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THE CURRENT STATE OF THE PROBLEM OF CORONARY ARTERY BYPASS GRAFTING

(LITERATURE REVIEW)

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Abstract: Coronary heart disease (CHD) remains the leading cause of death worldwide, despite the constantly improving methods of diagnosis and treatment. Advances in the diagnosis and treatment of cardiovascular risk factors and, in particular, acute coronary syndrome (ACS), have increased survival among patients with coronary heart disease, turning it into a chronic disease, which, to date, affects 15.5 million patients in the United States alone, and from which more than 538,000 people die annually.

Keywords: aorta carotid bypass, coronary artery disease, heart failure, dysfunction

According to forecasts, by 2030, the main long-term manifestations of coronary heart disease, left ventricular dysfunction (LV) and heart failure (HF) will affect 8 million patients, which has huge social consequences [1,2].

Clinical trials in the 80s of the last century showed that coronary artery bypass grafting (CABG) is an effective method of treating patients with disabling symptoms of angina pectoris [4-6]. In these studies, in patients with severe coronary heart disease and LV dysfunction, CABG was associated with better survival than only drug therapy[10]. However, these trials were conducted more than 40 years ago, before modern drug therapy based on recommendations for the treatment of coronary heart disease and HF appeared [4], and they did not include patients with severe LV dysfunction. In these studies, only 4% of participants had symptomatic HF [8].In the early 2000s, there was an increase in the number of patients with HF and LV dysfunction referred for CABG surgery [7]. The study of ICN (Surgical Treatment for Ischemic Heart Failure - Surgical treatment of ischemic heart failure) consisted of two components-a component of surgical revascularization and a component of surgical LV reconstruction. The surgical revascularization component was developed to test the hypothesis that CABG in combination with drug therapy in accordance with the recommendations of treatment of coronary heart disease, HF and LV dysfunction will improve survival compared with drug therapy alone. When analyzing the data of the surgical revascularization component (median follow-up was 56 months), there was no significant difference between the CABG group and the drug therapy group in terms of mortality from any cause, although the rates of mortality from cardiovascular causes and mortality from any cause or hospitalization for cardiovascular reasons were lower among patients in the CABG group [6]. Nevertheless, the results of the extended STICH study, which was conducted to assess the long-term (10 years) effects of CABG, confirm the significant advantage of CABG in combination with drug therapy compared with drug therapy alone in relation to the mortality rate from any cause among patients with ischemic cardiomyopathy [6].

Coronary bypass surgery (CABG) is the most common cardiac surgery procedure in adult patients [4]. The first coronary bypass operations performed in the 60s-70s of the last century were operations on a working heart without artificial circulation (IC) and cardioplegia (CP) [10]. However, due to the great technical complexity, non-standardized surgical techniques, these techniques are not widely used. At the same time, Favaloro

demonstrated the possibility of performing myocardial revascularization on a non-mobile and "dry" surgical field, i.e. in the conditions of IR and CP. Due to the standardized surgical technique and ease of training and control, CABG operations in the conditions of IC and CP gained universal worldwide recognition and quickly became the gold standard of myocardial revascularization [6]. Later, several decades of performing CABG operations in the conditions of IC and CP revealed a number of complications related both directly to the IC and CP procedure itself and to connecting the patient to the IC apparatus (cannulation of the main vessels and clamping on the aorta). The greatest number of perioperative complications are associated with the use of IR, especially in high-risk groups, and are caused by a pronounced systemic inflammatory response, hypoperfusion, micro- and macroembolization from the IR apparatus and the ascending aorta, which determine the development of various severe organ complications, such as neurological, renal, respiratory and others [8]. As a result, numerous eyes of cardiac surgeons were again turned to the possibility of performing CABG operations on a working heart without IC and CP, which also belongs to the category of minimally invasive heart surgery [13].

Minimal invasive myocardial revascularization (MIRM) currently includes two definitions: A.M. Calafiore et al. refers to it the technique without the use of full sternotomy and IC, while the Dutch group of scientists led by E. Jansen include in this concept myocardial revascularization without the use of IC and / or through mini-thoracotomy access.

According to terminology and classification , MIRM operations can be divided into:

MIDCAB (Minimally invasive direct coronary artery bypass) is the performance of a single anastomosis between the internal thoracic artery of the CAA and the permanent thoracic artery (LIMA-to-LAD) through thoracotomy access using special retractors, as the only stage in restoring blood flow in the symptom-dependent artery or as the first stage in hybrid myocardial revascularization.

A subspecies of the MIDCAB technique is video assisted MIDCAB, also called ENDOCAB (Endoscopic coronary artery bypass), the essence of which is the thoracoscopic isolation of the CAA using endovideosurgical intraments under the control of 2D or 3D endoscopy

MICSCAB (Minimally Invasive Cardiac Surgery / Coronary Artery Bypass Grafting) is a technique that allows performing complete myocardial revascularization using autoarterial and autovenous shunts through intercostal access.

