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Simultaneous Combined Procedure of Tavi with Coronary and Carotid Stenting (Clinical Case)

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Abstract

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Recently, we have frequently observed multifocal atherosclerotic lesions combined with critical aortic stenosis in elderly patients. In cases of concomitant aortic valve disease and atherosclerotic lesions of the coronary arteries, the treatment strategy is obvious, which cannot always be said for involvement of several vascular territories, particularly the carotid arteries. This clinical case presents an example of successful simultaneous endovascular transcatheter aortic valve implantation combined with coronary and carotid stenting.

Key words: transcatheter aortic valve implantation; critical aortic stenosis, multifocal atherosclerosis, simultaneous stenting.

Introduction:

Atherosclerotic aortic valve stenosis (AAVS) combined with coronary heart disease is quite often observed in elderly patients. Besides atherosclerotic changes in the coronary arteries in such patients, the lesions may have multifocal nature, in particular, atherosclerotic changes may be observed in the carotid arteries [1, 2]. Quite often, such impairments of the vital organs vascularization manifest as clinical signs of the disease.

However, currently there is no consensus on the strategy and tactics of treatment of patients with severe aortic stenosis and multifocal atherosclerosis (stenosis of the coronary and carotid arteries). Simultaneous coronary artery stenting and TAVI (transcatheter aortic valve implantation) within a single procedure in patients with high surgical risk, first performed in our country many years ago (D.G. Ioseliani, 2012), has now proven to be a safe and effective method and is being used quite frequently [3, 4]. The strategy of combined treatment for AAVS and CAD significantly reduces the incidence of adverse outcomes related to coronary insufficiency, such as myocardial infarction and other serious complications in the early postoperative period [5, 6]. Today, clinicians are unlikely to question the feasibility of procedures to correct aortic valve pathology and impaired coronary blood flow in patients with AAVS and CAD. However, in cases of multifocal atherosclerosis, particularly with carotid artery involvement and severe aortic stenosis, there is no clear unified strategy or algorithm for endovascular procedures [7, 8]. On the one hand, combined carotid artery stenting immediately following TAVI may impair central hemodynamics in these patients, leading to collapse due to bradycardia and hypotension caused by the baroreceptor reflex during and shortly after the procedure, which may lead to a stroke [9–11]. On the other hand, leaving critical carotid artery

stenosis untreated, especially with unstable hemodynamics in the postoperative period, is equally dangerous and undesirable. Only the accumulation of experience in this direction, with strict adherence to extreme precautions, will be able to clarify this important issue [12, 13].

Clinical Case Description

A 80-years-old female patient Sh. was admitted to the Scientific and Practical Center for Interventional Cardioangiology, Federal State Autonomous Educational Institution for Higher Education I.M. Sechenov First Moscow State Medical University with complaints of pressing retrosternal pain and dyspnea on slight exertion. Moreover, the patient has recently begun to notice frequent dizziness. The patient has increased blood pressure (BP) for more than 20 years (up to 200/100 mm Hg) and receives antihypertensive therapy. According to the medical history, in December 2022, the patient underwent transluminal angioplasty and stenting of the middle third of the LAD (DES 2.5 x 12 mm) with satisfactory immediate angiographic result. Rheumatism and angina: denies. The patient reported worsening of condition over the last year - dyspnea progression and more frequent angina attacks. The patient was examined at the consultative and diagnostic outpatient clinic of the Scientific and Practical Center for Interventional Cardioangiology, where the diagnosis of CAD was confirmed, as well as stenosing coronary atherosclerosis, angina at rest and on exertion, atherosclerotic aortic valve (AV) disease, severe stenosis of the aortic orifice with a maximum gradient of 96 mm Hg. The patient was hospitalized at the Center for additional examination and making a decision on further treatment strategy.

Electrocardiography: regular sinus rhythm, heart rate 73 beats per minute. Left bundle branch block and left anterior fascicular block. A 24-hour ECG monitoring showed: sinus rhythm over 24 h. Heart rate (HR): minimum 53 bpm, maximum 90 bpm, average 63 bpm, 8 supraventricular extrasystoles. ST-segment changes were recorded as greater than 2-mm depression in channel 1; occasionally it is associated with physical exertion at HR up to 90 bpm (walking, traveling by subway according to the patient diary). No pauses more than 2 seconds were detected.

