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АНЕВРИЗМАТИЧЕСКОЕ РАСШИРЕНИЕ АУТОВЕНОЗНОГО КОНДУИТА ПОСЛЕ КОРОНАРНОГО ШУНТИРОВАНИЯ: КЛИНИЧЕСКИЙ СЛУЧАЙ

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Aneurysmatic Dilation of Autovenous Conduit After Coronary Bypass Graft: Clinical Case

Резюме

Учитывая распространенность сердечно-сосудистой патологии и рост выполнения коронарных вмешательств, в том числе, коронарного шунтирования (КШ), терапевтическое наблюдение и оценка результатов, а также возможных осложнений в данной когорте пациентов является актуальной проблемой клиники внутренних болезней. Аутовенозные кондуиты, а именно большая подкожная вена является одним из самых распространенных кондуитов во время коронарного шунтирования. Сообщаемая частота незначительного расширения трансплантатов большой подкожной вены, используемых для КШ, варьирует до 14 %, однако значительное расширение аневризмы встречается редко. При проведении коронароангиографии или мультиспиральной компьютерной ангиографии возможно установить истинные размеры аневризмы, однако наличие пристеночных тромбов может исказить истинную картину. В качестве осложнений могут возникать: сдавление нативных коронарных сосудов, дистальная эмболизация, ишемизация миокарда, сдавление правого предсердия или образование свища и его разрыв в правое предсердие. В статье обсуждается редкий клинический случай аневризматического расширения аутовенозного кондуита до 7,3 см после 23 лет коронарного шунтирования. Учитывая, что развитие аневризм и псевдоаневризм поле коронарного шунтирования может возникать как в ранние, так и в поздние сроки, клиническая настороженность необходима на всем периоде диспансерного наблюдения и должна сочетаться с информированием пациента. В статье обсуждаются диагностические и лечебные алгоритмы при выявлении аневризм и псевдоаневризм.

Ключевые слова: *аорта, аневризма аутовенозного кондуита, аневризма аорты, коронарное шунтирование*

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Abstract

Considering the prevalence of cardiovascular pathology and the increase in coronary interventions, including coronary artery bypass grafting (CABG), therapeutic observation and assessment of results, as well as possible complications in this cohort of patients is an urgent problem in the clinic of internal medicine. Autovenous conduits, namely the great saphenous vein, is one of the most common conduits during coronary artery bypass grafting. The reported incidence of minor dilation of great saphenous vein grafts used for CABG varies up to 14 %, but significant dilation of the aneurysm is rare. When performing coronary angiography or multispiral computed angiography, it is possible to establish the true size of the aneurysm, but the presence of mural thrombi can distort the true picture. Complications may include compression of the native coronary vessels, distal embolization, myocardial ischemia, compression of the right atrium, or fistula formation and rupture into the right atrium. The article discusses a rare clinical case of aneurysmal dilatation of an autovenous conduit up to 7.3 cm after 23 years of coronary artery bypass grafting. Considering that the development of aneurysms and pseudoaneurysms in the field of coronary bypass surgery can occur both early and late, clinical vigilance is necessary throughout the entire period of follow-up and informing the patient. The article discusses diagnostic and treatment algorithms for identifying aneurysms and pseudoaneurysms.

Key words: *aorta, autovenous conduit aneurysm, aortic aneurysm, coronary bypass surgery.*

Conflict of interests

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IVUS — intravascular ultrasound, VSM — vena saphena magna, CAG — coronary angiography, CBS — coronary bypass surgery, LV — left ventricle, MSCT — multispiral computed tomography, MRI — magnetic resonance imaging, ACS — acute coronary syndrome, AIVA — anterior interventricular artery, SCD — spontaneous coronary artery dissection, TIA — transient ischaemic attack, EF — ejection fraction, HR — heart rate

Introduction

Taken the incidence of cardiovascular pathologies and an increase in the number of revascularisation procedures, therapeutic follow-up and results assessment, as well as evaluation of possible complications in this population are a relevant issue of the clinical internal medicine. One of the methods of myocardium revascularisation in ischaemic heart disease is coronary bypass surgery (CBS) [1]. In clinical practice, the most common conduit is vena saphena magna [2]. Autovenous conduit dissection and significant extension (aneurysm) are rare; however, a minor autovenous conduit dilatation is recorded in up to 14 % of cases [3].

