

Heart failure (pathology)

Definition

Heart failure (insufficiency) means a disproportion between the activity of the Heart and peripheral vascular resistance, i.e. the inability of the circulation (heart, vascular bed, blood) to fulfill its function (pump, blood distribution, exchange of O_2 a CO_2).

We distinguish acute or chronic failure.

Pathogenesis

The consequences of circulatory insufficiency are the slowing down of blood flow and its accumulation, so it is a failure:

- **forward** – the heart is unable to maintain optimal tissue and organ perfusion,
- **backwards** – there is an accumulation of blood (congestion) in front of the heart, in the venous part of the circulation.

Causes

1. **authorities** ,
 - *in the heart*,
 - Congenital Heart Defects,
 - Myocardial disease (infarction – CHD, myocarditis, cardiomyopathy),
 - endocardial disease (valvular defects, infectious endocarditis),
 - pericardial disease (cardiac tamponade, constrictive pericarditis),
 - *on the periphery* (in blood vessels and changes in the amount and composition of blood),
 - hypertension in the general circulation (systemic hypertension – blood pressure above 140/90 mmHg),
 - hypertension in the small circulation (pulmonary hypertension – blood pressure above 30/12 mmHg),
 - blood diseases (polyglobulia – increased blood viscosity, anemia – hypoxia of the myocardium),
2. **functional**,
 - irritation of the vagus nerve → activation of Parasympathetic → slowing of the heart rate up to arrest.

Speeches

Cardiac manifestations

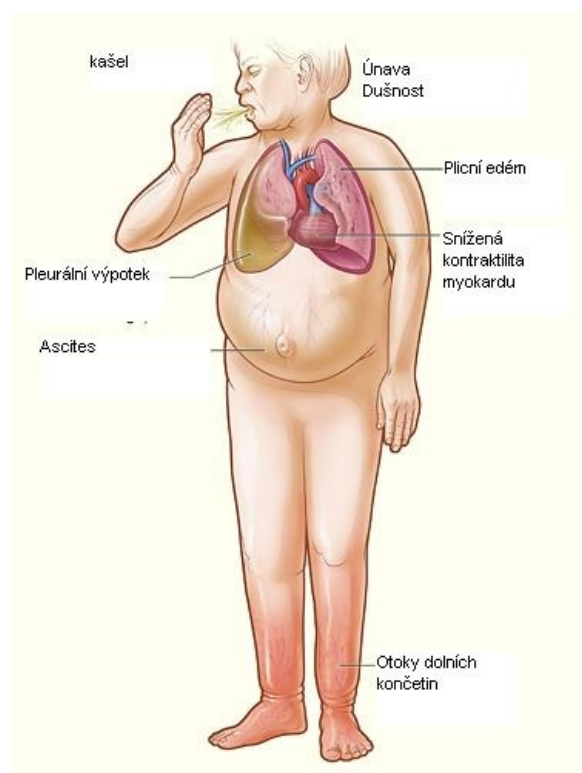
Dilation

Dilation is a manifestation of *acute* insufficiency (AIM, pulmonary embolism, sudden hypertension), where the heart tries to compensate by applying the Frank-Starling law (the greater the length of the sarcomere before contraction, the stronger the contraction). However, this applies only up to a certain length of the sarcomere – after that the cardiac output drops sharply and decompensation occurs. The ventricles are enlarged, the muscle is thin (LV less than 10 mm, PK 1–2 mm).

Hypertrophy

Hypertrophy is a manifestation of compensation for chronic insufficiency, when the volume of cells increases (microscopically, the diameter of cardiomyocytes is larger - over 12 μm , larger nuclei are often irregularly shaped, and the proliferation of contractile myofilaments and mitochondria). At autopsy, an increased weight of the heart (normally 290–350 g) or thickness of the walls of the ventricles (normally right 3–4 mm, left and septum 10–12 mm) is an indicator of hypertrophy. The positive side of hypertrophy is a greater force of contraction, the negatives are the increased demands of the hypertrophic myocardium for oxygen supply (ischemia occurs more easily - the so-called relative coronary insufficiency) and the extension of the diffusion path for oxygen.

- **Concentric** – pure hypertrophy of the respective heart compartment,
- **eccentric** – hypertrophy associated with dilatation, in case of hypertrophic heart failure (coronary arteries



Manifestations of heart failure

cannot supply oxygen to the excess myocardium), manifestation of decompensation.

According to the cause, hypertrophy of the heart is divided into:

- **tonogenic** – the heart works against increased resistance (systemic or pulmonary hypertension), expressed more in the vertical plane,
- **myogenic** – as a result of changes in the myocardium (myocarditis, toxic damage to the myocardium, excessive physical exertion, ischemia, anemia, CO poisoning, myofibrosis), expressed more in the horizontal plane,
- **plethoric** – with increased blood volume,
- **idiopathic** – apparently due to enzymopathy (mutations of genes coding for sarcomere components – hypertrophic cardiomyopathy).

