Examination of the patients with cardiovascular pathology: inquiry, inspection and palpation of precordial region, percussion of the heart

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include:
- inquiry,
- general inspection,
- inspection and palpation of the heart region,
- percussion (determination of the heart borders),
- auscultation

METHODS OF EXAMINATION
INQUIRY
Specific:
- Pain in the heart region
- Intermissions
- Palpitation
- Dyspnoea
- Asphyxia
- Cough
- Hemoptysis
- Syncope
• Nonspecific
  o Fever, Sweetness
  o Weight loss
  o Fatigue
  o Headache
  o Dizziness
  o Sleeplessness
  o Deranged vision and hearing
  o Voice changes
  o Dysphagia
  o Dyspepsia
  o Thirst
  o Pain in the abdomen
  o Pain in the joints
Or unpleasant retrosternal sensation can be caused by cardiovascular diseases and also by extra cardiac causes:

- Respiratory pathology,
- Spinal pathology,
- Muscle pathology,
- Abdominal organs and diaphragm pathology

*Specific complaints
Pain in the heart region*
- **Location**: retrosternal, in the apex region, to the left of the sternum...
- **Intensity**: severe, rather intense, moderate, mild...
- **Character**: a) superficial or profound (“deep”);
  b) type of the pain: squeezing, pressing, stabbing, piercing, burning, boring, gnawing, feeling of tightness, shooting;

**Pain in the heart region**

**Diagnostic approach to the patients with pain in the heart region**
• **Frequency**: seldom, every day, every week, several times a day (to indicate how many times);
• **Duration**: transitory, constant, intermittent,
• attacks of pain
• (to indicate in seconds,
• minutes, hours);

**Pain in the heart region**

*Diagnostic approach to the patients with pain in the heart region*
Radiation: to the left shoulder, left arm, left shoulder-blade, left supraclavicular and subclavicular region, to the back, interscapular region, to the left of the neck, lower jaw, to the epigastric region, to the right half of the chest;

Pain in the heart region

Diagnostic approach to the patients with pain in the heart region
• **Associated features:** morbid fear of death, palpitation, intermissions, dyspnoea, weakness, trembling in the body, cramps, feeling of air deficit, dizziness, excessive urination;

Pain in the heart region

*Diagnostic approach to the patients with pain in the heart region*
Pain in the heart region

Diagnostic approach to the patients with pain in the heart region

- **Provocation:** during insignificant physical exertion - during walk: quick, ordinary, slow; ascending the stairs or hill; frosty day; in going out of doors in 10-20 minutes; emotional factors; excessive meal; after alcohol use, smoking; in considerable physical loading; without visible cause.
• **Relieving conditions**: is abated by nitroglycerin (how many tablets a day, pain relieve at once, in few seconds, in few minutes); at rest; changing position; talking; is abated by analgetics.

Pain in the heart region

*Diagnostic approach to the patients with pain in the heart region*
Differential diagnosis of pain in the heart region from history

- Retrosternal, constricting, feeling of heaviness, from few seconds to 15 min, radiate to the left arm, scapula, jaws, the neck, associated with morbid fear of death, comes on with exertion, is relieved by rest, is relieved by nitrates

Favours angina pectoris (ischemic pain)
Differential diagnosis of pain in the heart region from history

- Pain as above but prolonged, continuous pain > 20-30 min, more severe, tight or burning, resist at rest, and does not respond to nitrates

Favours myocardial infarction
• Retrosternal, extremely severe, sharp and tearing, piercing, radiate to the spinal column, moves gradually along course of the aorta, associated with collapse, syncope, cyanosis, with very sudden onset

Consider aortic dissection

Differential diagnosis of pain in the heart region from history
Consider pericarditis

Differential diagnosis of pain in the heart region from history

- Middle of the sternum or heart apex or entire heart region, stabbing, shooting, feeling of heaviness, persist several days or may arise in attack during inspiration, coughing, radiate to the left scapular, the neck, epigastric region, left arm, varies in intensity with movements, the phase of respiration, and under the pressure of stethoscope
Differential diagnosis of pain in the heart region from history

• Behind manubrium sterni, permanent, does not respond to exertion

Consider aortitis

Differential diagnosis of pain in the heart region from history
• Very variable in site and intensity, may vary with posture or movement, very commonly accompanied by local tenderness over the rib or costal cartilage