There are pseudoaneurysms and true aneurysms; thus differential diagnosis is challenging. Pseudoaneurysms are not covered with endothelium and are a focal extension with a haematoma in proximal and distal sections of the conduit. Pseudoaneurysms are more common and appear earlier than true aneurysms; they rupture more easily because of a thinner wall. True aneurysms are less common and involve all wall of the transplant body [4].

Usually (12–47 %), chest X-ray shows this complication as an asymptomatic irregular mass. Coronary angiography or multispiral computed angiography (MSCT-angiography) allow identifying the true dimensions of an aneurysm; however, parietal thrombi can distort the true picture [5]. Complications can include compression of intact coronary vessels, distal embolisation, myocardial ischaemia, right atrium compression or fistula formation and its rupture in the right atrium [5,6]. Clinically, conduit aneurysm can be associated with angina (13–24 %), myocardial infarction (12–23 %); fit of coughing or sudden death are less common [6,7]. Rupture is observed only in 8 % of cases and is accompanied by catastrophic complications and death [8]. Of note, development of aneurysms and pseudoaneurysms is a late complication; however, according to literature, they can appear at earlier stages [4]. Therefore, clinicians should be vigilant in order to diagnose aneurysmal dilatation of the transplant after CBS, irrespective of the time of surgery; and timely imaging examination (MSCT-angiography, coronary angiography) should be performed, especially in comorbid patients with arterial hypertension, diabetes mellitus and peripheral artery disorders.

Taking into account that aneurysms and pseudoaneurysms after coronary bypass surgery can develop both at early and late stages, clinical suspicion of primary care providers is essential over the entire period of patient's follow-up care. Below is the discussion of a clinical case of dilated autovenous conduit 23 years after coronary bypass surgery.

Case Study

A male patient, 74 years old, complaining of chest pain, visited the clinic at the place of his residence, where he underwent multispiral contrast-enhanced computed tomography of the thoracic aorta. The patient sent a CD with thoracic aorta MSCT to the Federal Center of Cardiovascular Surgery of the Ministry of Health of

the Russian Federation, Astrakhan, for a telemedical consultation. His medical record shows that 23 years ago he underwent a bypass surgery on two coronary arteries; the left internal mammary artery and the vena saphena magna were used as conduits.

The contrast-enhanced thoracic aorta MSCT shows an aneurysmal dilatation of autovenous conduit with a maximum diameter of up to 7.3 cm, with parietal thrombi, a contrast orifice at the aneurysm level of up to 3.8 cm. At the sinotubular junction level, the aorta is 2.8 cm; the proximal section of the ascending aorta is 3.4 cm, proximal sections of the aortic arch are 3.0 cm, and distal sections of the aortic arch are 2.4 cm (Figure 1 a–r).

Following the MSCT review, the patient was invited to a face-to-face consultation for examination and development of a therapy approach. However, the patient did not have any pain syndrome any more and refused from further examinations. During case follow-up, it was found out that the patient had suddenly died 6 months after the consultation. His relatives decided to refuse from autopsy.

