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A clinical case of myocardial infarction after coronary artery bypass grafting using the internal mammary artery

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ABSTRACT

Coronary artery bypass grafting (CABG) is the most preferred method of myocardial revascularization in multivessel coronary artery disease and severe progressive forms of the disease. The material of choice for CABG of the left anterior descending artery (LADA) is the internal mammary artery (IMA). However, even when using IMA as a conduit for CABG, one should be aware of a possibility of graft failure, which indicates a need for constant vigilance in this category of patients. Endovascular interventions on coronary arteries make it possible to efficiently and safely revascularize an occluded bypass graft, minimizing existing risks and improving both the quality of life of patients and their subsequent survival. The article considers a clinical case of the development of recurrent anterior myocardial infarction in the patient due to occlusion of the mammary graft to the LADA.

Keywords: coronary artery bypass grafting, revascularization, internal mammary artery, stenting, myocardial infarction

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Клинический случай стентирования маммарного шунта у пациента с повторным инфарктом миокарда передней стенки левого желудочка

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РЕЗЮМЕ

Коронарное шунтирование является наиболее предпочтительным методом реваскуляризации миокарда при многососудистом поражении и наличии тяжелых прогрессирующих форм заболевания. Материалом выбора

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для коронарного шунтирования передней межжелудочковой ветви левой коронарной артерии является внутренняя грудная артерия. Однако даже при использовании шунта из внутренней грудной артерии, следует помнить о его возможной дисфункции, что диктует необходимость постоянной настороженности у данной категории пациентов. Эндоваскулярные вмешательства на коронарных артериях позволяют эффективно и безопасно, сводя к минимуму существующие риски, провести реваскуляризацию окклюзированного шунта, обеспечивая улучшение как качества жизни больных, так и последующую их выживаемость. В статье рассмотрен клинический случай развития повторного инфаркта миокарда передней стенки левого желудочка в связи с окклюзией маммарного шунта к передней межжелудочковой ветви левой коронарной артерии.

Ключевые слова: коронарное шунтирование, реваскуляризация, внутренняя грудная артерия, стентирование, инфаркт миокарда

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

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INTRODUCTION

According to the World Health Organization, cardiovascular diseases are the leading cause of death in the world, among which coronary artery disease (CAD) permanently occupies a leading position [1]. Coronary artery bypass grafting (CABG) is the preferred method of revascularization in severe progressive forms of the disease and multivessel myocardial damage, taking into account the consent of the patient and the anatomical features of lesion localization [2].

A meta-analysis of the effectiveness of CABG and percutaneous coronary intervention (PCI) in ischemic heart failure with the participation of 54,173 patients (CABG (n = 29,075) and transluminal balloon angioplasty (n = 25,098)) in 2002–2019 has shown the best long-term results after major surgical interventions. The risk of death, myocardial infarction, and repeat revascularization procedures was lower in the group that underwent CABG than in the group of patients after PCI, in the absence of a statistically significant difference in the occurrence of stroke [3].

The internal mammary artery (IMA) is currently the gold standard conduit for bypassing the left anterior descending artery (LADA). The study by F.D. Loop et al. discussed the prospects for the use of IMA graft based on 10-year survival and cardiac events, as a result of which the internal mammary artery bypass (IMAB) to the LADA was defined as the gold standard of coronary revascularization [4]. Despite the high clinical effectiveness of CABG, there is a group of patients with recurrent clinical manifestations of coronary artery disease after surgery, including those who underwent surgeries using IMA for grafting.

B.D. Morchadze et al. analyzed the results of repeat revascularization surgeries in 92 patients with coronary artery disease. The main reasons for recurrent angina pectoris in the general group were shunt dysfunction (77%) and progression of atherosclerosis in native coronary arteries (CA) (23%) [5]. According to the literature, the main causes of mammary graft dysfunction include thrombosis, progression of atherosclerosis, shunt rupture, as well as its compression by a tumor, artificial pacemaker or post-traumatic hematoma [6–10].

