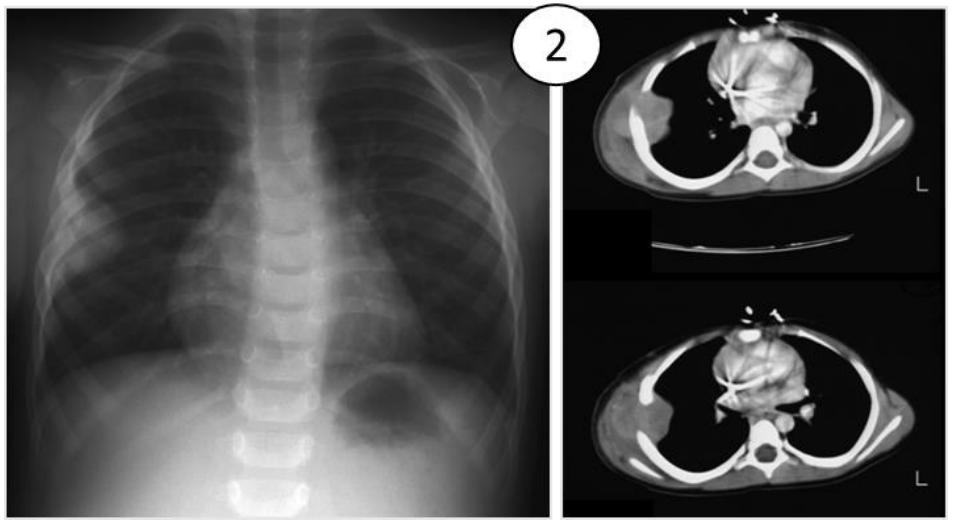
1. Write the X-ray imaging
2. Write the X-ray projection
3. Estimate the localization of the shadow (intrapulmonary or extrapulmonary)



1 _____

2 _____

3 _____



1 _____

2 _____

3 _____

SHADOW SIZE

Write characteristics:

- Widespread

- Focal

SHADOW INTENSITY

Write characteristics:

1 _____

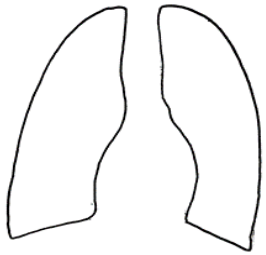
2 _____

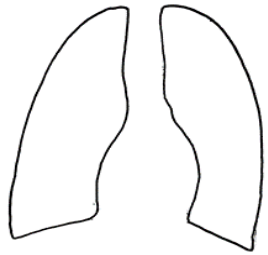
3 _____

SHADOW SHAPE

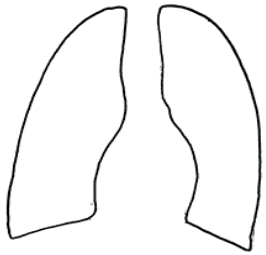
Draw and sign possible shapes.

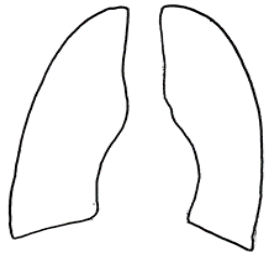
_____ _____





_____ _____

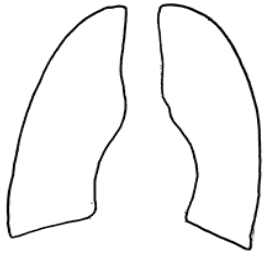


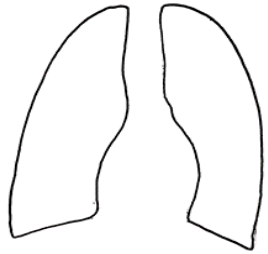


SHADOW HOMOGENEOUS /INHOMOGENEOUS

Draw and sign the possible structure.

_____ _____



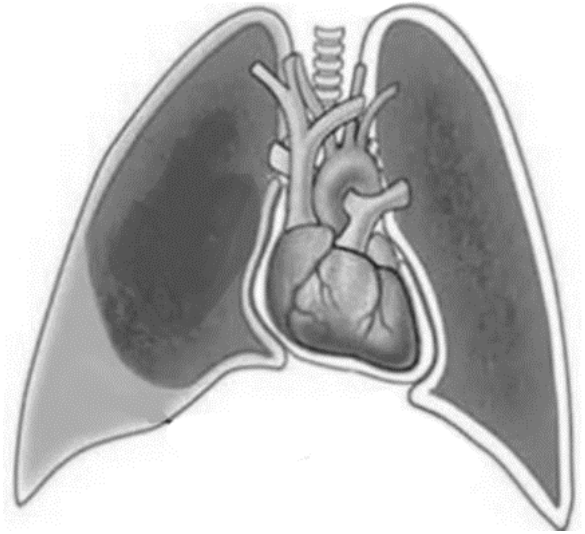


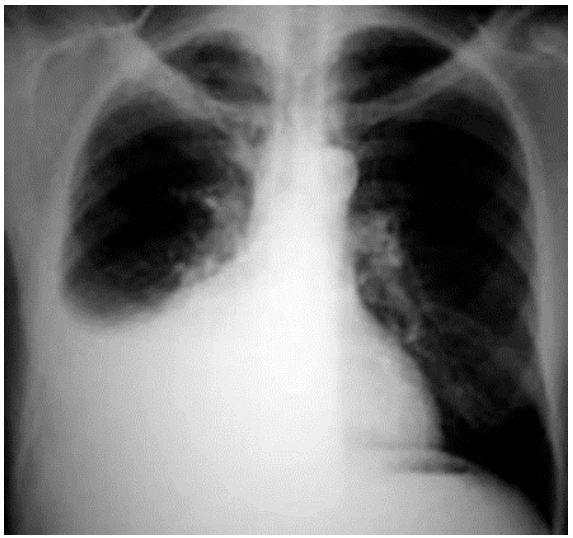
1. Write the syndrome presented on X-ray images and picture _____

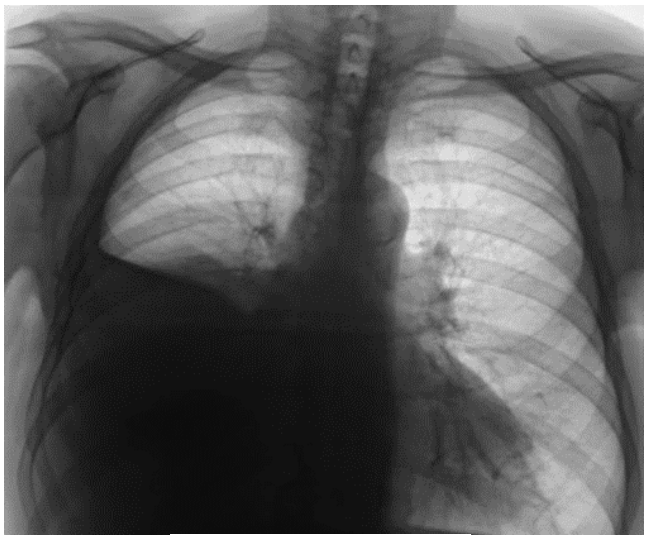
2. Find the positive and negative X-ray image _____

3. Sign with arrows and numbers on X-rays ray images and picture:

1 – lungs
2 – pleura
3 – liquid





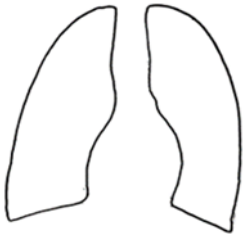


1. What is the Damoiseau line? _____

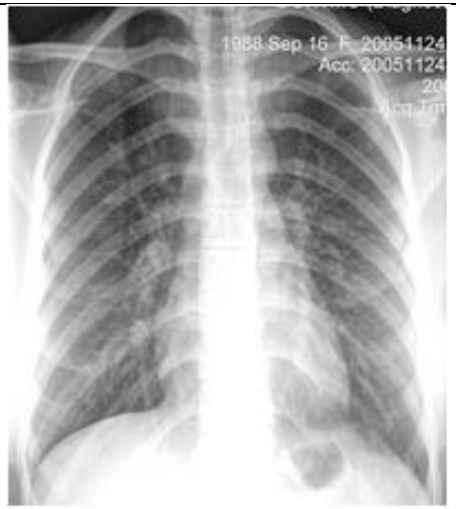
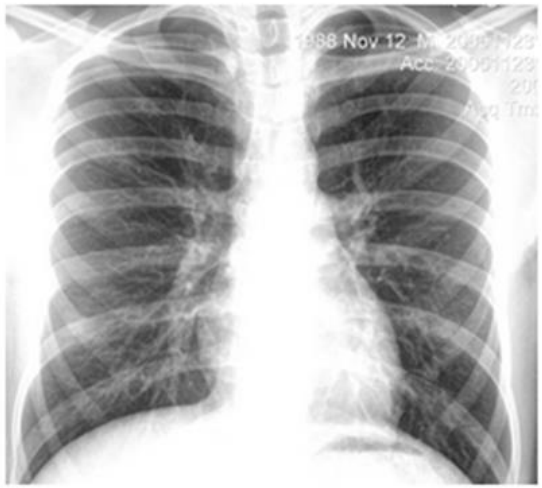
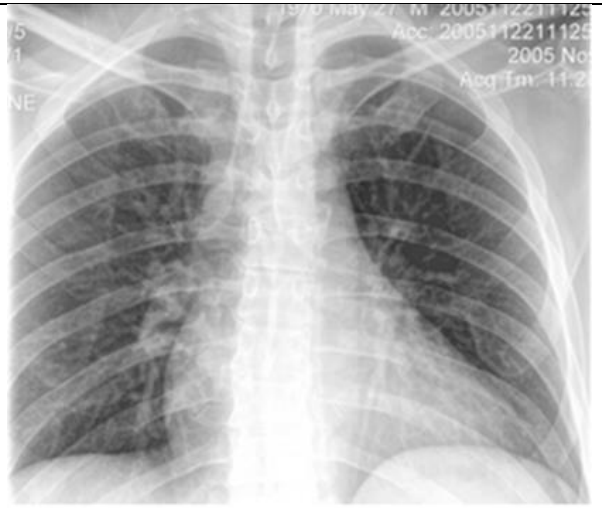
_____

2. Draw on the scheme the fluid accumulation, Damoiseau line, lung tissue.

3. Indicate in what direction the mediastinal organs are displaced.

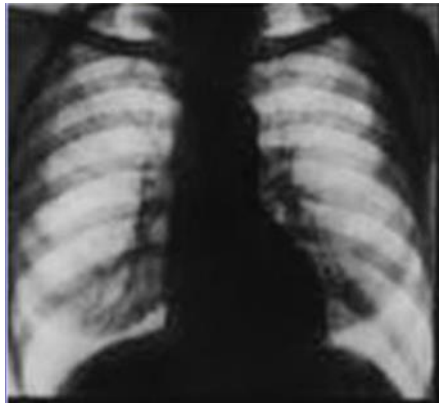
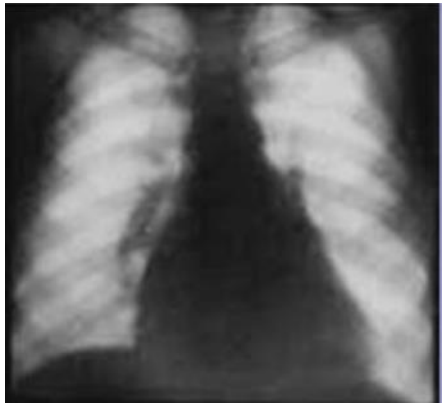
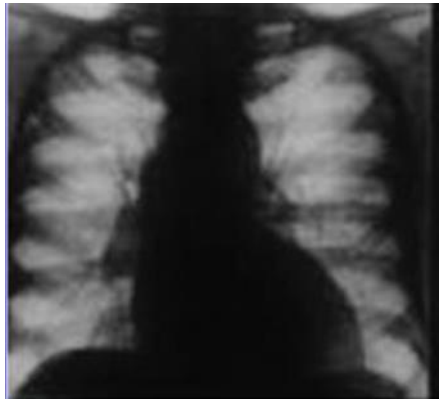
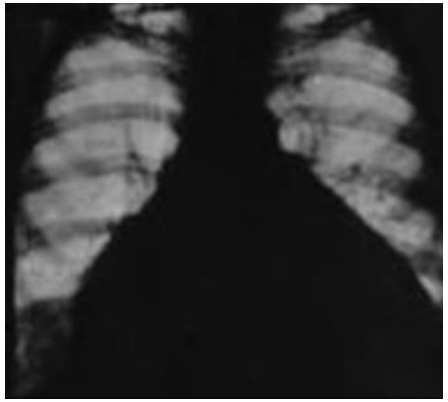
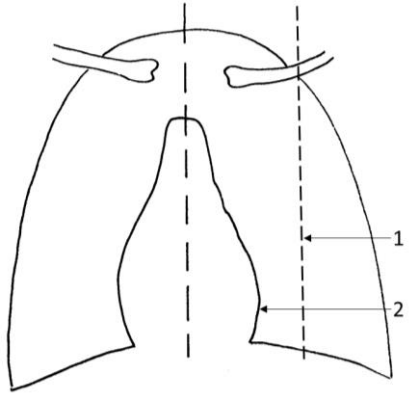
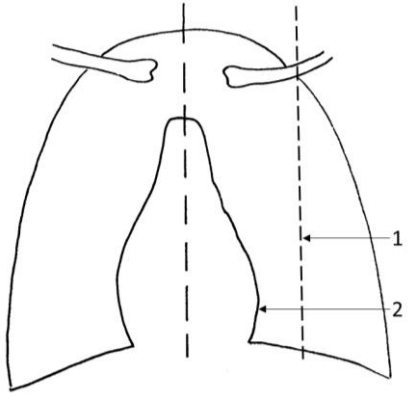
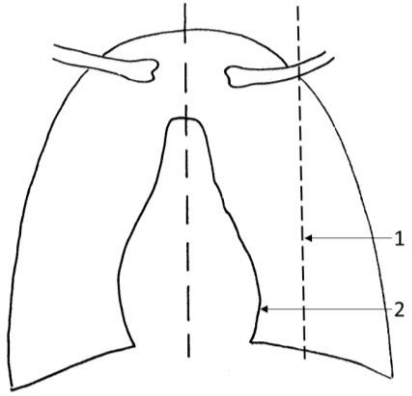
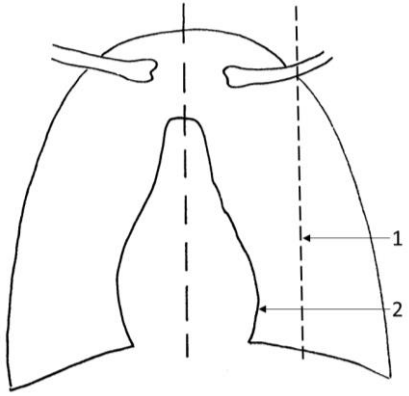


CHEST SHAPES ON THE X-RAY IMAGE

Asthenic (ectomorph)	Normosthenic (mesomorph)	Hypersthenic (endomorph)
		
Write the features of x-rays images in case of various types of chest shape:		
Rib direction Intercostal spaces Mediastinum position	Rib direction Intercostal spaces Mediastinum position	Rib direction Intercostal spaces Mediastinum position

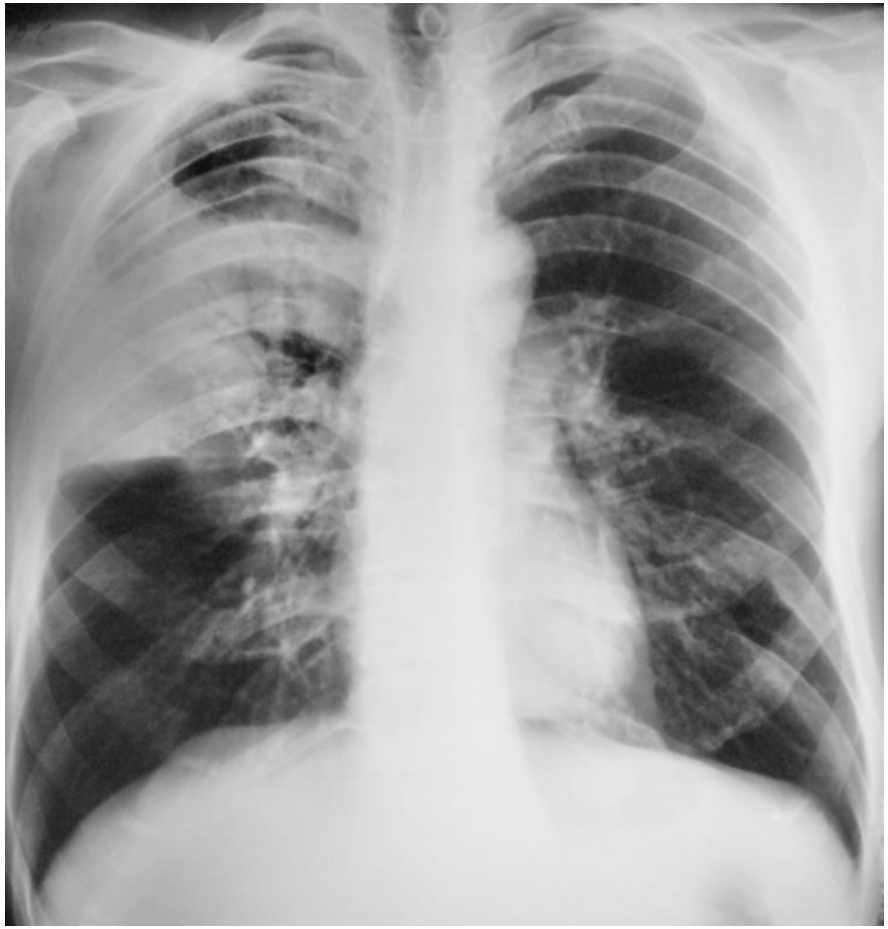
BASIC HEART SHAPE (SILHOUETTE) TYPES

1. Draw on the x-ray images the changes in the heart contours.
2. Write, what heart chambers are involved in the process?

Normal	Mitral	Aortic	Trapezoidal
			
			

1 — Left midclavicular line, 2 — Left ventricle

1



X-ray imaging	
Image quality	
Examination area	
X-ray projection	
Assessment of the chest shape, walls, diaphragm	
Chest shape	
Mediastinum position	
Position of the hemidiaphragm	
Costophrenic angles	
Lung fields and lung roots (hila) assessment	
Sizes of lung fields	
Density of lung fields	
Condition of lung roots (hila)	
Shadows characteristics	
Heart size and contours	

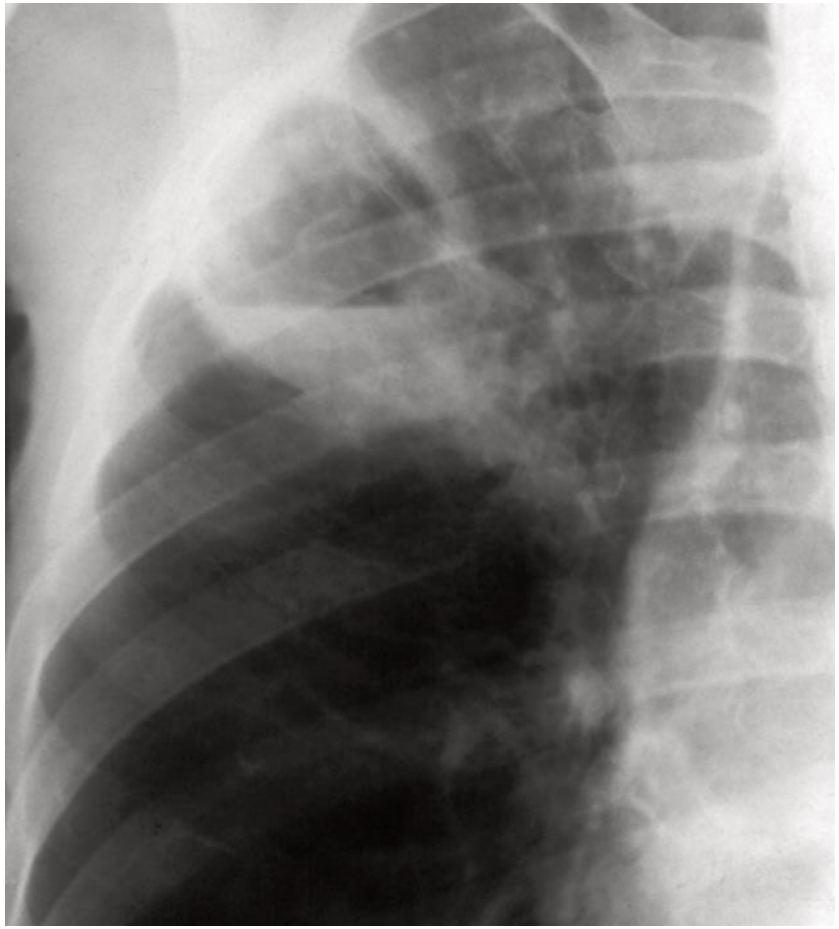
Clinical syndrome at presented X-ray image:

_____

Conclusion: _____

_____

2



X-ray imaging	
Image quality	
Examination area	
X-ray projection	
Assessment of the chest shape, walls, diaphragm	
Chest shape	
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Shadows characteristics	
Heart size and contours	

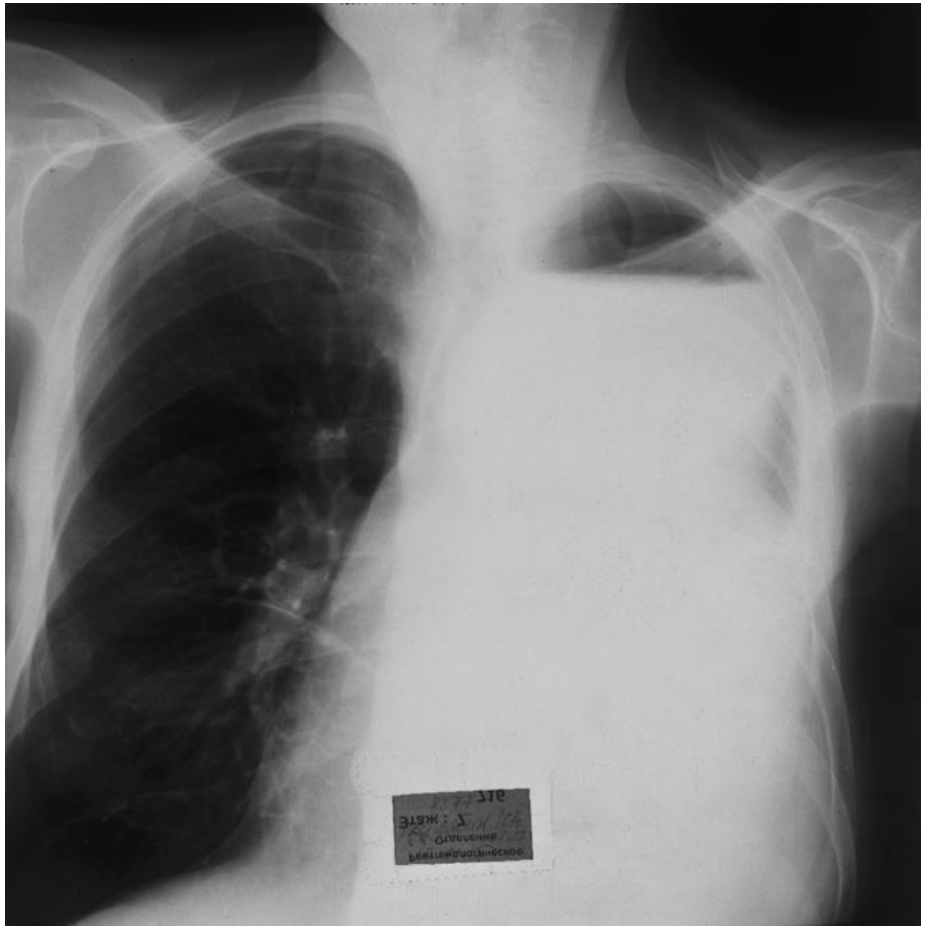
Clinical syndrome at presented X-ray image:

_____

Conclusion _____

_____

3



X-ray imaging	
Image quality	
Examination area	
X-ray projection	
Assessment of the chest shape, walls, diaphragm	
Chest shape	
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Density of lung fields	
Condition of lung roots (hila)	
Shadows characteristics	
Heart size and contours	

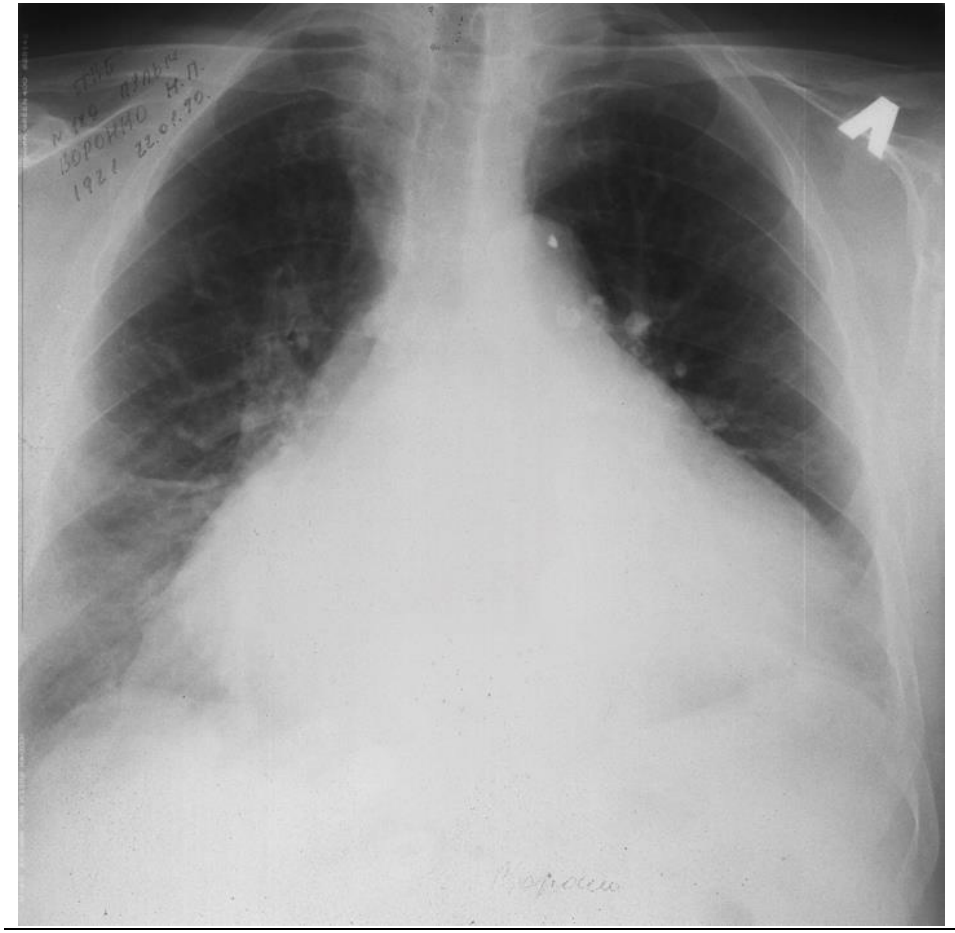
Clinical syndrome at presented X-ray image:

_____

Conclusion _____

_____

4



X-ray imaging	
Image quality	
Examination area	
X-ray projection	
Assessment of the chest shape, walls, diaphragm	
Chest shape	
Mediastinum position	
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Density of lung fields	
Condition of lung roots (hila)	
Shadows characteristics	
Heart size and contours	

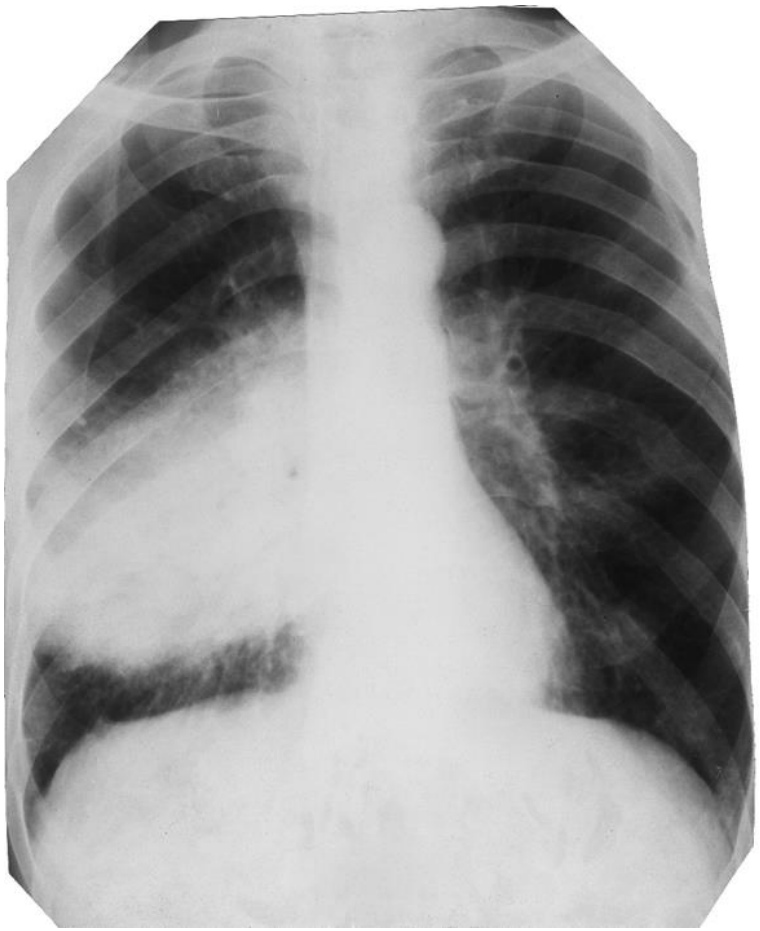
Clinical syndrome at presented X-ray image:

_____

Conclusion _____

_____

5



X-ray imaging	
Image quality	
Examination area	
X-ray projection	
Assessment of the chest shape, walls, diaphragm	
Chest shape	
Mediastinum position	
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Heart size and contours	

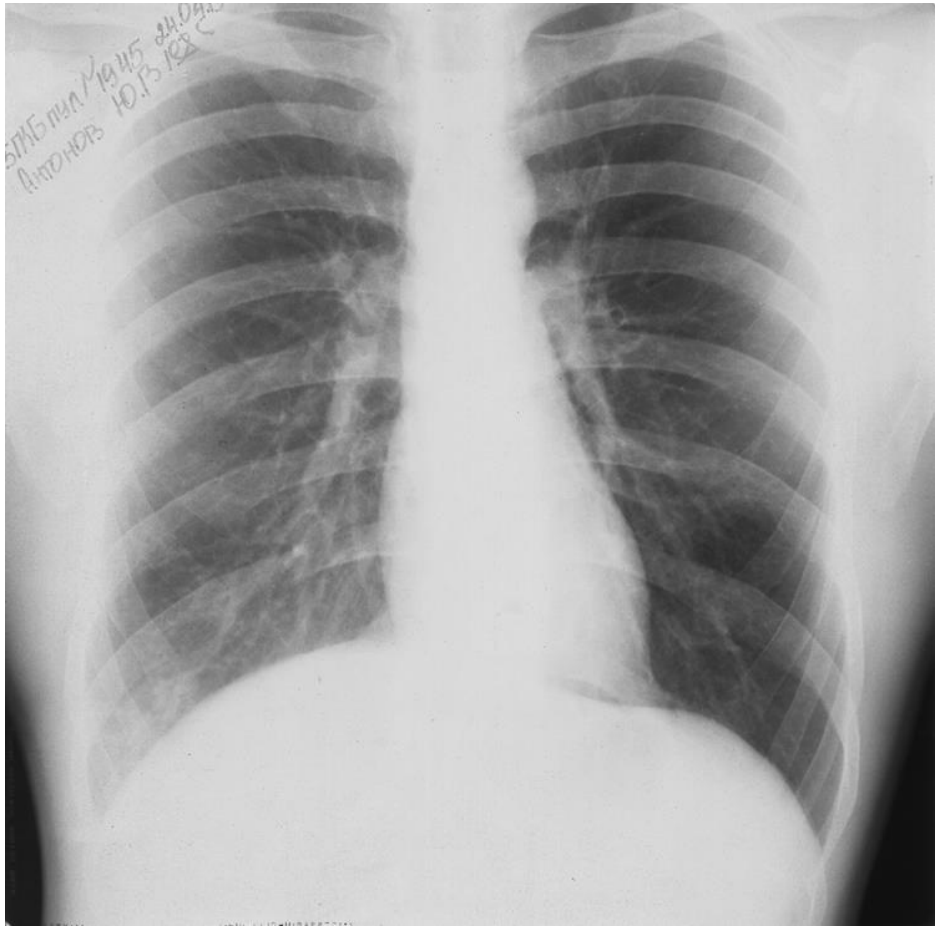
Clinical syndrome at presented X-ray image:

_____

Conclusion _____

_____

6



X-ray imaging	
Image quality	
Examination area	
X-ray projection	
Assessment of the chest shape, walls, diaphragm	
Chest shape	
Mediastinum position	
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Density of lung fields	
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Heart size and contours	

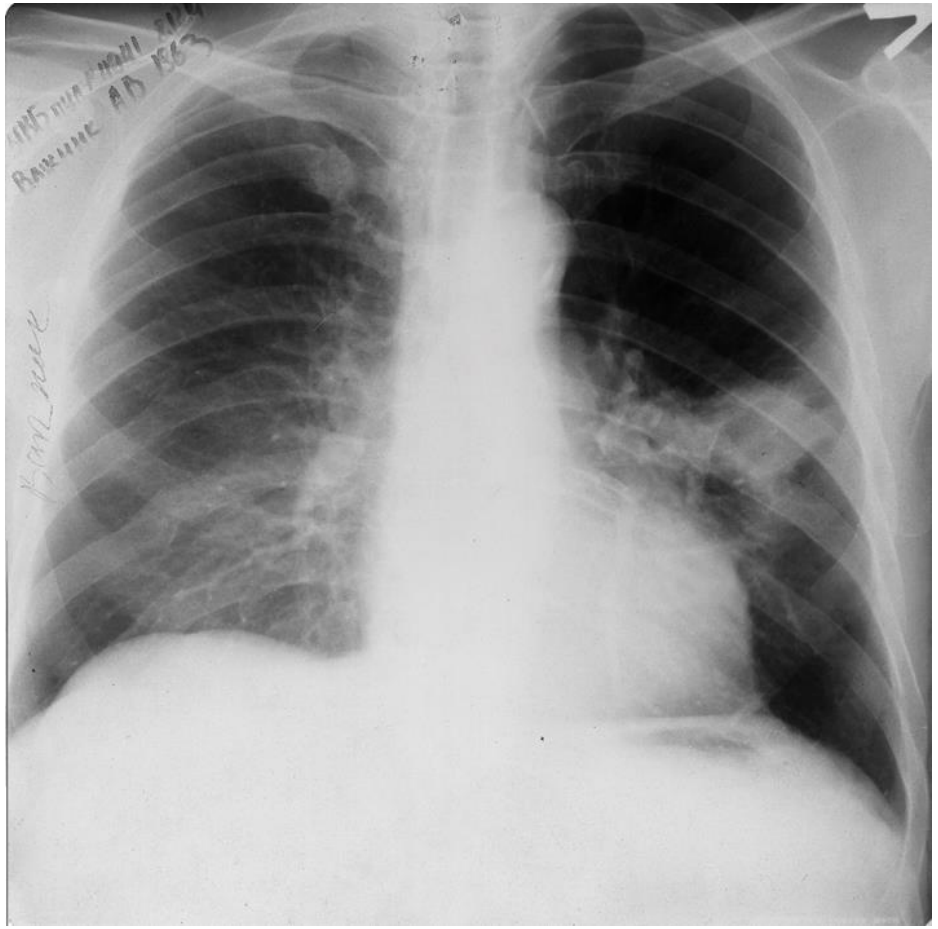
Clinical syndrome at presented X-ray image:

_____

Conclusion _____

_____

7



X-ray imaging	
Image quality	
Examination area	
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Assessment of the chest shape, walls, diaphragm	
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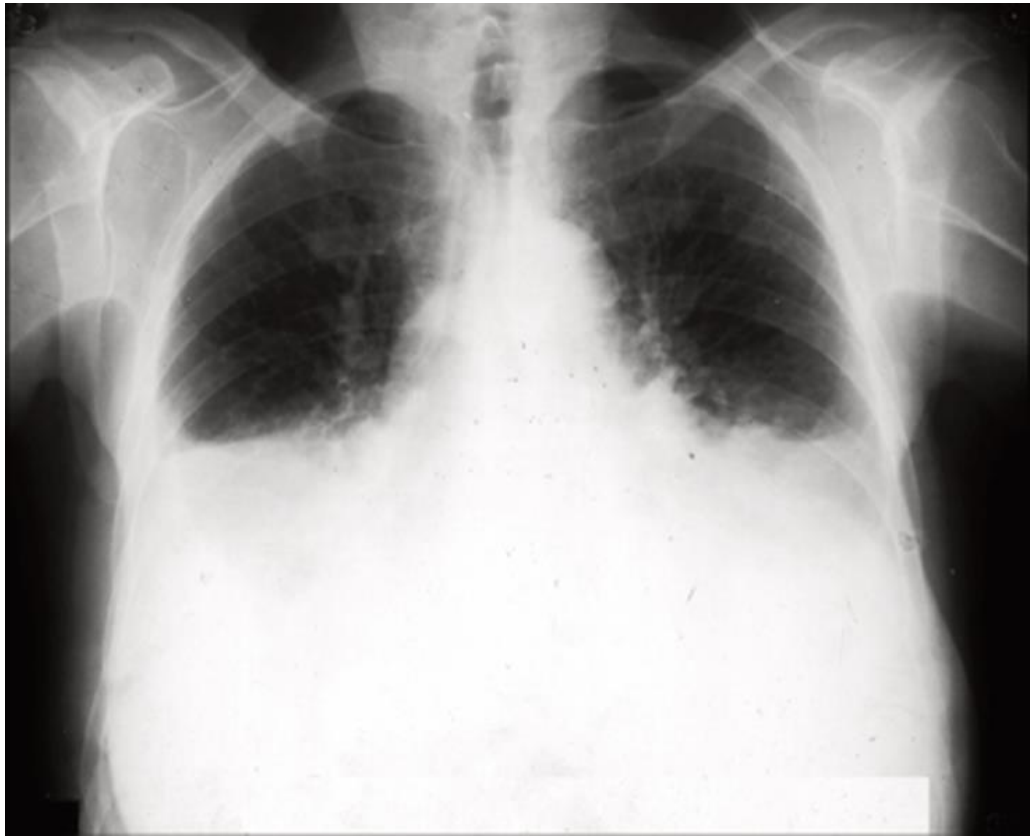
Clinical syndrome at presented X-ray image:

_____

Conclusion _____

_____

8



X-ray imaging	
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Assessment of the chest shape, walls, diaphragm	
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Heart size and contours	

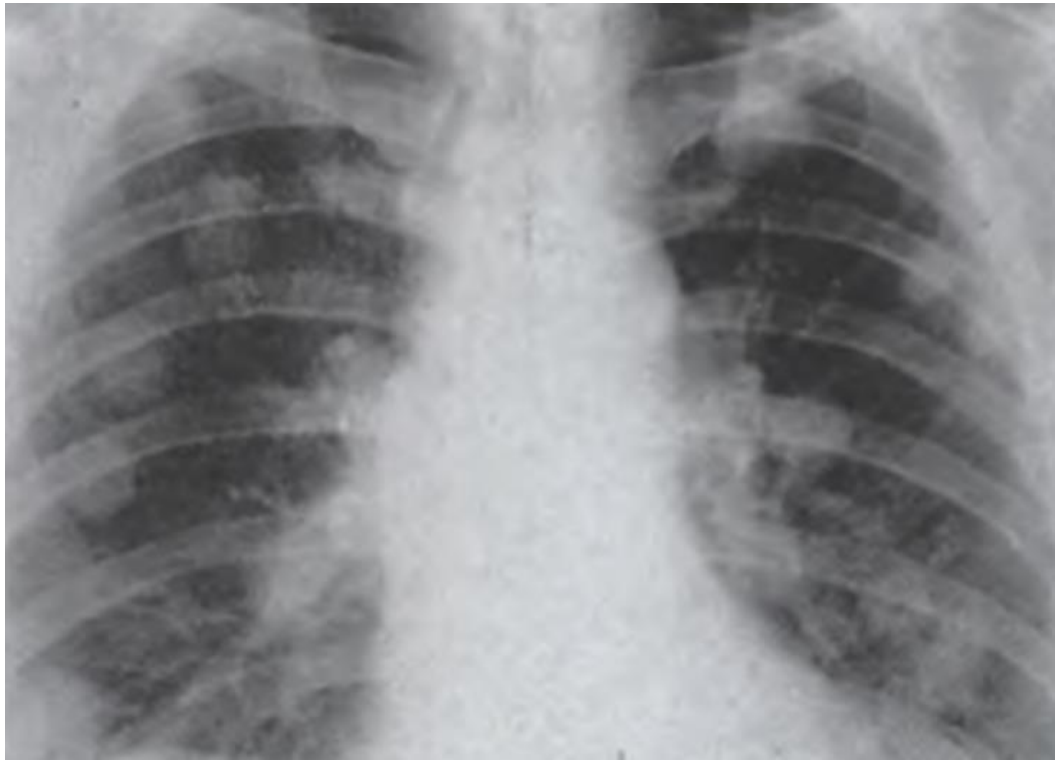
Clinical syndrome at presented X-ray image:

_____

Conclusion _____

_____

9



X-ray imaging	
Image quality	
Examination area	
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Assessment of the chest shape, walls, diaphragm	
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Heart size and contours	

Clinical syndrome at presented X-ray image:

_____

Conclusion _____

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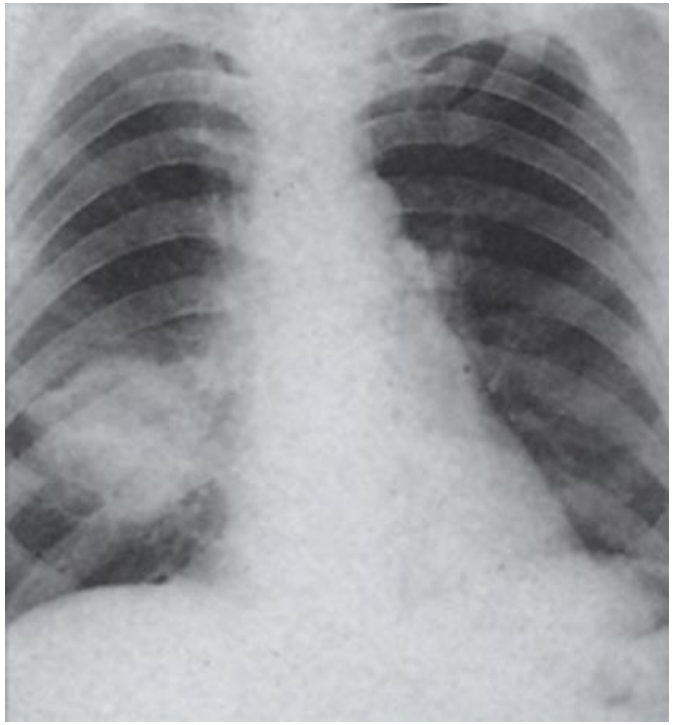
10



X-ray imaging	
Image quality	
Examination area	
X-ray projection	
Assessment of the chest shape, walls, diaphragm	
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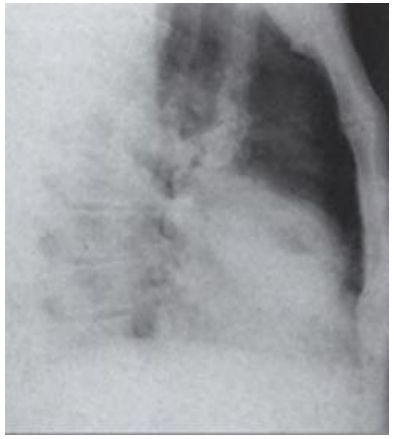


X-ray imaging

_____

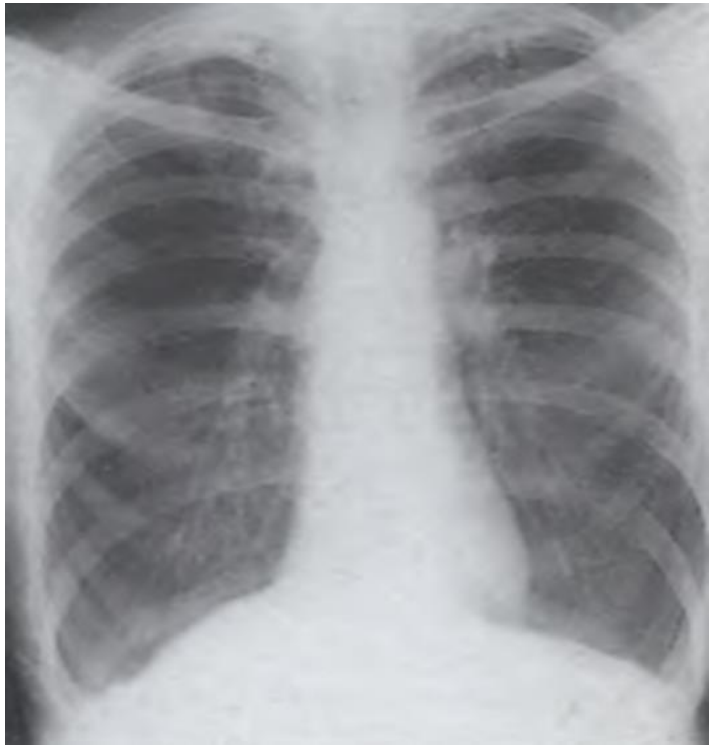
Clinical syndrome at presented X-ray image:

_____

Conclusion _____

_____

11



X-ray imaging

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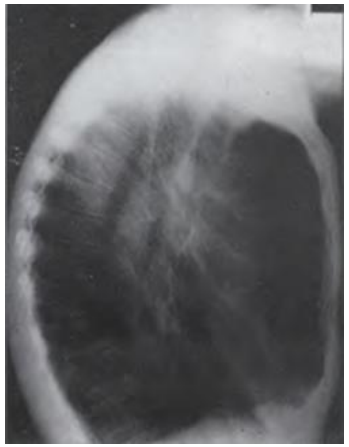

X-ray imaging	
Image quality	
Examination area	
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Assessment of the chest shape, walls, diaphragm	
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Condition of lung roots (hila)	
Shadows characteristics	
Heart size and contours	

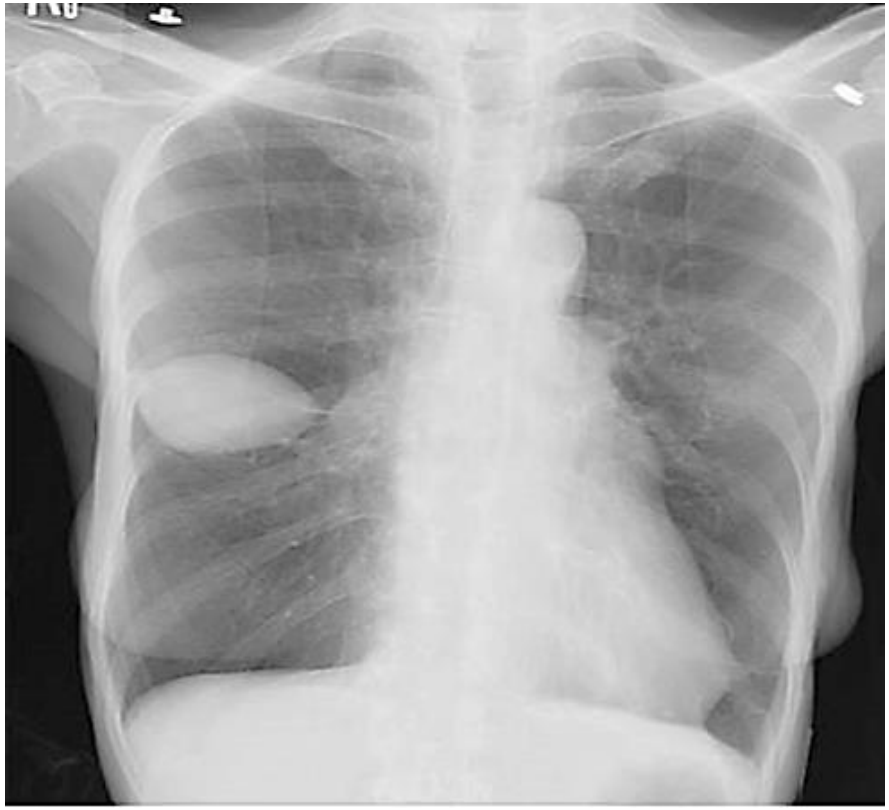
Clinical syndrome at presented X-ray image:

_____

Conclusion _____

_____

12



X-ray imaging	
Image quality	
Examination area	
X-ray projection	
Assessment of the chest shape, walls, diaphragm	
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Shadows characteristics	
Heart size and contours	

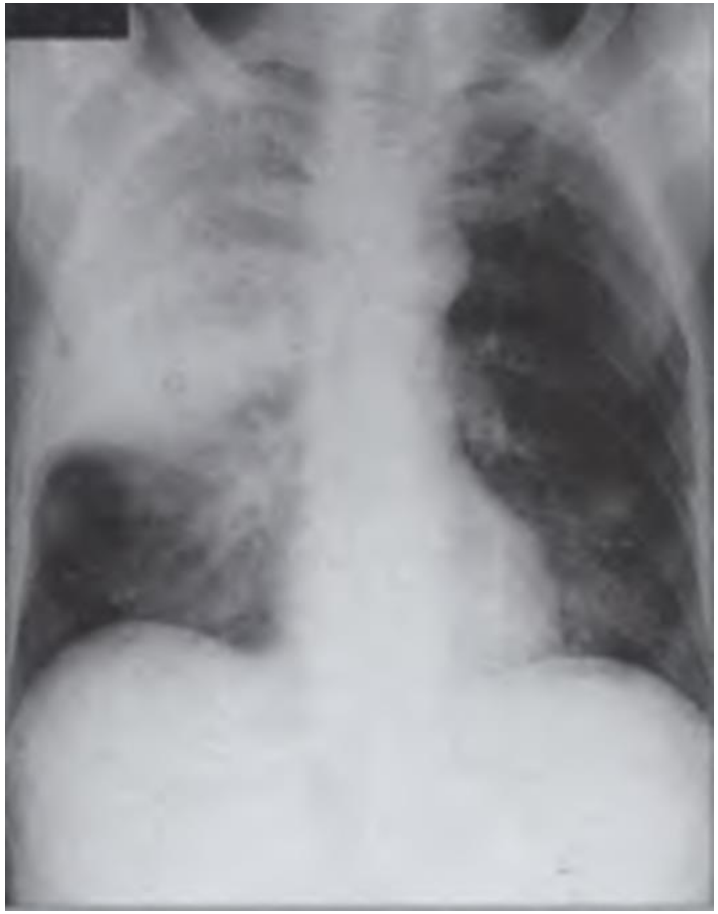
Clinical syndrome at presented X-ray image:

_____

Conclusion _____

_____

13



X-ray imaging	
Image quality	
Examination area	
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Assessment of the chest shape, walls, diaphragm	
Chest shape	
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Density of lung fields	
Condition of lung roots (hila)	
Shadows characteristics	
Heart size and contours	

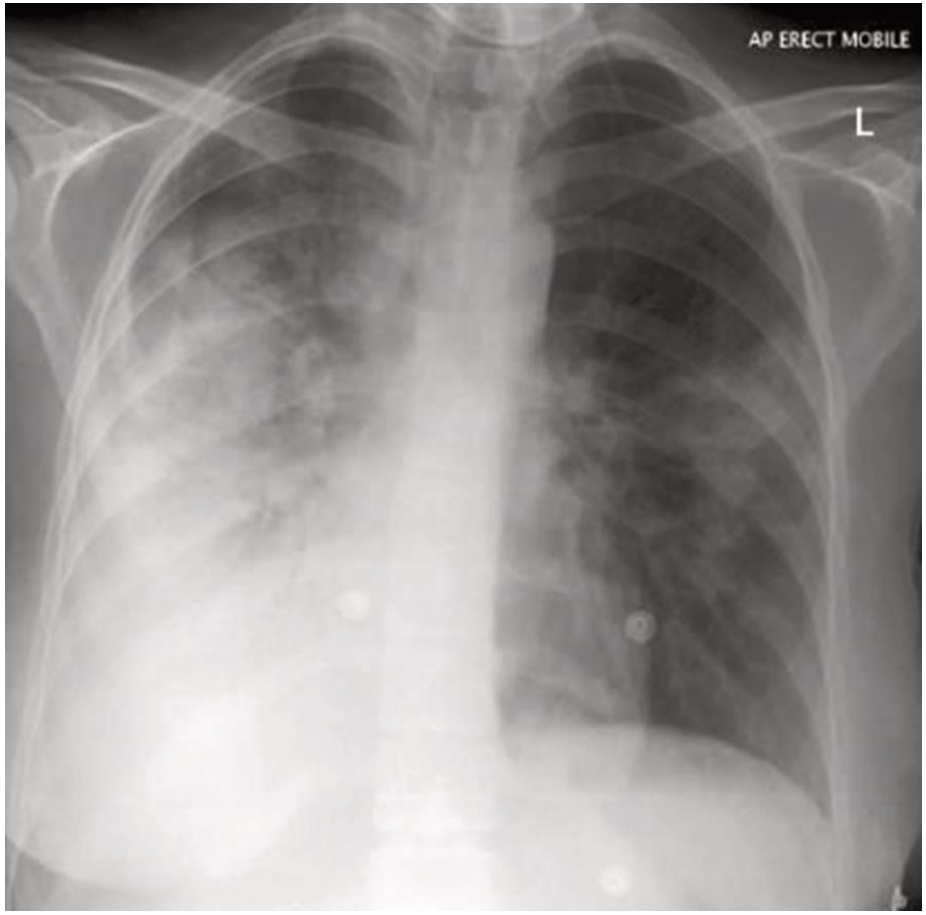
Clinical syndrome at presented X-ray image:

_____

Conclusion _____

_____

14



X-ray imaging	
Image quality	
Examination area	
X-ray projection	
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Condition of lung roots (hila)	
Shadows characteristics	
Heart size and contours	

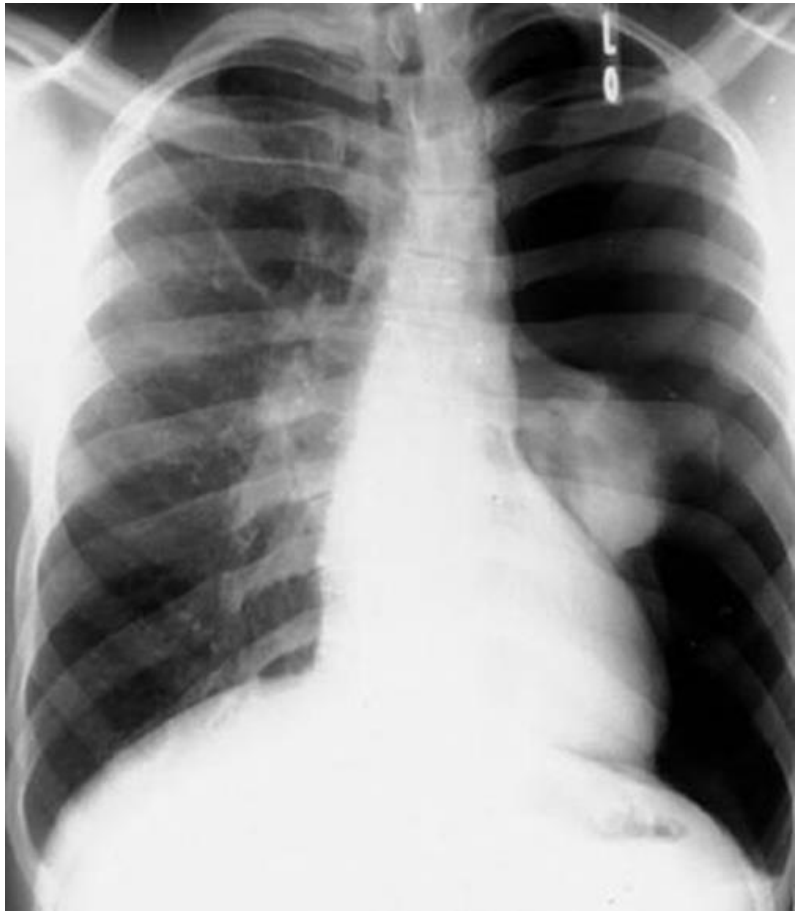
Clinical syndrome at presented X-ray image:

_____

Conclusion _____

_____

15



X-ray imaging	
Image quality	
Examination area	
X-ray projection	
Assessment of the chest shape, walls, diaphragm	
Chest shape	
Mediastinum position	
Position of the hemidiaphragm	
Costophrenic angles	
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Density of lung fields	
Condition of lung roots (hila)	
Shadows characteristics	
Heart size and contours	

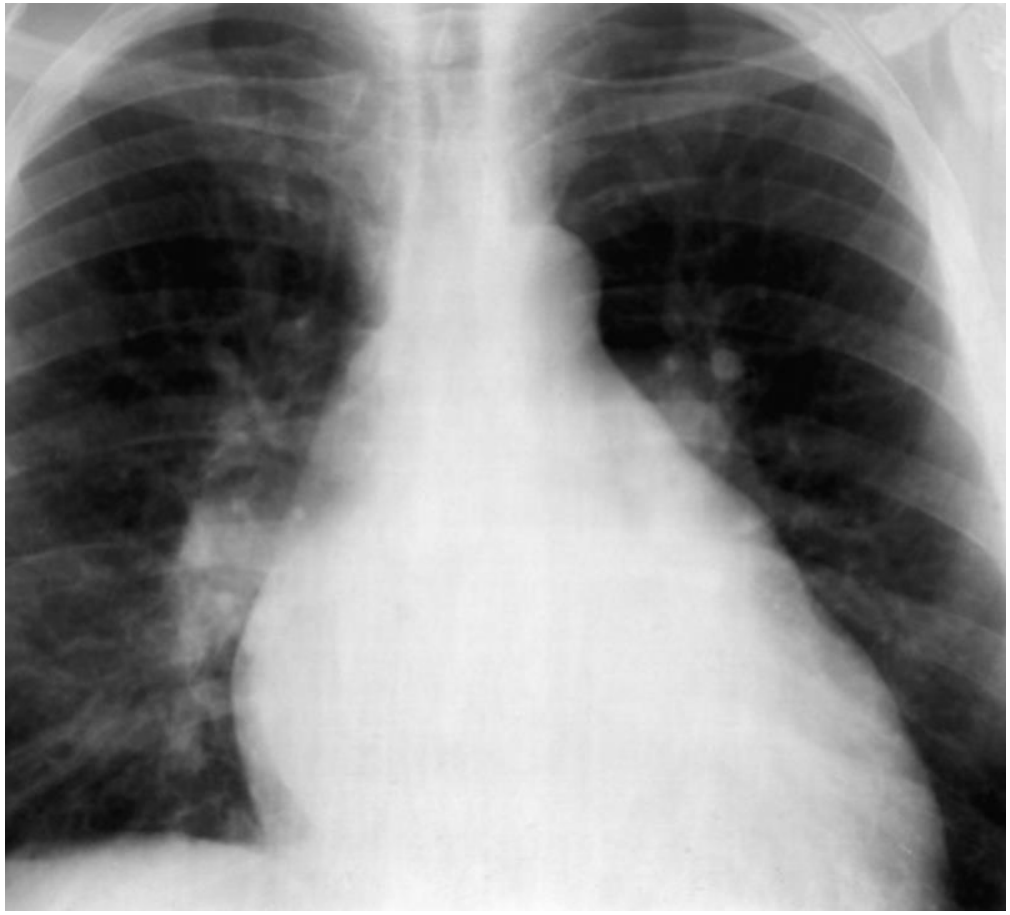
Clinical syndrome at presented X-ray image:

