Ministry of Health of Ukraine
Kharkiv National Medical University

PHYSICAL METHODS OF CARDIOVASCULAR SYSTEM EXAMINATION. INQUIRY AND GENERAL INSPECTION OF THE PATIENTS WITH CARDIOVASCULAR PATHOLOGY. INSPECTION AND PALPATION OF PRECORDIAL AREA

Methodical instructions for students

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INQUIRY OF A PATIENT WITH CARDIOVASCULAR PATHOLOGY

The main complaints in patients with cardiovascular disease include:

1. Dyspnea, asthma attacks
2. Pain in the heart region
3. Palpitations
4. Intermissions of heart beats
5. Swelling of the lower extremities and accumulation of fluid in cavities
6. Cough, hemoptysis
7. Dyspepsia
8. Asthenovegetative disorders: weakness, fatigue, decline in performance

Dyspnea is a painful feeling of lack of air, one of the symptoms of heart failure, predominantly is of inspiratory type and can be associated with physical activity (in the early stages of compensation) or occur at rest (a sign of severe cardiac decompensation). It is a compensatory responsive activation of the respiratory center in case of congestion and decreased blood flow in larger and small circulation due to reduced myocardial contractility. Dyspnea is typical for heart failure on the background of valvular heart disease (especially mitral valve pathology), ischemic heart disease (angina pectoris, myocardial infarction, cardiosclerosis, arrhythmias and heart blockages), essential and symptomatic hypertension (due to chronic kidney disease, pheochromocytoma, Cushing's disease, primary aldosteronism etc.).

Suffocation (cardiac asthma) is an extreme manifestation of dyspnea that may develop both at rest and during exercise, is characterized by feeling the acute shortage of air, inability to take a deep breath. In case of development of pulmonary edema cardiac asthma can be accompanied by large amount of foamy expectorations and presence of coarse pulmonic rales that may be audible distantly.

Pain in the heart region (cardialgia) may be associated with heart causes such as angina pectoris, myocardial infarction, endocarditis, myocarditis, pericarditis, acute aortic dissection, pulmonary thromboembolism, vegetative dysfunction. Cardialgia also may be associated with extracardiac reasons such as gastrointestinal diseases (gastritis, peptic ulcer, gastroesophageal reflux) and diseases of the skeletomuscular system (myositis, rib fractures, periostitis, intercostal neuralgia, osteochondrosis of the thoracic spine).

For the differential diagnosis of pain in the heart region, the details of the complaint should be specified thoroughly cardialgia, which will help to suggests causal features of cardialgia.

The anginal pain is characterized as sensation of compression/burning, lasting up to 10 minutes, usually manifesting on physical exertion or emotional stress, radiating to the left arm, shoulder, arm, jaw, relieved at rest and by nitroglycerin intake.

The pain in myocardial infarction is similar to anginal one, but is typically characterised by greater intensity and duration (hours, days), is not relieved by nitroglycerin, is accompanied by specific ECG signs, sometimes followed by a cold sticky sweat, anxiety, blood pressure decrease on the background of tachycardia.

In acute aortic dissection, the pain is sharp, very intense, radiate to the spine and move along the aorta following the site of current dissection.

Pains in myocarditis usually is pressing, dull, of moderate to low intensity, increases during exercise, in the acute period is accompanied by signs of inflammatory response (fever, leukocytosis, increased ESR).

In pericarditis, the pain is localized in the middle of sternum or over the entire precordial region, may be sharp, stabbing, “shooting”, lasts from several hours to several days, varies with the position of the body, increases with movement, coughing, pressing by the stethoscope, pericardial friction rub can be revealed on auscultation.

In vegetative dysfunction (cardiac type), the pain is localized in the apical region, is usually piercing, of varying duration, moderate intensity, not related to physical activity, often associated with psycho-emotional stress, mainly occurs in the evening and at night (at bedtime), is rfelieved by sedatives intake.

Pulmonary thromboembolism pain can be is localized behind the sternum or in the lateral part of the chest, is accompanied by hemoptysis, pronounced dyspnea, tachycardia and hypoxemia.