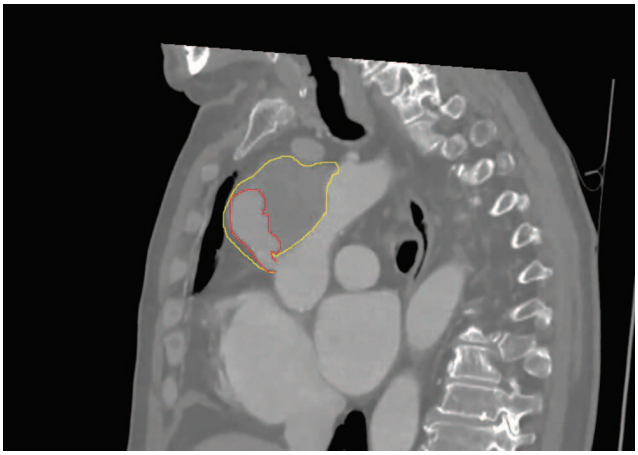

Figure 1 a. *Contrast-enhanced computed tomography of the thoracic aorta, sagittal plane*
Note: Yellow color — the outer contour of the aneurysmal expansion of the arteriovenous shunt with partial thrombosis of the lumen. Red color is the residual contrasted lumen of the arteriovenous shunt

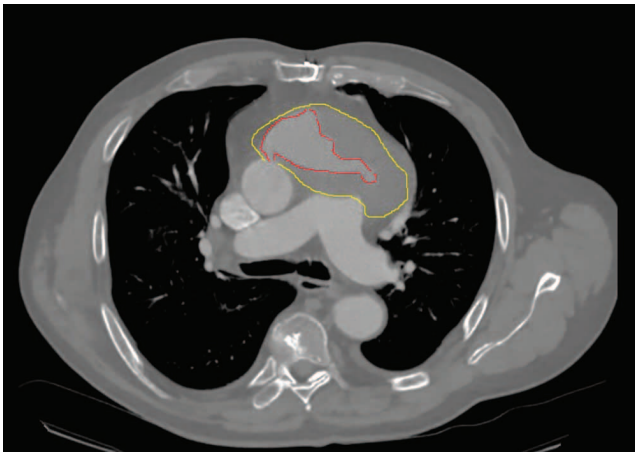

Figure 1 б. *Computed tomography of the thoracic aorta with contrast, axial plane*
Note: Yellow color — the outer contour of the aneurysmal expansion of the arteriovenous shunt with partial thrombosis of the lumen. Red color is the residual contrasted lumen of the arteriovenous shunt

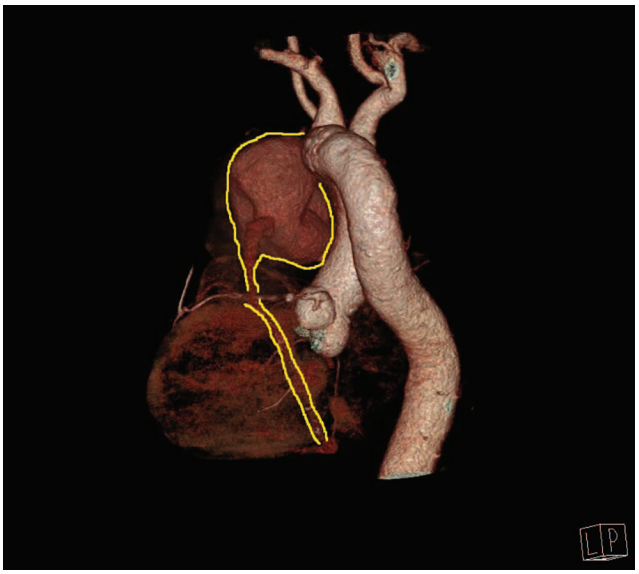

Figure 1 в. *Computed tomography of the thoracic aorta with contrast. Contour of the external size of the aneurysmally dilated lumen of the arteriovenous shunt*