This report describes a case of recurrent myocardial infarction of the anterior wall of the left ventricle (LV) due to occlusion of a mammary graft to the LADA.

CLINICAL CASE

A 60-year-old patient was admitted to the Regional Vascular Disease Center for the treatment of patients with acute coronary syndrome with complaints of intense burning pain behind the sternum radiating to the left half of the chest, left arm, interscapular region, severe weakness, and cold sweat. He had considered himself ill for 11 years, when, after a myocardial infarction of the anterior wall of the LV, CABG of

the right coronary artery (RCA) was performed, using IMAB to the LADA with the LV aneurysm plication. For a long time, the patient had noted arterial hypertension (maximum blood pressure 180/100 mm Hg). Previous surgical interventions included appendectomy in 2006 and cholecystectomy in 2017. Clinician-observed, the patient's general condition was of moderate severity; the patient was alert. The heart sounds were muffled. The heart rhythm was regular, 56 beats per minute; no noises were heard. Blood pressure in both arms was 160 / 90 mm Hg. Breathing was vesicular, 18 breaths per minute, no abnormal breath sounds were heard. The abdomen was soft and painless.

Electrocardiography (ECG) revealed sinus rhythm, bradycardia, and left axis deviation. Blockade of the anterior – superior fascicle of the left bundle branch was also revealed. The examination showed signs of anterior ST-elevation myocardial infarction (Fig. 1). The rapid diagnostic test for the qualitative detection of troponin I in the whole blood was positive.

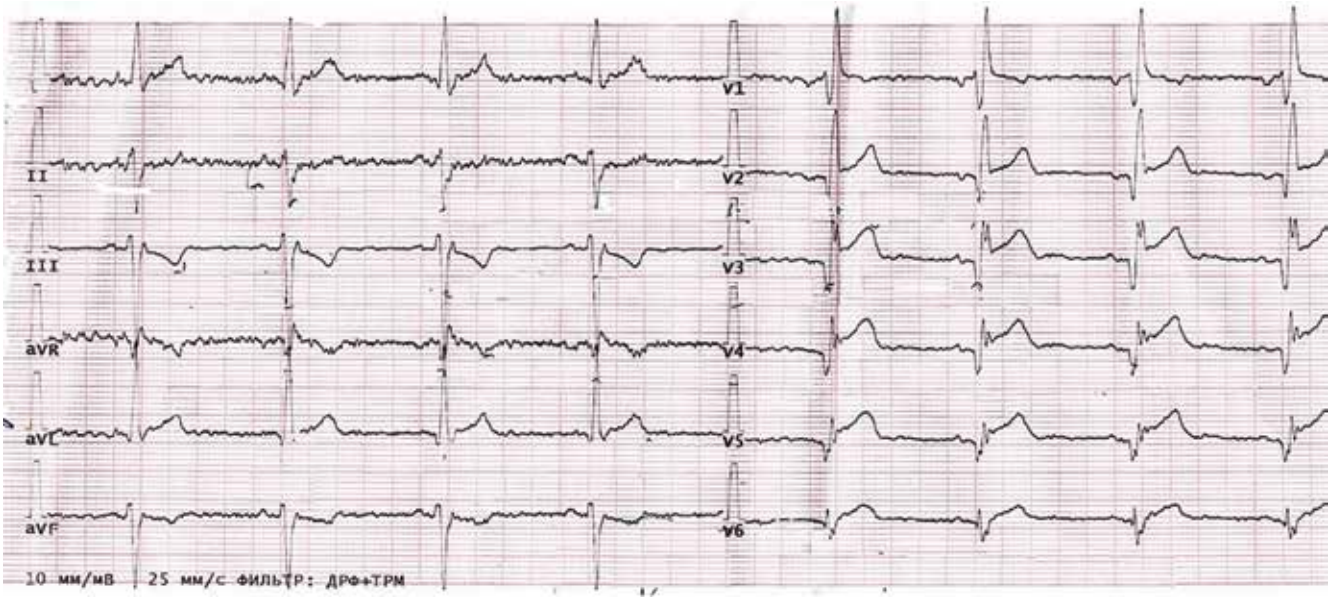

Fig. 1. Electrocardiogram before coronary angiography. Here and in Fig. 2, 3: speed 25 mm / s, voltage 10 mm / mV