_____

Conclusion _____

_____

16



X-ray imaging	
Image quality	
Examination area	
X-ray projection	
Assessment of the chest shape, walls, diaphragm	
Chest shape	
Mediastinum position	
Position of the hemidiaphragm	
Costophrenic angles	
Lung fields and lung roots (hila) assessment	
Sizes of lung fields	
Density of lung fields	
Condition of lung roots (hila)	
Shadows characteristics	
Heart size and contours	

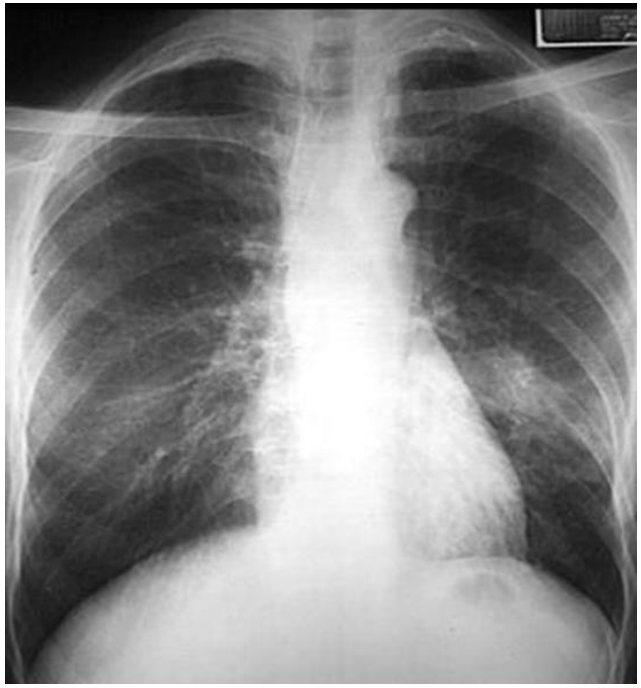
Clinical syndrome at presented X-ray image:

_____

Conclusion _____

_____

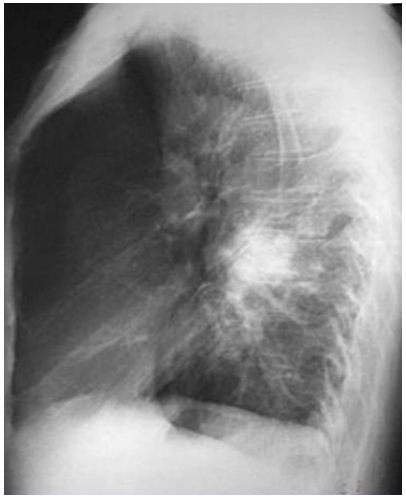
17



X-ray imaging	
Image quality	
Examination area	
X-ray projection	
Assessment of the chest shape, walls, diaphragm	
Chest shape	
Mediastinum position	
Position of the hemidiaphragm	
Costophrenic angles	
Lung and lung roots (hila) assessment	
Sizes of lung fields	
Density of lung fields	
Condition of lung roots (hila)	
Shadows characteristics	
Heart size and contours	

X-ray imaging

_____



Clinical syndrome at presented X-ray image:

_____

Conclusion _____

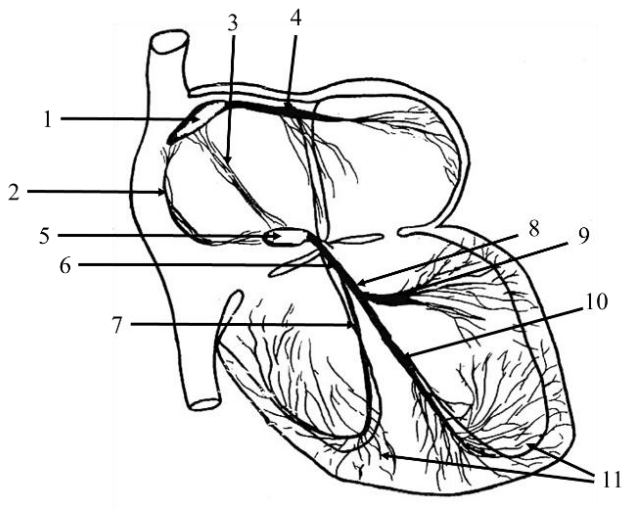
_____

CHAPTER 3. ELECTROCARDIOGRAPHY

THE CARDIAC CONDUCTION SYSTEM

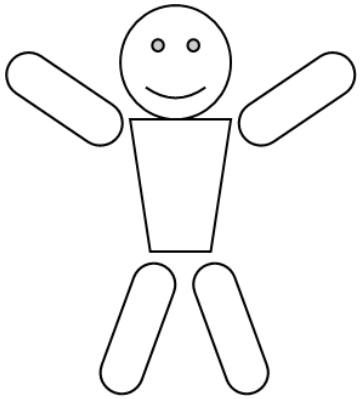
Write the elements of the cardiac conduction system:

1 –
2 –
3 –
4 –
5 –
6 –
7 –
8 –
9 –
10 –
11 –



ECG ELECTRODE PLACEMENT

1. Color the electrodes applied to the limbs.
2. Draw the standard leads by arrows.



Limb Leads (write)

I — between _____ and _____

II — between _____ and _____

III — between _____ and _____

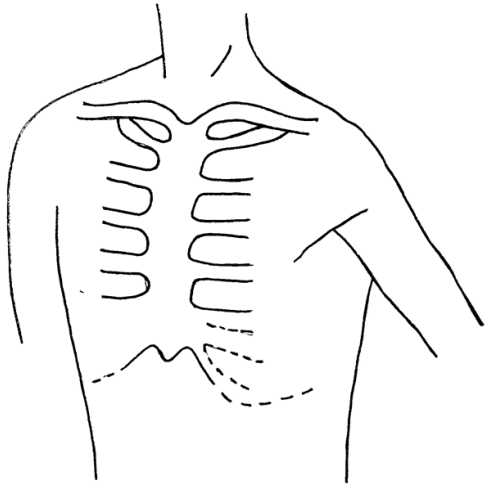
Augmented Limb Leads (write)

aVR — augmented lead from _____

aVL — augmented lead from _____

aVF — augmented lead from _____

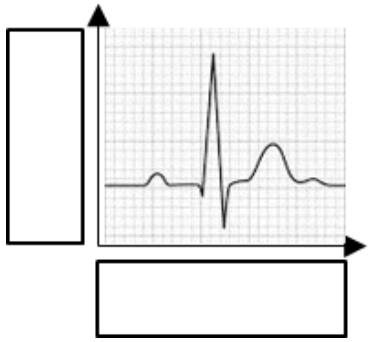
Draw the location of the chest electrodes



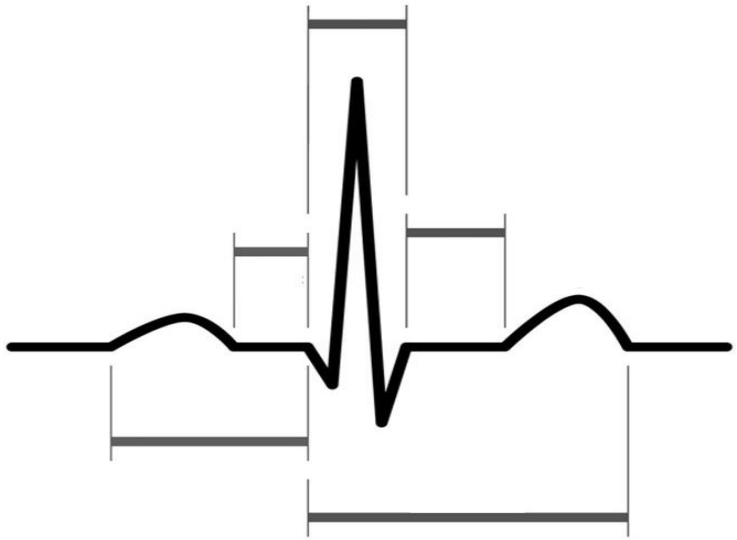
NORMAL ELECTROCARDIOGRAM

ECG elements		Duration, sec	Amplitude, mm
wave	P	0.08–0.1	0.05–2.5
wave	Q	0–0.03	$^1/_4$ R-wave at the same lead
wave	R	0.03–0.04	5–25
wave	S	0–0.03	0–6
wave	T	0.16–0.24	$^1/_2$–$^1/_3$ R-wave at the same lead
interval	P-Q	0.12–0.2	
interval	Q-T	0.35–0.42	
interval	R-R	0.75–1.0	
segment	S-T		Elevation or depression less than 1 mm from isoline
complex	QRS	0.06–0.1	

Indicate the amplitude and speed of the ECG recording



Indicate the elementss of a normal ECG

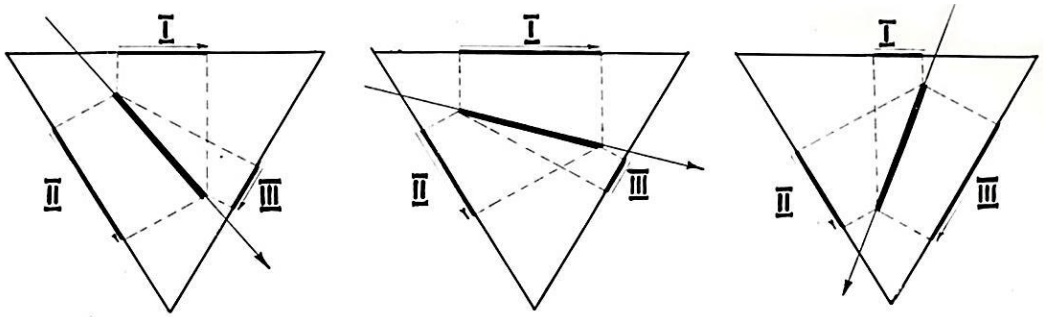


ECG ANALYSIS ALGORITHM

1. Rhythm	Sinus rhythm	• wave P precedes every QRS complex, P is positive in standard lead II, the same in shape and direction in the same lead; • RR intervals are equal, regularно If the difference between RR intervals is more than 10 %, arrhythmia presents
	Heart rate	Heart rate = 60 / RR (sec), 60–90 beats per minute — normocardia, less than 60 — bradycardia, more than 90 — tachycardia
2. Voltage	Amplitude of waves RI + RII + RIII < 15 mm — low voltage	
3. Position of the electrical axis of the heart	RII > RI > RIII — normal position of the electrical heart axis RI > RII > RIII — left axis deviation RIII > RII > RI — right axis deviation	
4. Analysis of waves and intervals in standard lead II	Wave P: normal duration does not exceed 0.1 sec, amplitude — less than 2.5 mm. Interval PQ: 0.02 sec x … mm = … (0.12–0.20 sec). Wave Q — normally does not exceed 0.03 sec in duration, amplitude — ¼ R wave (in III — not more than ½ R). Transition zone (R = S) in V3 (or between V3 and V4). The amplitude of the R and T waves is maximum in V4. Interval QRS: 0.02 sec x … mm = … (normally 0.06–0.1 sec); QRS > 0.1 sec, but less than < 0.12 sec — incomplete bundle brunch block; QRS ≥ 0.12 sec — complete bundle brunch block. Segment ST: the position in relation to the isoline (on the isoline, higher by … mm, lower by … mm). Normally, segment ST is on the isoline. Wave T: positive, negative, isoelectric — in what leads. Interval QT: 0.02 sec x … mm = … (less than 0.44 sec). Interval QT by Bazett formula = K x √ RR, with K (male) = 0.37 K (female) = 40	

0. Conclusion: *For example: Sinus rhythm, regular, with a heart rate of 66 per minute (normocardia), normal voltage, normal position of the electrical axis of the heart.*

THE ELECTRICAL AXIS OF THE HEART



ECG SIGNS OF NORMAL SINUS RHYTHM

- The heart rate is between 60 and 90.
- Each QRS complex is preceded by a normal P wave.
- The RR intervals and PR intervals remain constant.
- The P waves are visible, positive at lead II and have the same shape and direction in the same lead.

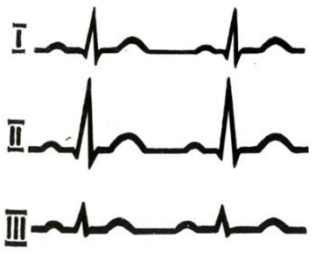
Quick Heart Rate count:

at a speed of 50 mm/s **Heart rate** $= \frac{600}{LB}$

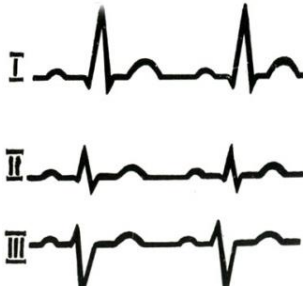
at a speed of 25 mm/s **Heart rate** $= \frac{300}{LB}$

LB — the number of large boxes (5 mm each) in the RR interval

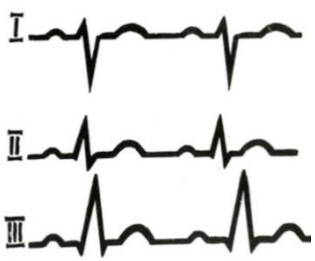
Normal axis



Left axis deviation

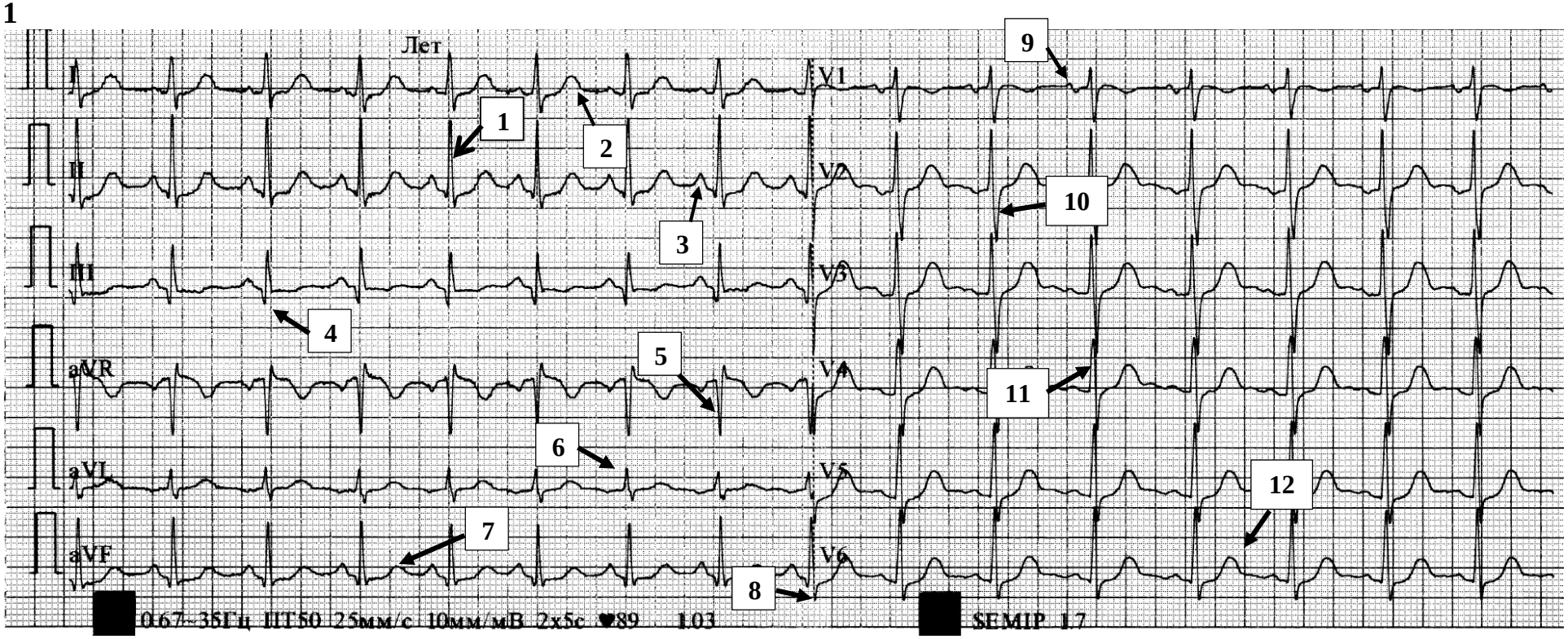


Right axis deviation



ECG signs of Sinus Tachycardia (write)	**ECG signs of Sinus Bradycardia** (write)
• Heart rate is • Rhythm	• Heart rate is • Rhythm

1



Paper speed:

50 mm/sec 1 mm = 0.02 sec

25 mm/sec 1 mm = 0.04 sec

Rhythm (sinus or not)

Heart rate: interval RR

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

HR = 60 / RR interval (sec) =

Name the marked waves:

1 –

2 –

3 –

4 –

5 –

6 –

7 –

8 –

9 –

10 –

11 –

12 –

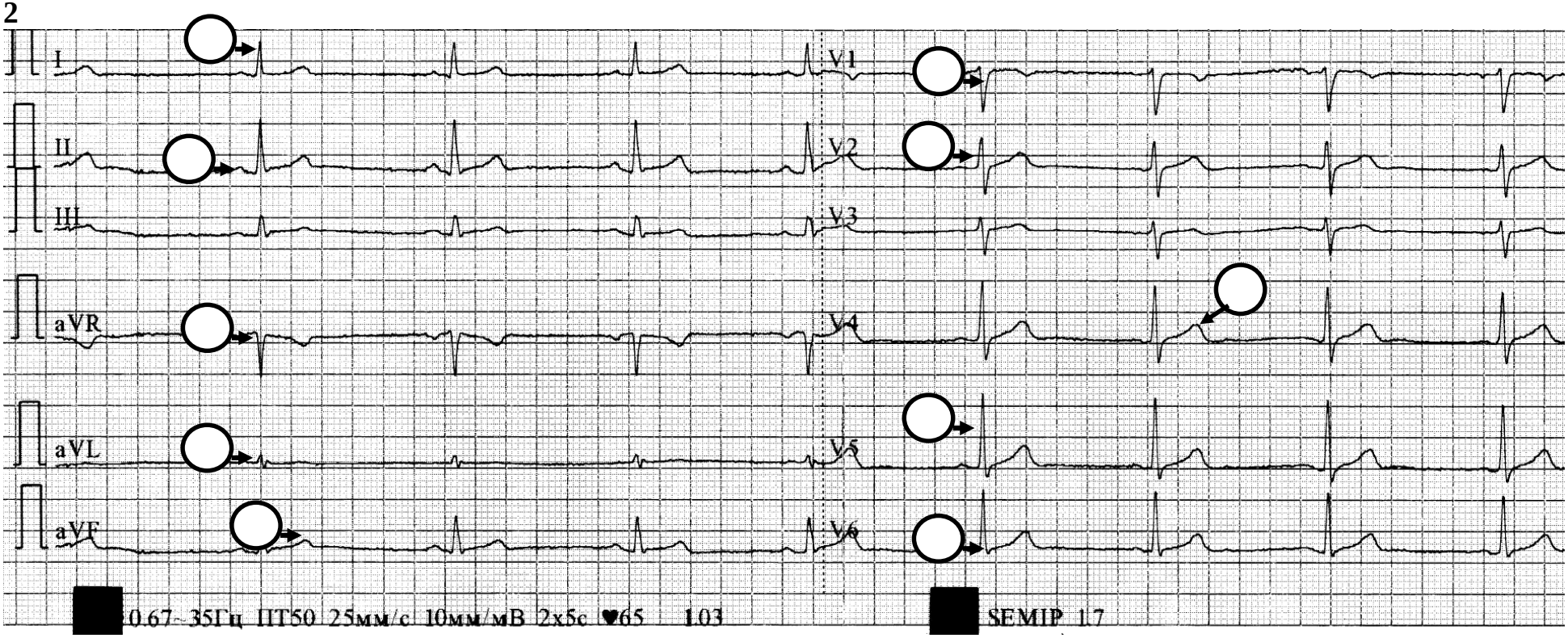
Position of the electrical axis of the heart
(underline the correct answer)

normal position

left axis deviation

right axis deviation

2



Paper speed:
50 mm/sec 1 mm = 0.02 sec
25 mm/sec 1 mm = 0.04 sec

Rhythm (sinus or not)

Heart rate: interval RR
0.02 (or 0.04) sec × mm = sec
0.02 (or 0.04) sec × mm = sec
0.02 (or 0.04) sec × mm = sec

HR = 60 / RR interval (sec) =

Name the marked waves:

I – **V1 –**
II – **V2 –**
III – **V4 –**
aVL – **V5 –**
aVF – **V6 –**

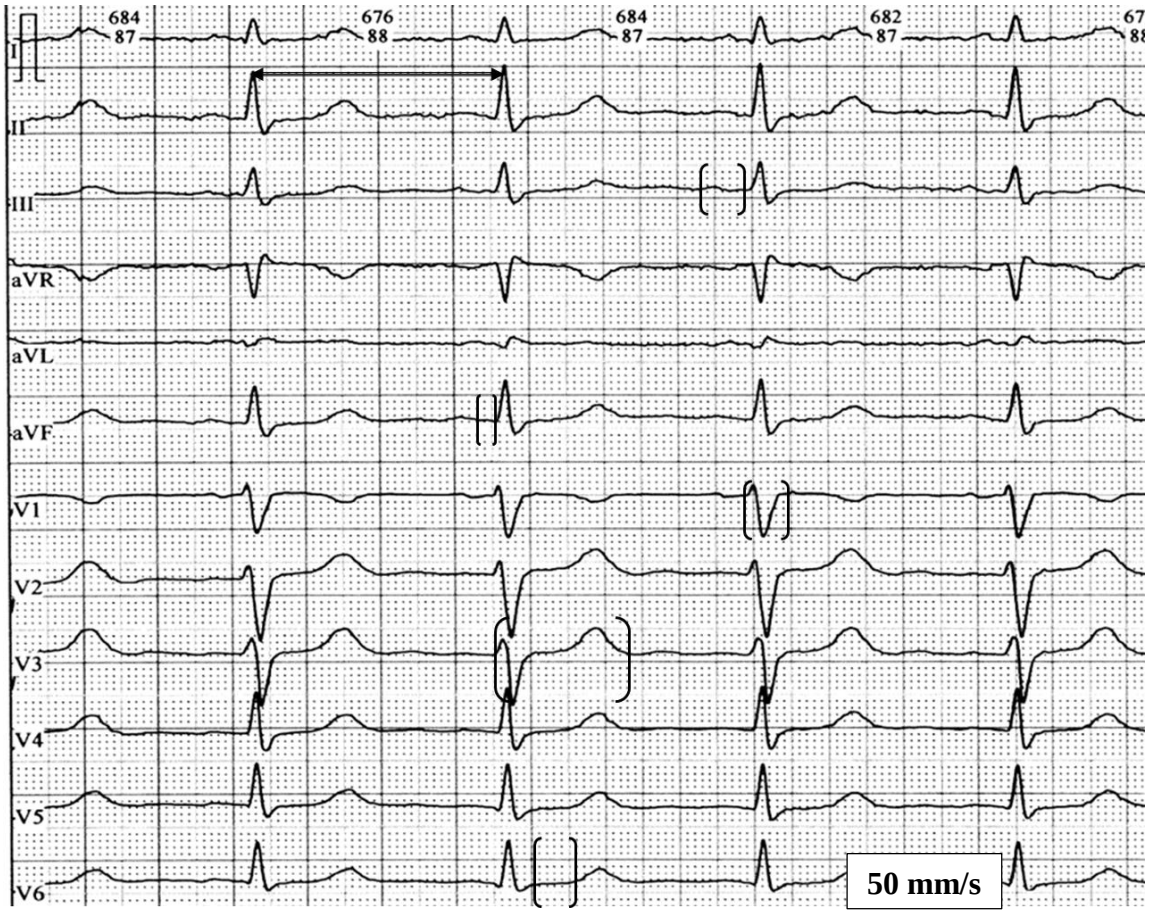
Position of the electrical axis of the heart
(underline the correct answer)

normal position
left axis deviation
right axis deviation

Write the ECG elements and appropriate components of the electrical sequence of the heart

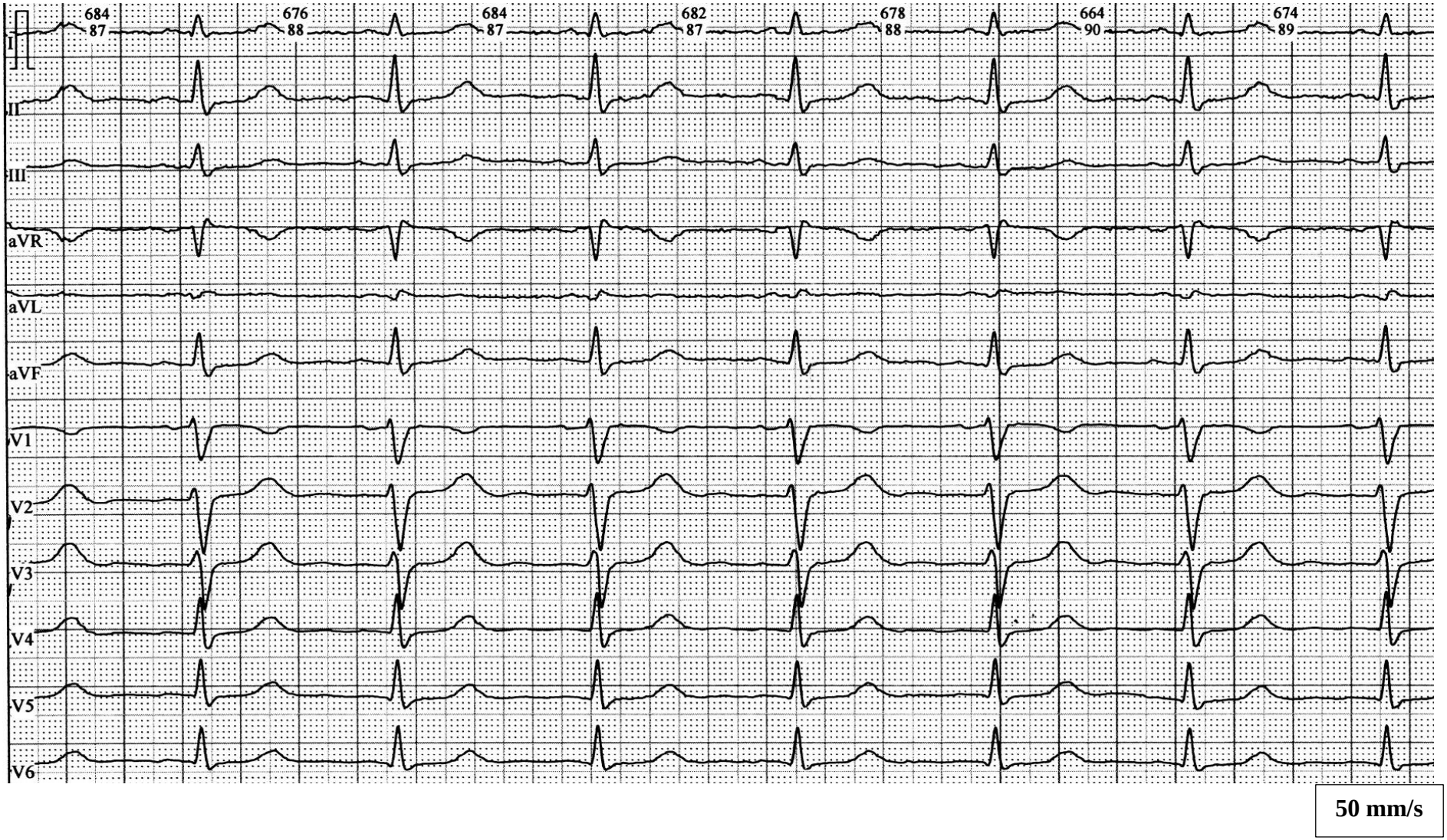
P		RR	
PQ	Segment Interval	QT	
QRS		ST	
T		TP	

Write the segments and intervals (in brackets) and compare their duration with normal values



Lead	Segments or intervals	Duration, sec
II		
III		
aVF		
V1		
V3		
V6		

3


684
87
676
88
684
87
682
87
678
88
664
90
674
89
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
50 mm/s

3

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

Normal sinus rhythm: normal heart rate is between 60 and 90.
Each QRS complex is preceded by a normal P wave.
The RR intervals and PR intervals remains constant, the P waves are visible, positive at II lead and have the same morphology in each lead.