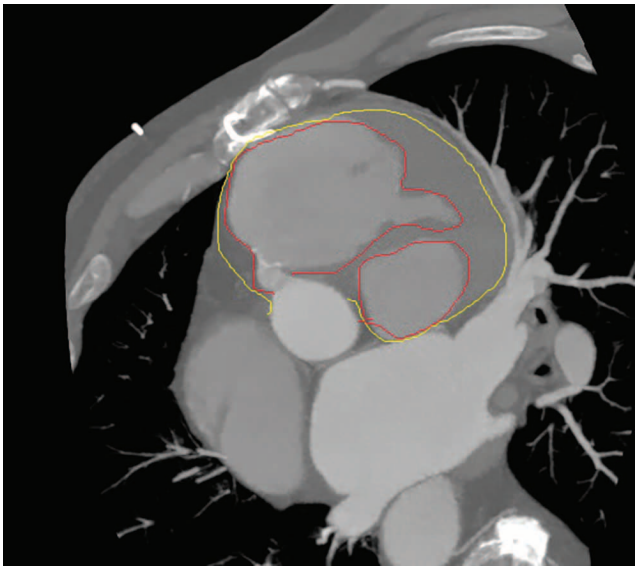

Figure 1 г. *Contrast-enhanced computed tomography of the thoracic aorta.*
Note: Axial plane. Yellow color — the outer contour of the aneurysmal expansion of the arteriovenous shunt with partial thrombosis of the lumen. Red color is the residual contrasted lumen of the arteriovenous shunt

Discussion

CBS is a surgery, which allows bypassing atherosclerotic stenotic arteries by using autovenous and autoarterial conduits; it is one of the most common manipulations in cardiovascular surgery, while the vena saphena magna (VSC) is commonly used as a conduit in CBS [2, 9]. According to the Russian clinical guidelines, bypass surgery is still a gold therapy in multiple, hemodynamically significant coronary artery atherosclerosis [10]. For all patients, it is recommended that bypasses are the left internal mammary artery, so that the bypass service life is extended. In addition to internal mammary arteries, Russian experts recommend using the radial artery as bypasses for coronary artery stenosis of over 80 % and/or occlusions; for revascularisation of other branches, autovenous transplants are used [2, 10-11].

Both transplant types are associated with early and late complications. For autovenous CBS, early complications are more common during the first year after the surgery (10–20 %); they include venous occlusion, embolism, infections, arrhythmias, and cardiac arrest [12]. Late complications develop 10–15 years later and include aneurysmal dilatation of the transplant. There are reports on early cases of aneurysmal rupture of the conduit, associated primarily with infections, endocarditis or sepsis, which cause venous transplant degeneration. However, it is possible that transplant aneurysm rupture is not associated with an infection. Harskamp R.E. et al. (2013) noted that the main risk factors of aneurysm rupture are female sex, young age, hypercholesterolemia and a history of cardiac insufficiency with low ejection fraction [13].

Aneurysmal dilatations of the VSM and pseudoaneurysmal degeneration are rare, but potentially fatal complications, and there are hardly any reports in scientific literature [5, 14]. Clinical presentation of an aneurysm rupture includes bleeding, haemothorax and haemorrhagic shock [15]. It is worth mentioning that chest pain is a common symptom of a ruptured aneurysm. In this clinical case, the retrosternal pain syndrome was the reason why the patient sought medical assistance; however, since the pain was cyclic, the patient refused from any additional interventions. Of note, according to the literature, aneurysms are asymptomatic and stable in a majority of cases; they are diagnosed during autopsy [16]. The most reliable diagnostic method for autovenous conduit dilatation or aneurysm rupture is contrast-enhanced thoracic aorta MSCT [17].