Consider musculoskeletal cause

Differential diagnosis of pain in the heart region from history
Intermissions (escaped beats) are due to disorders of the cardiac rhythm. Patients describe it as a feeling of

- “disordered activity” of the heart,
- “stroke of the heart of various strength”,
- “sinking” or “stoppage” of the heart. Intermissions are clinical sign of:

- atrial fibrillation,
- premature beats (extrasystoles),
- heart blocks.
Premature beats (extrasystoles)

**Signs**
- “sinking” or “stoppage” of the heart,
- “premature” heart contraction,
- “escaped” pulse

**Causes**
- Organic affection of the myocardium (main cause)
- Extracardiac (hormonal disorders)
- Nervous-reflectory (viscerocardioc cardiac reflex)
- Toxic affection of the myocardium
**Atrial fibrillation**

**Signs**

- “disordered activity” of the heart

**Causes**

- Mitral stenosis
- Atherosclerotic cardiosclerosis
- Thyrotoxicosis

**Atrial fibrillation**
Heart blocks

**Signs**

- feeling of “stoppage” of the heart

**Causes**

- Organic affection of the myocardium with incomplete or complete block of impulse transmission through conduction system:
  - Incomplete sinoatrial block
  - Complete atrioventricular block
Palpitation

- is subjective feeling of accelerated and intensified heart contractions onto the chest wall. Heart palpitation is clinical sign of tachycardia.
1. Palpitation periodic and transitory occurs in healthy persons after intensive physical exertion, during running, after emotional stress. It can be provoked by some pharmacological preparations: adrenaline, caffeine, atropine sulphate. Such palpitation is physiologic, and is due to increased chronotropic activity of sympathetic nervous system on the heart and decreased chronotropic influence of vagus nerve.

**Clinical variants of palpitation**
As a result of organic affection of the myocardium in coronary heart disease, reumocarditis, pericarditis, heart valvular disease, cardiac tumor, myocardiopathy, mitral valve prolapse, and ventricular preexitation syndromes (WPW, CLC). It has lingering character, accompanied by the pain in the heart region, disorders of the heart rate, feeling of compression in the chest, feeling of fear, stoppage of breathing, headache, noise in the ears and “net” before eyes.

Clinical variants of palpitation
Attacks of palpitation with the heart rate over 160 per minute - paroxysmal tachycardia. This is a sudden acceleration of the cardiac rate (to 180-240 beats per minute). May last from several seconds to a few days, and terminate just as unexpectedly as it begins. During an attack the patient feels strong palpitation, discomfort, feeling of compression in the chest, squeezing pain in the heart region, dyspnoea, lack of air, dizziness, and weakness. Paroxysmal tachycardia arises in the patients with organic affection of the heart: in myocardial infarction, heart valvular diseases, and in cardiosclerosis. It may occur in subjects with increased nervous excitability in the absence of pronounced affection of the heart muscle.
• Palpitation periodic, of not long duration, appeared regular after moderate physical activity, is a symptom of the heart failure. In increased pressure in the lesser circulation, elevated pressure in the orifice of the vena cava by reflex through the sympathetic nerve accelerates cardiac rate (Bainbrigde reflex) to unload lesser circulation.

Clinical variants of palpitation
• Palpitation often develops as a reflex in diseases of some internal organs: in disease of the central nervous system, neurosis, endocrine pathology (thyrotoxicosis), in fever, anemia, hypotension, and in many infectious diseases

Clinical variants of palpitation
• Gr. *dys* (difficult, painful) and *pnoia* (breathing).

Breathlessness or dyspnoea is disorder of the respiratory ventilation of the lungs, manifested by unreasonably accelerated and intensified breathing.

**Dyspnoea (breathlessness)**
• Patients describe dyspnoea as 'the sensation of difficult, laboured, uncomfortable breathing', as 'distressing feeling of air deficit', and as 'the consciousness of the necessity for increased respiratory effort'. Often dyspnoea accompanied by the feeling of the fear and alarm, and by others unpleasant feelings.