RR (the same).
The difference between RR intervals is more than 0.16 sec — arrhythmia

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec)

II. Voltage

RI + RII + RIII < 15 mm — low voltage

III. Axis

normal position
left axis deviation
right axis deviation

QT interval corresponds to _____ ventricles
What does Bazett formula calculate? _____

V. Conclusion

IV. Analysis of waves and intervals

P wave — duration < 0.1 sec amplitude < 2.5 mm

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

0.11–0.12 sec — incomplete bundle branch block
> 0.12 sec — complete bundle branch block

PQ — 0.02 (or 0.04) sec × mm = (0.12–0.20 sec)

QT — 0.02 (or 0.04) sec × mm = (less 0.44 sec)

QT by Bazett formula $K \times \sqrt{RR/sec}$

Kmale = 0.37

Kfemale = 0.40

T wave — positive in leads _____

flat in leads _____

negative in leads _____

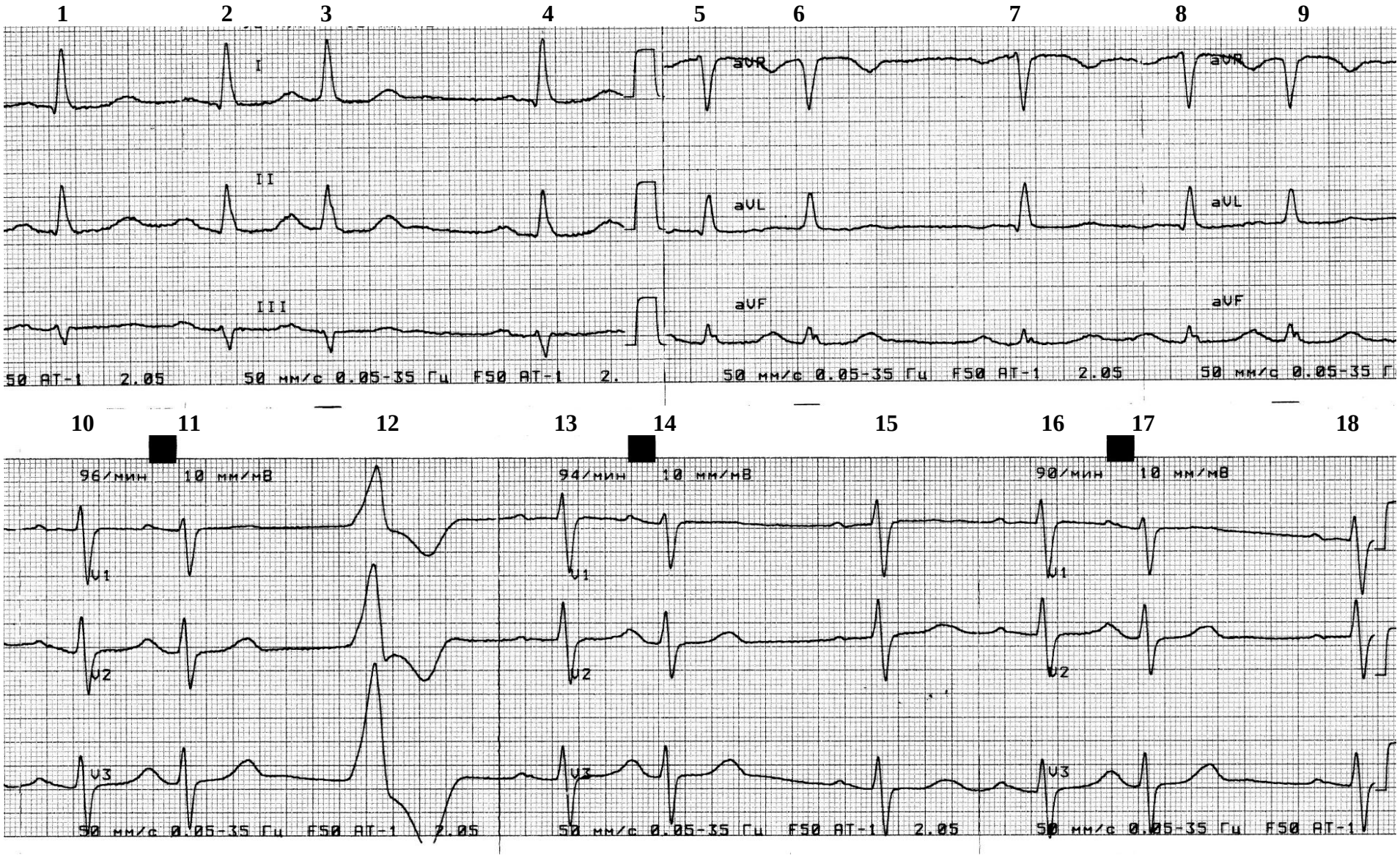
segment ST is characterized the position in relation to the isoline
(on the isoline, higher by … mm, lower by … mm)

I	aVR	V1	V4
II	aVL	V2	V5
III	aVF	V3	V6

Q wave should be less than $^1/_4$ R wave in the same lead, duration < 0.03 sec.

Transition zone (R = S) in V3 (or between V3 and V4)
R increases from V1 to V4, then decreases

4


1 2 3 4 5 6 7 8 9
I
II
III
aVR
aVL
aVF
50 мм/с 0.05-35 Гц F50 AT-1 2.05
10 11 12 13 14 15 16 17 18
96/мин 10 мм/мВ
94/мин 10 мм/мВ
90/мин 10 мм/мВ
V1
V2
V3

4

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

Normal sinus rhythm:

Each QRS complex is preceded by a normal P wave.
The RR intervals and PR intervals remains constant, the P waves are visible, positive at II lead and have the same morphology in each lead.
RR (the same).
The difference between RR intervals is more than 0.16 sec — arrhythmia.

RR (minimum and maximum)

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60/R-R interval (sec) (minimum and maximum)

II. Voltage

RI + RII + RIII < 15 mm — low voltage

III. Axis

normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

P wave — duration < 0.1 sec amplitude < 2.5 mm

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

0.11–0.12 sec — incomplete bundle branch block
> 0.12 sec — complete bundle branch block

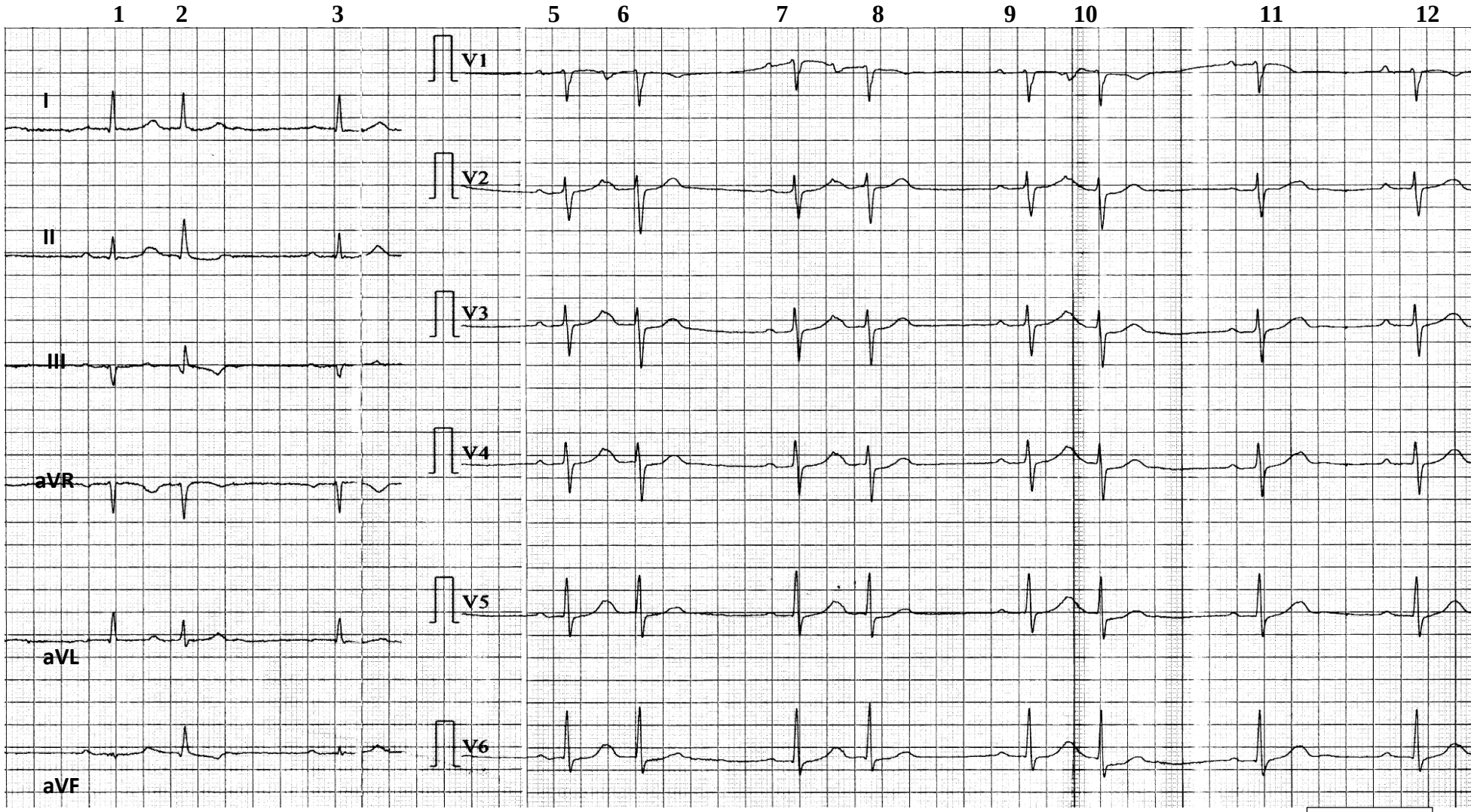
PQ — 0.02 (or 0.04) sec × mm = (0.12–0.20 sec)

QT — 0.02 (or 0.04) sec × mm = (till 0.44 sec)

Name the impulse source for each QRS complex

1 –
2 –
3 –
4 –
5 –
6 –
7 –
8 –
9 –
10 –
11 –
12 –
13 –
14 –
15 –
16 –
17 –
18 -

5



5

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

Normal sinus rhythm:

Each QRS complex is preceded by a normal P wave.
The RR intervals and PR intervals remains constant.
P waves are visible, positive at II lead.

RR (minimum and maximum)

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec) (minimum and maximum)

II. Voltage

RI + RII + RIII < 15 mm — low voltage

III. Axis

normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

P wave — duration < 0.1 sec amplitude < 2.5 mm

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

PQ — 0.02 (or 0.04) sec × mm = (0.12–0.20 sec)

QT — 0.02 (or 0.04) sec × mm = (till 0.44 sec)

Name the impulse source for each QRS complex:

1 – 7 –

2 – 8 –

3 – 9 –

4 – 10 –

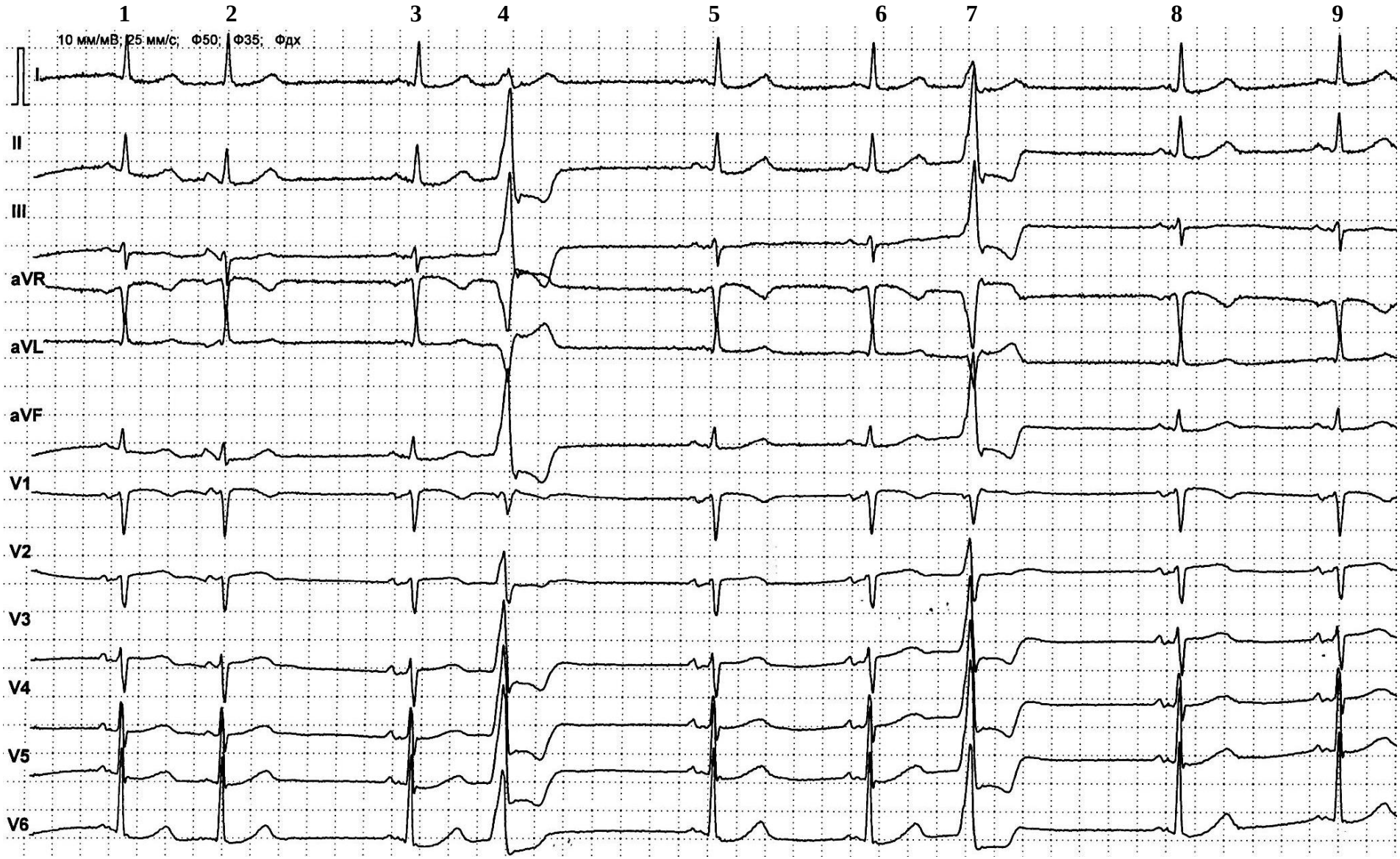
5 – 11 –

6 – 12 –

What is the arrhythmia type when after each sinus contraction a premature contraction follows?

_____

6


1
2
3
4
5
6
7
8
9
10 мм/мВ; 25 мм/с; Ф50; Ф35; Фдх
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6

6

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

Normal sinus rhythm:

Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR (minimum and maximum)

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec) (minimum and maximum)

II. Voltage

RI + RII + RIII < 15 mm — low voltage

III. Axis

normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

P wave — duration < 0.1 sec, amplitude < 2.5 mm

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

Measure all QRS complexes in lead II:

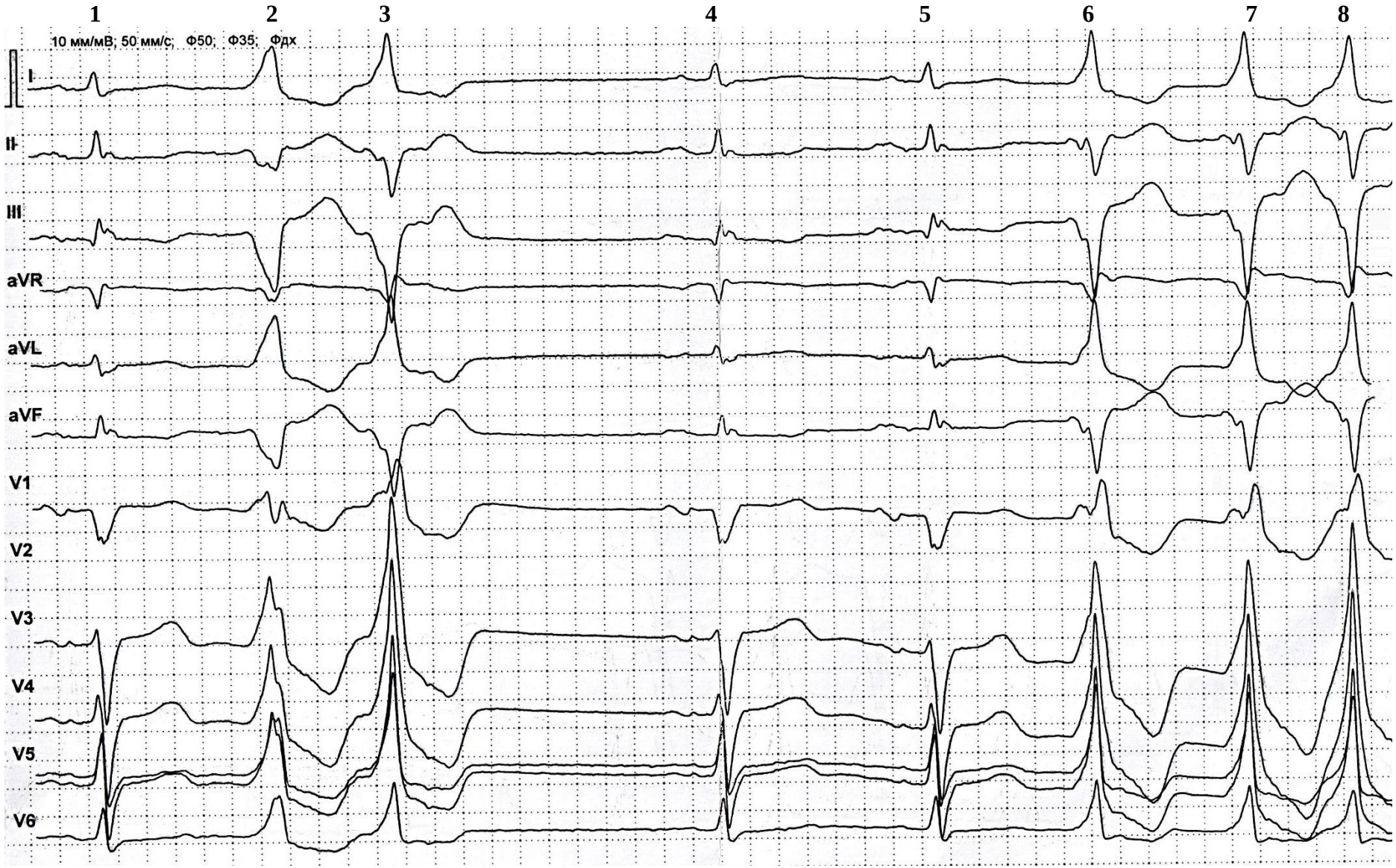
1) QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)
2) QRS =
3) QRS =
4) QRS =
5) QRS =
6) QRS =
7) QRS =
8) QRS =
9) QRS =

Name the impulse source for each QRS complex:

1 –
2 –
3 –
4 –
5 –
6 –
7 –
8 –
9 –

- Sign all P waves in lead V2
- Indicate a compensatory pause in lead III

7


1
2
3
4
5
6
7
8
10 мм/мВ; 50 мм/с; Ф50; Ф35; Фдх
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6

7

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

Normal sinus rhythm:

Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR (minimum and maximum)

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60/R-R interval (sec) (minimum and maximum)

II. Voltage

RI + RII + RIII < 15 mm — low voltage

III. Axis

normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

P wave — duration < 0.1 sec, amplitude < 2.5 mm

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

Measure all QRS complexes in lead II:

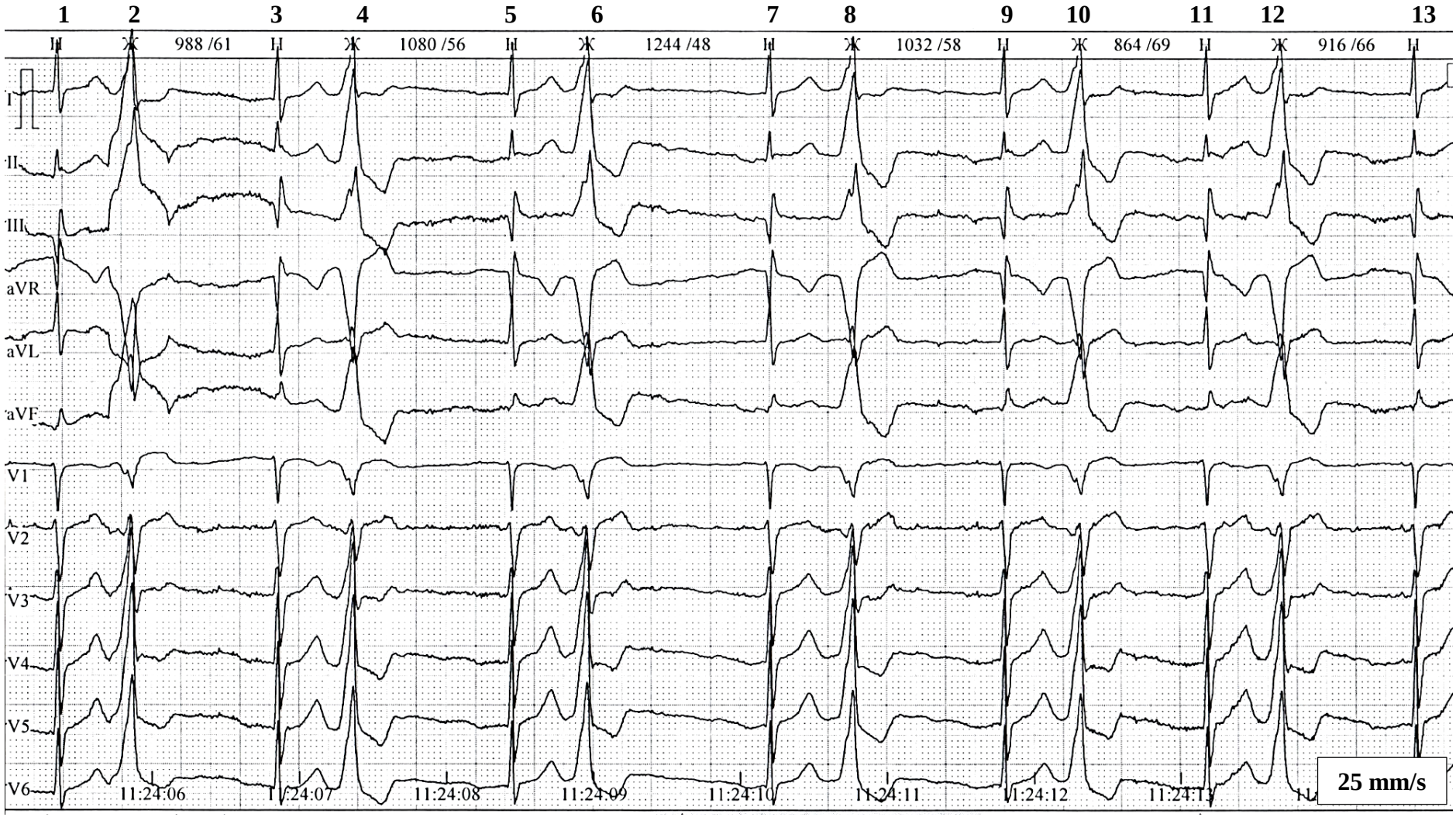
1) QRS — 0.02 (or 0.04) sec × mm =
2) QRS =
3) QRS =
4) QRS =
5) QRS =
6) QRS =
7) QRS =
8) QRS =
9) QRS =

Name the impulse source for each QRS complex:

1 – 5 –
2 – 6 –
3 – 7 –
4 – 8 –

- Assess the shape and duration of the P wave in lead V1
- What part of the heart does produce pathological impulses in this ECG?

8


1
2
3
4
5
6
7
8
9
10
11
12
13
988 /61
1080 /56
1244 /48
1032 /58
864 /69
916 /66
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
11:24:06
11:24:07
11:24:08
11:24:09
11:24:10
11:24:11
11:24:12
25 mm/s

8

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

Normal sinus rhythm:
Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR (minimum and maximum)

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60/R-R interval (sec) (minimum and maximum)

II. Voltage
Sufficient or low

III. Axis
normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals
P wave — duration < 0.1 sec, amplitude < 2.5 mm

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

Measure all QRS complexes in lead II

1) QRS — 0.02 (or 0.04) sec × mm =
2) QRS =
3) QRS =
4) QRS =
5) QRS =
6) QRS =
7) QRS =
8) QRS =
9) QRS =
10) QRS =
11) QRS =
12) QRS =
13) QRS =

Write the impulse source for each QRS complex

1 –
2 –
3 –
4 –
5 –
6 –
7 –
8 –
9 –
10 –
11 –
12 –
13 –

ECG SIGNS OF PREMATURE CONTRACTION (EXTRASYSTOLE)

Write the signs.

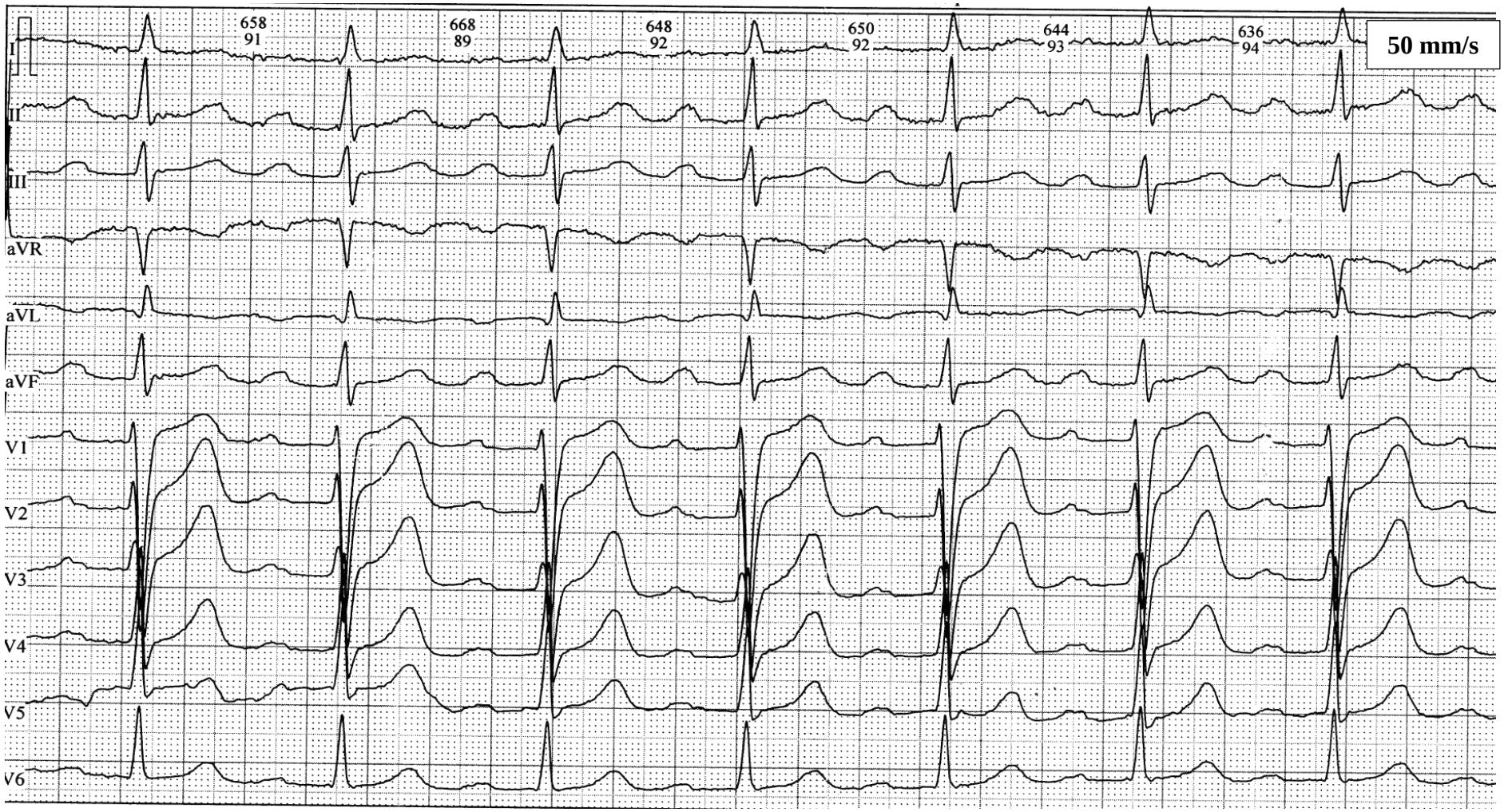
Give a definition Extrasystole is	**Types of extrasystoles by origin:** **1 –** **2 –** **3 –**	**General ECG signs of extrasystole:** **A –** **B –** **C –**
Write ECG signs of extrasystole of various origins:		
1 – ECG signs of extrasystole	2 – ECG signs of extrasystole	3 – ECG signs of extrasystole

ECG SIGNS OF ATRIOVENTRICULAR BLOCK

Write the signs

AV block I degree	AV block II degree			AV block III degree (complete AV block)
	Mobitz type I	Mobitz type II	Mobitz type III (High-grade AV block)	

9


658
91
668
89
648
92
650
92
644
93
636
94
50 mm/s
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6

9

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

Normal sinus rhythm:

Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR (minimum and maximum)

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec) (minimum and maximum)