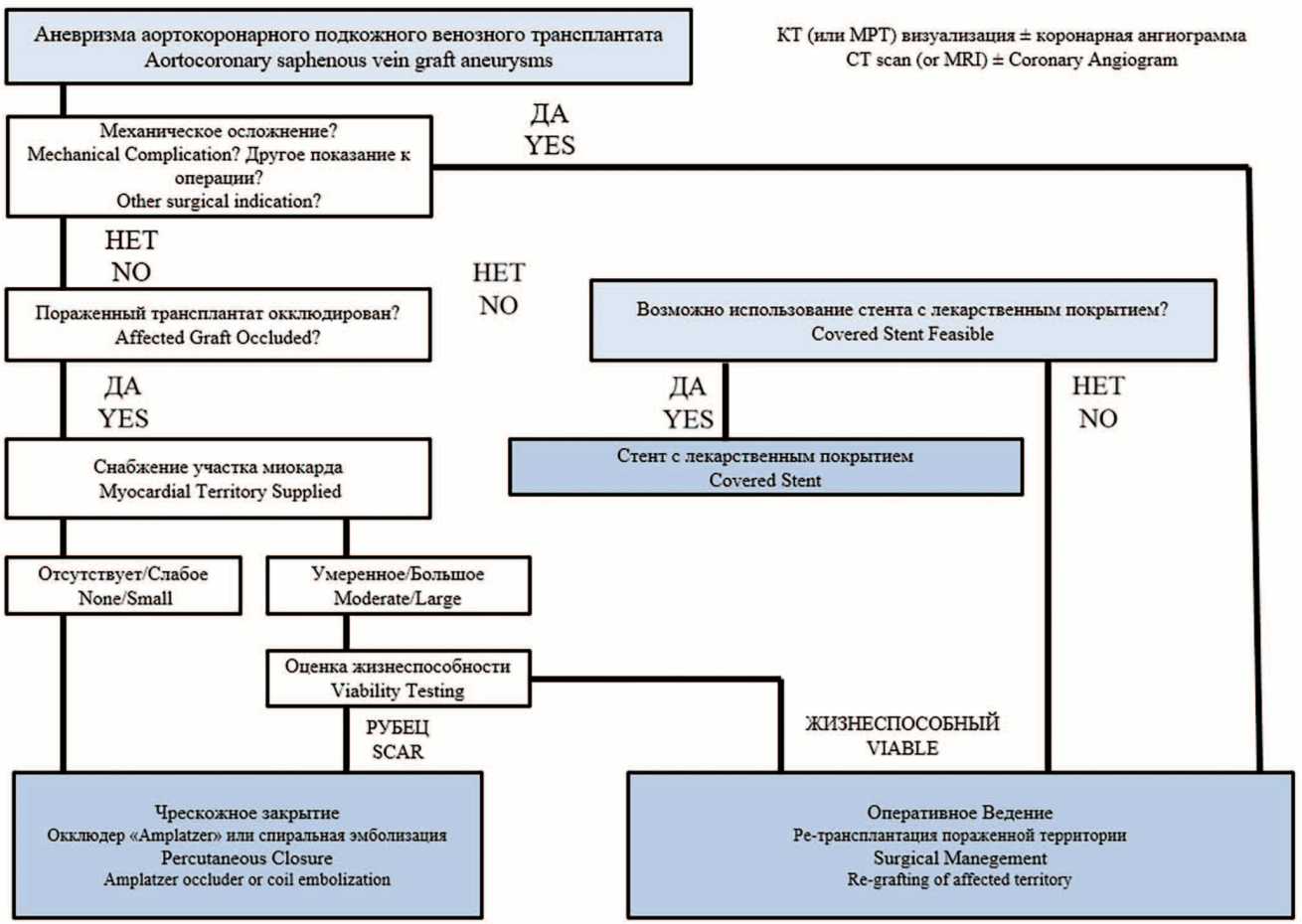

Figure 2. *Algorithm for the investigation and management of aortocoronary saphenous vein graft aneurysms [5]*
Abbreviations: CT– indicates computed tomography; MRI — magnetic resonance imaging

Chest X-ray or echocardiography can be a first-line of diagnostic search, taken that the sensitivity and specificity of transesophageal echocardiography in cardiac pathology identification are 99 % and 98 %, respectively [18]. However, coronary angiography and MSCT-angiography are essential for diagnosis verification. In this clinical case, the diagnosis was made with the help of thoracic aorta MSCT.

In autopsy, transplant histology shows systemic atherosclerosis, myocardial infarction and polymorphonuclear infiltration of the myocardium. If conduit aneurysms are present, fibrin and calcificates are reported in the long-term period, indicating a long-lasting pathological process [19]. In this case, there were no autopsy findings for the patient; however, his sudden death allows assuming aneurysm dissection, which is consistent with literature.