Dyspnoea (breathlessness)
Asphyxia is an attack of grave dyspnoea that occurs due to acute congestion in the lungs and upset of gas exchange in acute left ventricular failure, and is observed in patients with myocardial infarction, aortic stenosis and regurgitation, and in essential hypertension.
Attacks of asphyxia, which are known as **cardiac asthma**, arise suddenly at rest or soon after physical or emotional stress, and usually during night sleep. This can be explained by an increased vagus tonus during sleep, which causes narrowing of the coronary arteries and thus impairs nutrition of the myocardium. During an attack of cardiac asthma in patients appears feeling of intense pressure in the chest, acute lack of air; the patient suffocates, catches the air by the mouth, marked weakness develops, and appears cold sweat. The skin becomes pallid and cyanotic. The face of the patient, not infrequently, expresses the fear and suffering. **Death of the patient.**
• Respiration becomes superficial and accelerated, inspiratory dyspnoea develops. The patient become coughing and expectorated tenacious sputum. During an attack of cardiac asthma the patient has to assume forced position - orthopnoea, or stands up. If congestion in the lesser circulation progresses, edema of the lungs develops. The feeling of suffocation and cough intensify still more, respiration becomes stertorous, ample foaming sputum with traces of blood (pink or red) is expectorated. Edema of the lungs requires prompt and energetic measure to be taken to prevent possible death of the patient.

Cardiac asthma
• **Cough** in the patients with cardiovascular diseases is due to congestion in the lesser circulation. Cough, as a rule, at first dry, arises during exertion, and particularly in the lying posture of the patient. In prolonged congestion cough is with sputum.
Haemoptysis. Coughing up blood is an alarming symptom and nearly always brings the patient to the doctor. Haemoptysis in cardiac pathology is mostly due to congestion in the pulmonary circulation and rupture of fine bronchial vessels during coughing.
• **Syncope** - is sudden loss of consciousness. Cardiac syncope is caused by a sudden drop in cardiac output and recoverable loss of adequate blood supply to the brain (cerebral ischemia) due to an arrhythmic or a mechanical problem.

• A faint is often preceded by a brief feeling of "lightheadness"; vision then darkens and there may be ringing in the ears.

• Cardiac syncope may be provoked by exertion (e.g. with severe aortic stenosis) or occur completely “out of the blue” (as in heart block). The loss of consciousness is brief, and the patient recovers quickly as long as he or she has assumed the horizontal position.
Examination plan:
• General condition
• Posture of the patient
• Consciousness
• Skin and visible mucosa
• Inspection of the face and neck
• Edema
• Muscular-skeletal system
• General condition depends on severity of the disease. Condition is satisfactory in the patients with cardiovascular pathology in compensation stage. Condition becomes worse in progression of pathological process and associated with complications.
• **Posture** of the cardiac patients may be active, passive or forced. Active posture is in patients with heart valvular diseases, arterial hypertension, and coronary heart disease without sighs of the heart failure. Passive posture - horizontal with low head of the bed is observed in the patients with acute vascular failure. In some cardiac diseases patients assume forced posture.
Forced posture
Lying with head end of the bed elevation

- Pathological condition
- Acute left ventricular failure, chronic heart failure of II-III degree
- Pathophysiological mechanisms
  - Re-distribution of blood into the low extremities,
  - reducing of circulating blood volume,
  - decreasing of venous pressure in the lesser circulation,
  - improvement of gas exchange in the “alveoli-pulmonary capillaries” system,
  - displacement of ascitis fluid
• Sitting position due to the acute left ventricular heart failure cardiac asthma is characterized a forced position sitting with legs hanging down from the bed.
Sitting posture bending forward

• Pathological condition
• Dry pericarditis
• Pathophysiological mechanisms
• Pericardial layers presses to one another, reduce their movement that decrease irritation of pain receptors in pericardium
Knee-elbow posture

- Pathological condition
- Effusive pericarditis
- Pathophysiological mechanisms
- Improvement of diastolic cardiac function
Consciousness of the patients with various cardiovascular diseases is clear.

Significant hypoxia, as a result of acute and chronic heart failure, is accompanied by consciousness disorders in a form of *stupor* or *sopor*.
Inspection of the face and the neck

- ‘Facies mitrale’ is characterized by cyanotic blush on the cheeks, cyanotic lips, tip of the nose, ears, young-looking, observes in the patients with mitral stenosis.
'Corvisart’s face'

- 'Corvisart’s face'
- Observes in patients with severe heart failure.
- The face is edematous,
- Pale yellowish with cyanotic tint,
- The eyes are dull and eyelids are sticky,
- Always open mouth,
- Cyanotic lips.
• Excitement, fear of death, suffering expression of the face are typical to the patients with acute left ventricular failure.

• In myocardial infarction complicated by cardiogenic shock the face of the patient is pale with cyanotic hue, covered by cold sweat.