Heart ultrasonography: chambers are not enlarged (LV EDD = 5.1 cm, LV ESD = 3.4 cm, LA area = 26 cm^2, RA area = 14 cm^2), severe stenosis of AV (maximum velocity 4.6 m/s, maximum systolic gradient 85 mm Hg, mean systolic gradient 53 mm Hg, estimated AV area = 0.5 cm^2), severe calcinosis of the AV cusps, moderate aortic insufficiency (aortic regurgitation of grade 2.5) - a wide central stream is determined, reaching the base of the papillary muscles (PHT 310 ms). Concentric myocardial hypertrophy of the LV with wall thickening was also observed. No areas with impaired local contractility of the LV were identified. LV ejection fraction was 54%. The aorta is not dilated, sclerotic. LV outflow tract diameter: 18 mm; AV annulus diameter: 21 mm, aortic diameter at the level of sinuses of Valsalva: 28 mm; aortic diameter at the level of sinotubular junction: 25 mm; maximum diameter of the ascending aorta at its widest segment: 32 mm; height of the sinuses of Valsalva: 14-16 mm. The mitral valve (MV) leaflets are thickened, with asynchronous motion. Calcification of the mitral annulus extending to the posterior leaflet was revealed (mean diastolic gradient on the MV = 4.8 mm Hg). Mitral regurgitation of grade 2. Tricuspid regurgitation of grade 1-2. Systolic pulmonary artery pressure: 55 mm Hg (Fig. 1).

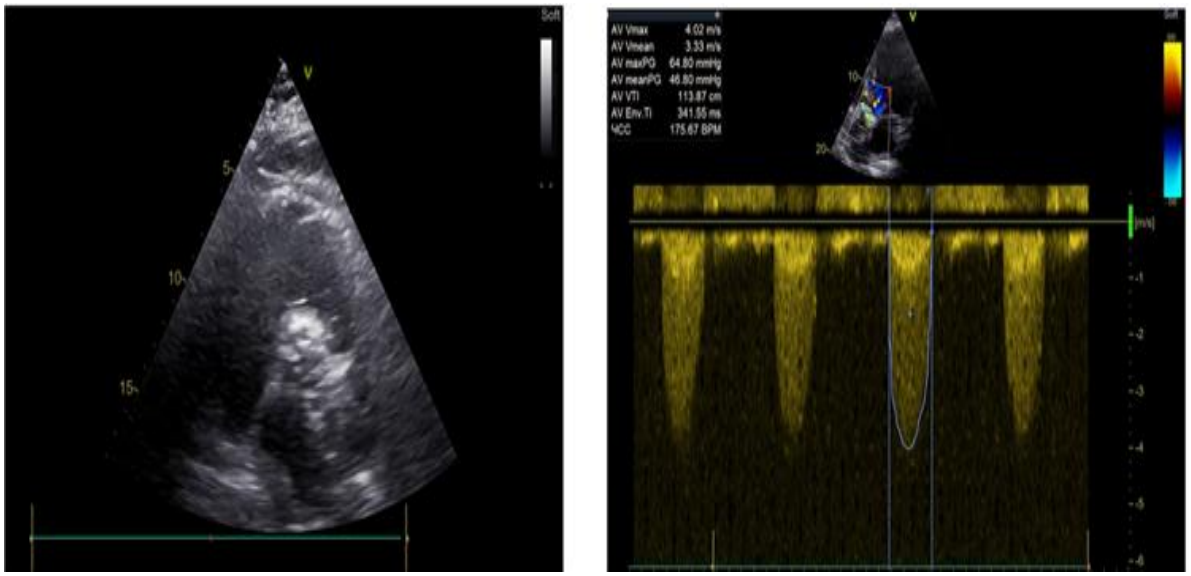

Figure 1: ***Preoperative transthoracic EchoCG. In the projection of the aortic valve, severe calcinosis of the annulus and leaflets is visualized.***

According to the ultrasound color duplex scanning of the brachiocephalic arteries, signs of atherosclerotic lesions of the brachiocephalic arteries walls with 80-85% stenosis of the left ICA and borderline narrowing of the right ICA and left subclavian artery are revealed.

According to laboratory tests, no abnormalities in blood and urine were found.