In their 2023 overview, Mezzetti E. et al. described all cases of autovenous conduit rupture available in the literature [7]. According to analysed data, aneurysmal and pseudoaneurysmal damages are diagnosed more often in men, however, the mortality is higher among women. Young men (below 45 years old) are less susceptible to aneurysmal dilatations than elderly population. It is worth mentioning that in men, aneurysmal dilatations rupture more often 5 years after CBS, while in women, it happens earlier. In this case study, an aneurysm was diagnosed 23 years after CBS.

There is no standard approach to the management of patients with diagnosed aneurysmal dilatation of the transplant. Decisions are made by an experienced cardiology team taking into account the patient's anatomic features and comorbidities [5]. If concurrent cardiosurgical correction (revascularisation or valve surgery) is required, surgery should be performed (aneurysm resection and bypass if technically possible). In some cases, transcutaneous treatment is possible using a drug-eluting stent in patients with acceptable anatomic features. A choice between surgery and transcatheter intervention should take into account any surgical risks, venous transplant patency and myocardium viability.

A decision-making algorithm was developed by Ramirez F.D. et al. (2023) and is based on the account of alternative indications, such as presence of a fistula, rupture or compression of adjacent anatomical structures (Figure 2) [5].

In an asymptomatic disease, a conservative approach is possible if a small aneurysm (< 40 mm) is diagnosed

