

According to data from the World Health Organization, cardiovascular diseases are the leading cause of death in the countries of Central and Eastern Europe. More than half of these cases are due to a single condition—acute and chronic ischemic heart disease (IHD). Therefore, the goal of both clinical and experimental cardiologists researching the prevention and treatment of IHD is to improve this unfavorable situation.

IHD arises as a result of an imbalance between the amount of oxygen (and substrates) supplied to the heart cell and the amount of oxygen the cell currently needs to meet its metabolic demands. In ischemia (unlike hypoxia), not only is the supply of nutrients disrupted, but also the removal of byproducts and harmful waste products of cellular metabolism. The result is a switch of the heart muscle to anaerobic metabolism, accumulation of metabolites, and disruption of energy and ion homeostasis; this leads to impaired contractility, and as a final consequence of reduced myocardial perfusion, heart cell death and myocardial infarction may occur. The duration of ischemia plays a decisive role in determining whether the damage is reversible or irreversible.

The only way to prevent or at least mitigate irreversible damage to the heart muscle is the timely restoration of blood flow through the coronary vessels in the affected area.

The extent of ischemic damage to the heart muscle depends not only on the intensity and duration of the ischemic insult but also on the heart's resistance to oxygen deficiency. This parameter changes in a characteristic way during ontogenetic development: in general, resistance is highest immediately after birth and then gradually decreases over the course of development, with the first postnatal week in laboratory rats being the period of the most dramatic changes.

However, the mechanisms behind the increased resistance of the immature myocardium are not yet known. Analyzing these mechanisms, along with the search for potential protective mechanisms, is of clinical importance—especially for pediatric cardiology and cardiac surgery.