II. Voltage (underline)

Sufficient or low

III. Axis

normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

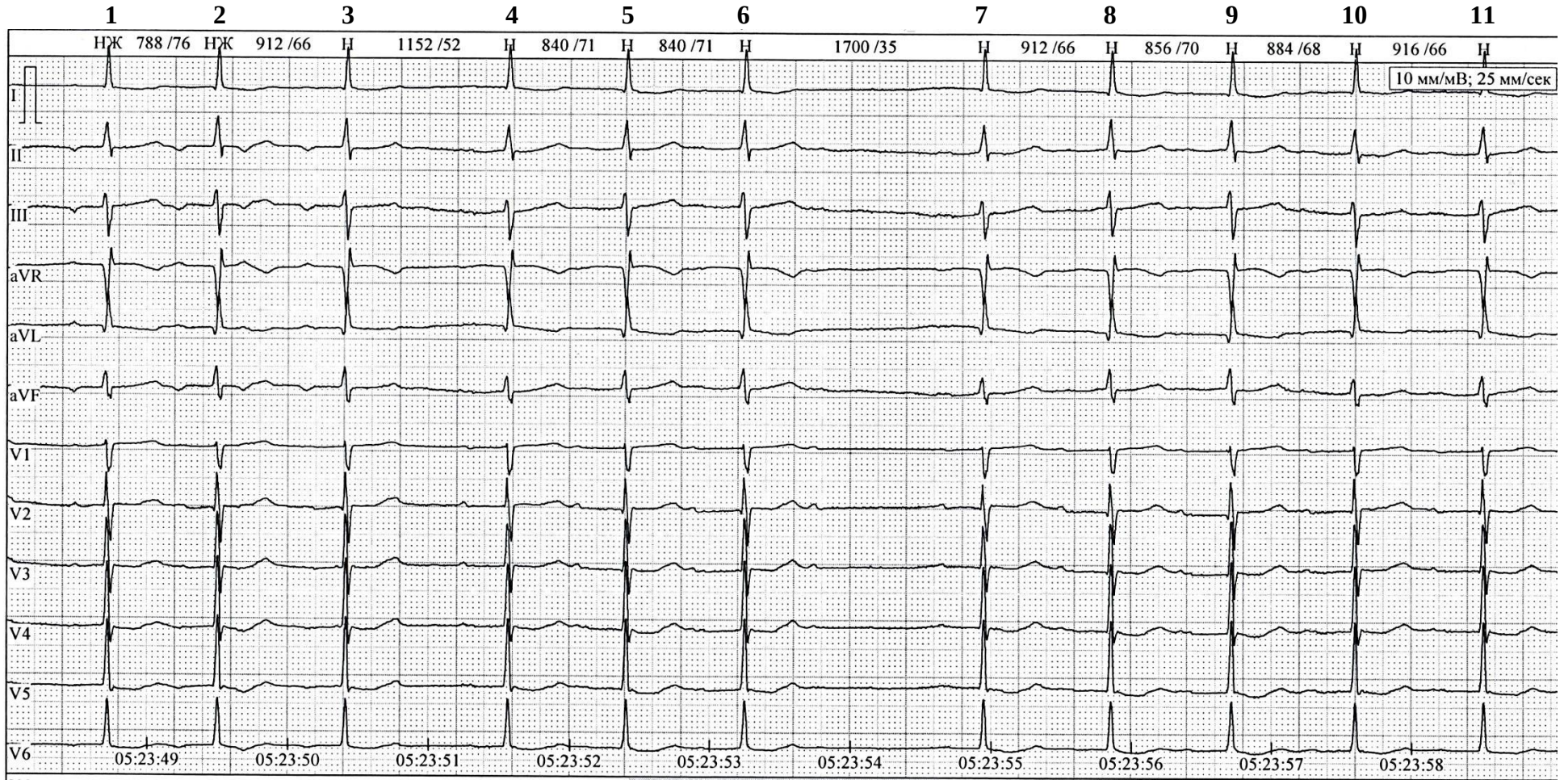
P — duration < 0.1, amplitude < 2.5 mm

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

PQ — 0.02 (or 0.04) sec × mm = (0.12–0.20 sec)

- **Mark all PQ segments in lead II**
- **Mark all PQ intervals in lead III**
- **Assess the duration of the PQ intervals**

10


1
2
3
4
5
6
7
8
9
10
11
НЖ 788 /76
НЖ 912 /66
Н 1152 /52
Н 840 /71
Н 840 /71
Н 1700 /35
Н 912 /66
Н 856 /70
Н 884 /68
Н 916 /66
Н
10 мм/мВ; 25 мм/сек
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
05:23:49
05:23:50
05:23:51
05:23:52
05:23:53
05:23:54
05:23:55
05:23:56
05:23:57
05:23:58

10

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

Normal sinus rhythm:

Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR (minimum and maximum)

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60/R-R interval (sec) (minimum and maximum)

II. Voltage (underline)

Sufficient or low

III. Axis

normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

P — duration < 0.1, amplitude < 2.5 mm

QRS — 0.02 (or 0.04) sec × mm = (till 0.1 sec)

PQ — 0.02 (or 0.04) sec × mm = (0.12–0.20 sec)

Mark each P wave in lead V2

Determine the duration of the PQ interval in QRS complexes # 4, 5, 6 and 7

4 –

5 –

6 –

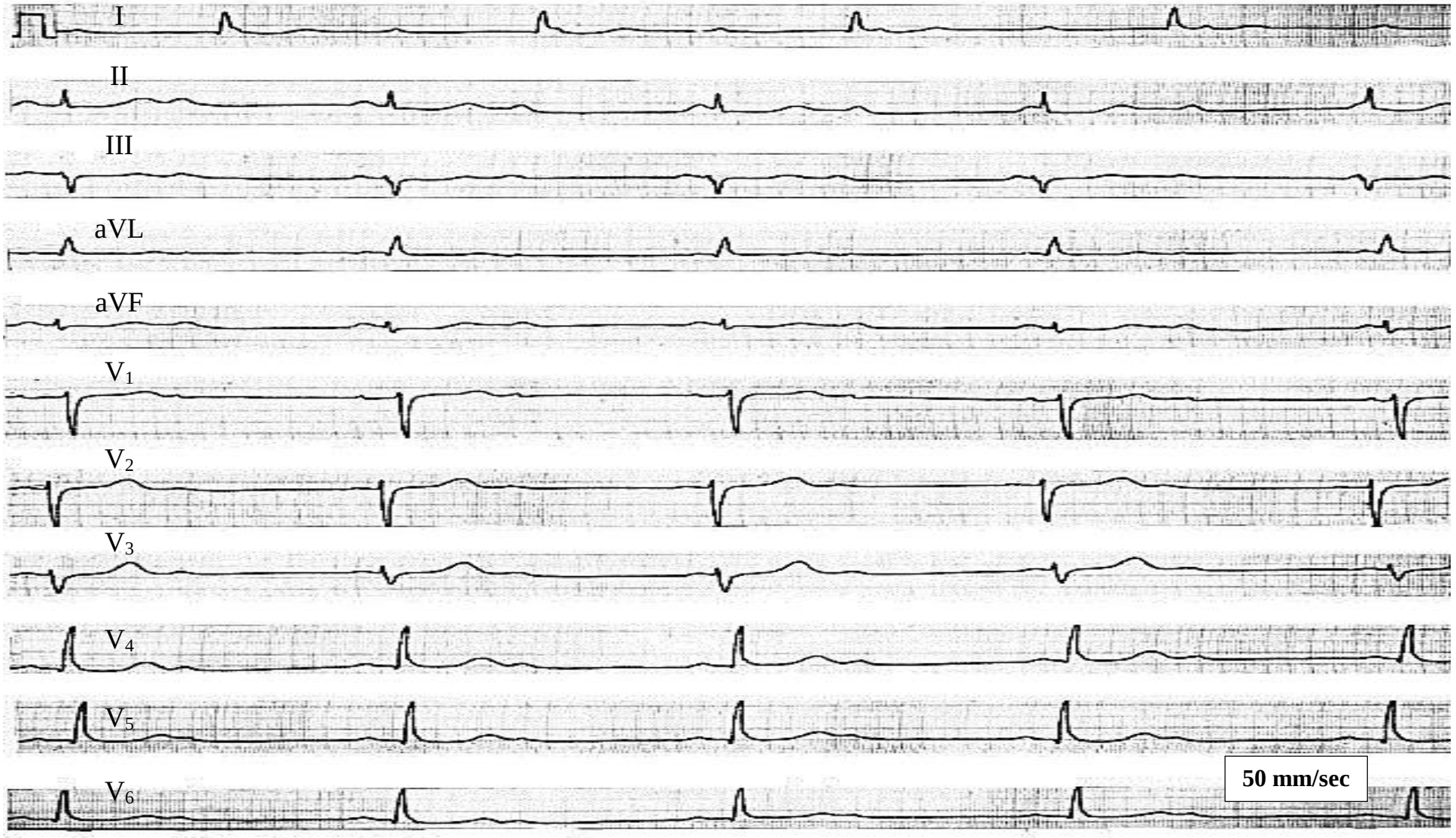
7 –

How to call the disappearance of the QRS complex after the P wave

(write) _____

11

ECG recorded sequentially, on a single-channel device



11

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)
Normal sinus rhythm:
Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR (minimum and maximum)

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec) (minimum and maximum)

II. Voltage (underline)
Sufficient or low

III. Axis
normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

P duration _____ sec

P amplitude _____ mm

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

Mark each P wave in leads II, V2, V3 and V4

Calculate the duration of the PP intervals

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Atrial contraction rate = 60 / PP interval (sec)

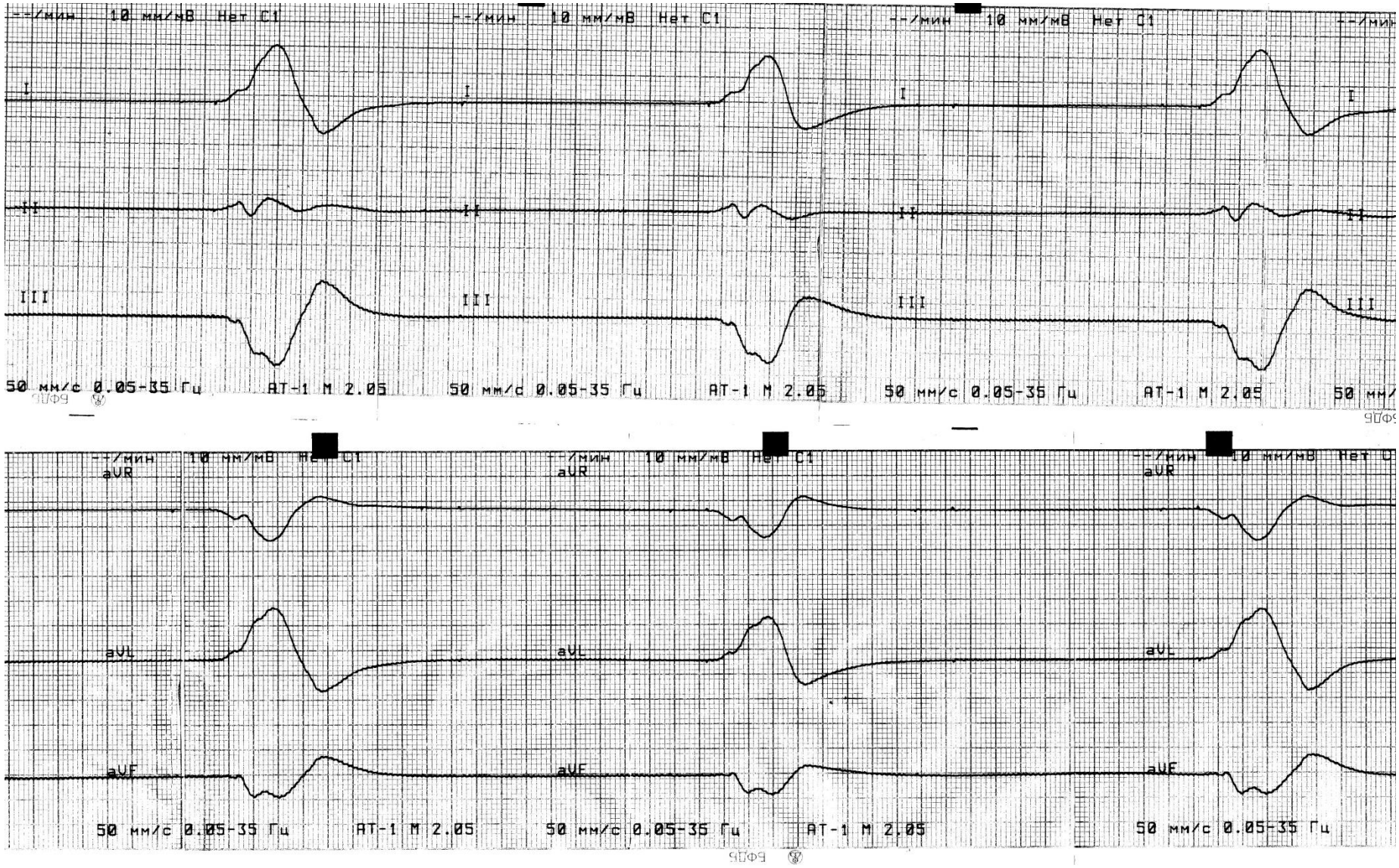
What is the normal rate of impulses comming from the sinus node? (write) _____

What is the normal rate of impulses comming from the atrio-ventricular node? (write) _____

What is the normal rate of impulses comming from the His bundle? (write) _____

What is the normal rate of impulses comming from Purkinje fibers? (write) _____

12



12

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)
Normal sinus rhythm:
Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR (minimum and maximum)

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec) (minimum and maximum)

II. Voltage (underline)
Sufficient or low

III. Axis
normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

P duration _____ sec

P amplitude _____ mm

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

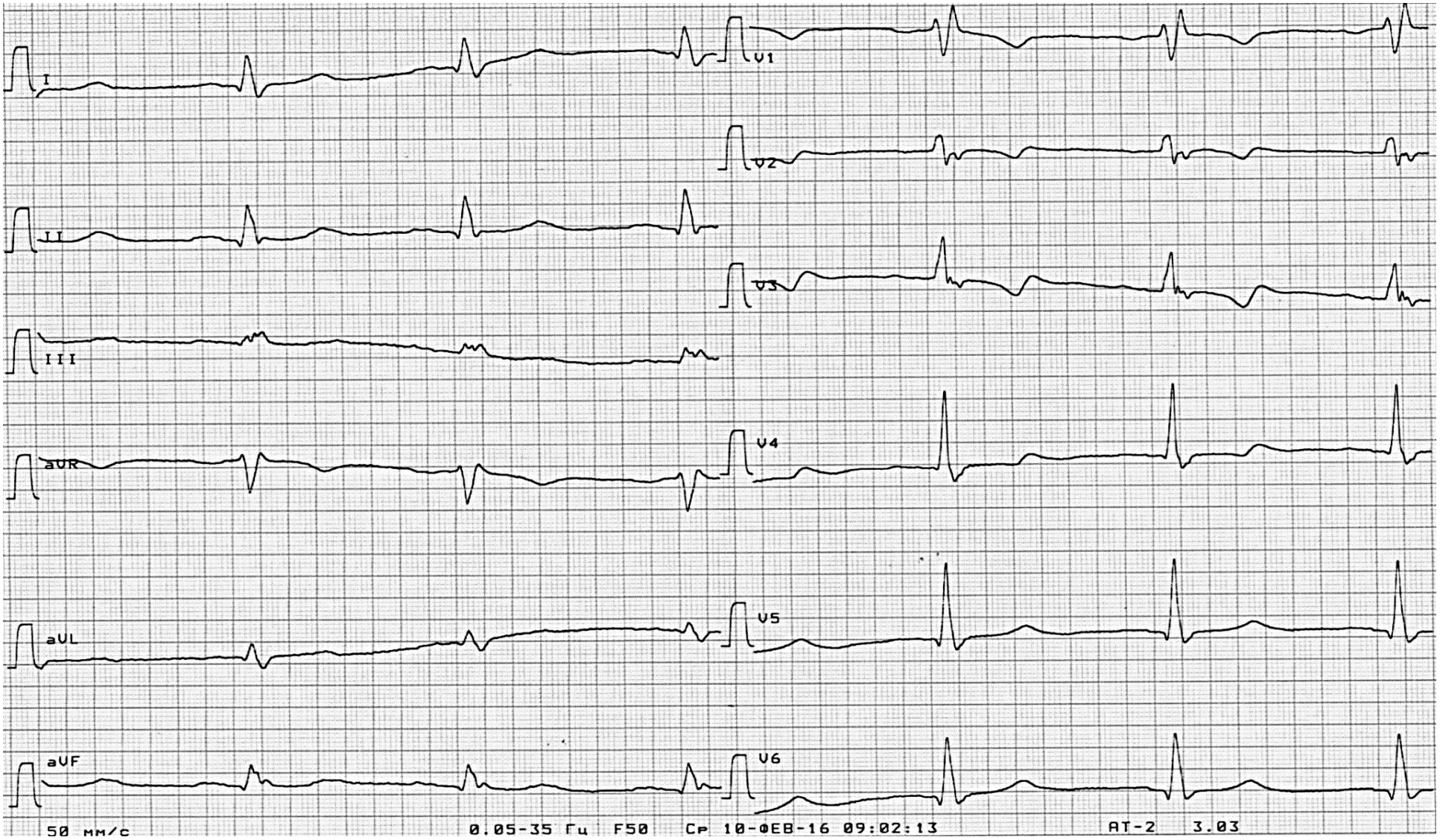
Mark the duration QRS in leads I и III

An Idioventricular rhythm is _____

_____

_____

13


I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
50 мм/с
0.05-35 Гц F50
Ср 10-ФЕВ-16 09:02:13
AT-2 3.03

13

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

Normal sinus rhythm:

Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec)

II. Voltage (underline)

Sufficient or low

III. Axis

normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

P duration _____ sec

P amplitude _____ mm

PQ — 0.02 (or 0.04) sec × mm =

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

Mark the r and R waves in lead V1

Note the QRS duration in leads I, III and V1

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

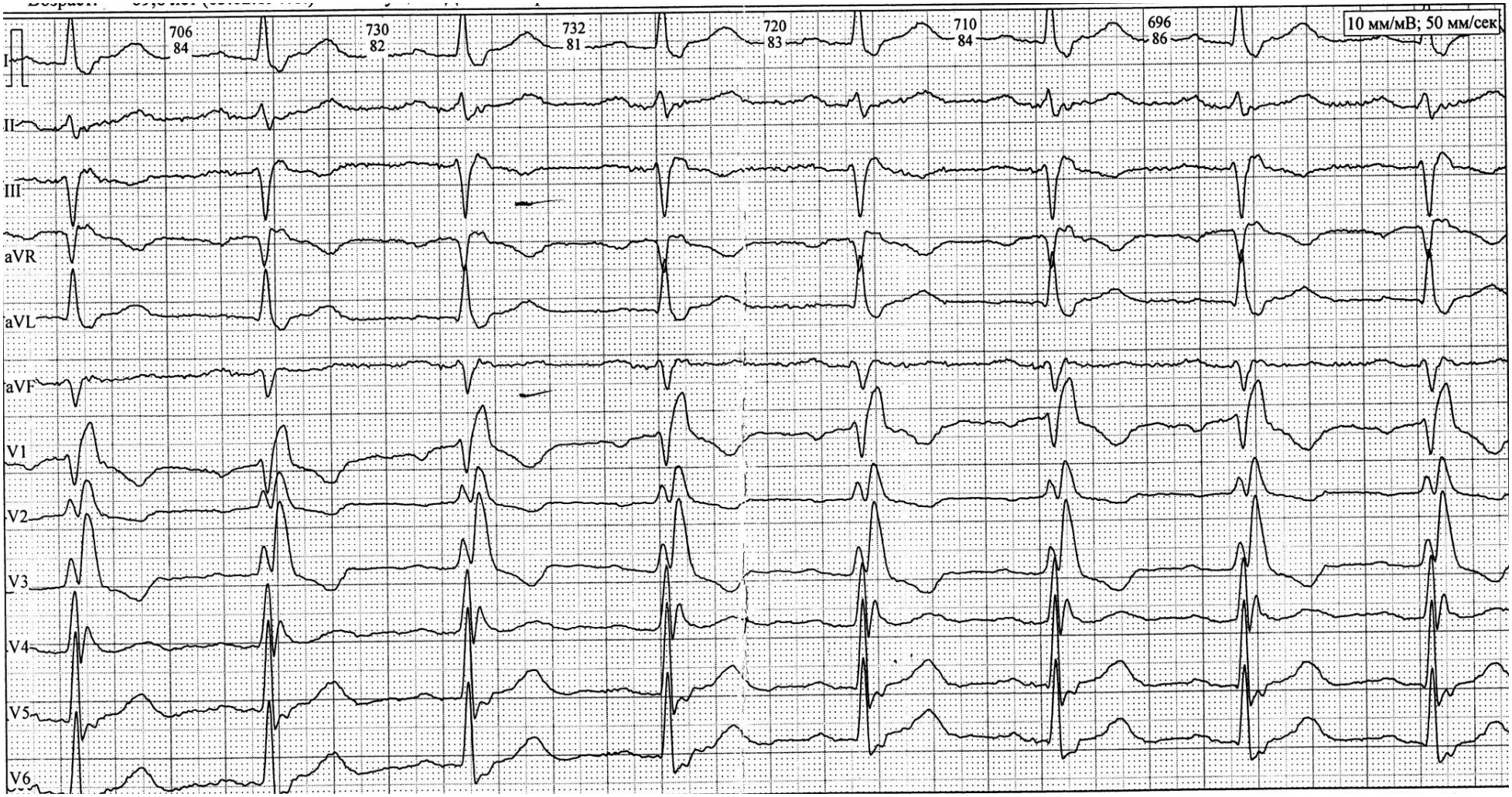
0.02 (or 0.04) sec × mm = sec

QRS

0.11–0.12 sec — incomplete bundle branch block

> 0.12 sec — complete bundle branch block

14


706
84
730
82
732
81
720
83
710
84
696
86
10 мм/мВ; 50 мм/сек
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6

14

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)
Normal sinus rhythm:
Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec)

II. Voltage (underline)
Sufficient or low

III. Axis
normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

P duration _____ sec

P amplitude _____ mm

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

Mark the r and R waves in lead V1, V2, V3 and V4

Note the QRS duration in leads I, III, V1 and V2

I QRS 0.02 (or 0.04) sec × mm = sec

III QRS 0.02 (or 0.04) sec × mm = sec

V1 QRS 0.02 (or 0.04) sec × mm = sec

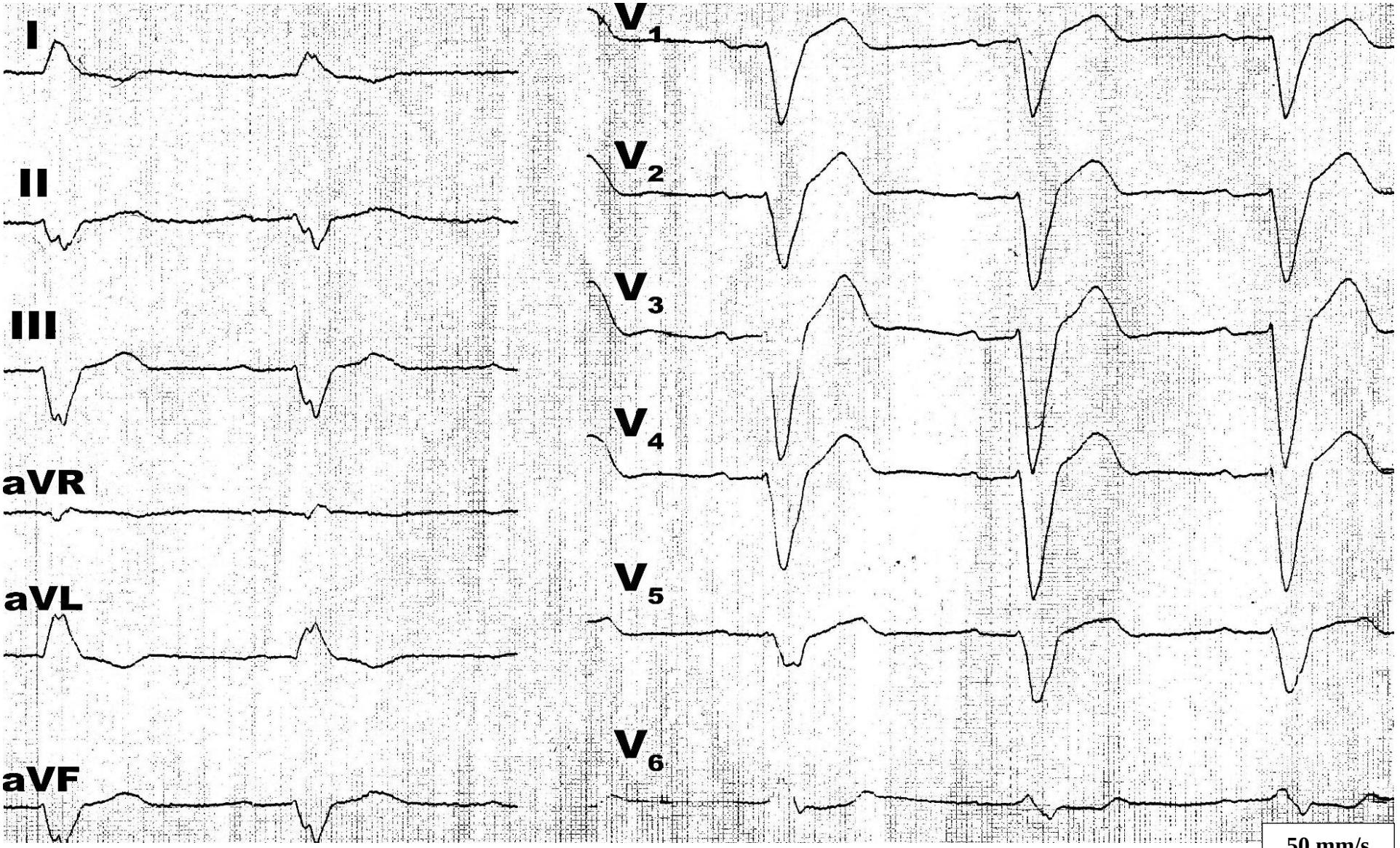
V2 QRS 0.02 (or 0.04) sec × mm = sec

QRS

0.11–0.12 sec — incomplete bundle branch block

> 0.12 sec — complete bundle branch block

15



15

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

Normal sinus rhythm:

Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec)

II. Voltage (underline)

Sufficient or low

III. Axis

normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

P duration _____ sec

P amplitude _____ mm

PQ — 0.02 (or 0.04) sec × mm = (0.12–0.20 sec)

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

Note the QRS duration in leads I, III, V1 and V6

I QRS 0.02 (or 0.04) sec × mm = sec

III QRS 0.02 (or 0.04) sec × mm = sec

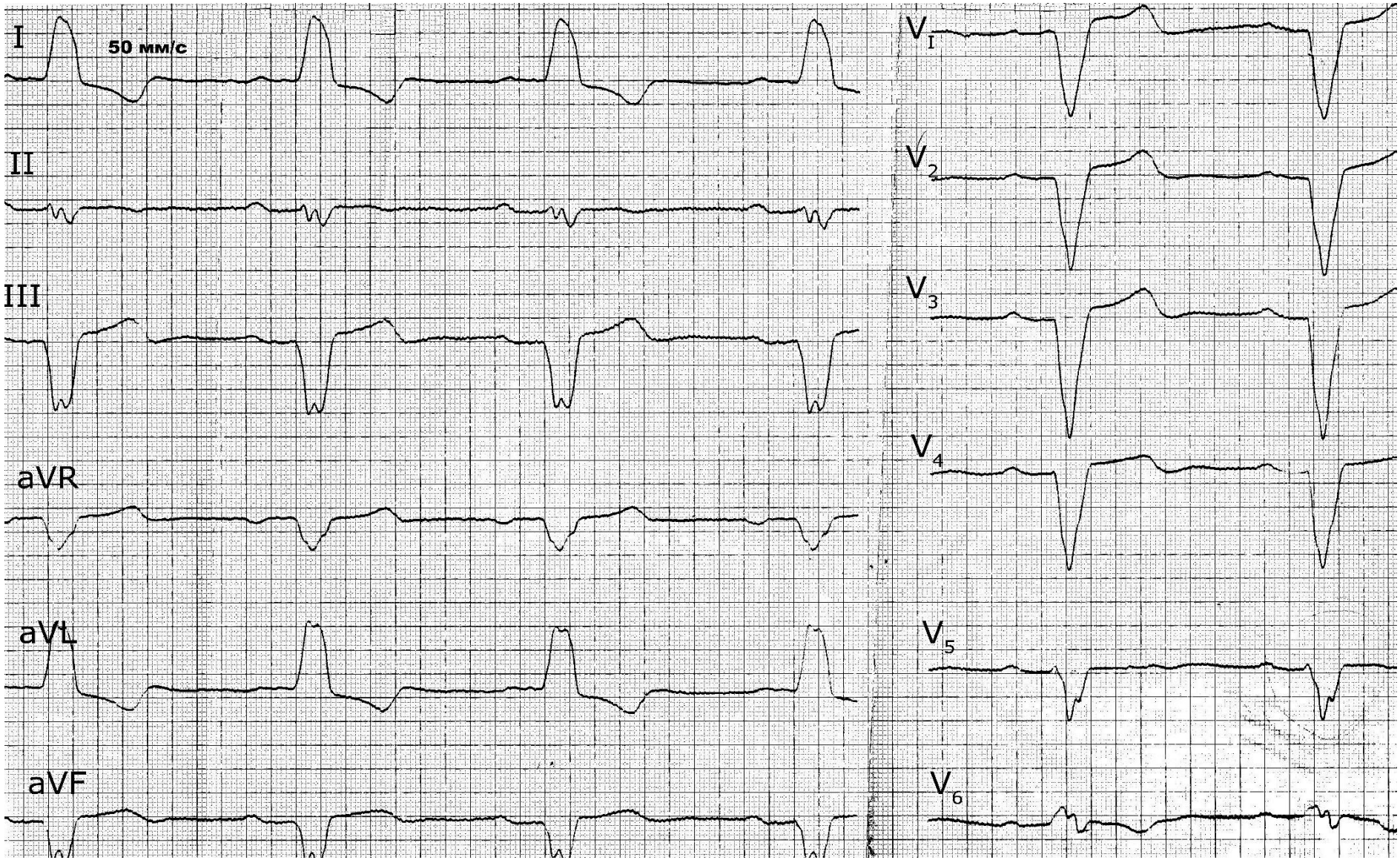
V1 QRS 0.02 (or 0.04) sec × mm = sec

V6 QRS 0.02 (or 0.04) sec × mm = sec

Find the Transition zone (chest lead where R = S)