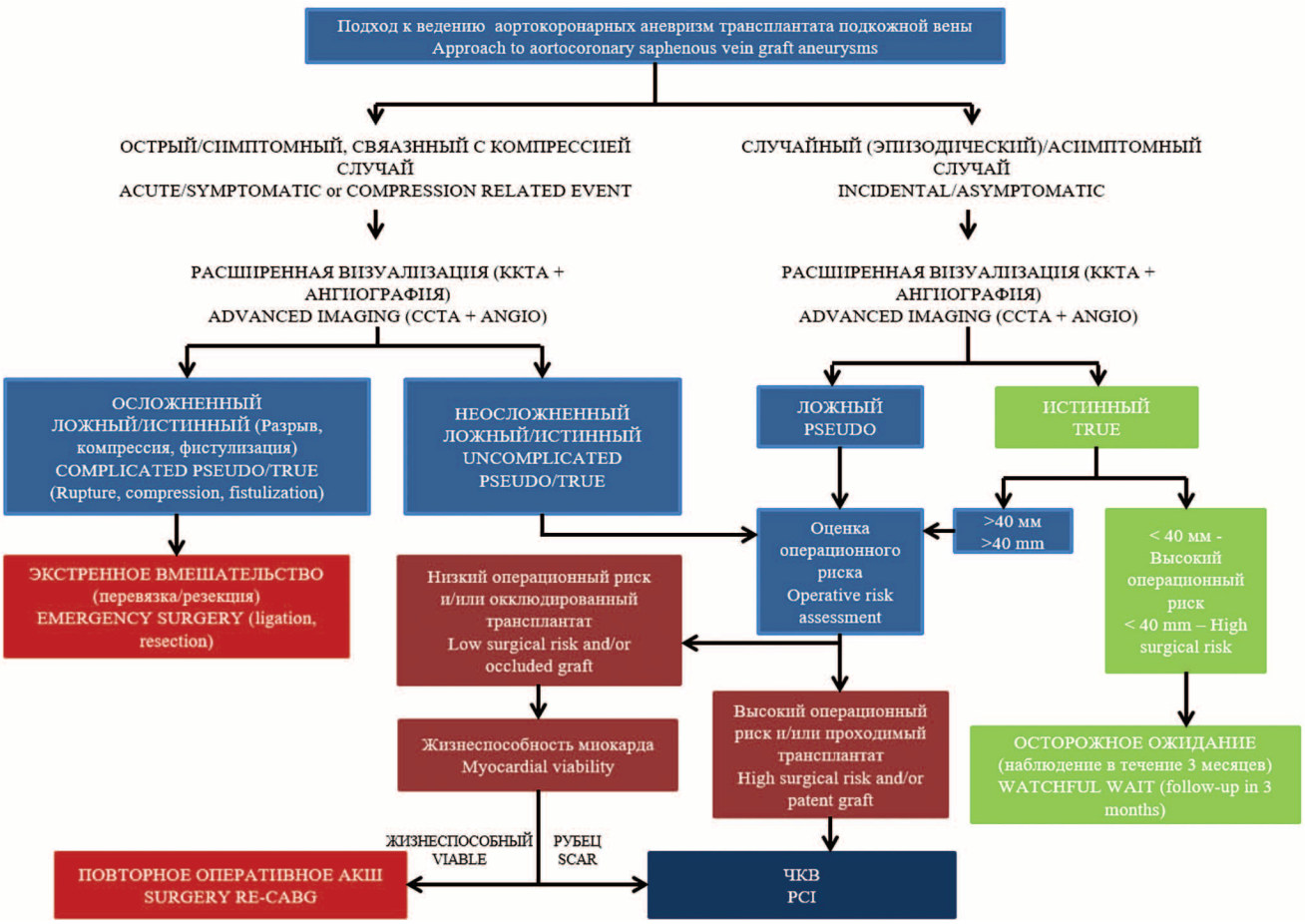

Figure 3. *Algorithm for Saphenous Vein Graft Aneurysms*
Abbreviations: CCTA — coronary computed tomography angiography; PCI — percutaneous coronary intervention, CABG — coronary artery bypass grafting

accidentally. However, medical follow-up is required, since aneurysms tend to grow and potentially dissect (Figure 3) [20].

In order to ensure succession of therapies, a cardiac rehabilitation program has been developed for post-CBS patients. According to the Russian clinical guidelines, Bypass Surgeries in IHD. Rehabilitation and Secondary Prevention, (2016) [21], cardiac rehabilitation comprises two stages — an early and a late stage. The late stage — outpatient cardiac rehabilitation substage — lasts until the end of the first year after CBS. The patient visits the clinic routinely once every three months for a control examination and correction of medical recommendations; they undergo stress tests (bicycle ergometry test, treadmill test, 6-minute walking test) in order to develop an individual rehabilitation program. In accordance with the Ischaemic Heart Disease Clinical Guidelines (2020), all IHD patients, who develop angina after myocardial revascularisation, are recommended to undergo imaging examinations in order to confirm myocardial ischaemia (exercise echocardiography, or echocardiography with pharmacological load, or myocardium scintigraphy with functional tests, or myocardium positron emission tomography, or perfusion single-photon emission computed tomography of the myocardium, with functional tests). At the same time, routine control CAG at the early and late stages after PCI is not recommended, unless clinical symptoms recur [10].

The Clinical Guidelines on the Follow-up Care of Patients with Stable Ischaemic Heart Disease by a Primary Healthcare Provider (2023) also emphasise long-lasting monitoring with mandatory timely laboratory and instrumental tests, as well as referral for imaging examinations [22].

Taking into account that aneurysms and pseudoaneurysms after CBS can develop both at early and late stages, clinical suspicion and patient awareness are essential over the entire period of follow-up care. This clinical case illustrates the significance of therapy succession and patient-oriented approach: patient's decision to refuse from further examinations and therapy because he had not had any symptoms in outpatient settings is likely to be associated with poor awareness of possible fatal complications of CBS. Timely hospitalisation and multidisciplinary approach could have improved the prognosis for this patient.

Conclusion

Aneurysmal dilatation of an autovenous conduit after coronary bypass surgery is a rare, but life-threatening complication of CBS both at late and early stages after the surgery. Clinical vigilance and successive patient follow-up with referral for imaging examinations, especially in the presence of clinical symptoms, will make it possible to improve prognosis and quality of patients' life after revascularisation.

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Author Contribution:

All the authors contributed significantly to the study and the article, read and approved the final version of the article before publication

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