• Face of the patient with aortic regurgitation is pale, rhythmic movements of the head, synchronous with carotid arteries pulsation - Musset’s symptom is observed.

Face of the patient
Face of the patient  

**Stokes' collar**

- ‘Stokes’ collar’ - marked dilation of neck veins, oedema of the neck, head, shoulders. These signs arise as a result of compression of superior vena cava by aortic aneurysm, tumor of mediastinum, and enlarged mediastinal lymph nodes.
Cardiomyopathy

With marked acrocyanosis

Cyanosis of lips, nose-mouth triangle
• Oedema is caused by penetration of fluid through the capillary walls and its accumulation in tissues.
• Retention of fluid in the body does not immediately cause visible oedema but provokes a rapid gain in the patient’s weight and his decreased urination.
• Oedema becomes visible in the first instance in the malleolus region, on the dorsal side of the foot, shins (if the patient sits or stands), and in sacral region (if the patient keeps bed).
• Oedema first develops only in the evening and resolves during the night sleep.
• If the heart failure progresses, oedema increases, and transudate may accumulate in the body's cavities: in the abdominal cavity (ascitis), pleural cavity (hydrothorax), and in the pericardium (hydropericardium).
• General distribution of oedema throughout the entire body is called anasarca.

Cardiac oedema
Methods of oedema revelation

**Inspection**

Swollen glossy skin. The specific relief features of the oedema-affected parts of the body disappear due to the leveling of all irregularities on the body surface. Stretched and tense skin appears transparent, and is especially transparent on loose subcutaneous tissues (the eyelids, the scrotum, etc.)
• **Palpation**

Methods of oedema revelation

- When the pressed by the finger, the oedematous skin overlying bones (external surface of the leg, malleolus, loin, etc) remains depressed for 1-2 minutes after the pressure is released.
Methods of oedema revelation

Weighing of the patient

Gain of the body mass
Methods of oedema revelation

- Diuresis control
- The amount of intake fluid exceeds the amount of urine
Ascitis revealing methods
Ascitis revealing methods

**Percussion**
- Tympanic sound
- Dull sound

**Palpation**
• Marfan’s syndrome is characterized by affection of the aorta in a form of aneurysm, coarctation, regurgitation and others congenital heart valvular diseases.

Skeletal and muscular system
Marfan's syndrome

Phenotype of the patients - tall, long narrow limbs, arachnodactyly, kyphoscoliosis, deformation of the sternum, and hypermobility of the joints.
• **Drum-stick (Hippocratic) fingers** - clubbing of the terminal phalanges of the fingers and toes, nails in a form of ‘hour glass’ - are characteristic of congenital heart valvular diseases, subacute septic endocarditis, and chronic cor pulmonale.

**Skeletal and muscular system**
In aortic coarctation, disproportion of the muscular system of upper and low limbs are observed: muscles of upper limbs are hypertrophied, and on the other hand, muscles of low limbs are relatively hypotrophied.

Skeletal and muscular system
Examination plan:

1. Presence of deformation of the chest in the heart region:
   a) cardiac “humpback”,
   b) effusive pericarditis;
2. Presence of the apex beat;
3. Presence of the pathological pulsation in the heart region;
4. Presence of the remoted pathological pulsation.

INSPECTION OF THE HEART REGION
• Presence of deformation of the chest in the heart region:
  a) cardiac “humpback” - constant, diffuse bulging of the area over the heart.

• Enlargement of the heart chambers in childhood, when the chest is liable to changes.
  2. Heart valvular diseases acquired in childhood
• Presence of deformation of the chest in the heart region:

• Temporary, diffuse and general protrusion of the cardiac region and leveling of the costal interspaces

b) **Effusive pericarditis**

**INSPECTION OF THE HEART REGION**
• 2. Presence of the apex beat;

• **Apex beat** - limited rhythmic pulsation in the site of projection of the heart apex, synchronous to the left ventricle contraction.