According to ECG, the heart cavities were not dilated; there were no abnormalities in the pulmonary artery; the aorta, the cusps of the aortic and mitral valves were compacted, with the sufficient cusp opening. Moderate concentric LV myocardial hypertrophy was revealed. The septa appeared to be continuous. There was hypokinesis of the anterior LV segments. The global myocardial contractility was moderately reduced (LV ejection fraction 40%). Diastolic dysfunction of the LV myocardium was of the relaxation type. At the time of the study, the distance between the pericardial layers along the LV contour was noted to be 5 mm.

The patient underwent coronary angiography. Atherosclerosis and calcification of the coronary arteries were found. Stenosis of the orifice of LADA was 98%. The patient had chronic occlusion of the proximal third of the LADA. The middle third of the circumflex branch of the LCA had irregular contours. Stenosis of the proximal third of the RCA was 70%. There was chronic occlusion of the distal third of the RCA. The graft to the RCA was functioning. The proximal third of the graft to the LADA was occluded. In the area of occlusion, recanalization and predilation with balloons were performed: 1.0 x 15 mm and 2.5 x 15 mm, pressure 6–8 atm for both, respectively. A BioMatrix Flex stent 3.0 x 24 mm, under the pressure of 14 atm, was introduced and installed in the predilation zone. A check-up examination revealed that the functioning stent fully extended, occlusion of the graft to the LADA was eliminated, the vessel was patent, TIMI 3 flow.

The patient had no complications in the early postoperative period. The ECG showed positive changes (Fig. 2, 3). The patient was discharged 9 days later in improving condition.