Extracardiac manifestations

Venostasis

Venostasis means stagnation of blood in the venous system (congestion, congestion, passive hyperemia). There is an accumulation of venous blood in dilated Veins and capillaries - although the tissues are congested, it is oxygen-poor blood (tissues suffer from hypoxia).

- **Macroscopy:** affected organs (mainly liver, spleen, kidneys, GIT) enlarged (swollen), soft, red-blue in color,
- **microscopy:** hemorrhagic necrosis of cells on the venous side of the capillaries (e.g. the center of the Liver lobule),
- **clinical manifestations:** increased filling of jugular veins, hepatosplenomegaly.

Induration

Induration means venostatic fibrosis (hypoxia leads to cell necrosis and they are replaced by tissue).

- **Macroscopy:** stiffer consistency of affected organs (liver, spleen, kidneys).

Edema

Edema (the outflow of fluid from vessels into the interstitium or body cavities) is the result of an increase in hydrostatic pressure due to venostasis, the emerging fluid contains little protein and is referred to as **transudate**. Swelling occurs mainly in the subcutaneous tissue in places with the highest hydrostatic pressure (influence of gravity) - first perimalleolar, then on the lower legs, thighs and external genitalia - in the highest form, the entire subcutaneous tissue is soaked (anasarka). Transudate can also exit into body cavities – hydroperitoneum (Ascites), hydrothorax, hydropericardium.

Note: in contrast to perimalleolar swellings typical of cardiac patients, hypoalbuminemia has eyelid swellings!

Cyanosis

Blue coloring of the skin and mucous membranes caused by an increased content of reduced hemoglobin in the blood (above 50 g/l). It easily arises in polycythemia, it does not arise in anemia. It is found in venostasis (**peripheral cyanosis**), cyanotic heart defects (right-left shunt – **central cyanosis**). With longer duration, **Clubbed fingers** are lengthened (extension of the end joints of the fingers and toes).

Left-sided heart failure

- **Etiology:** CHD, hypertension, aortic and mitral valve defects, myocarditis and cardiomyopathy,
- **heart:** hypertrophy and dilatation of the LV (with the exception of mitral stenosis) – **cor hypertonicum**, with heart weight over 1000 g (enlargement of all heart compartments, especially in aortic insufficiency) – **cor bovinum**,
- **lungs:** venostasis occurs, transudate emerges from the capillaries and pulmonary edema occurs - the lungs are enlarged, soaked and heavy, foamy clear fluid flows from the cut, or hydrothorax occurs. hemosiderin is produced from disintegrated erythrocytes, which is phagocytosed by alveolar macrophages (siderophages) - it accumulates in the alveoli. At the same time, induration occurs - rusty induration of the lungs. Clinically, this condition is manifested as Shortness of breath, an auscultatory finding in edema with expectoration of pink to rusty sputum. A secondary infection is also possible on this terrain - hypostatic bronchopneumonia.

Right-sided heart failure

- **Etiology:** alone in chronic diseases of the lungs or pulmonary vessels that lead to increased resistance in the pulmonary basin, in heart defects with left-right shunt, transferred in left-sided failure and in mitral stenosis,
- **heart:** RV hypertrophy – **cor pulmonale** (the designation is used only if the cause of RV hypertrophy is primarily in the lungs, this does not include enlargement of the right heart due to mitral stenosis, etc.), can take the form of cor pulmonale acutum (dilation of the RV in acute insufficiency) or chronicum (hypertrophy of PK in chronic insufficiency),
- **liver:** enlarged (norm 1500 g), dark red, heavier, on section they have a nutmeg appearance - **nutmeg liver**, long-term failure leads to induration and so-called **cardiac cirrhosis** (but there is no portal hypertension),

- **spleen:** enlarged (norm 150 g), cyanotic induration,
- **kidneys:** enlarged, harder, blue-violet color,
- **subcutaneous:** edema, first occurs symmetrically perimalleolar, then spreads cranially - up to anasarca, pleural transudates also occur, especially on the right,
- **brain:** congested, heavier, edematous (cerebral cones, flattened gyri),
- **portal canal:** mild portal hypertension, which results in congestion in the spleen, ascites and redness and swelling of the mucous membrane of the Stomach and intestines – venostatic catarrh.

Links

Related Articles

- Edema
- Cyanosis
- Ascites
- Pulmonary edema
- Heart failure (internal)
- Heart failure (pediatrics)
- Nursing care of a patient with heart failure/HF (nurse)
- Heart failure/case report
- Heart failure/Repetitorium

Source

- PASTOR, Jan. *Langenbeck's medical web page* [online]. ©2005. [cit. 11.3.2012]. <<https://langenbeck.webs.com/>>.

References

- STŘÍTESKÝ, Jan. *Patologie*. 1. edition. Epava, 2001. ISBN 80-86297-06-3.