The pain in esophageal and gastric pathology is characterized by a burning sensation behind the sternum, is triggered by certain types of food, increases in a prone position, does not depend on the level of physical exertion, is relieved by antacids, but not nitroglycerin, may be accompanied by dysphagia and dyspeptic symptoms.

Pain in the skeletomuscular system pathology can have “shooting”, pierceng character, is often constant, associated with the movement, stopped by nonsteroidal anti-inflammatory drugs.

Palpitations a feeling of strengthened and rapid contractions of the heart, which is associated with increased excitability of neural centers that regulate heart activity. May be observed in healthy people at high physical

exertion, emotional stress, coffee and tobacco abuse; in cardiovascular disease (myocarditis, coronary heart disease, hypertension, heart failure, valvular heart disease); in reflex disorders (on the background of fever, anemia, neurosis, hyperthyroidism, after intake of cholinoblockers, in depression, vegetative dysfunction).

The feeling of **intermissions** of heart beats occur due to cardiac arrhythmias, is felt as a temporary stop in heart beating. May be observed in various disorders of heart rhythm and conduction (extrasystolic arrhythmia, atrial fibrillation, supraventricular and ventricular tachyarrhythmias, heart block) that develop on the background of an organic lesion of the heart muscle (coronary heart disease, cardiosclerosis, myocarditis, valvular heart disease). Also, arrhythmias and bradycardia may occur with an overdose of drugs – cardiac glycosides, beta-blockers, anti-arrhythmic drugs.

Edema develops as a result of a compensatory reaction of the body to reduced cardiac preload (decrease in blood flow to the heart) due to:

1) deceleration and extravasation of blood fluids to the tissues, increased the hydrostatic pressure in the capillaries.

2) dysregulation of electrolyte metabolism (insufficient supply of arterial blood to kidney → activation of the RAAS, increased secretion of ADH)

3) long-term venous stasis in the larger circulation → decrease in production of albumin and globulin in liver → decrease in plasma oncotic pressure.

Edema occuring in cardiovascular disease is characterized by the appearance on the lower limbs, spreading upwards, increasing by the end of the day, decreasing at night or after rest; the edematous region is typically of pale or cyanotic tint, cold to the touch, firm with remaining pit after applying presure. Fluid retention up to 5 liters is almost invisible and can be expressed only in weight gain. Visible swelling in the vertical position of the patient is localized on the calf, back of the foot, in lying position – in the sacral region and lower back. Accumulation of fluid in body cavities is also possible (ascites - in the abdominal cavity, hydrothorax - in the pleural cavity, hydropericardium - between the sheets of pericardium). Generalized edema is called anasarca and is characterized by swelling of the whole body (edema of the lower extremities, abdominal wall, combined with the accumulation of fluid in the cavities). Anasarca is typical for end-stage heart failure.

Cough in cardiovascular pathology is characterized by the release of a small amount of mucous expectoration, mostly in the morning, with no signs of intoxication and inflammation and is associated with the development of congestion in the pulmonary circulation. **Hemoptysis** occurs in pulmonary hypertension and blood stasis when sputum streaked with blood is be

expectorated after cough. Cough and hemoptysis are more common in the left heart chambers pathology and pulmonary thromboembolism. It should be distinguished from large amounts of foamy pink sputum associated with acute left ventricular failure (pulmonary edema) and pulmonary hemorrhage when large amounts of blood are released - 100 ml and more (pulmonary cancer, destructive pulmonary tuberculosis).

Dyspeptic symptoms in cardiovascular diseases are associated with blood congestion in the liver and blood vessels of larger circulation, which leads to an increase in the liver size (accompanied by sensation of heaviness and discomfort in the right upper quadrant of the abdomen) and digestive disorders (nausea, belching, vomiting, bloating, disturbance of bowel motility).

Weakness and fatigue are the most common complaints in patients with myocarditis, chronic heart failure. Along with shortness of breath, palpitations they severely limit the patients' physical activity.