• The thrust of the heart apex against chest wall

• Observed in healthy persons with moderately developed subcutaneous fat and wide intercostals spaces

**INSPECTION OF THE HEART REGION**
• **Negative apex beat** - precordial depression during systole.

• **Adhesion of the parietal and visceral layers of the pericardium.**

• **Adhesive pericarditis, mediastinopericarditis**

**INSPECTION OF THE HEART REGION**
• **Cardiac beat** - spread pulsation in the III-IV interspaces along left edge of the sternum with synchronous pulsation in the epigastric region

• Dilation and hypertrophy of the right ventricle

• **Mitral valvular diseases, tricuspid regurgitation, chronic cor pulmonale**

**INSPECTION OF THE HEART REGION**
<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic depression and diastolic bulging of the chest in the III-IV interspaces along left edge of the sternum</td>
<td>Decreased volume of the right ventricle during systole and considerable enlargement of it during diastole</td>
<td>Tricuspid regurgitation</td>
</tr>
<tr>
<td>Weak restricted pulsation in the III-IV interspaces somewhat laterally from the left sternal edge</td>
<td>Presence of the bulging in the ventricular wall after myocardial infarction</td>
<td>Aneurysm of the left ventricular anterior wall</td>
</tr>
<tr>
<td>Pulsated bulging in the jugular fossae</td>
<td>Dilation of the aortic arch</td>
<td>Aneurysm of the aortic arch</td>
</tr>
<tr>
<td>Pulsation in the II interspace to the right of the sternum edge</td>
<td>Dilation of the ascending part of the aorta</td>
<td>Aneurysm of the ascending part of the aorta, aortic regurgitation, syphilitic mesoarthritis</td>
</tr>
<tr>
<td>Pulsation in the II interspace to the left of the sternum edge</td>
<td>Pulmonary hypertension, poststenotic dilation of the pulmonary artery</td>
<td>Mitral stenosis</td>
</tr>
<tr>
<td>Epigastric pulsation, which increased in deep inspiration</td>
<td>Hypertrophy and dilation of the right ventricle</td>
<td>Mitral valvular diseases, tricuspid regurgitation, chronic cor pulmonale</td>
</tr>
<tr>
<td>Epigastric pulsation, which decreased in deep inspiration</td>
<td>Pulsation of the abdominal aorta</td>
<td>In healthy persons with underdeveloped subcutaneous fat, enteroptosis, aneurysm of the abdominal aorta</td>
</tr>
</tbody>
</table>
PALPATION
• Examination plan:

1. Estimation of location and properties of the apex beat;
2. Determination of the “cat’s purr” symptom presence;

PALPATION OF THE HEART REGION
• Palpation of the apex beat

• Location. A normal apex beat is found in the 5th intercostal space 1-1.5 centimeters toward to the sternum from the left midclavicular line.
Displacement of the apex beat may depend on physiological and pathological causes.

<table>
<thead>
<tr>
<th>Physiological</th>
<th>Pathological</th>
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<tbody>
<tr>
<td>Respiration phases</td>
<td>Noncardiac</td>
</tr>
<tr>
<td>Position on the left, right side, lying, standing position</td>
<td>Changes of pressure in the chest and diaphragm level</td>
</tr>
<tr>
<td>Constitutional types</td>
<td>Changes of pressure in the pleural cavities</td>
</tr>
<tr>
<td></td>
<td>Tumor of the lungs and mediastinum</td>
</tr>
<tr>
<td></td>
<td>Cardiac</td>
</tr>
<tr>
<td></td>
<td>Changes of the heart chambers size</td>
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</tbody>
</table>

PALPATION OF THE HEART REGION
• In changes of the heart chambers size there may be different variants of the apex beat displacement. In left ventricular hypertrophy apex beat is displaced outward (Fig.1b), in dilation of left ventricular cavity apex beat is displaced downward (Fig.1c), in combination of hypertrophy and dilation apex beat is displaced outward and downward.

• Cardiac causes of the apex beat displacement: a) norm; b) left ventricular hypertrophy; c) left ventricular dilation; d) left ventricular hypertrophy and dilation; 1 - left midclavicular line; 2 - left anterior axillary line; 3 - line of displacement.
• Apex beat is displaced outward

• Hypertrophy of the left ventricle: mitral regurgitation, aortic stenosis, essential hypertension, atherosclerotic cardiosclerosis, hypertrophic cardiomyopathy.

• Hypertrophy and dilation of the right ventricle: mitral stenosis, tricuspid regurgitation, cor pulmonale.