Normally, Transition zone is in the lead _____

16



16

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

Normal sinus rhythm:

Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec)

II. Voltage (underline)

Sufficient or low

III. Axis

normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

P duration _____ sec

P amplitude _____ mm

PQ — 0.02 (or 0.04) sec × mm = (0.12–0.20 sec)

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

Note the QRS duration in leads I, III, V1 and V6

I QRS 0.02 (or 0.04) sec × mm = sec

III QRS 0.02 (or 0.04) sec × mm = sec

V1 QRS 0.02 (or 0.04) sec × mm = sec

V6 QRS 0.02 (or 0.04) sec × mm = sec

QRS

0.11–0.12 sec — incomplete bundle branch block

> 0.12 sec — complete bundle branch block

What are the causes for bundle branch block? (write):

-
-
-
-
-
-

ECG SIGNS OF BUNDLE BRANCH BLOCK

Write

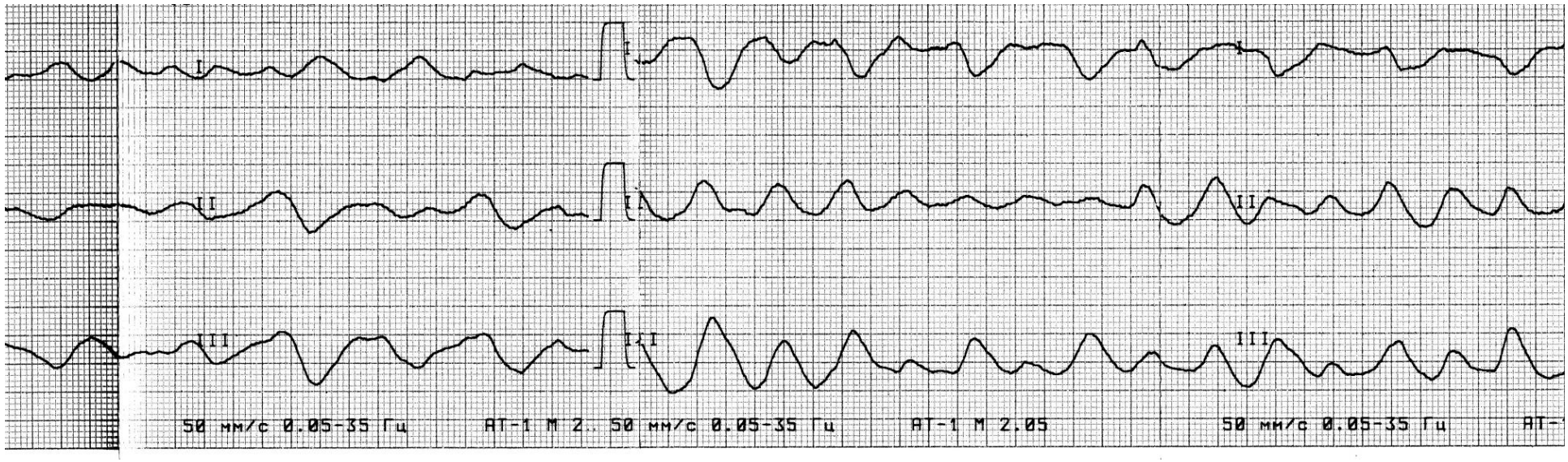
Right bundle branch block		**Left bundle branch block**
incomplete QRS =	**complete** QRS =	**complete** QRS =

ECG SIGNS OF ATRIAL FIBRILLATION AND FLATTER, VENTRICULAR FIBRILLATION

Write

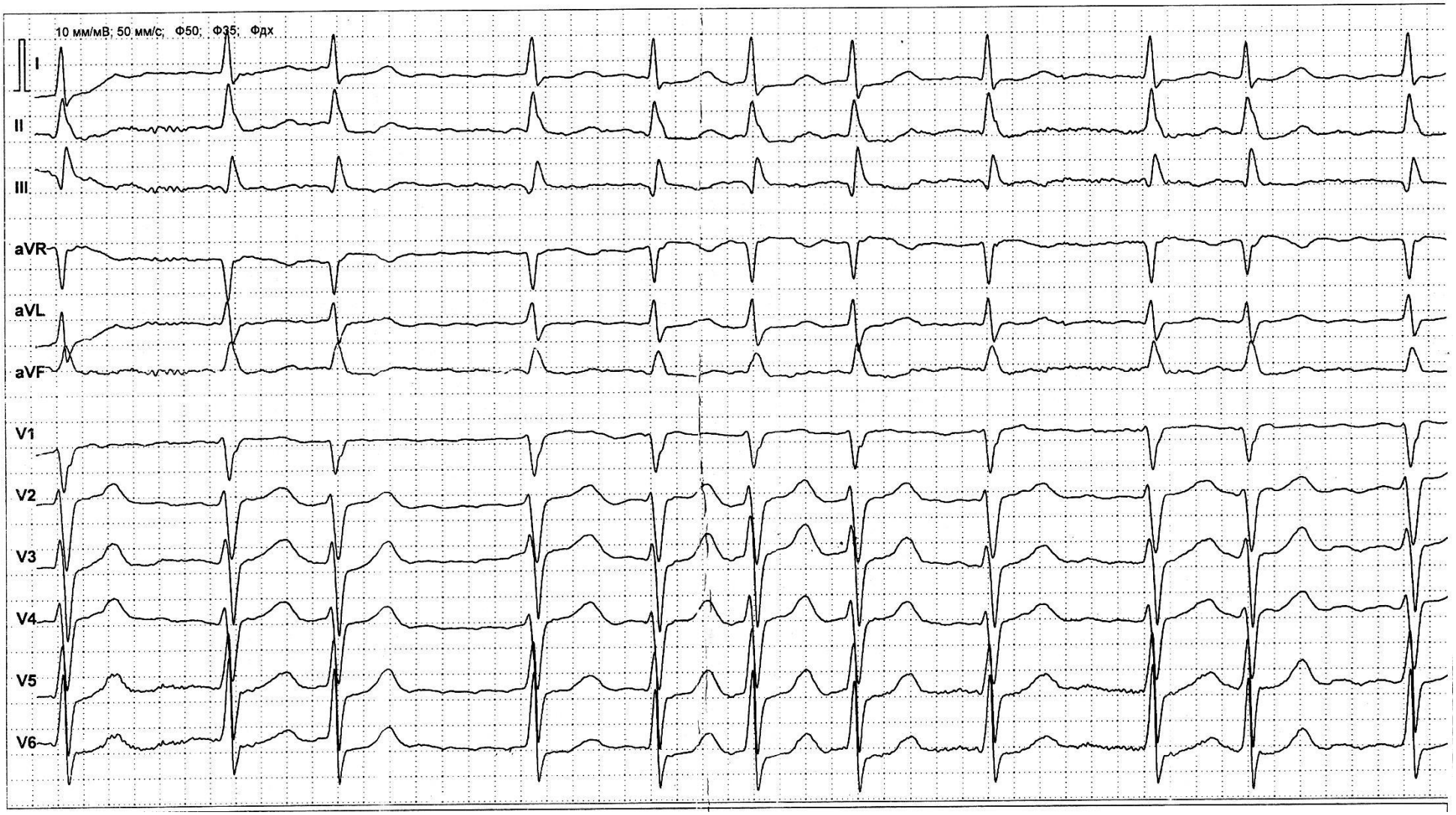
Atrial fibrillation	Atrial flutter	Ventricular fibrillation

17



Conclusion:

18



18

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

Normal sinus rhythm:

Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR (minimum and maximum)

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec) (minimum and maximum)

II. Voltage (underline)

Sufficient or low

III. Axis

normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

QRS — 0.02 (or 0.04) sec × mm = (till 0.1 sec)

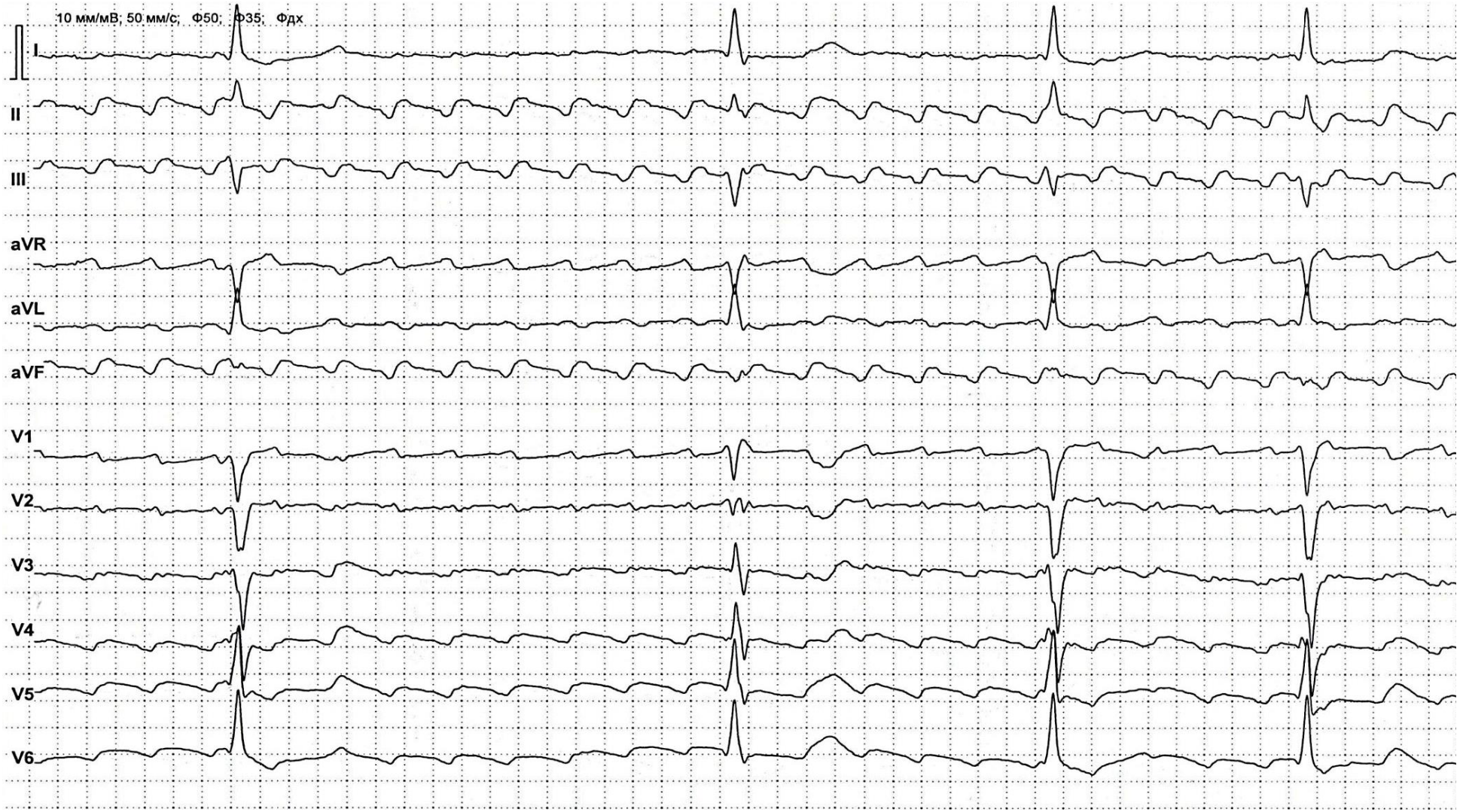
Mark the f or F waves in lead V2

Give a definition of the term "pulse deficit" —

What are the signs of atrial fibrillation (choose)

1. Elongation of the QRS complex
2. Absolutely irregular RR intervals
3. Absence of P waves
4. Duration P less than 0.2 sec
5. The appearance of waves f
6. Appearance of F waves
7. Extension of the RR interval

19



19

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

Normal sinus rhythm:

Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR (minimum and maximum)

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec) (minimum and maximum)

II. Voltage (underline)

Sufficient or low

III. Axis

normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

Mark the f or F waves in lead III

Give a definition of the term "paradoxical pulses" —

What are the signs of atrial flutter (choose)

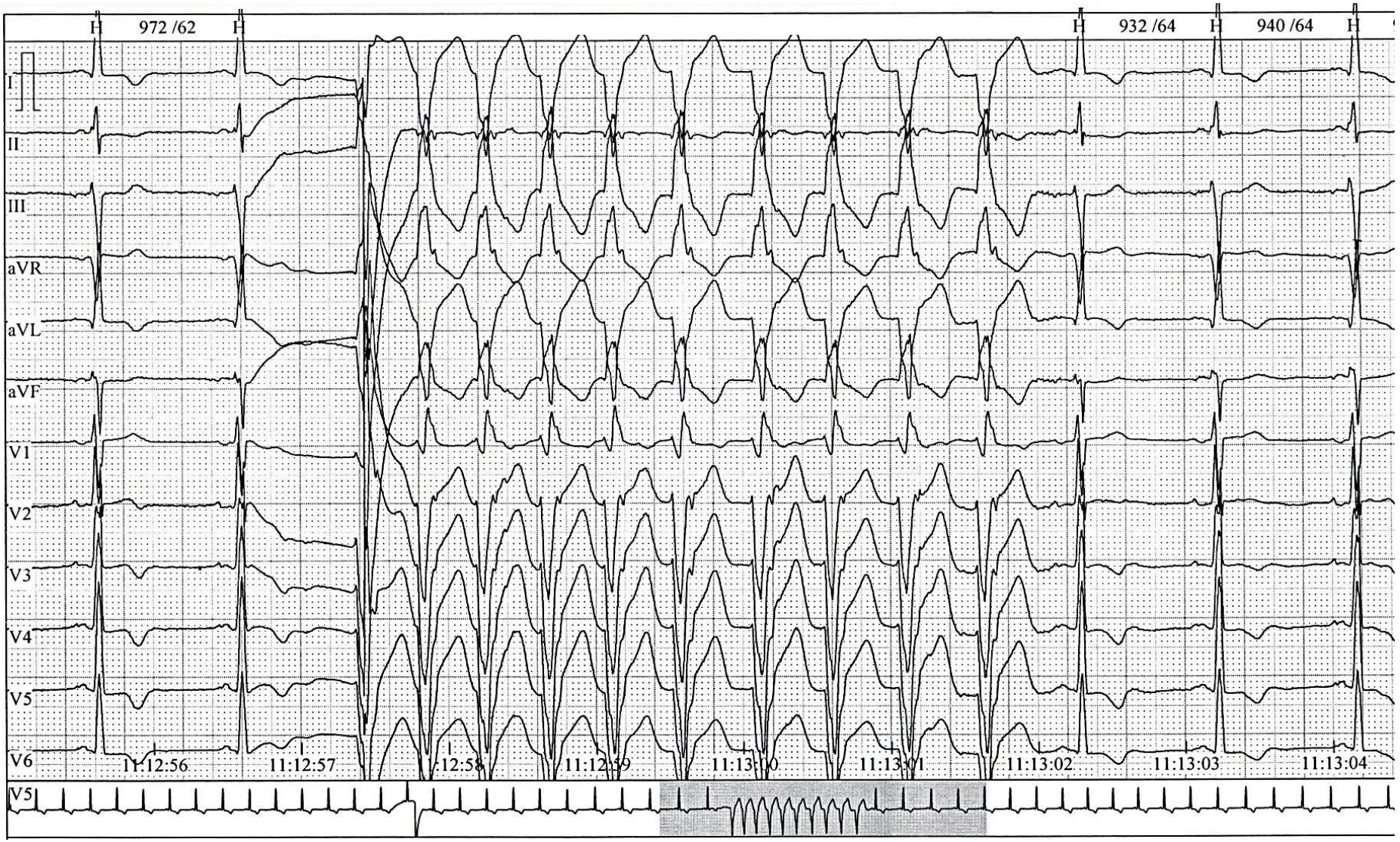
1. Elongation of the QRS complex
2. Absence of P waves
3. Duration P less than 0.1 sec
4. The appearance of waves f
5. Appearance of F waves
6. Extension of the RR interval
7. The duration of the PQ interval is more than 0.2 sec

Give a definition of the term "re-entry" —

What are the causes for arrhythmia by the re-entry mechanism?

1. _____
2. _____
3. _____

20


H
972 /62
H
H
932 /64
H
940 /64
H
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
11:12:56
11:12:57
11:12:58
11:12:59
11:13:00
11:13:01
11:13:02
11:13:03
11:13:04
V5

20

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

Normal sinus rhythm:

Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR (minimum and maximum)

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec) (minimum and maximum)

II. Voltage (underline)

Sufficient or low

III. Axis

normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

P — 0.02 (or 0.04) sec × mm =

PQ — 0.02 (or 0.04) sec × mm =

Mark all P waves in lead V2

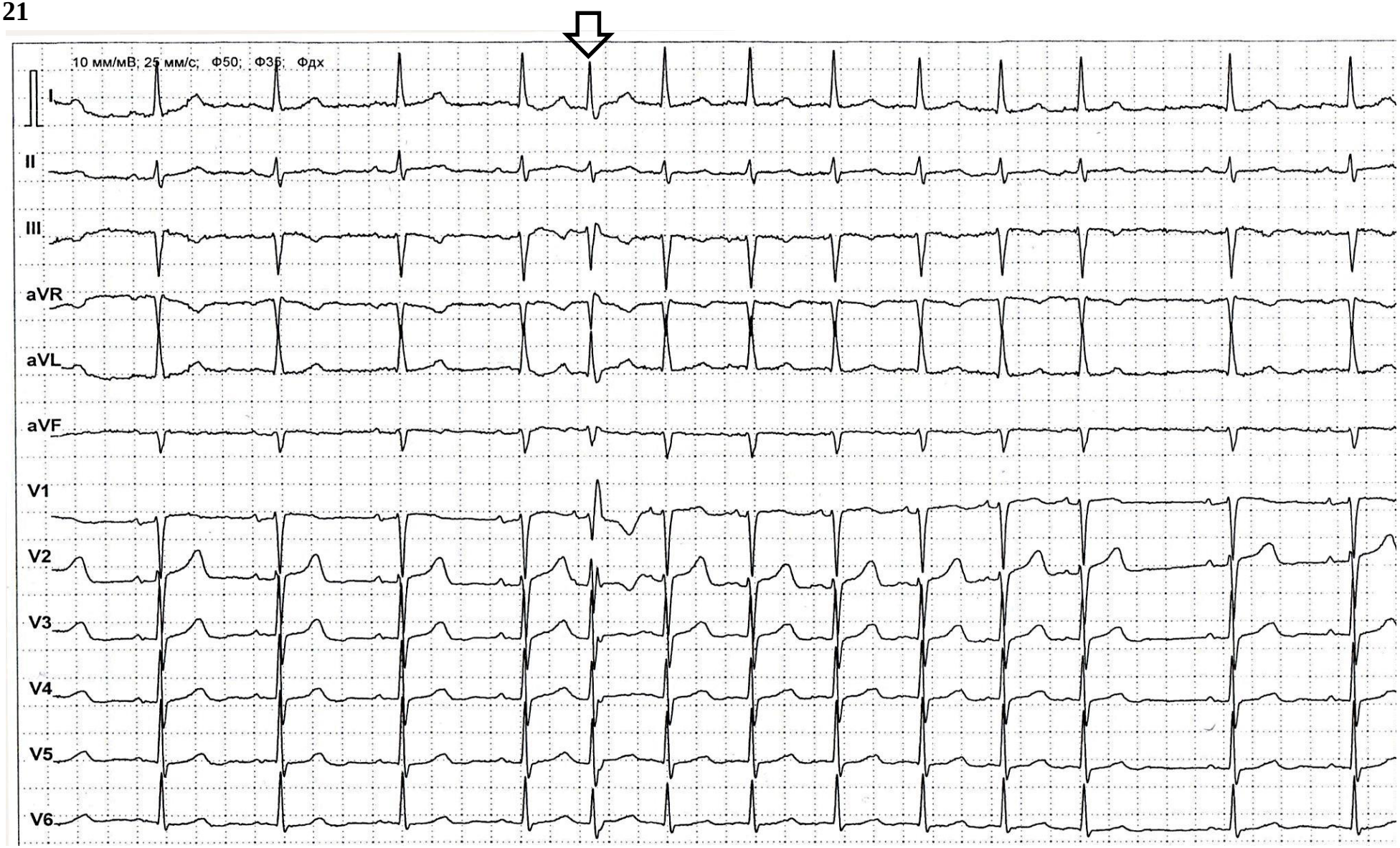
Calculate the minimum and maximum duration of the QRS complex in lead III

QRS min 0.02 (or 0.04) sec × mm = sec

QRS max 0.02 (or 0.04) sec × mm = sec

Give the definition for the term "paroxysm" —

21



21

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)
Normal sinus rhythm:
Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR (minimum and maximum)

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec) (minimum and maximum)

II. Voltage *(underline)*
Sufficient or low

III. Axis
normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

P — 0.02 (or 0.04) sec × mm =

PQ — 0.02 (or 0.04) sec × mm =

Mark all P waves in lead V2.

Mark with the letter "S" each sinoatrial P wave.

Measure the duration of the QRS complex in lead II QRS —

0.02 (or 0.04) sec × mm = sec

What is the source of the indicated contraction (see arrow)?

_____

PAROXYSMAL TACHYCARDIA ECG SIGNS

Write

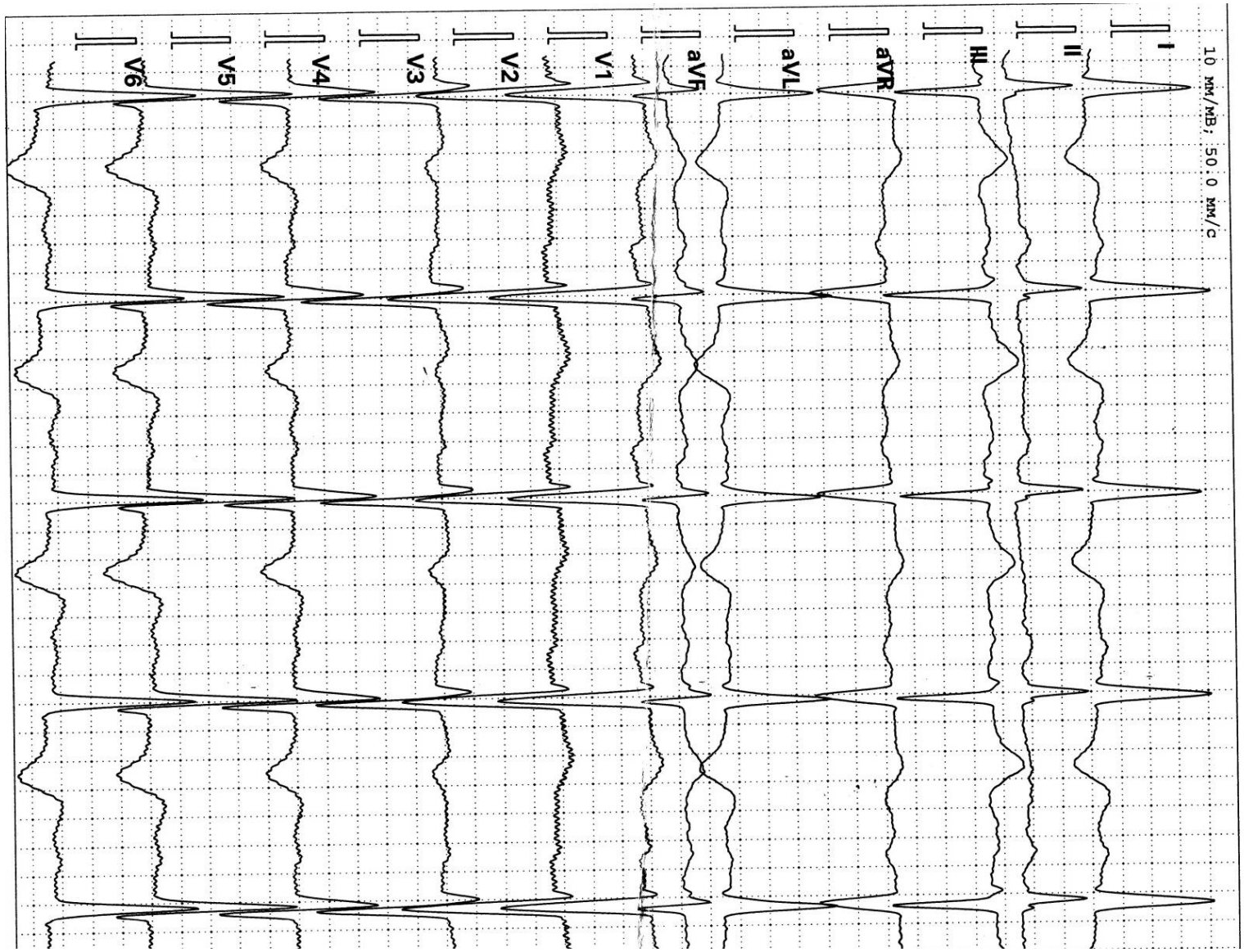
Supraventricular Tachycardia	Atrioventricular Tachycardia	Ventricular Tachycardia

ECG SIGNS OF ATRIAL AND VENTRICULAR HYPERTROPHY

Write

Right atrium	Right ventricle	Left atrium	Left ventricle

22


Возраст : 45 лет
Текущее АД : не измерено
Врач :
Диагноз : Боль в обл сердца
Адрес : ЦС и СА
Комментарий : Срочно
Пол : мужской
Отведения : стандартные 12
10 мм/мВ; 50.0 мм/с
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6

22

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)
Normal sinus rhythm:
Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR (minimum and maximum)

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec) (minimum and maximum)

II. Voltage (underline)
Sufficient or low

III. Axis
normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

P duration _____ sec

P amplitude _____ mm

QRS — 0.02 (or 0.04) sec × mm =

PQ — 0.02 (or 0.04) sec × mm =

QT — 0.02 (or 0.04) sec × mm =

T wave — positive in leads _____

flat in leads _____

negative in leads _____

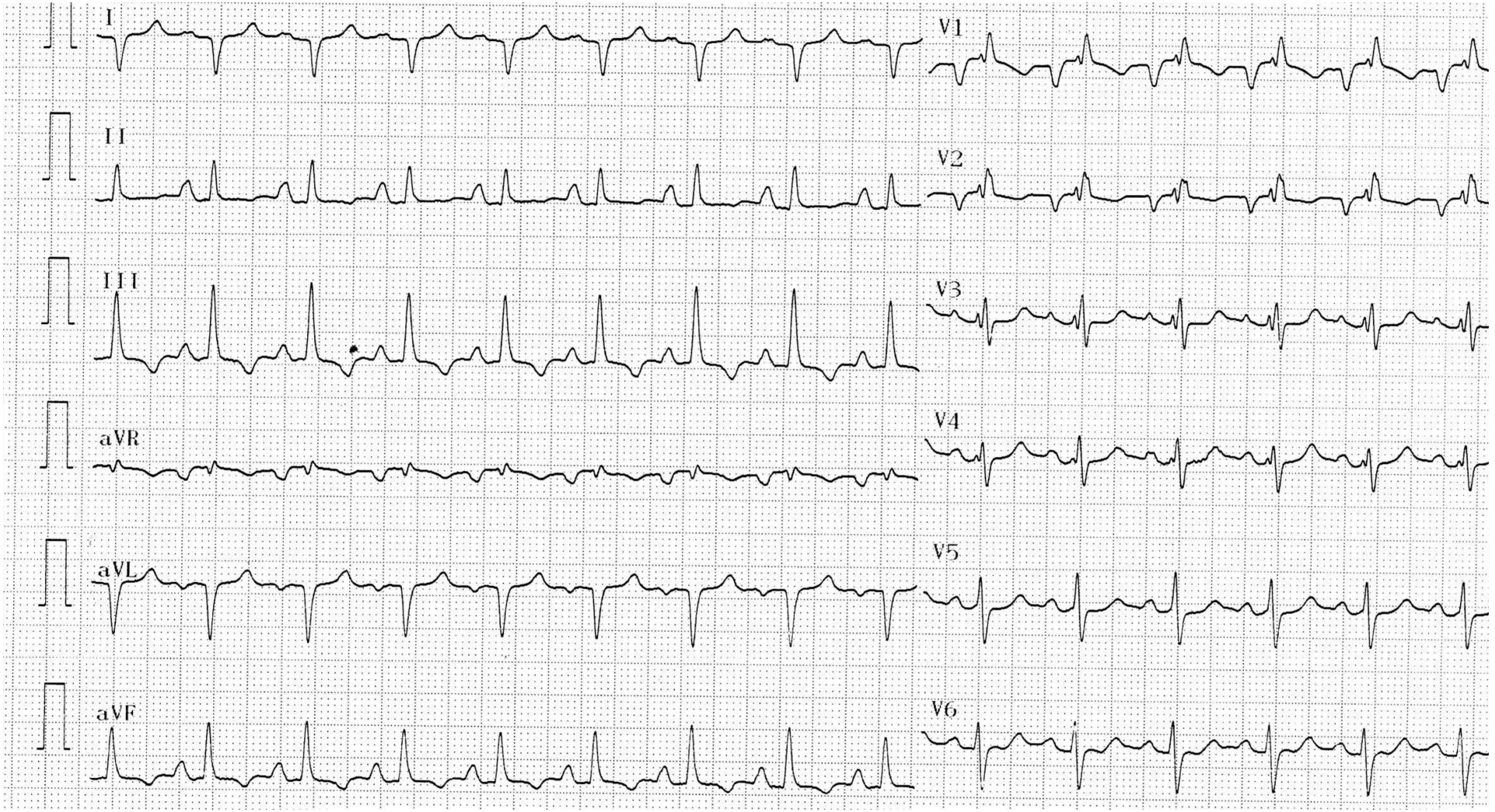
segment ST (on the isoline, higher by … mm, lower by … mm):

I	aVR	V1	V4
II	aVL	V2	V5
III	aVF	V3	V6

Calculate the Sokolow–Lyon index.