GENERAL INSPECTION OF A PATIENT WITH CARDIOVASCULAR PATHOLOGY

On examination, attention should be payed to the ***forced position of the patient, the presence of specific changes in the face, the color of the skin, condition of the skin derivatives (nails), lower limbs swelling***. In order not to miss important details, you need to examine the patient from top to bottom.

Forced position in cardiovascular disease: orthopnea without arms fixation - typical for end-stage heart failure. Prolonged sitting leads to depositing of the blood in the vessels of lower extremities, decreased venous return to the heart, and as a consequence in reduced congestion in the pulmonary circulation. It improves blood oxygenation; lowers the diaphragm and decreases pressure on it in the presence of ascites. Forced position on the right side is typical for severe heart dilation, as it also decreases cardiac pre-load and allows to eliminate the unpleasant feeling due to the heart adjoining chest.The position of sitting, hunched forward is typical for exudative pericarditis.

The presence of specific changes in the face: "Facies mitrale" - a person with mitral stenosis has a distinctive crimson on the cheeks, so-called "mitral butterfly" due to cyanosis, intensely colored lips that may give a person the good looks and the patient looks younger than his chronological age. "Corvisart face" is seen in patients with terminal heart failure and is characterized by yellowish-earthy shade of skin, opened mouth, arocyanosis, pronounced dyspnea at rest; "worm symptom" is the visualisation of convoluted temporal arteries, a sign of atherosclerosis and hypertension.

Coloration of the skin, condition of the skin derivatives (nails). In heart defects that are accompanied by a decreased cardiac output, the skin is usually pale (pallor aortic). In aortic stenosis it is associated with decreased blood filling of the aorta. In aortic regurgitation, the reason is an insufficient filling of precapillaries during diastole. Stenosis of the pulmonary artery gives skin a shade of pale and cyanotic at the same time.

In heart failure, skin has a waxy yellowish tint, in bacterial septic endocarditis - the color of coffee with milk.

Cyanosis of the skin in patients with cardiovascular disease may be manifested as acrocyanosis (cyanosis of the tip of the nose, lips, ear lobes, nasolabial triangle, fingers) and a central cyanosis (cyanosis of the face, upper body). Acrocyanosis emergence is associated with an increase of restored hemoglobin in venous blood due to increased tissue oxygen consumption and slow blood flow on the background of insufficient pumping function of the heart. The development of central cyanosis is due to insufficient oxygenation of blood on the background of blood congestion in lesser circulation and pulmonary hypertension in insufficient myocardial contractility.

Acropachia - deformation of nail phalanges of hands by the type of drum sticks (thickening of distal phalanges) and the shape of the nail plate in the form of handwatch glasses (concave, exfoliating, with transverse and longitudinal striation, large convex) are important feature of cardiovascular disease, including congenital heart defects. Acropachia development is related to the mechanisms of excessive growth of the periosteum in conditions of chronic hypoxia due to heart failure; it can also be observed in case of pulmonary-cardiac insufficiency (chronic pulmonary heart).

Swelling of the lower extremities (cardiac edema) is formed due to development of congestion in the systemic circulation, when affected heart does not provide an adequate stroke volume. In conditions of decelerated venous blood flow, the liquid portion of plasma diffuses through the vascular wall into the extracellular space, thereby forming the lower limb edema and (in the terminal stage of heart failure) ascites.

Inspection of the neck and head

Retrosternal pulsation may be observed in the jugular fossa (above the handle of the sternum between the inner edges of the sternocleidomastoid muscle) as a pulsator protrusion of the aortic arch synchronous with the systole. It can be associated with the expansion and extension of the aortic arch (aortic aneurysm).

The pulsation of the carotid arteries ("carotid dance") occurs in case of pronounced aortic regurgitation. This defect is characterized by "pulsating man" syndrome, which is manifested by the following symptoms: Musset symptom - rhythmic swaying of the head synchronized with the pulsing artery,

Landolfi sign - narrowing and dilation pupils during systole and diastole respectively, Quincke pseudocapillar pulse - a white area formed at the end of the nail phalanx with pressure applied expands and decreases during systole and diastole respectively.