• Extracardiac causes: right-sided effusive pleurisy, hydrothorax, left-sided obstructive atelectasis
• Apex beat is displaced outward and downward

• Considerable hypertrophy and dilation of the left ventricle: aortic regurgitation, considerable dilation of the left ventricle – dilative myocardiopathay
• Apex beat is displaced **outward and upward**

• Elevated pressure in abdominal cavity, high diaphragm level: ascitis, meteorism, pregnancy, hepatomegaly
Apex beat is displaced **inward**

- Right-sided obstructive atelectasis

**PALPATION OF THE HEART REGION**
• Apex beat is displaced **inward and downward**

• Low diaphragm level: asthenic constitution, visceroptosis

**PALPATION OF THE HEART REGION**
• Apex beat properties:
  • area,
  • height,
  • strength (or resistance).

PALPATION OF THE HEART REGION
• **Area** of normal apex beat is near 2 cm². Different physiological or pathological conditions can cause diffuse or restricted apex beat.

**PALPATION OF THE HEART REGION**
Causes of the **diffuse** apex beat

<table>
<thead>
<tr>
<th>Causes</th>
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<tbody>
<tr>
<td><strong>Physiological</strong></td>
</tr>
<tr>
<td>Deep inspiration, pregnancy, in subjects</td>
</tr>
<tr>
<td>with thin chest wall, wide intercostal</td>
</tr>
<tr>
<td>spaces (asthenic chest)</td>
</tr>
<tr>
<td><strong>Pathological</strong></td>
</tr>
<tr>
<td>Tumor of mediastinum, high diaphragm level</td>
</tr>
<tr>
<td>(ascitis, meteorism), sclerotic affection</td>
</tr>
<tr>
<td>of the lower border of the left lung,</td>
</tr>
<tr>
<td>hypertrophy and dilation of the left</td>
</tr>
<tr>
<td>ventricle (aortic regurgitation, aortic</td>
</tr>
<tr>
<td>stenosis, arterial hypertension in</td>
</tr>
<tr>
<td>myogenic dilation stage)</td>
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</table>
### Causes of restricted apex beat

<table>
<thead>
<tr>
<th>Causes</th>
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</thead>
<tbody>
<tr>
<td><strong>Physiological</strong></td>
</tr>
<tr>
<td>Deep expiration</td>
</tr>
<tr>
<td>Low diaphragm level</td>
</tr>
<tr>
<td><strong>Pathological</strong></td>
</tr>
<tr>
<td>Pulmonary emphysema</td>
</tr>
<tr>
<td>Left-sided effusive pleurisy*</td>
</tr>
<tr>
<td>Left-sided pneumothorax*</td>
</tr>
<tr>
<td>Effusive pericarditis*</td>
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</tbody>
</table>

* - in considerable accumulation of fluid or air apex beat is impalpable.

**PALPATION OF THE HEART REGION**
• **Height** of the apex beat is the amplitude of vibration of the chest wall.

Fig. Height of the apex beat

- Usually, the height varies with the area. High and low apex beats are differentiated

PALPATION OF THE HEART REGION
**Physiological causes of the apex beat height changes**

<table>
<thead>
<tr>
<th>Properties</th>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical exertion</td>
<td></td>
<td>Obesity</td>
</tr>
<tr>
<td>Emotional exertion</td>
<td></td>
<td>Overdeveloped muscles</td>
</tr>
</tbody>
</table>
Pathological causes of the apex beat height changes

<table>
<thead>
<tr>
<th>Causes</th>
<th>Noncardiac</th>
<th>Cardiac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tumor of posterior mediastinum</td>
<td><strong>High</strong></td>
<td><strong>Low</strong></td>
</tr>
<tr>
<td>Diffuse toxic goiter (Basedow’s disease)</td>
<td></td>
<td>Pulmonary emphysema Effusive pleurisy</td>
</tr>
<tr>
<td>Fever</td>
<td></td>
<td>Pneumothorax</td>
</tr>
<tr>
<td>Left ventricular hypertrophy</td>
<td><strong>High</strong></td>
<td><strong>Low</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Effusive pericarditis</td>
</tr>
</tbody>
</table>
• **Strength** of the apex beat is determined by resistance of the heart apex to palpated fingers during systole.

  - **Strong** or resistant apex beat - sign of the left ventricular hypertrophy in aortic valvular diseases, arterial hypertension, and mitral regurgitation.
  - **Weak** apex beat is determined in pulmonary emphysema, obesity, left-sided effusive pleurisy, effusive pericarditis (in small amount of fluid).
  - **Dome-like** apex beat in VI - VII intercostals spaces on left anterior or midaxillary line, diffuse, high, strong is determined in aortic regurgitation.