The MICSCAB on-pump technique was first applied in Dresden in the late 90s of the XX century and was called the "Dresden Technique", it is also known in the literature as PACAB (Port-access coronary artery bypass) or TCRAT (Total coronary revascularization via anterior thoracotomy). The essence of this technique is the use of IR and cardioplegia when performing coronary bypass surgery through the intercostal minidostup. The obvious advantage of this technique is the possibility of complete revascularization of the myocardium using a less traumatic minimally invasive technique. The disadvantage is the technical features in the form of connecting the IR through the femoral or subclavian vessels, using a special balloon for clamping the aorta and supplying cardioplegic solution, which require large economic costs that are inaccessible to most centers. The stage of CAA sampling with MIDCAB and MICSCAB can be performed either with the help of a mini-thoracic access and a specialized thoracic retractor, or thoracoscopically or with a video assist. [10].

TECAB (Fully endoscopic coronary artery bypass grafting) - The TECAB technique involves performing all stages of coronary bypass surgery thoracoscopically and/or using the da Vinci SiHD system.The TECAB technique in the literature is divided into 2 types:

nrTECAB (non-robot general endoscopic coronary artery bypass grafting) and robotics assisted TECAB.The nrTECAB technique involves performing all stages of coronary bypass surgery through thoracoscopic access using endovi-deosurgical technique with preliminary connection of IR and endovascular injection of a balloon for aortic compression and the supply of cardioplegic solution. Attempts to perform such operations at the moment are considered heroic rather than rationally applicable in everyday clinical practice, since they require sufficient technical equipment, including microsurgical instruments for thoracoscopy, as well as a large endoscopic experience of the surgeon necessary to perform such jewelry work with a limited angle of movement of instruments [15].

Robotic systems for conducting minimally invasive cardiac surgery were developed in the mid-90s of the XX century. The first systems were called AESOP (automated endoscopic system for optical positioning) and Zeus. Currently, the Da Vinci system is used in all branches of surgery, including cardiac surgery. Robotically assisted TECAB, as well as nrTECAB, involves performing all stages of the operation thoracoscopically, however, a surgical robot is used to perform manipulations in this modification of TECAB [12].

OPCAB (Off-pump coronary artery bypass), as a method of surgical treatment of coronary artery disease with a multivessel lesion, became widely used in the late 90s and is now an alternative technique to traditional operations on coronary vessels using IR. Although OPCAB is performed through a complete median sternotomy, the latter still refers to minimally invasive interventions and allows avoiding or significantly reducing a number of complications associated with the use of IC, cardioplegic cardiac arrest, aortic manipulation [19]. Elderly patients with diffuse atherosclerotic changes of the aorta, peripheral and carotid arteries, chronic obstructive pulmonary diseases, ahistory of stroke, renal insufficiency and a reduced ejection fraction benefit especially when using this technique [15]. From all of the above, it follows that the interest in MIRM is due to the search for techniques that meet the requirements of modern medicine - REDUCING the TRAUMATIC NATURE of the OPERATION, which, in turn, includes:

- Reduction of the frequency and severity of complications (especially those associated with the use of IR);
- Reduction of the length of stay in the hospital;
- Reduction of the cost of treatment;

Cosmetic effect.Now it can be stated that the further development of minimally invasive myocardial revascularization goes in several directions. The first and most common is hybrid myocardial revascularization (HCR, Hybrid Coronary Revascularization), which combines the advantages of MIDCAB and percutaneous coronary intervention (PCI). Initially, HCR was considered as a treatment method capable of providing adequate myocardial revascularization in high-risk patients. Acceptable results contributed to its further introduction into the clinic, and now HCR is included in most modern recommendations for the treatment of patients with coronary heart disease [20]. In particular, this technology is indicated for use in severe atherocalcinosis of the ascending aorta, "poor" condition of the target coronary arteries, a deficiency of conduits, an unfavorable lesion of the PNA for stenting with a low SYNTAX score.

There are 3 variants of HCR execution, each of which has its advantages and disadvantages [21]: The first intervention option is possible in the presence of a hybrid operating room, in which MIDCAB is first performed and then intracoronary stenting is immediately performed. The positive aspects of this option are the initial restoration of blood flow to the PA and subsequent angiographic quality control of mammary-

coronary anastomosis, the negative ones are the high risk of bleeding due to the need to start disaggregant therapy immediately after neutralization of heparin, as well as the risk of developing contrast-induced nephropathy against the background of surgical stress. All of the above requires coordinated, highly professional work of cardiac surgeons, anesthesiologists and interventional cardiologists [12].

The second option is intracoronary stenting delayed for several days after MIDCAB, which does not require a hybrid operating room. Previously restored blood flow in the PA allows in such situations to safely perform angioplasty with damage to the trunk of the left coronary artery (LCA) and oral damage to the envelope artery (OA), there is a possibility of angiographic quality control of mammary-coronary anastomosis. There is no high risk of bleeding, however, the patient undergoes two interventions, while in the waiting period for angioplasty there is a risk of developing ischemia of non-revascularized myocardium [19]. The third variant of hybrid intervention with initial coronary angioplasty and delayed MIDCAB is rarely performed, mainly in acute coronary syndrome and the need for intracoronary stenting of infarct-responsible OA or right coronary artery (PKA). A hybrid operating room is not required in such situations. In addition, there is a risk of thrombosis of previously implanted stents with temporary interruption of disaggregant therapy and neutralization of heparin after MIDCAB [20].

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