

Causes of circulatory insufficiency in the heart

Circulatory failure caused by the heart is called Heart failure.

The causes of heart failure can be: Congenital heart disease, myocardial, pericardial or endocardial damage.

Congenital heart defects

Atrial septal defect

- persistent communication between the atria, left-right shunt, acyanotic defect, no murmur
- **small-scale defects** (up to 0.5 cm) - usually asymptomatic (there is a relatively small pressure difference between the atria)
- **large defects** lead to volume overload of the right heart (presented by dilation)
- may cause the development of pulmonary hypertension with a consequent risk of right heart failure
- change of direction of short circuit - in case of failure of the right heart a right-left short circuit occurs, cyanosis may occur
- risk : atrial fibrillation and supraventricular tachycardia in right ventricular dilatation
- paradoxical embolism - from the systemic venous system through the septal defect to the arterial systemic system

Ventricular septal defect

- persistent communication between the chambers, left-right shunt, acyanotic defect
- most defects are in the membranous part, less in the muscular part
- it may shrink or close spontaneously
- leads to volume overload of both chambers
- hypercirculation causes a reactive increase in pulmonary system resistance, **pulmonary hypertension** develops
- as the pressure in the pulmonary system increases, the amount of blood flowing through the defect decreases
- change in the direction of the short circuit - in escalating pulmonary hypertension, when the pressure in the right ventricle exceeds the pressure in the left, cyanosis may occur
- **ostium primum type** - in case of incomplete closure of AV septum, associated with mitral valve cleft and mitral insufficiency

Patent ductus arteriosus

- Physiologically, the ductus arteriosus closes during the first days after delivery with an increase in pO₂.
- There is a risk of non-closure in obstetric hypoxemia , premature infants and children with right-sided short circuit.
- Left-right shunt - blood flows from the aorta to the pulmonary artery.
- Volume overload of the left ventricle, pressure overload of the right ventricle.
- Systolic murmur at the time of blood flow through the ductus arteriosus.
- Hypercirculation in the pulmonary circulation leads to an increase in resistance - a reduction in the pressure difference between the circuits, a reduction in the volume of blood in the defect.
- **Pulse magnus** - caused by a large systolic-diastolic difference (low diastolic pressure due to the flow of part of the blood through the ductus arteriosus).

Pulmonary stenosis

- reduction in lung lumen, the normal diameter at the valve site is around 3.5 cm
- **subvalvular** (hypertrophy of the PK infundibula muscle), **valvular** (most common, valve thickening), **supravalvular** (thickening of the trunk and branches of the lung)
- leads to pressure overload of the right ventricle and its compensatory hypertrophy
- long asymptomatic - hypertrophied chamber overcomes lung resistance
- may occur as part of Fallot's tetralogy

Aortic stenosis

- less common than pulmonary stenosis
- **subvalvular** (thickening of the fibrous ligament under the valve or hypertrophy of the muscular septal muscle), **valvular** (most common), **supravalvaric** (in syphilis)
- leads to pressure overload of the left ventricle and its compensatory hypertrophy
- **aortitis luetica** - thickening of the wall, wrinkling of the intima , significant atherosclerotic changes with calcifications

mainly in the thoracic part of the asc. aorta and its branches in the 3rd stage of the disease (up to 15 - 20 years after the infection)

Aortic coarctation

- narrowing of the aorta at the site of the aortic isthmus (beyond the left subclavian artery)
- preductal, juxtaductal, postductal (according to the position of the duct. arteriosus)

1. With an open ductus arteriosus

preductal (= infantile type) - the upper part of the body is supplied by the aorta, the lower part through the ductus Arteriosus.

lower body cyanosis, leads to early heart failure

postductal - the upper body supplied by the aorta, blood flows through the ductus arteriosus into the lungs, lower body hypoxia

leads to circulatory overload and pulmonary hypertension

2. With a closed ductus arteriosus = adult type

during life, in the place of closed ductus arteriosus, it creates a narrowing

LV hypertrophy, dilation of the ascending aorta in front of an obstacle, exacerbated atherosclerotic changes in the branches before narrowing

formation of many collaterals for the lower half of the body (from aa. intercostales, mammae, subcl.)

high blood pressure in the upper half of the body, low in the lower half (almost intangible on the femoral arteries)

Transposition of the great vessels

- the aorta originates from the RV, the pulmonary artery from the LV
- 2 parallel cycles must be connected by a septal defect or via a ductus arteriosus
- **uncorrected** (2 parallel circulations) / **corrected** (aorta emerges from the right ventricle (trait: trabecula septomarginalis), which connects to the left atrium)

Tetralogy of Fallot

= ventricular septal defect + pulmonary stenosis + aorta attached to septal defect + hypertrophic RV

blood flow: from RV through septal defect to LV - into aorta (mixed blood) - through duct. arteriosus to the lungs

Myocardial disease

- Myocardial infarction - reduced performance of the part of the heart affected by the infarction (necrotic lesion or dysfunctional ligament scar)
- Ischemic heart disease - risk of developing a heart attack, ischemia of the cardiac conduction system, ventricular fibrillation
- Myocarditis - infectious, toxic or immune damage to the myocardium
- Cardiomyopathy - dilated, hypertrophic or dystrophic myocardial involvement (amyloidosis, fat and ligament storage) impairs the systolic or diastolic ability of the heart

Endocardial disease

- Valve defects - insufficiency / stenosis leads to ventricular overload, compensatory hypertrophy and decompensated dilatation and failure
- Infectious endocarditis - leads to insufficiency / stenosis of the valves, it can also damage the myocardium (infectious agents or toxins)

Pericardial disease

- Constrictive pericarditis - leads to deterioration of diastolic function, poor filling of the heart with blood and congestion in front of the heart
- Cardiac tamponade - leads to impaired diastolic heart function to arrest in systole

pericardial cavity filled with inflammatory exudate, blood (hemopericardium) or transudate (hydropericardium)

Links

Related articles

- Heart failure (pathology)
- Congenital heart defects

- Myocardial infarction (pathology)
- Valve defects
- Constrictive pericarditis

References

- POVÝŠIL, Ctibor, ŠTEINER, Ivo, et al.: Speciální patologie. 2. vydání. Praha : Galén, Karolinum, 2007. ISBN 978-80-7262-494-2.
- NEČAS, Emanuel, et al.: Patologická fyziologie orgánových systémů. Část I. Praha : Karolinum, 2004. ISBN 80-246-0615-1.
- KLENER, Pavel, et al.: Vnitřní lékařství. 2. vydání. Praha : Galén, 2001. ISBN 80-246-0273-3.

Recommended literature

- POVÝŠIL, Ctibor, ŠTEINER, Ivo, et al.: Special Pathology. 2nd Edition. Praha : Galén, Karolinum, 2007. ISBN 80-246-1442-7.
- NEČAS, Emanuel, et al.: Patologická fyziologie orgánových systémů. Část I. Praha : Karolinum, 2004. ISBN 80-246-0615-1.