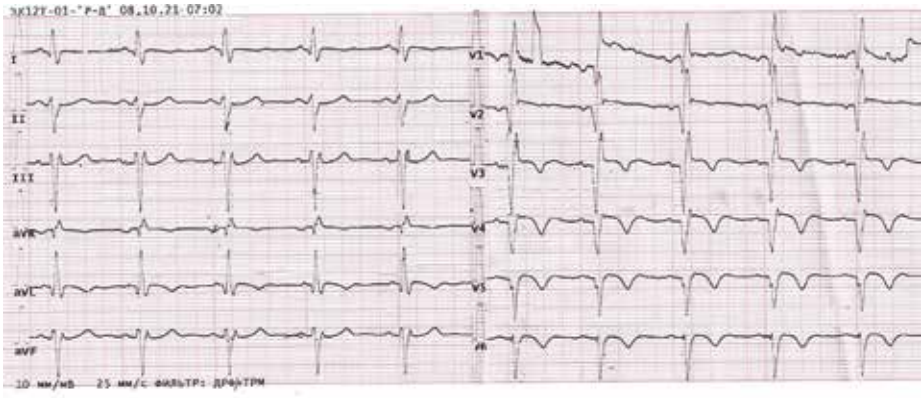

Fig. 2. Electrocardiogram 17 hours after percutaneous coronary intervention

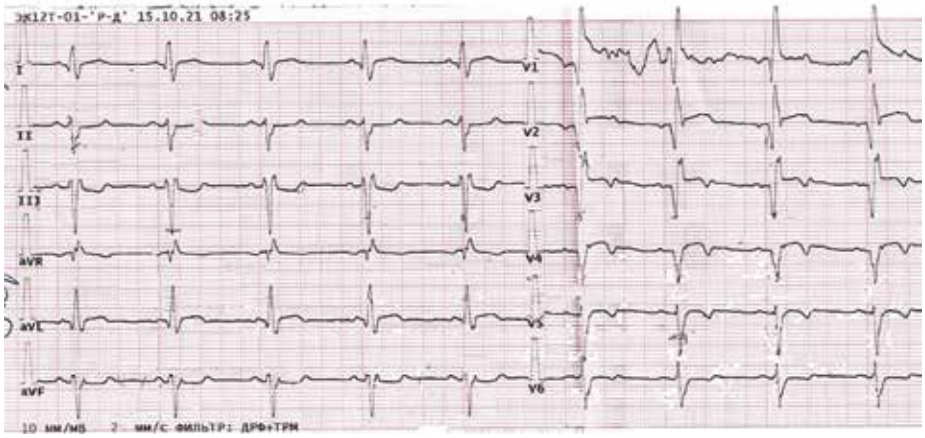

Fig. 3. Electrocardiogram 1 week after percutaneous coronary intervention

DISCUSSION

In this case, the cause of acute insufficiency of the mammary graft to the LADA was acute thrombotic occlusion, which led to repeat myocardial infarction of the anterior LV wall. PCI is the best procedure for revascularization in such cases. However, performing PCI using IMAB has additional risks compared to its performance in the native coronary bed. Due to the tortuous course of the IMA, there is a risk of its unintentional perforation or dissection with the development of adverse events during the procedure [6–8, 11]. Repeat open revascularization is indicated in a case of early graft failure (fresh anastomosis, complicated anatomy or tortuous graft course, as well as resternotomy for non-coronary reasons) [12]. At the same time, the acute onset, age, the presence of diabetes mellitus, low LV ejection fraction, and the development of myocardial infarction are the risk factors for poor outcomes in this category of patients [13].

To date, the use of IMA as a conduit remains the method of choice for LADA bypass due to its greater durability, the anatomical proximity of the artery to the heart, less further thickening of the intima, as well as a higher quality of life after surgery in comparison with the use of such transplants as radial or gastroepiploic arteries and great saphenous vein [14, 15]. Differences in the perioperative state of grafts and long-term patency may be caused by their different characteristics, in particular, tissue heterogeneity when using the great saphenous vein. However, arterial grafts can also be heterogeneous. For example, the IMA has an enhanced endothelial function and produces more nitric oxide and other relaxing factors, while radial and gastroepiploic artery grafts are more prone to spasms [16].

The study by D.P. Taggart highlighted that atherosclerotic lesions of the IMA graft were rarely noted. It was found that 10–15 years after CABG, the patency of the IMA was about 90–95%, while the saphenous vein was affected in about 50% of cases after 5–10 years with severe atheroma formation [17]. However, even when using IMA, possible shunt

occlusion should be kept in mind, which dictates the need for constant vigilance in all patients who have undergone such revascularization surgery. As a rule, repeat surgery is associated with a high operational risk, especially in debilitated, decompensated patients, as well as in the presence of concomitant diseases. Endovascular interventions allow to provide revascularization of the occluded shunt effectively and safely, minimizing the existing risks and securing the improvement in both the quality of life and subsequent survival of patients.

Repeat endovascular revascularization is safe and effective even in the presence of unfavorable prognostic factors (elderly population, manifesting type 2 diabetes mellitus, chronic heart failure). In the long term (3 years later), the intervention still displays high anti-ischemic efficacy, which ensures regression of LV myocardial remodeling and improvement in intracardiac hemodynamics [18].

This strategy is reflected in the ESC / EACTS Guidelines on Myocardial Revascularization (2018), where indications for repeat revascularization in patients with shunt occlusion are extensive myocardial ischemia and severe clinical symptoms that do not respond to conservative therapy. It is noted that repeat CABG is associated with higher risks of intraoperative mortality, therefore, PCI is the method of choice. The IMA is the preferred vessel for repeat CABG if it has not been used before [19].

Thus, in the long term after surgical intervention, there remains a risk of atherosclerosis progression both in native arteries and in grafts, which determines the need for careful monitoring of the patient's condition after CABG during follow-up. The use of PCI in patients after previous CABG is the method of choice.

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