

Heart failure is a clinical condition in which the heart is unable to pump enough blood to meet the body's needs. While in the twentieth century the dominant cause of this pathology was the weakening of left ventricular contraction force due to necrosis of myocardial tissue as a result of suboptimally treated myocardial infarction, in the twenty-first century there is a sharp increase in the incidence of heart failure related to a decreased ability of the left ventricle to properly fill with blood flowing from the pulmonary circulation due to left ventricular stiffening. This situation is a consequence of improving the treatment of myocardial infarction on the one hand and the growing prevalence of diseases leading to impaired diastolic function of the left ventricle, such as hypertension, diabetes and obesity on the other hand. Residual blood in the lungs causes shortness of breath, at the initial stage mainly during exercise, and insufficient blood supply to the body's organs results in fatigue. Heart failure due to left ventricular systolic dysfunction is called heart failure with reduced ejection fraction, and heart failure resulting from impaired left ventricular filling is called heart failure with preserved ejection fraction. Left ventricular ejection fraction is the percentage of left ventricular volume at the end of diastole that is ejected into the aorta during ventricular systole, and is relatively easy to determine during routine echocardiography. Therefore, the diagnosis of heart failure with reduced ejection fraction consists in finding the presence of impaired exercise tolerance in a patient with decreased ejection fraction of the left ventricle, and does not require in-depth diagnostic assessment. In contrast, in heart failure with preserved ejection fraction, correct diagnosis is much more difficult because at rest there are often no abnormalities indicative of severe diastolic dysfunction that underlies heart failure. Thus, in many patients with exertional dyspnea, direct invasive measurements of intracardiac pressures during exercise (routinely performed on a cycloergometer in the supine position) using a vascular catheter is necessary to make a definitive diagnosis.

This research project aims at investigating whether in patients with symptoms suggesting heart failure with preserved ejection fraction, direct invasive measurements of intracardiac pressures can be replaced in diagnostic algorithms with non-invasive parameters obtained during echocardiography, and whether dynamic exercise on a cycloergometer can be replaced with isometric exercise using the handgrip test with a dynamometer and/or passive leg lifting – the maneuver increasing blood flow to the left ventricle, which may unmask decreased left ventricular filling capacity. For this purpose, it is planned to recruit 135 patients undergoing invasive diagnosis of heart failure in our center, and to conduct simultaneous echocardiographic and invasive assessment of their heart responses to the tested procedures (handgrip, passive leg lifting and their combination). We expect, in particular in the case of simultaneous performance of handgrip test and passive leg lifting, to obtain results proving the diagnostic usefulness of this type of cardiac stress in non-invasive, echocardiographically-guided diagnosis of heart failure with preserved ejection fraction. The results of this research project would make it possible to resign from costly, time-consuming and carrying additional risk invasive procedures, which can only be carried out in highly specialized cardiology centers, and from the need to perform dynamic exercise - in many cases unfeasible for subjects with musculoskeletal disorders. This would make it easier for patients to access an adequate diagnostic assessment, and then benefit from targeted treatment.