What are the signs of:
P-pulmonale **P-mitrale**

23



25 mm/s

23

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

Normal sinus rhythm:

Each QRS complex is preceded by a normal P wave
The RR intervals and PR intervals remains constant
P waves are visible, positive at II lead

RR (minimum and maximum)

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

Heart Rate = 60 / R-R interval (sec) (minimum and maximum)

II. Voltage (underline)

Sufficient or low

III. Axis

normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

P duration _____ sec

P amplitude _____ sec

QRS — 0.02 (or 0.04) sec × mm =

PQ — 0.02 (or 0.04) sec × mm =

QT — 0.02 (or 0.04) sec × mm =

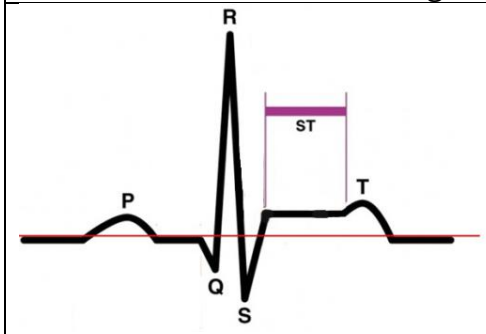
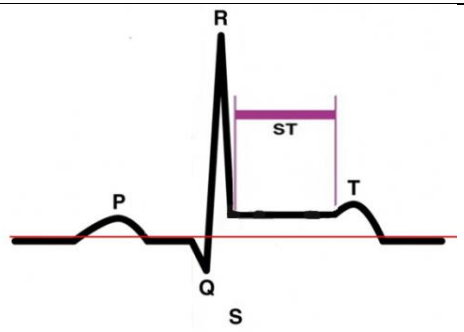
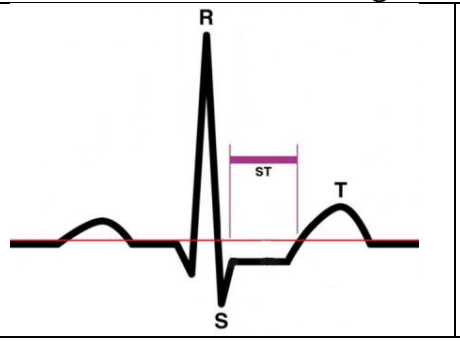
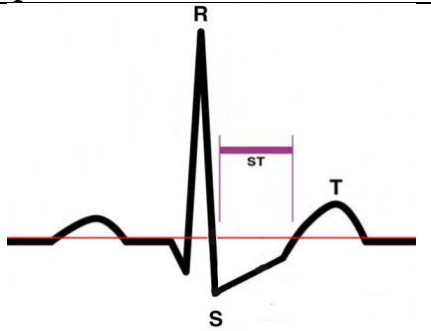
What are the causes of hypertrophy?	
Right ventricle	**Left ventricle**

ECG SIGNS OF MYOCARDIAL ISCHEMIA

Write the appropriate anatomical relations of the leads in a standart 12 leads ECG

Leads	Localization
I	
II	
III	
aVL	
aVF	
V_1, V_2	
V_3	
V_4	
V_5, V_6	

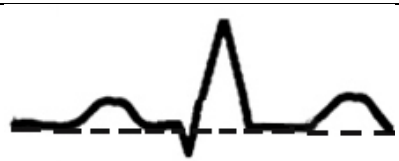
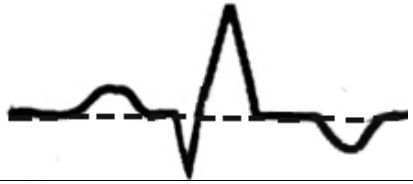
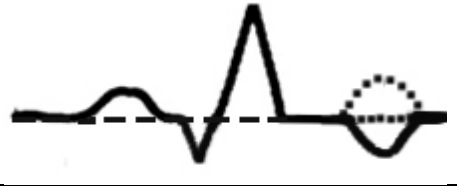
ST segment elevation and depression options

ST segment elevation		ST segment depression	
			

What deviation of the ST segment from the isoline is considered significant:

In the standart leads? _____ In the chest leads? _____

Signs of ST-elevation Acute Myocardial Infarction (STEMI)

		Signs	ECG
Normal ECG		Q wave is less than $^1/_4$ R wave, duration < 0.03 sec. ST segment is at the isoline. T-wave is positive	
Evolution of STEMI	The most acute period (first hours)	ST elevation (single monophasic deflection)	
	Acute period (till 7–10 days)	Pathological Q wave. Segment ST gradually decreases, but remains above the isoline. Formation of a negative T wave	
	Subacute period (till 28th day)	Pathological Q wave (QS). Segment ST on isoline. Wave T negative	
	Infarct scar period (after 29th day)	Pathological Q wave (QS). Segment ST on isoline. Wave T positive, negative or flat	

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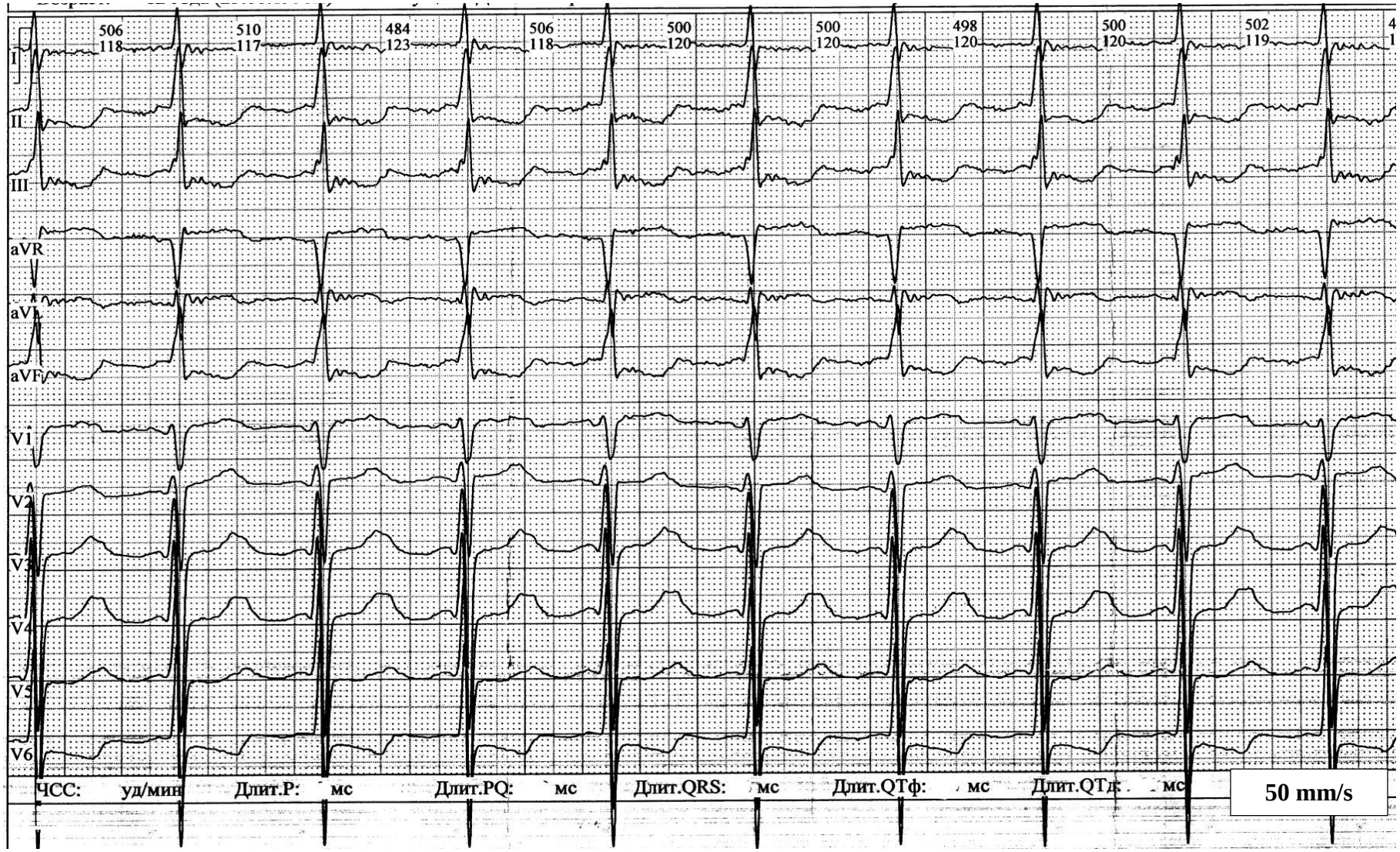

506 118
510 117
484 123
506 118
500 120
500 120
498 120
500 120
502 119
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
ЧСС: уд/мин
Длит.P: мс
Длит.PQ: мс
Длит.QRS: мс
Длит.QTф: мс
Длит.QTд: мс
50 mm/s

24

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)
RR

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

0.02 (or 0.04) sec × mm = sec

HR = 60 / RR interval (sec)

II. Voltage (underline)
Sufficient or low

III. Axis
normal position
left axis deviation
right axis deviation

V. Conclusion

IV. Analysis of waves and intervals

QRS — 0.02 (or 0.04) sec × mm =

PQ — 0.02 (or 0.04) sec × mm =

Draw an isoline in all leads

Wave T — positive in leads _____

flat in leads _____

negative in leads _____

Segment ST is on the isoline in leads _____

elevation by _____ mm in leads _____

depression by _____ mm in leads _____

Wave Q in leads _____

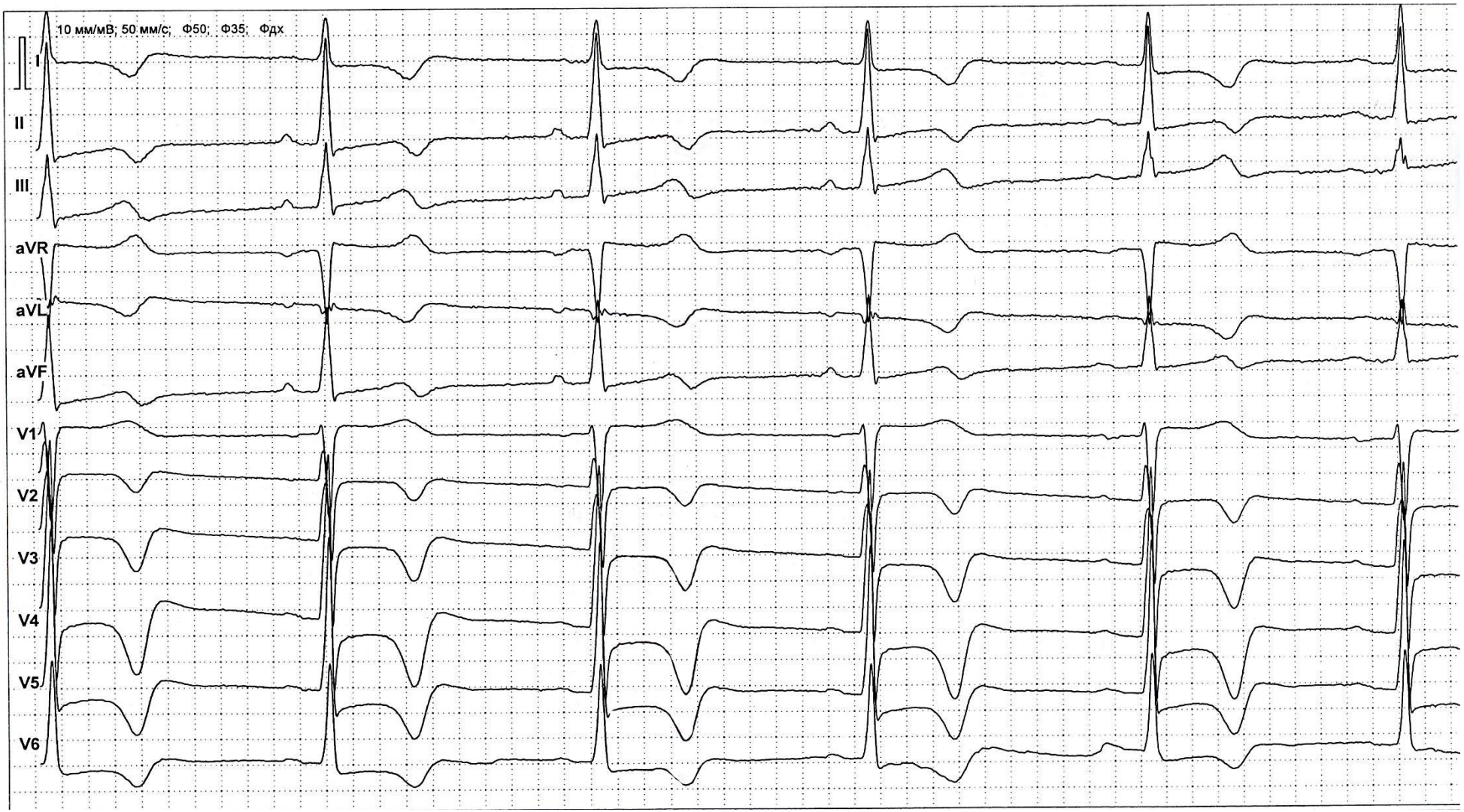
Duration _____ sec

Amplitude *(what part)* _____ of R wave

Localization of the ischemia _____

_____

25



25

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

RR = 0.02 (or 0.04) sec × mm = sec

HR = 60 / RR interval (sec)

II. Voltage (underline)
Sufficient or low

III. Axis
normal position
left axis deviation
right axis deviation

Ischemia (write in the definition) — _____

_____

_____

V. Conclusion

IV. Analysis of waves and intervals

P duration _____ sec

P amplitude _____ sec

QRS — 0.02 (or 0.04) sec × mm = (till 0.1 sec)

PQ — 0.02 (or 0.04) sec × mm = (0.12–0.20 sec)

QT — 0.02 (or 0.04) sec × mm = (till 0.44 sec)

Draw an isoline in all leads

Wave T — positive in leads _____

flat in leads _____

negative in leads _____

Segment ST is on the isoline in leads _____

elevation by _____ mm in leads _____

depression by _____ mm in leads _____

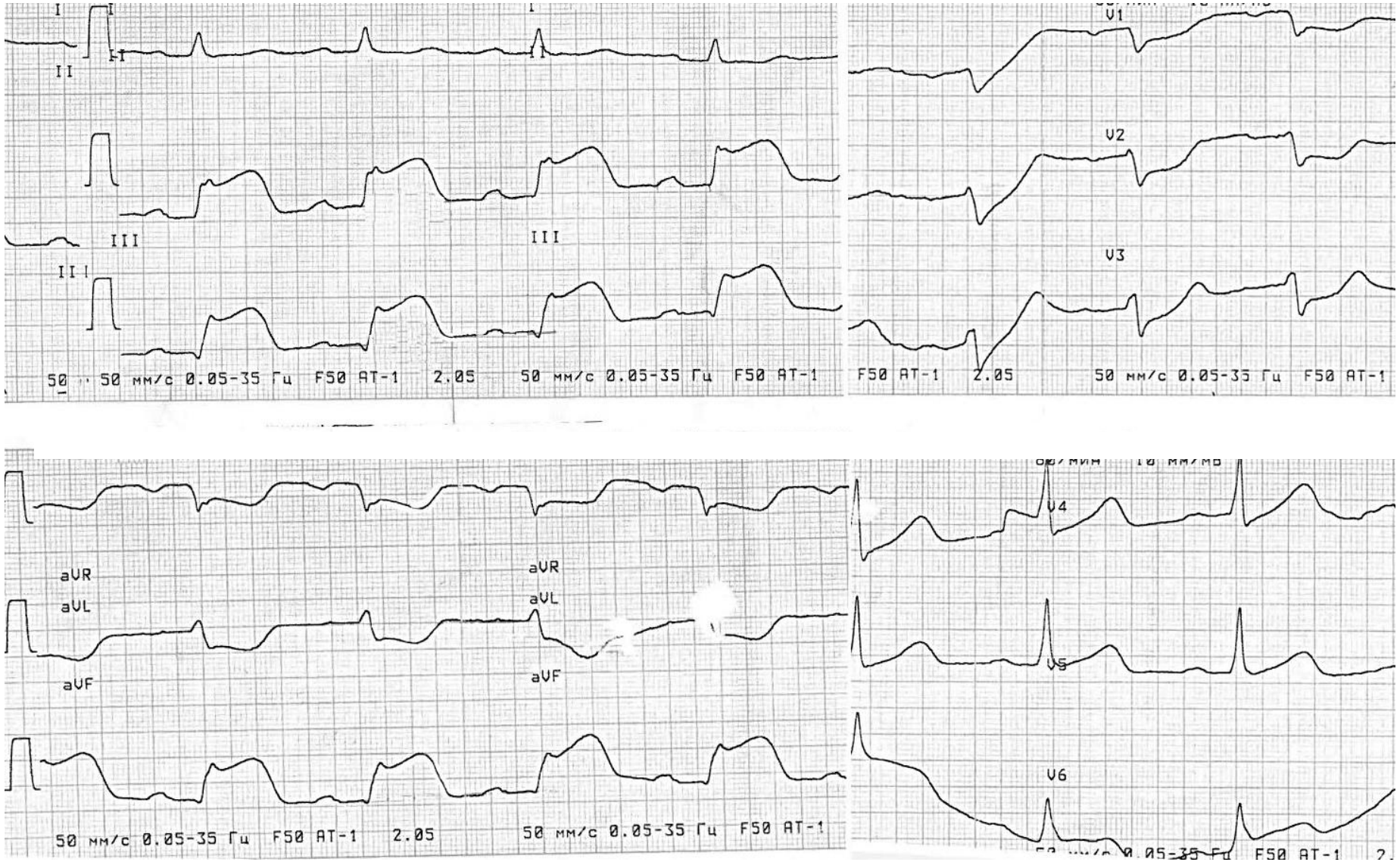
Wave Q in leads _____

Duration _____ sec
Amplitude *(what part)* _____ from R wave

Localization of the ischemia _____

_____

26


I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
50 мм/с 0.05-35 Гц F50 AT-1 2.05
50 мм/с 0.05-35 Гц F50 AT-1
F50 AT-1 2.05
50 мм/с 0.05-35 Гц F50 AT-1

26

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

RR = 0.02 (or 0.04) sec × mm = sec

HR = 60 / RR interval (sec)

II. Voltage (underline)
Sufficient or low

III. Axis
normal position
left axis deviation
right axis deviation

Ischemia (write in the definition) — _____

_____

V. Conclusion

IV. Analysis of waves and intervals

P duration _____ sec

P amplitude _____ sec

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

PQ — 0.02 (or 0.04) sec × mm = (0.12–0.20 sec)

QT — 0.02 (or 0.04) sec × mm = (less 0.44 sec)

Draw an isoline in all leads

Wave T — positive in leads _____

flat in leads _____

negative in leads _____

Segment ST is on the isoline in leads _____

elevation by _____ mm in leads _____

depression by _____ mm in leads _____

Wave Q is pathological in leads _____

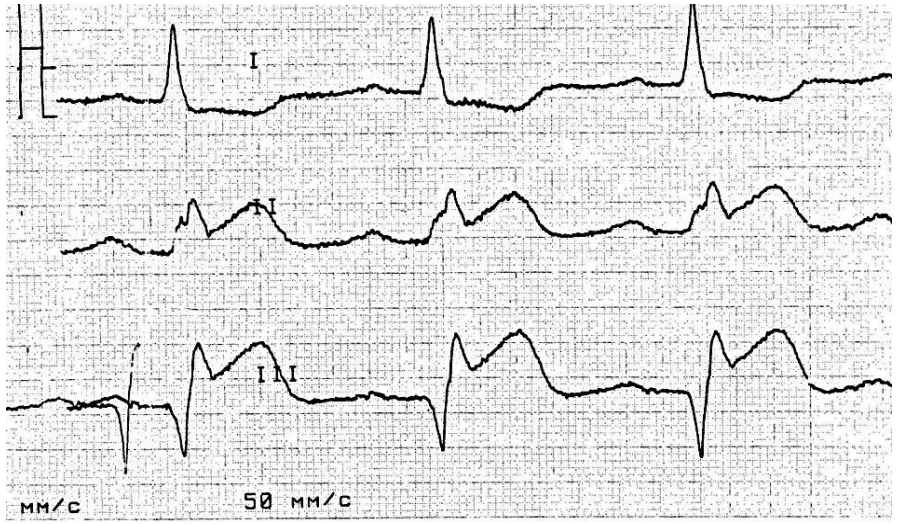
Duration _____ sec

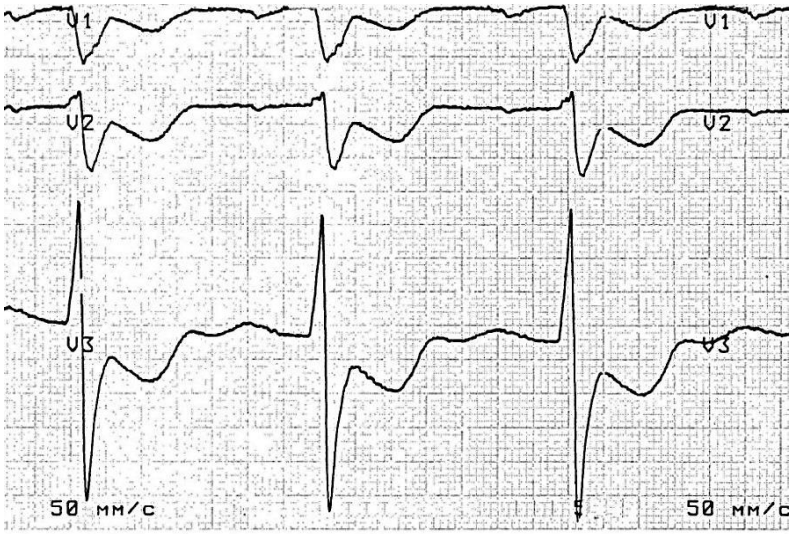
Amplitude *(what part)* _____ of R wave

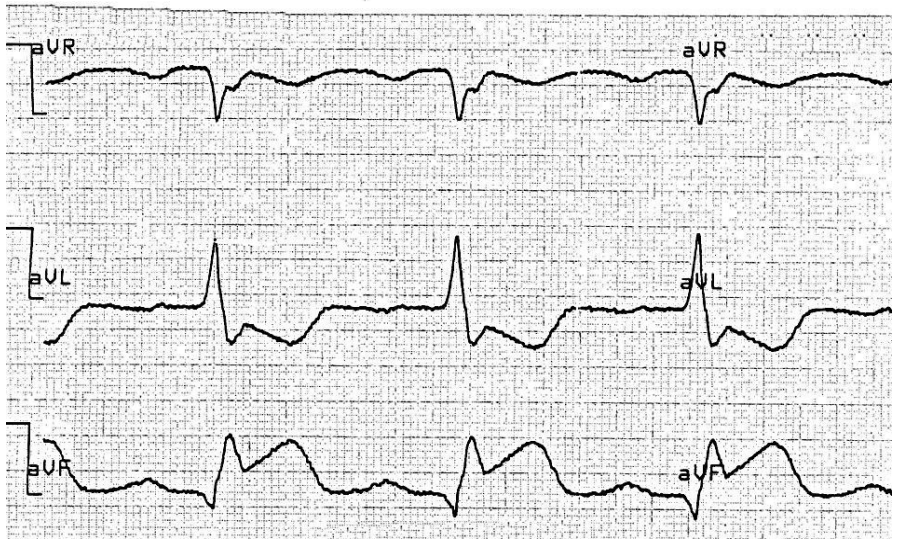
Localization of the ischemia _____

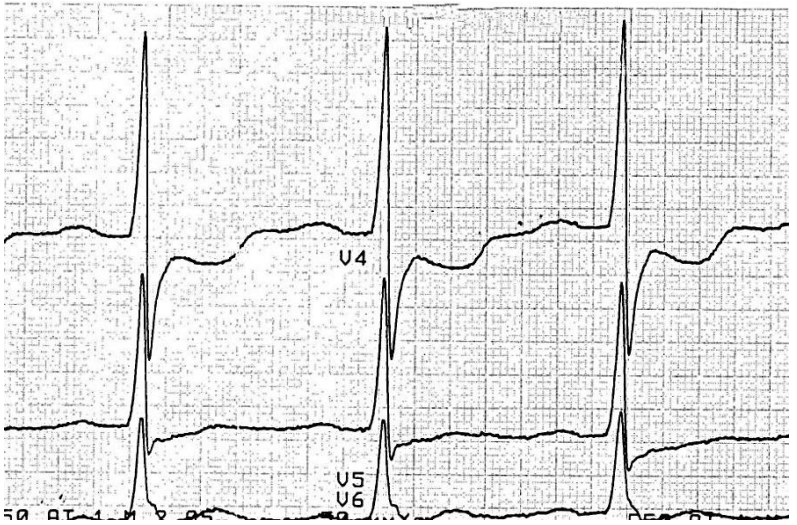
_____

27









27

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

RR = 0.02 (or 0.04) sec × mm = sec

HR = 60 / RR interval (sec)

II. Voltage (underline)
Sufficient or low

III. Axis
normal position
left axis deviation
right axis deviation

Reciprocal changes on ECG (write in the definition)

_____

_____

V. Conclusion

IV. Analysis of waves and intervals

P duration _____ sec

P amplitude _____ sec

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

PQ — 0.02 (or 0.04) sec × mm = (0.12–0.20 sec)

QT — 0.02 (or 0.04) sec × mm = (less 0.44 sec)

Draw an isoline in all leads

Wave T — positive in leads _____

flat in leads _____

negative in leads _____

Segment ST is on the isoline in leads _____

elevation by _____ mm in leads _____

depression by _____ mm in leads _____

Wave Q is pathological in leads _____

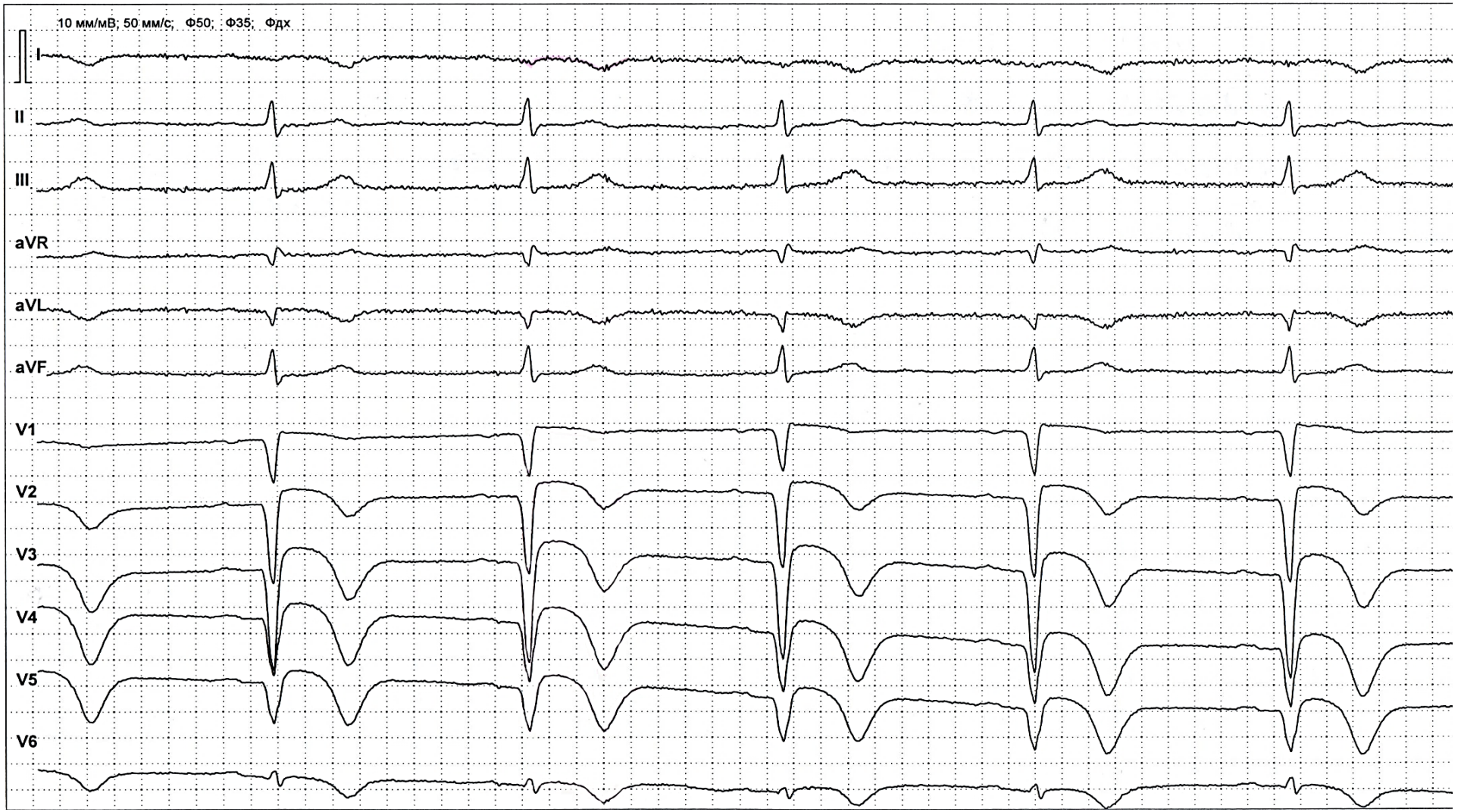
Duration _____ sec

Amplitude *(what part)* _____ of R wave

Localization of the ischemia _____

_____

28


10 мм/мВ; 50 мм/с; Ф50; Ф35; Фдх
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6