**PALPATION OF THE HEART REGION**
• **“Cat’s purr” symptom**

Cat’s purr symptom is thrill of the chest wall in the heart region, low vibrating murmur, which resembles purring of the cat. This sign is of great diagnostic significance. The cat’s purr symptom is palpatory equivalent of cardiac murmur in organic heart valvular diseases.
PALPATION OF THE HEART REGION

mitral stenosis

aortic stenosis

DIASTOLE

SYSTOLE

PALPATION OF THE HEART REGION
Depend on cardiac cycle phases systolic and diastolic thrill are differentiated

PHASES OF THE CARDIAC CYCLE

<table>
<thead>
<tr>
<th>SYSTOLE</th>
<th>DIASTOLE</th>
</tr>
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<tbody>
<tr>
<td>Aortic stenosis</td>
<td>Mitral stenosis</td>
</tr>
<tr>
<td>Pulmonary artery stenosis</td>
<td>Tricuspid stenosis</td>
</tr>
</tbody>
</table>

LOCATION

2nd interspace to the right of the sternum 2nd interspace to the left of the sternum

heart apex the right edge of the sternum

aortic stenosis pulmonary artery stenosis mitral stenosis tricuspid stenosis
PERCUSSION
Examination plan:
- Borders of the relative cardiac dullness;
- Transverse length of the heart;
- Borders of the vascular bundle;
- Configuration of the heart;
- Borders of the absolute cardiac dullness;

PERCUSSION OF THE HEART
• Determination of the size, position, and shape of the heart is based on the distinction between percussion sounds. Being the airless organ, the heart gives dull percussion sound. But since it is partly covered by the lungs on its sides, the sound here is intermediate. The heart is surrounded by the lungs, which give clear pulmonary sound in percussion.
• Projection of the heart chambers onto the chest is represented on the Figure.
• The right contour of the heart is formed by the right atrium at the bottom and by the superior vena cava to the upper edge of the 3rd rib. The left contour is formed by the arch of the aorta, pulmonary trunk, auricle of the left atrium, and downward by the narrow strip of the left ventricle.
Relative cardiac dullness - is the projection of its anterior surface onto the chest. The relative cardiac dullness corresponds to the true borders of the heart.

PERCUSSION OF THE HEART
In order to determine the borders of the relative cardiac dullness the remotest points of cardiac contour are first found on the right, then at the top, and finally on the left.
<table>
<thead>
<tr>
<th>Borders</th>
<th>Location</th>
<th>Formed by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>4&lt;sup&gt;th&lt;/sup&gt; intercostal space 1 cm laterally of the right edge of the sternum</td>
<td>Right atrium</td>
</tr>
<tr>
<td>Upper</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt; intercostal space in the left parasternal line</td>
<td>Cone of the pulmonary artery, the auricle of the left atrium</td>
</tr>
<tr>
<td>Left</td>
<td>5&lt;sup&gt;th&lt;/sup&gt; intercostal space 1,5 cm medially of the left midclavicular line</td>
<td>Left ventricle</td>
</tr>
</tbody>
</table>
## Clinical variants of the relative cardiac dullness borders displacement

<table>
<thead>
<tr>
<th>Heart borders displacement</th>
<th>Extracardiac causes</th>
<th>Changes of the heart chambers size and volume</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Conditions</td>
</tr>
<tr>
<td>To the right</td>
<td>Left-sided pneumothorax, effusive pleu-risy, hydrothorax. Right-sided obstructive atelectasis</td>
<td>Dilation of the right ventricle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dilation of the right atrium and ventricle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pulmonary artery stenosis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tricuspid steno-sis, chronic pulmonary diseases (cor pulmonale)</td>
</tr>
<tr>
<td>To the right and upward</td>
<td></td>
<td>Dilation of the right ventricle and left atrium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mitral stenosis</td>
</tr>
<tr>
<td>Upward and to the left</td>
<td></td>
<td>Dilation of the left atrium and ventricle, protrusion of the pulmo-nary artery cone</td>
</tr>
<tr>
<td>To the left</td>
<td>Right-sided pneumothorax, effusive pleuri-sy, hydrothorax. Left-sided obstructive atelectasis</td>
<td>Dilation of the right ventricle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypertrophy and dilation of the left ventricle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mitral stenosis</td>
</tr>
<tr>
<td>To the left and downward</td>
<td></td>
<td>Dilation of the left ventricle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aortic regurgitation</td>
</tr>
</tbody>
</table>
• Transverse length of the heart is the sum of distance from the right border of the relative cardiac dullness to the anterior median line (3-4 cm) and from the left border of the relative cardiac dullness to the median line (8-9 cm).