In addition to noninvasive investigations, the patient underwent selective coronary angiography and angiography of the

brachiocephalic arteries. Selective coronary angiography revealed the right-sided type of coronary circulation, signs of parietal calcification in the left main coronary artery without hemodynamically significant stenosis. LAD has diffuse changes; on the border between proximal and middle thirds there is a condition after stenting without restenosis. The LCX, represented by large marginal branch, also has diffuse changes in the proximal and middle segments without hemodynamically significant stenosis (Fig. 2, 3).

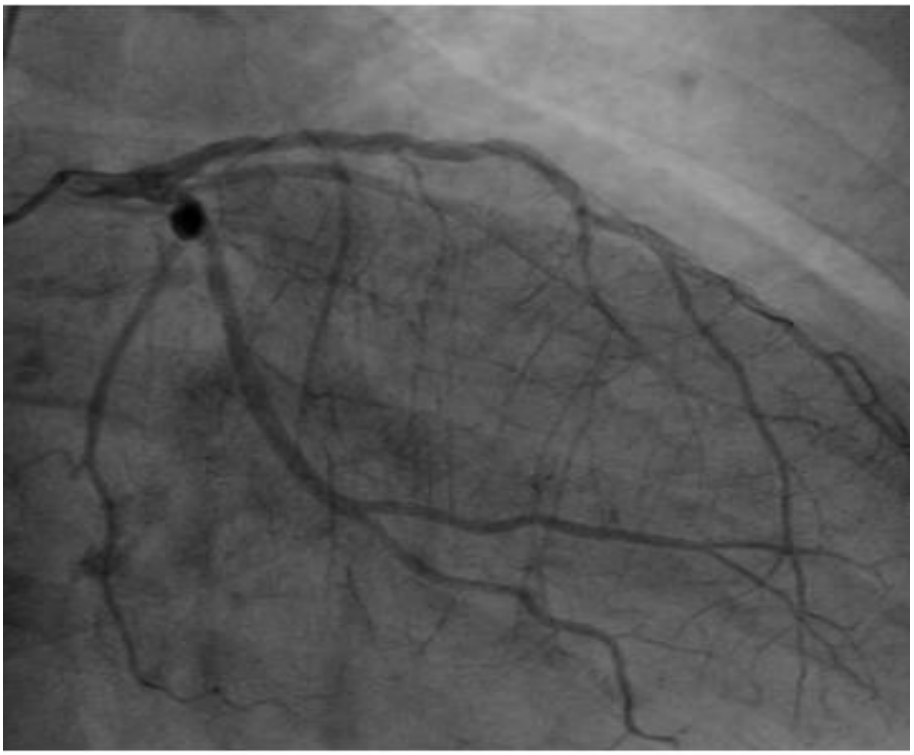

Figure 2: ***Selective angiography of the LCA. Status post stenting of the LAD branch of the LCA without restenosis.***