28

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

RR = 0.02 (or 0.04) sec × mm = sec

HR = 60 / RR interval (sec)

II. Voltage (underline)
Sufficient or low

III. Axis
normal position
left axis deviation
right axis deviation

Biochemical markers of myocardial damage are
(write down the names of parameters that increase in myocardial necrosis)

_____

_____

V. Conclusion

IV. Analysis of waves and intervals

P duration _____ sec

P amplitude _____ sec

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

PQ — 0.02 (or 0.04) sec × mm = (0.12–0.20 sec)

QT — 0.02 (or 0.04) sec × mm = (less 0.44 sec)

Draw an isoline in all leads

Wave T — positive in leads _____

flat in leads _____

negative in leads _____

Segment ST is on the isoline in leads _____

elevation by _____ mm in leads _____

depression by _____ mm in leads _____

Wave Q is pathological in leads _____

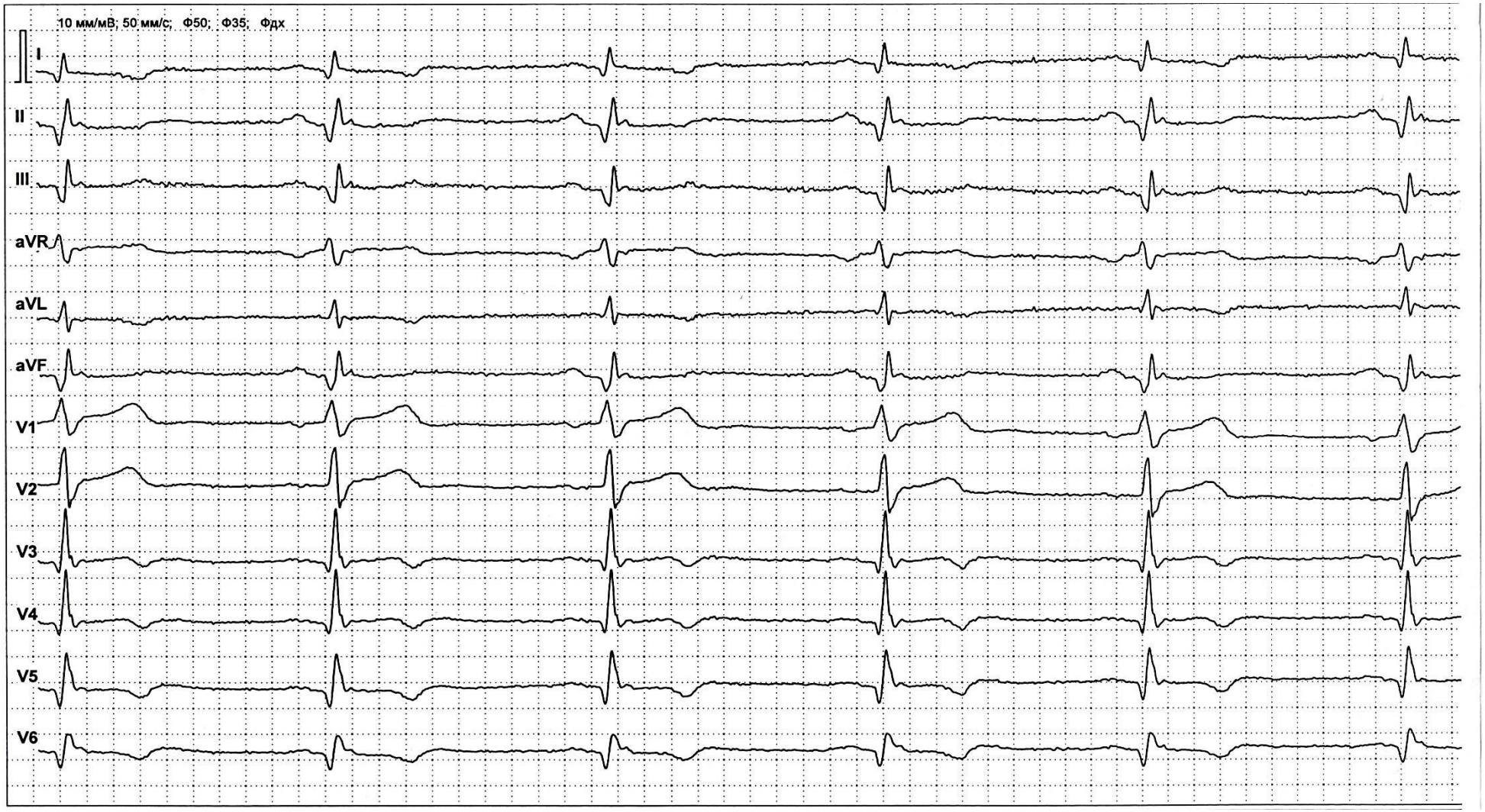
Duration _____ sec

Amplitude *(what part)* _____ of R wave

Localization of the ischemia _____

_____

29



29

Paper speed: 50 mm/s 1 mm = 0.02 sec
25 mm/s 1 mm = 0.04 sec

I. Rhythm (sinus or not)

RR = 0.02 (or 0.04) sec × mm = sec

HR = 60 / RR interval (sec)

II. Voltage (underline)
Sufficient or low

III. Axis
normal position
left axis deviation
right axis deviation

Pathological Q wave on the ECG corresponds to (write what changes in the myocardium)

_____

_____

V. Conclusion

IV. Analysis of waves and intervals

P duration _____ sec

P amplitude _____ sec

QRS — 0.02 (or 0.04) sec × mm = (less 0.1 sec)

PQ — 0.02 (or 0.04) sec × mm = (0.12–0.20 sec)

QT — 0.02 (or 0.04) sec × mm = (less 0.44 sec)

Draw an isoline in all leads

Wave T — positive in leads _____

flat in leads _____

negative in leads _____

Segment ST is on the isoline in leads _____

elevation by _____ mm in leads _____

depression by _____ mm in leads _____

Wave Q is pathological in leads _____

Duration _____ sec

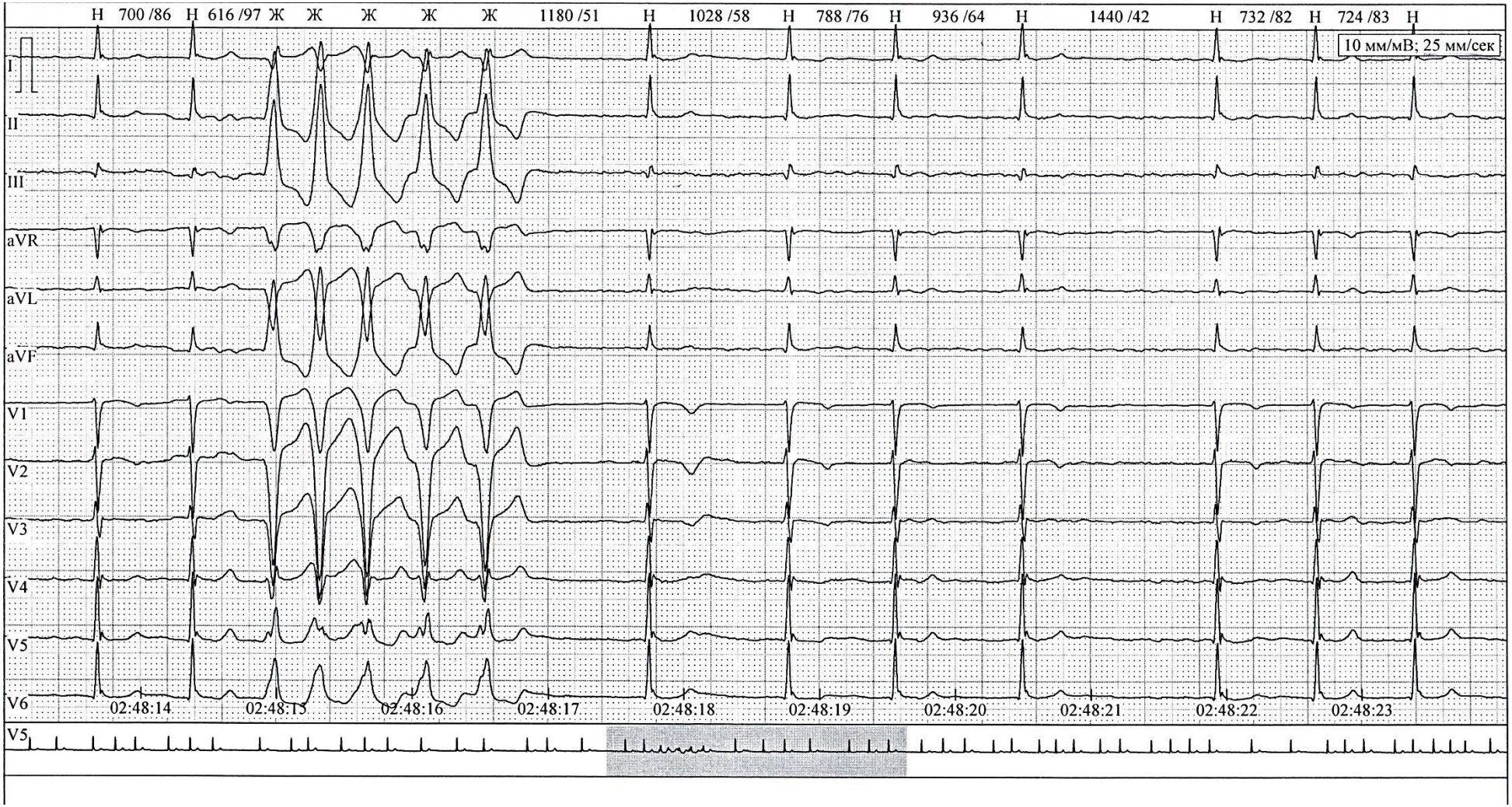
Amplitude *(what part)* _____ of R wave

Localization of the ischemia _____

_____

ELECTROCARDIOGRAMS WITH COMBINATION OF DISORDERS

30



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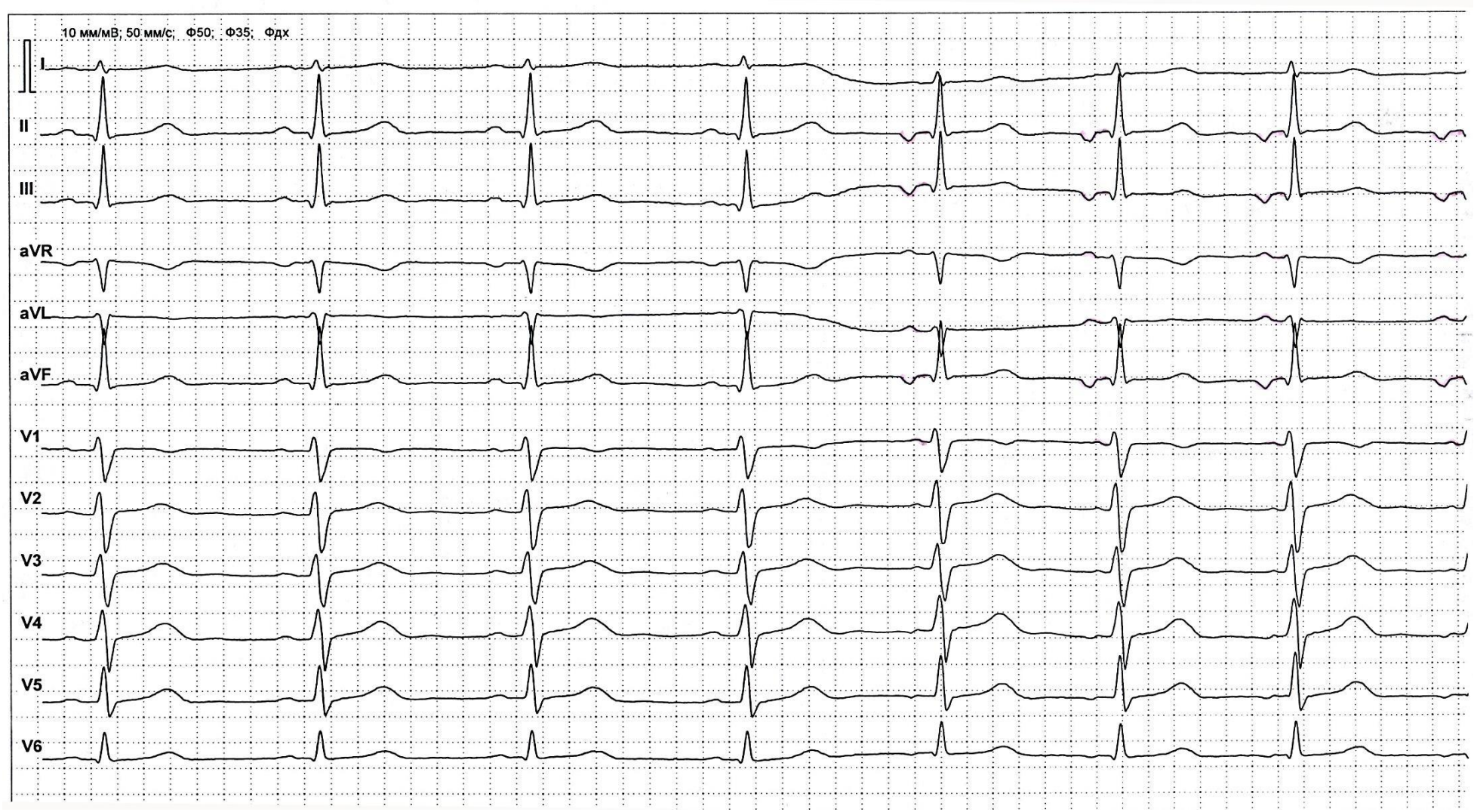

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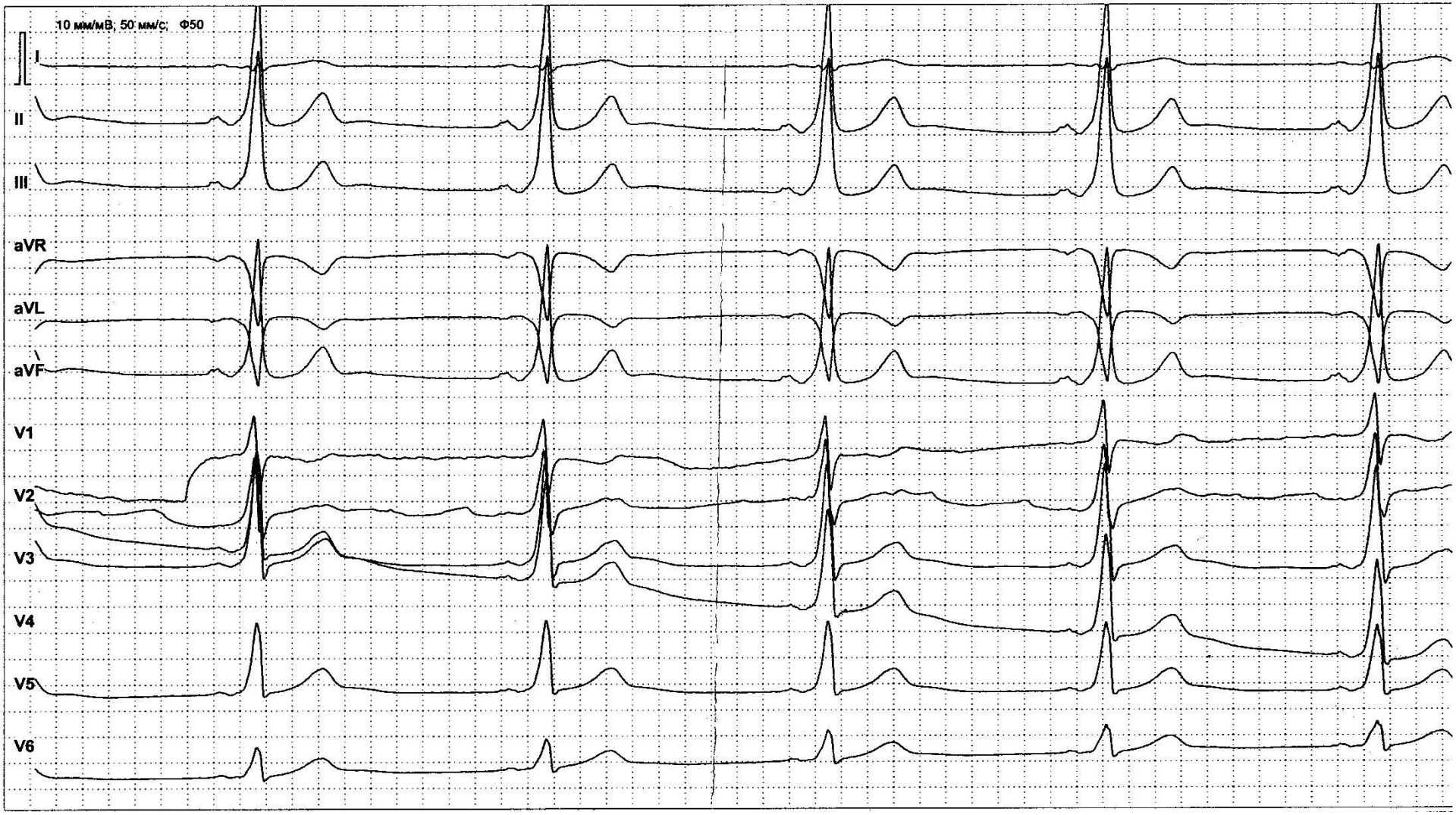

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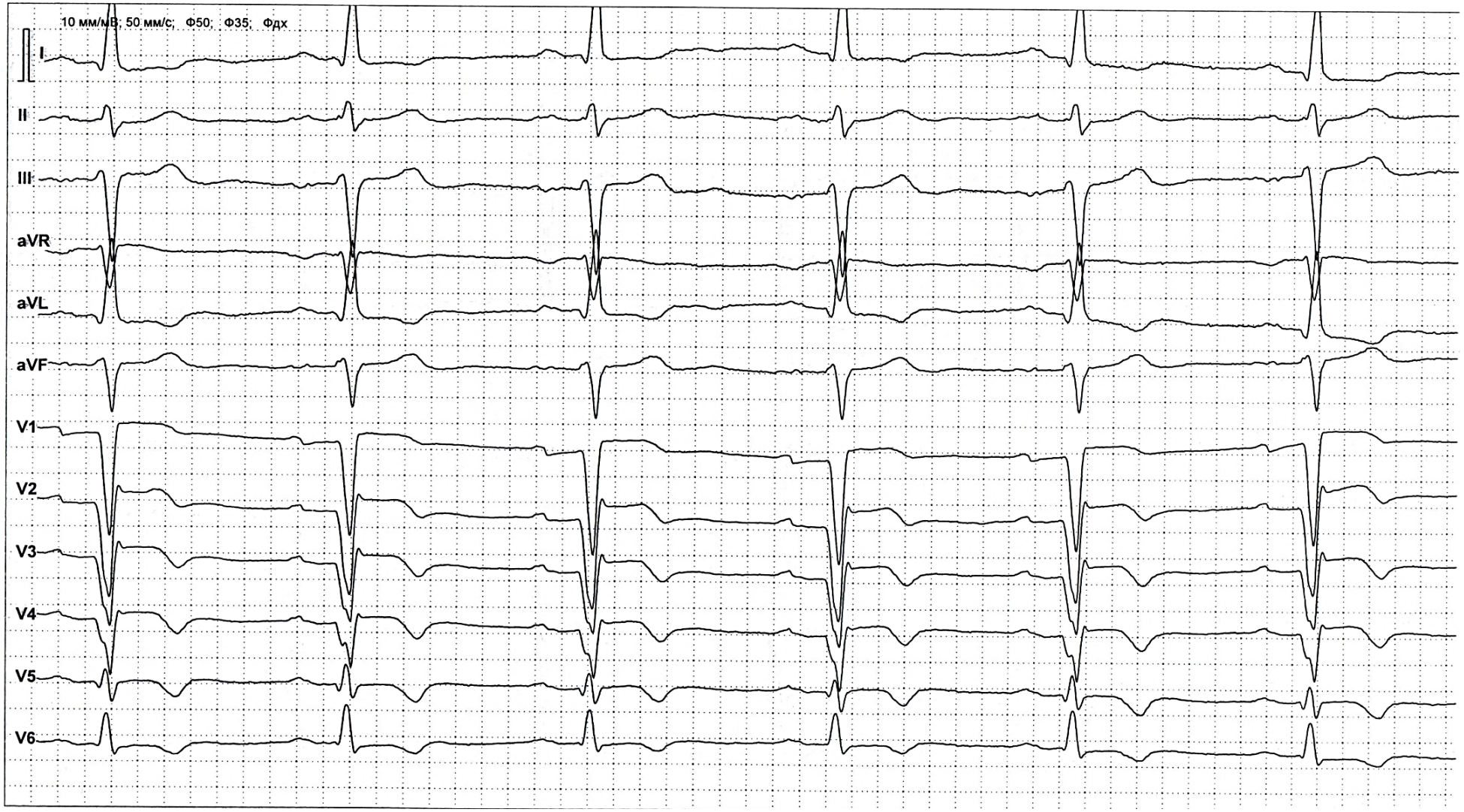

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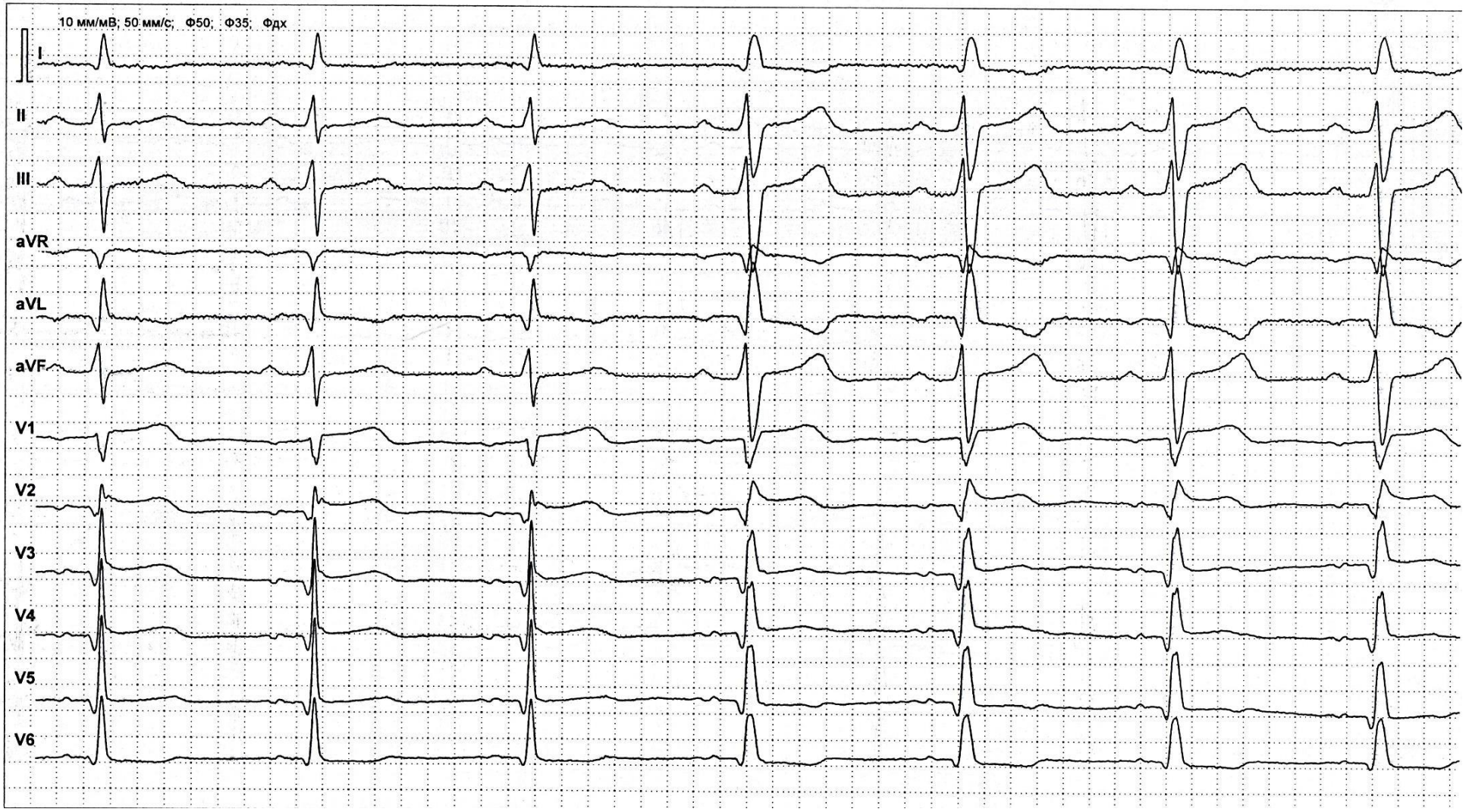

35

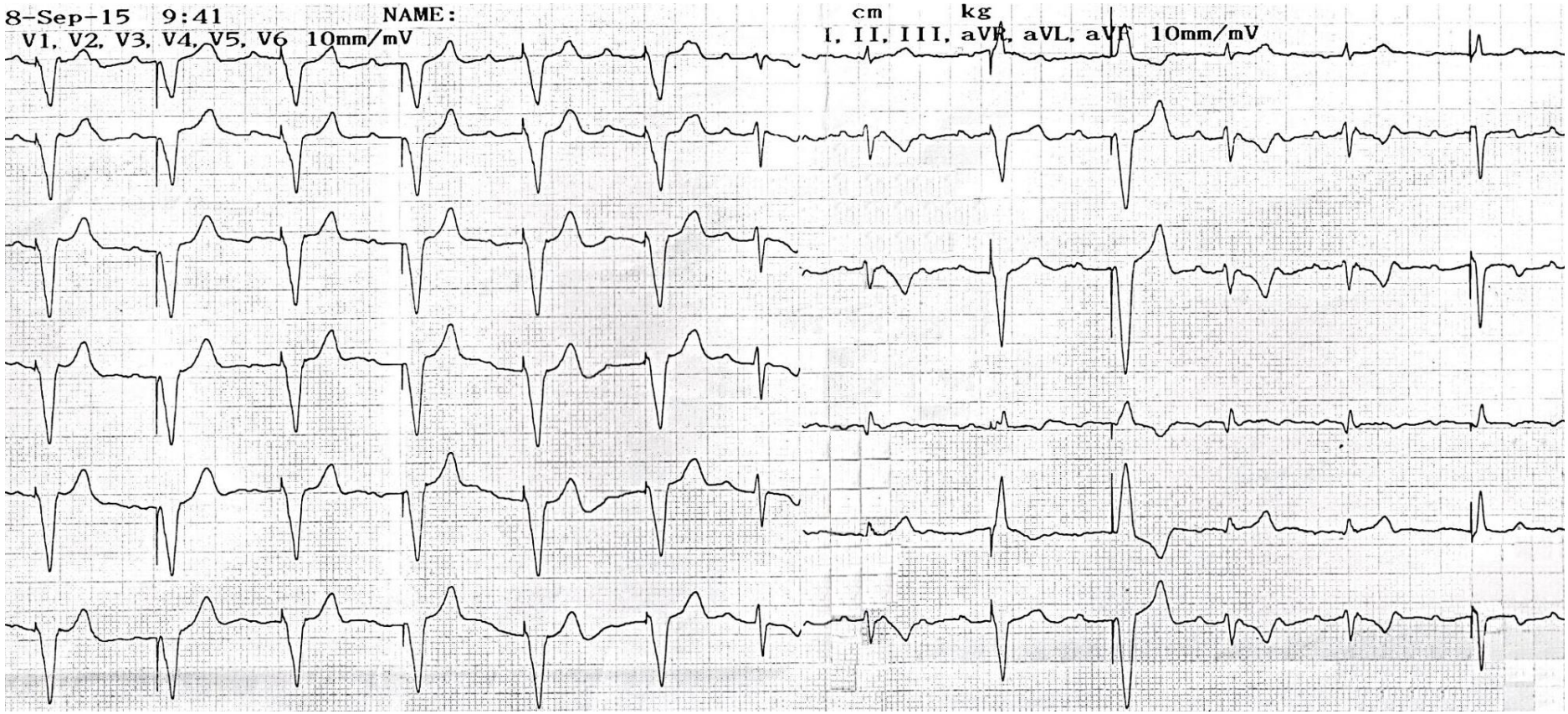
8-Sep-15 9:41
NAME:
cm kg
V1, V2, V3, V4, V5, V6 10mm/mV
I, II, III, aVR, aVL, aVF 10mm/mV

TABLE OF CONTENTS

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