• The transverse length is measured by a measuring tape, and normally is 11-13 cm.

• Enlargement of the cardiac transverse length is observed in hypertrophy and dilation of the heart chambers.

PERCUSSION OF THE HEART
• The borders of the vascular bundle are determined by light percussion in the 2nd intercostal space from midclavicular line to the right and left toward the sternum.

• The borders of the vascular bundle are normally found along the edges of the sternum.

• The normal width of the vascular bundle is 4-6 cm.

• The width of the vascular bundle is increased in:
  
  • Dilation of the pulmonary artery in elevated pressure in it;
  
  • Aortic aneurysm;
  
  • Syphilitic mesoaortitis.
• Configuration of the heart can be determined by percussion in the 2\textsuperscript{nd}, 3\textsuperscript{rd}, 4\textsuperscript{th} intercostal spaces on the right and 2\textsuperscript{nd}, 3\textsuperscript{rd}, 4\textsuperscript{th}, 5\textsuperscript{th} intercostal spaces on the left. The pleximeter-finger is moved parallel to sought border. The elicited points are marked on the patient’s skin and connected by a line.
• **Normal configuration of the heart**

• **Right contour**: 2\(^{nd}\) intercostal space along right sternal edge, 3\(^{rd}\) intercostal space along right sternal edge, 4\(^{th}\) intercostal space 1 cm laterally of right sternal edge;

• **Left contour**: 2\(^{nd}\) intercostal space along left sternal edge; 3\(^{rd}\) intercostal space along left parasternal line; 4\(^{th}\) and 5\(^{th}\) intercostal spaces 1.5 cm medially of left midclavicular line
• The angle formed by the bundle of the great vessels and left ventricle is called \textit{waist of the heart}.

In normal configuration of the heart this angle is dull.

In pathological conditions \textit{mitral}, \textit{aortic}, and \textit{trapezium} configurations of the heart are distinguished.
<table>
<thead>
<tr>
<th>Configuration</th>
<th>Features</th>
<th>Conditions</th>
<th>Pathological state</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitral</td>
<td>Protrusion of the upper part of the left contour, indistinct or protruded waist of the heart</td>
<td>Dilation of the left atrium and blood pressure elevation in the pulmonary artery</td>
<td>Mitral stenosis and regurgitation</td>
</tr>
<tr>
<td>Aortic</td>
<td>Protrusion of the lower part of the left contour, pronounced waist of the heart</td>
<td>Dilation of the left ventricle</td>
<td>Aortic stenosis and regurgitation</td>
</tr>
<tr>
<td>Trapezium</td>
<td>Symmetrical protrusion of both cardiac contours</td>
<td>Transudate or exudate in the pericardium</td>
<td>Effusive pericarditis, hydropericardium</td>
</tr>
<tr>
<td>Cor bovinum)</td>
<td>Protrusion of all cardiac contours</td>
<td>Myogenic dilation of both ventricles</td>
<td>Dilative cardiomyopathy</td>
</tr>
</tbody>
</table>
Absolute cardiac dullness is the projection of the anterior surface of the heart, which is not covered by the lungs onto the chest. Absolute cardiac dullness is formed by the right ventricle.
Normal borders of the absolute cardiac dullness:

The right - along the left edge of the sternum from 4\textsuperscript{th} to 6\textsuperscript{th} rib;

The upper - lower edge of the 4\textsuperscript{th} rib in the site of its connection with the left sternal edge;

The left - 5\textsuperscript{th} intercostal space 0.5 cm medially of the left border of the relative cardiac dullness.
### Changes of absolute cardiac dullness area

<table>
<thead>
<tr>
<th>Decreasing</th>
<th>Increasing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low diaphragm level</td>
<td>Pregnancy</td>
</tr>
<tr>
<td>Pulmonary emphysema</td>
<td>High diaphragm level (ascitis, meteorism)</td>
</tr>
<tr>
<td>Left-sided pneumothorax</td>
<td>Tumor of mediastinum</td>
</tr>
<tr>
<td></td>
<td>Dilation, hypertrophy of the right ventricle</td>
</tr>
</tbody>
</table>
Thank you for your attention!

Any Questions?