On examination, overfilling and swelling of the veins can be seen. This is due to the development of superior vena cava syndrome (SVC), which is caused by compression of the SVC in such conditions as aortic aneurysm, mediastinal tumors, pericardial effusion, venous thrombosis, pulmonary embolism. When compression of the SVC creates the preconditions for the opening and expansion of collateral veins, it clinically manifests as a venous extension mesh on anterior and posterior chest walls not lower than the 5^{th} ribs level, accompanied by swelling of the face, neck, hands (Stokes collar) and diffuse cyanosis of the face and upper limbs. The inferior vena cava syndrome (IVC) is caused by compression, thrombosis and hypertension in the portal vein system and occurs in the terminal stages of heart failure, cirrhosis of the liver, mesenteric arterial thrombosis. Clinically IVC syndrome is characterized by swelling of the lower extremities, cyanosis of the lower half of the body, extended venous network (Medusa's head) appears in the umbilical region area, accompanied by the expansion of hemorrhoidal veins, formation of ascites.

INSPECTION OF PRECORDIAL REGION

The signs that can be revealed during precordial region inspection include:

1. Cardiac hump
2. Apex beat
3. Cardiac beat
4. Visible pathological pulsations

Deformation of the sternum in the heart region – cardiac hump – can be found in patients suffering from heart disease since childhood. Cardiac hump is formed under the conditions where the hypertrophied heart in a child with congenital heart defect is putting pressure on the unformed bone and cartilage. This deformation ma be also observed in patients with Marfan syndrome. There may also be a non-permanent protrusion in this area senn as the smoothed intercostal spaces in pericardial effusion.

In healthy individuals in the V intercostal space, 1-1.5 cm medially from the left mid-clavicular line (in the apical region) a limited area of physiological rhythmic pulsation – **apex beat** – may be observed. The origin of the apex beat is the fact that during systole of the heart muscle thickens, lifts the apex of the heart, moving forward and striking the anterior chest wall. Apex beat is visualised in approximately 50% people, in rest of the cases it is covered by the

rib. To visualise the apex beat in women sometimes it is needed to ask a patient to lift the left breast. In right-sided heart location (dextracardia) apex beat is revealed medially from the right mid-clavicular line in the V intercostal space.

Cardiac beat is formed by the contraction of the right ventricle. As the right ventricle is located behind the sternum, in healthy individuals its pulsation can not be seen. The exceptions are those with asthenic type of constitution and low body mass index. The presence of cardiac beat in patients with cardiopulmonary pathology (visualized on the left edge of the sternum and in the epigastric region) is a sign of right ventricular hypertrophy (chronic pulmonary heart, mitral stenosis and regurgitation, pulmonary artery valve stenosis and regurgitation, tricuspid regurgitation). In the epigastric region, pulsation of the abdominal aorta can also be observed.

For the differential diagnosis of epigastric pulsation (hypertrophied right ventricle or abdominal aorta) the patient should be asked to take a deep breath: cardiac beat pulsation in this case increases, the abdominal aorta pulsation is reduced. Pulsation of the abdominal aorta is localized in the lower part of the epigastric area to the left of the median line of the abdomen and is better visible in the horizontal position of the patient.

Pulsation on the base of the heart. Pulsation in the II intercostal space at the right edge of the sternum can be caused by aortic aneurism, and in the II intercostal space at the left sternal border – by pulmonary hypertension: chronic pulmonary heart, mitral stenosis and regurgitation, pulmonary artery valve stenosis and regurgitation, etc.)

The standard description (in healthy individual): On inspection of precordial region, cardiac hump is absent, apex beat is not visualised, cardiac beat is not visualised, visible patholigical pulsations are absent.

PALPATION OF PRECORDIAL REGION

It allows you to palpate the apical beat (AB) and to identify its properties, as well as to identify the symptom of "cat's purr"

Properties of the AB: localization, strength, area, height.

Localization of the AB:

Normally palpable in the V intercostal space 1-2 cm medially from the left midclavicular line.