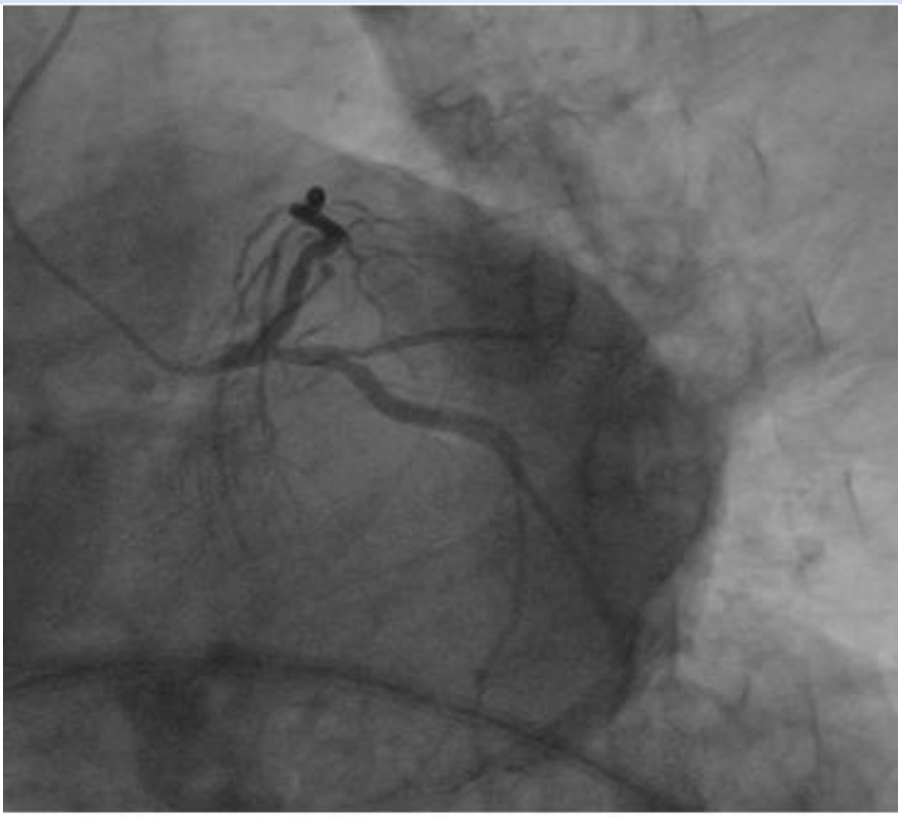

Figure 3: ***Selective angiography of the LCA. "Spider view". The LAD branch of the LCA and the LCX branch of the LCA without hemodynamically significant stenosis.***

The RCA has signs of significant calcification; there is an extended stenosis up to 75-80% in the middle segment, without signs of hemodynamically significant stenosis distally (Fig. 4).

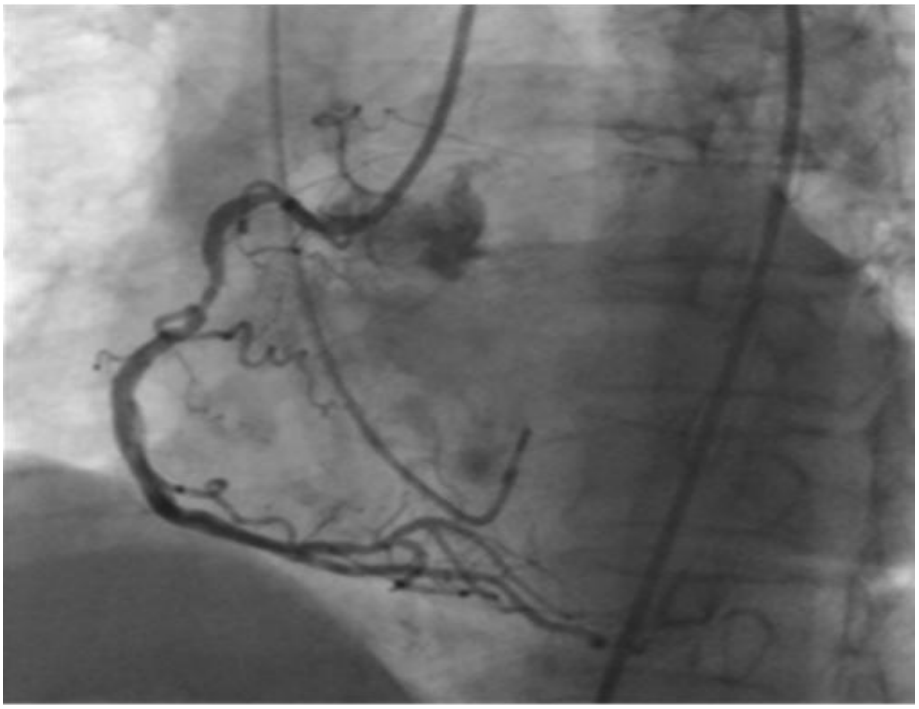

Figure 4: ***Selective angiography of the RCA. Extended stenosis with maximum narrowing up to 75 80% in the middle segment of the RCA is indicated by arrow.***

Angiography of the brachiocephalic trunk revealed hemodynamically significant stenosis of the left ICA in the extracranial region with maximum narrowing up to 80% (Fig. 5).

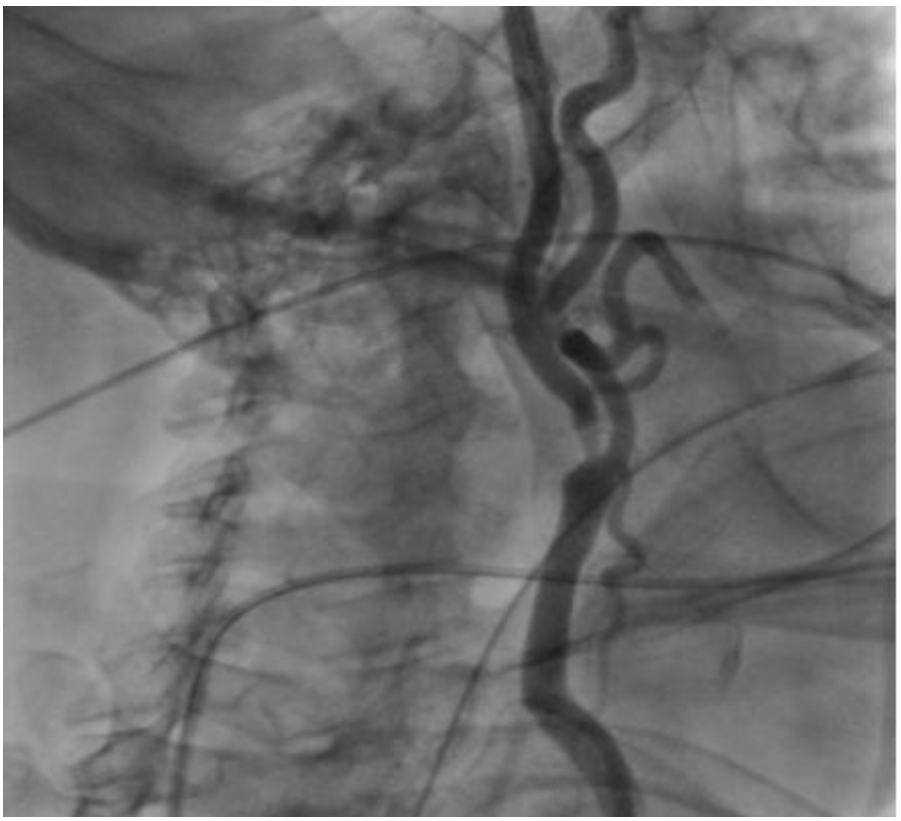

Figure 5: ***Selective angiography of the extracranial region of the left carotid territory. Stenosis in the orifice of the left ICA with maximum narrowing up to 80% is indicated by arrow.***

After the examinations, the case was discussed by a council of physicians, and a decision was made on simultaneous stenting

of the right coronary artery, transcatheter AV implantation, and stenting of the left carotid artery. On the first stage, PTA procedure and stenting of the middle third of the RCA were performed, for which, under local anesthesia, retrograde catheterization of the aorta using the left transfemoral access was performed and a 6 Fr introducer installed. A 6 Fr JR guide catheter was installed into the RCA orifice. The coronary guidewire was inserted into the distal part of the RCA. In the stenotic region, PTA (predilatation) with 2.5x15 mm balloon catheter at a pressure of 14 atm was performed with subsequent implantation of a 3.5x18 mm drug-eluting stent (DES) at a maximum pressure of up to 12 atm. The control CAG showed an adequate positioning, full deployment of the stent, no dissections, and TIMI-3 blood flow through the RCA. There was a good immediate angiographic effect (Fig. 6).