AB dislocation to the left and downside may be observed due to the:

- Hypertrophy and dilatation of the left ventricle: aortic regurgitation, aortic stenosis in the stage of decompensation, mitral regurgitation, hypertension, cardiomyopathy (hypertrophic, dilated) acute myocardial injury (myogenic dilatation).

- Mediastinal shift: right-sided hydrothorax, right-sided pneumothorax, left-sided obstructive atelectasis.

AB dislocation to the left and upside may be due to the increase in abdominal pressure: high position of the diaphragm (hypersthenics), ascites, meteorizm, abdominal obesity, pregnancy, bulky tumor masses in the abdomen (oncopathology, acute intestinal obstruction, etc.)

The strength of the AB. Normally BT is of moderate strength. The strength is measured by the pressure exerted by the apex of the heart to fingers of the physician. Increased strength of the AB can be associated with left ventricular hypertrophy: aortic defects, mitral regurgitation, arterial hypertension (primary and secondary), also during physical activity and psycho-emotional arousal, in endocrine disorders.

The weakening of the AB is mainly due to extracardiac factors: obesity, excessive development of chest muscles, narrow intercostal spaces in hypersthenics, emphysema, exudative pericarditis, left-sided pnemo- and hydrothorax.

Area of the AB. Normally is approximate 2 cm^2.

Increased area of the AB indicates hypertrophy / dilatation of the left ventricle in conditionss such as mitral and aortic regurgitation, hypertension, hypertrophic and dilated cardiomyopathy, high position of the diaphragm, the posterior mediastinum tumor.

Reduc area of the AB is mainly due to extracardiac factors: obesity, excessive development of chest muscles, narrow intercostal spaces at hypersthenics, emphysema, exudative pericarditis, left-sided pnemo- and hydrothorax.

Height of the AB. Normally AB is of moderate height, which is defined as the amplitude of anterior chest wall excursions synchronous to the AB.

High AB is associated with conditions such as physical and psycho-emotional stress, fever, hyperthyroidism, any condition associated with the development of tachycardia.

Low AB is associated with extracardiac factors: obesity, excessive development of chest muscles, narrow intercostal spaces at hypersthenics, emphysema, exudative pericarditis, left-sided pnemo- and hydrothorax.

The domed AB is the AB that is shifted to the left and downside, increased in area, tall, inforced; it can be seen in cases of significant left ventricular hypertrophy in aortic valve disease (stenosis and regurgitation).

The phenomenon of "cat's purr" is a palpable equivalent of the low-frequency component of cardiac murmur, which occurs when a turbulent blood flow passes through the narrowed orifice (stenosis of the corresponding valve). It may be defined as in systole and diastole. Depending on which auscultation point the "cat's purr" is revealed at, the corresponding valve stenosis may be

diagnosed. The apex of the heart - the diastolic "cat's purr" - mitral stenosis; II intercostal space to the right of the sternum - systolic - aortic stenosis; II intercostal space on the left of the sternum systolic - stenosis of the pulmonary trunk; the base of the sternum - diastolic - the tricuspid valve stenosis.

The standard description (in healthy individual): On palpation of precordial region, apex beat is palpated in the V intercostal space 1.5 cm medially from the left midclavicular line, with an area of about 2 cm^2, moderate strength and height; cardiac beat is not palpable; a symptom of "cat's purr" is absent.

TEST CONTROL

1. ***Which color of the skin is typical in the patients with aortic regurgitation?***

A. Pale
B. Peripheral cyanosis
C. Jaundice
D. Diffuse cyanosis
E. Purple

2. ***Edema of the feet, more pronounced in the evening, acrocyanosis, cold skin over edema are typical in:***

A. Pericarditis
B. Glomerulonephritis
C. Heart failure
D. Liver cirrhosis
E. Thyrotoxicosis

3. ***Cardiac hump is observed in:***

A. Mitral heart valvular disease that arises in 30 years old patient
B. Aortic aneurism
C. Congenital heart disease
D. Pericarditis with effusion
E. Hydrothorax