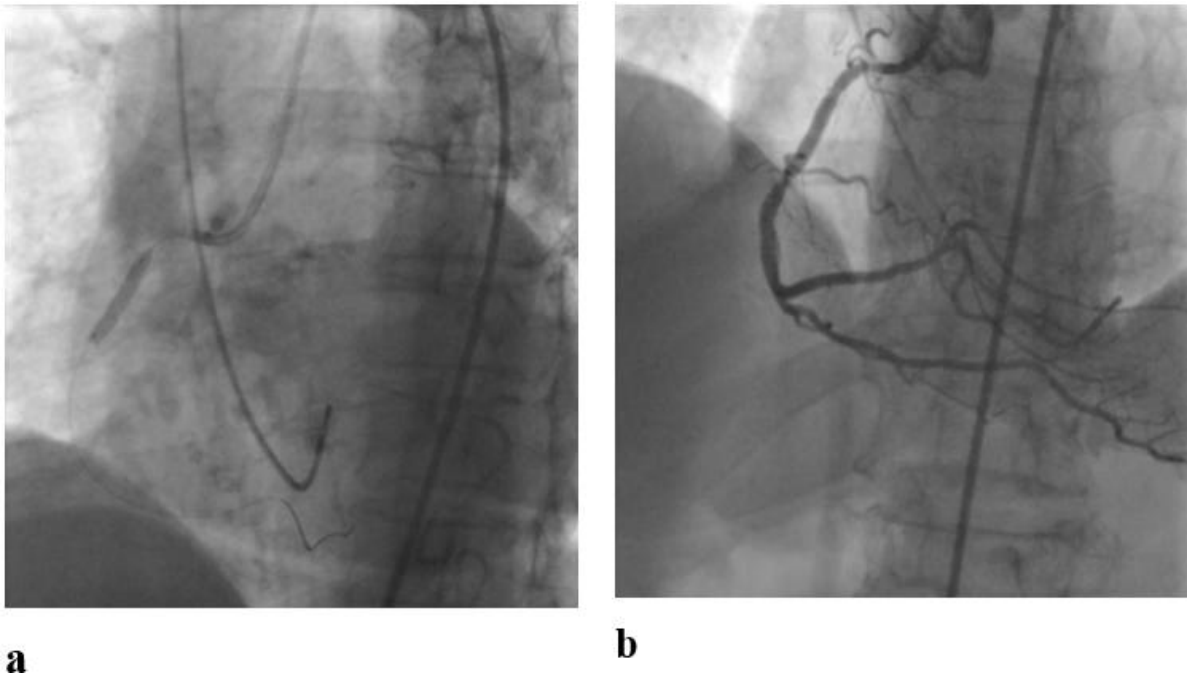

Figure 6: ***Endovascular procedure on the RCA. a - Implantation of the 3.5 x 18 mm drug-eluting stent into the middle segment of the RCA; b - Angiographic result.***

After myocardial revascularization, on the second stage, a transcatheter AV implantation with 23 mm balloon-expandable Myval prosthesis was performed. A catheter-electrode for temporary pacing was inserted and installed into the right ventricle through the right jugular vein. The right CFA was surgically isolated. A puncture of the CFA was performed and a 7 Fr introducer installed. A 5 Fr pigtail catheter was inserted through the contralateral femoral artery and placed to the non-coronary sinus. The pressure gradient in the LV and ascending aorta was 60 mm Hg. After passing the aortic valve and installing a rigid guidewire, the 7 Fr introducer was replaced with a 14 Fr introducer, and AV balloon valvuloplasty performed. A 20 mm balloon catheter was delivered to AV through the guidewire, and AV dilatation was performed at the pacing rate of 220 per minute. Then, 23-mm Myval prosthesis was inserted on a delivery device into the AV and implanted in compliance with the standard technique (Fig. 7).

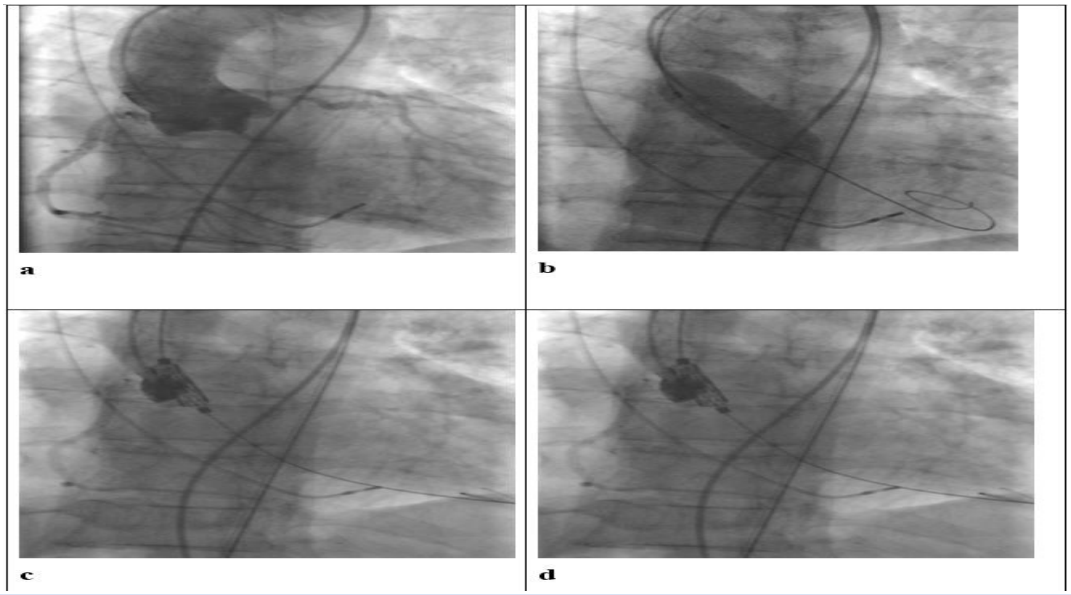

Figure 7: ***Stages of transcatheter implantation of the 23 mm Myval aortic valve. a - Thoracic aortography; b - Valvuloplasty with a 20 mm balloon catheter; c - Positioning of the 23 mm Myval aortic valve; d - Implantation of the 23 mm balloon-expandable Myval aortic valve.***

Control angiography showed insignificant signs of regurgitation and paravalvular leaks (Fig. 8).

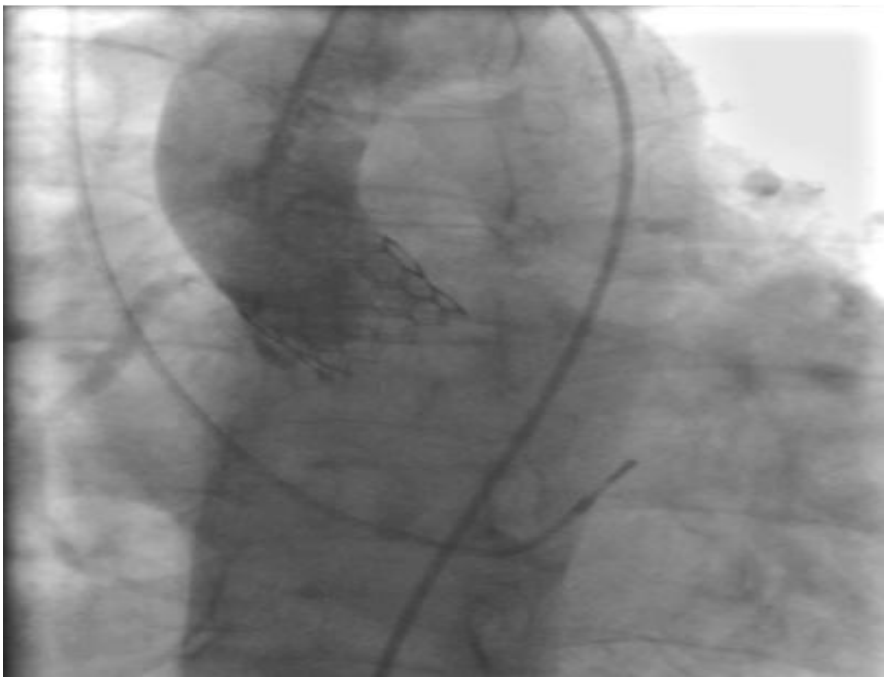

Figure 8: ***Final angiographic result of the implantation of the 23 mm balloon-expandable Myval aortic valve.***

The AV prosthesis was visualized by intraoperative transesophageal EchoCG; aortic regurgitation is minimal (Fig. 9).

Figure 9: ***Control of the implantation of the 23 mm balloon-expandable Myval aortic valve; aortic regurgitation is minimal (transthoracic EchoCG).***

The prosthesis function was satisfactory. The peak gradient was 13 mm Hg. There was no fluid in the pericardial cavity. Delivery device was extracted.

On the third stage, a FilterWire distal embolic protection device was delivered and placed into the distal part (intracranial) of the left ICA under the angiographic guidance. A 6-8 mm x 40 mm XACT stent was delivered, positioned and implanted into the stenosis area. Then, post-dilatation with 6.5 x 20 mm balloon catheter was performed at a pressure of up to 16 atm. On the control angiography, the stenting result was considered satisfactory (Fig. 10).