4. ***Which heart chamber takes part in the cardiac beat formation?***

A. Left ventricle
B. Right ventricle
C. Left atrium
D. Right atrium
E. Left atrium and left ventricle

5. ***Which color of the skin is typical in the patients with mitral stenosis?***

A. Pale
B. Peripheral cyanosis

C. Jaundice
D. Diffuse cyanosis
E. Purple

6. ***In which pathology protrusion of the heart region, leveling of the intercostals spaces are observed in inspection?***

A. Mitral stenosis
B. Pericarditis with effusion
C. Aortic aneurism
D. Pulmonary artery stenosis
E. Tricuspid regurgitation

7. ***In which pathology apex beat is impalpable?***

A. Right-sided pleurisy with effusion
B. Right-sided lobar pneumonia
C. Left-sided lobar pneumonia
D. Left-sided pleurisy with effusion
E. Right-sided spontaneous pneumothrorax

8. ***Which color of the skin is typical in the patients with aortic stenosis?***

A. Pale
B. Peripheral cyanosis
C. Jaundice
D. Diffuse cyanosis
E. Purple

9. ***Edema of the lower limbs, more pronounced in the evening is typical in:***

A. Pericarditis
B. Glomerulonephritis
C. Heart failure
D. Liver cirrhosis
E. Thyrotoxicosis

10. ***In which pathology pulsation in the jugular fossae is observed?***

A. Mitral regurgitation
B. Mitral stenosis
C. Pericarditis with effusion
D. Myocarditis
E. Aortic arch aneurism

11. ***In which pathology apex beat is displaced to the left?***

A. Aortic stenosis
B. Tricuspid regurgitation
C. Mitral stenosis
D. Dry pericarditis
E. Left-sided pleurisy with effusion

12. ***Which color of the skin is typical to the patients with cardiogenic shock?***

A. Pale
B. Peripheral cyanosis
C. Jaundice
D. Diffuse cyanosis
E. Purple

13. ***Which color of the skin is typical in the patients with infectious endocarditis?***

A. Pale with yellowish tint
B. Peripheral cyanosis
C. Jaundice
D. Diffuse cyanosis
E. Coffee with milk

14. ***In which pathology pulsation and protrusion in the second intercostals space to the left of the sternum can observed?***

A. Aortic stenosis
B. Combined aortic defect
C. Tricuspid regurgitation
D. Aortic regurgitation
E. Pulmonary hypertension in mitral valve defects

15. ***In which pathology carotid arteries pulsation is observed?***

A. Mitral stenosis
B. Aortic stenosis
C. Tricuspid regurgitation
D. Aortic regurgitation
E. Mitral regurgitation

16. ***In which cardiac disease diffuse cyanosis can be observed?***

A. Essential hypertension
B. Aortic stenosis
C. Congenital heart diseases
D. Mitral regurgitation
E. Mitral stenosis

17. ***In which acute condition forced sitting posture, dyspnoea, diffuse cyanosis, hemoptysis are typical?***

A. Loss of consciousness
B. Pulmonary artery thromboemolism
C. Pericarditis with effusion
D. Cardigenic shock
E. Edema of the lungs

18. ***In which pathology protrusion and pulsation in the second intercostals space to the right of the sternum is observed?***

A. Aortic stenosis
B. Mitral stenosis
C. Aortic aneurism
D. Pericarditis with effusion
E. Myocarditis

19. ***In which pathology apex beat is displaced to the left and downward?***

A. Aortic stenosis
B. Tricuspid regurgitation
C. Mitral stenosis
D. Aortic regurgitation
E. Myocarditis

20. ***In which pathology protrusion and pulsation in the third-fourth intercostals spaces to the right of the sternum can be observed?***

A. Mitral regurgitation
B. Aneurism of the anterior wall of the left ventricle
C. Mitral stenosis
D. Aortic stenosis
E. Essential hypertension

Answers: 1A, 2C, 3C, 4B, 5B, 6B, 7D, 8A, 9C, 10E, 11A, 12A, 13E, 14E, 15D, 16C, 17E, 18C, 19D, 20B.

Methodical instructions

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