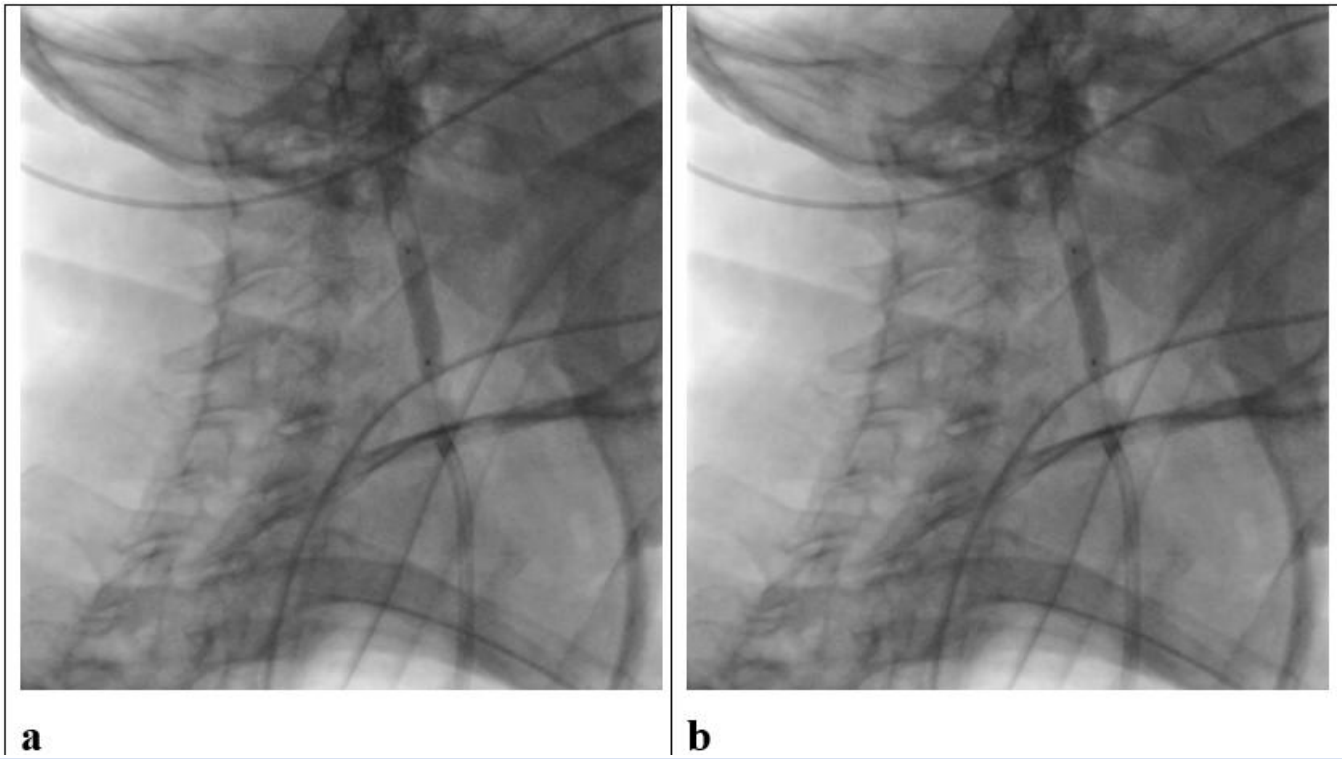

Figure 10: ***Stages of the endovascular procedure on the left ICA. a – Implantation of the 6 8 x 40 mm XACT stent into the left ICA. b – Angiographic control immediately after the endovascular procedure on the left ICA.***

The wound of the right CFA was sutured. All procedures (stenting of the coronary and carotid arteries as well as AV implantation) were performed without any complications. Total duration of the procedures was 148 minutes; fluoroscopy time - 30.5 minutes; volume of the contrast agent - 320 mL.
The patient was discharged from the hospital on the 7th day in a fair condition with recommendations for antiplatelet therapy, follow-up by a cardiologist at the place of residence, and a control examination in 1 year.

Conclusion:

Thus, this clinical case demonstrates that simultaneous transcatheter aortic valve implantation and stenting of the coronary and carotid arteries in the patient with high-risk critical aortic stenosis and multifocal atherosclerosis, including coronary heart disease, is feasible, safe and can be performed successfully. There is a need for data from randomized studies comparing various approaches to treat this condition. In our opinion, the decision on treatment strategy should be made individually in each case taking into account multiple factors related to the patient themselves, their condition, the presence of serious concomitant diseases, etc.

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Conflict of Interest:

The authors also not declare any conflict of interest.