Journal of the Saudi Heart Association

Volume 33 | Issue 4 Article 2

2021

Simultaneous bicarotid and microscope-assisted coronary revascularization as an individual surgical strategy

Simultaneous Bicarotid and Microscope-assisted Coronary Revascularization as an Individual Surgical Strategy

Andrey N. Semchenko

Federal Center for Cardiovascular Surgery of Healthcare Ministry of the Russian Federation, Krasnodarskaia 2 B str., Khabarovsk, 680000, Russia

Abstract

A 59-year-old man presented with complaints of giddiness caused by changes in body position, unsteady gait, daily episodes of vision loss, breathlessness, and chest pain flowing minor physical exertion. Computed tomography revealed occlusion of the right common carotid artery, critical stenosis of the left common carotid artery, and significant stenosis of the left internal carotid artery. A coronarography detected stenosis of the left main coronary artery plus 3-vessel disease. Simultaneous aortic-bicarotid bifurcation prosthesis and coronary artery bypass grafting were performed. The patient showed a satisfactory postoperative outcome.

Keywords: Carotid artery diseases, Coronary artery bypass grafting, Endarterectomy, Operating microscope

1. History of presentation

A 59-year-old man was admitted to the hospital with complaints of giddiness caused by changes in body position, an unsteady gait, daily episodes of vision loss, breathlessness, and chest pain flowing minor physical exertion, and pain in calf muscles.

2. Past medical history

Over the previous 2 years, he had noticed the appearance of the neurological complaints mentioned above. He had suffered a stroke 5 months earlier, resulting in transient mild hemiparesis. Angina pectoris first appeared 4 years before the current hospitalization, and its progression was noted over the last year.

3. Investigations

Echocardiography showed left ventricular dysfunction with a decreased ejection fraction to 40% and diffuse hypokinesia with akinesis in the basal and the middle-lower segments. Computed tomography revealed occlusion of the right common carotid artery, a 95% stenosis of the left common carotid artery, a 90% stenosis of the left internal carotid artery, occlusion of the left vertebral artery, and a 70% stenosis of the right vertebral artery (Fig. 1). A coronarography detected a 50% stenosis of the left main coronary artery and 3-vessel disease with a 60% proximal stenosis of the left anterior descending coronary artery, and occlusions of the circumflex and right coronary arteries. The distal bed of the right and circumflex coronary arteries was poorly visualized due to a poor collateral flow (Fig. 2).

4. Management

The surgery was as follows. A median sternotomy was performed. The great saphenous veins from both legs and the left internal mammary artery (LIMA) were harvested. At the same time, bilateral longitudinal incisions in the neck were performed, exposing bifurcations of the right and left common

Received 09 August 2021; revised 01 September 2021; accepted 07 September 2021.
Available online 15 October 2021
E-mail address: semch@mail.ru.

https://doi.org/10.37616/2212-5043.1273

carotid arteries. A proximal end-to-side anastomosis between the 14-mm main branch of Dacron bifurcated prosthesis and the ascending aorta was constructed, using a side-biting clamp. The remaining branches of the bifurcation prosthesis were tunneled one at a time to the incisions on the right and left sides of the neck. The right common carotid artery was clamped and cut off. A satisfactory retrograde blood flow was observed. Moderate hypertension was maintained during revascularization of the right common carotid artery to prevent cerebral hypoperfusion. A distal end-to-end anastomosis between the right common carotid artery and the right 7-mm branch of Dacron bifurcated prosthesis was performed. The carotid clamping time was 8 min. After clamping the left carotid vessels, the bifurcation of the left common carotid artery was cut off, and a longitudinal arteriotomy was continued into the initial part of the internal carotid artery beyond the stenosis. The plaque was mobilized, and the left internal carotid endarterectomy was completed. Since pressure in the common carotid artery after clamping was 55 mmHg, shunt into the carotid arterial system was not deployed. Then a distal anastomosis between the left common carotid artery with the initial part of the left internal carotid artery and the remaining 7-mm branch of the bifurcated prosthesis was performed. The left common carotid artery was ligated 1 cm below the distal anastomosis. The carotid clamping time was 22 min.

A cardiopulmonary bypass was instituted. A pharmacological brain protection protocol included sodium oxybutyrate, magnesium sulfate, and methylprednisolone. A revision and assessment of the distal bed of the circumflex and the right coronary arteries found they were of too small diameter to perform coronary artery bypass grafting (CABG) in a traditional manner. The operating microscope with up to 24× magnifications was applied to perform distal anastomoses to achieve complete revascularization. The heart was arrested, and the myocardium was protected with antegrade blood warm cardioplegia. The left anterior descending artery was revascularized with the LIMA. The right coronary and the circumflex arteries were revascularized with venous grafts. The measurement of target coronary sizes taken with calibration probes found that the diameters of the left anterior descending, right coronary, and circumflex arteries were 1.5, 1.0, and 1.0 mm respectively. The proximal anastomoses of the vein grafts were constructed in the ascending aorta after the cross-clamp was removed. Ischemic and pump times were 40 and 71 min, respectively.

After the surgery, the patient was taken to the intensive care unit for a three-day-long treatment.

Abbreviations

LIMA	left internal mammary artery
CABG	coronary artery bypass grafting

Special attention was paid to neuroprotective therapy; controlled hypotension was provided by keeping the systolic pressure at maximum values between 100 and 110 mm Hg to prevent a hemorrhagic stroke following the restoration of blood circulation in the precerebral arteries. In the first 2 days after the surgery, neurovegetative blockade was provided. The patient was extubated on the third postoperative day after complete recovery of consciousness. The patient was discharged from the hospital on day 15 after the surgery. Before discharge, the patency of the aortic-bicarotid prosthesis, carotid arteries, and coronary grafts was confirmed by computed tomography (Fig. 3). Postoperative echocardiography detected an improvement in the left ventricular contractility with an increased ejection fraction to 57% and moderate hypokinesia in the basal-lower segments.

5. Discussion

Patients with severe concomitant lesions of coronary and carotid arteries represent a specific high-

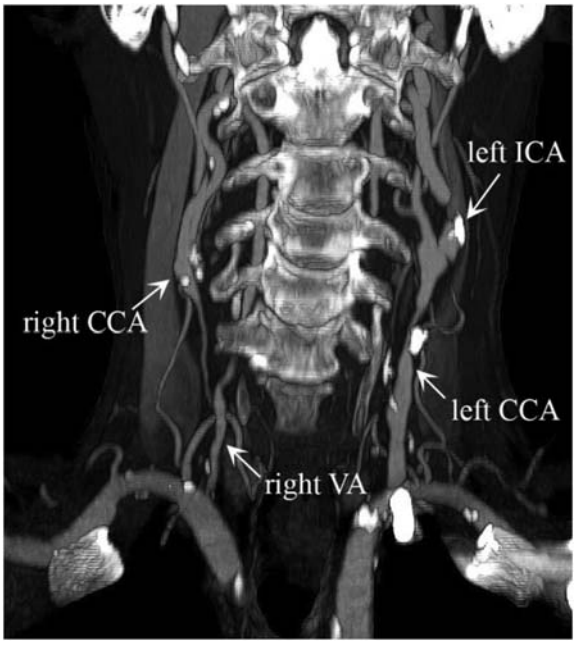

Fig. 1. Computed tomography image showing occlusion of the right common carotid artery (right CCA), 95% stenosis of the left common carotid artery (left CCA), 90% stenosis of the left internal carotid artery (left ICA), 70% stenosis of the right vertebral artery (right VA).

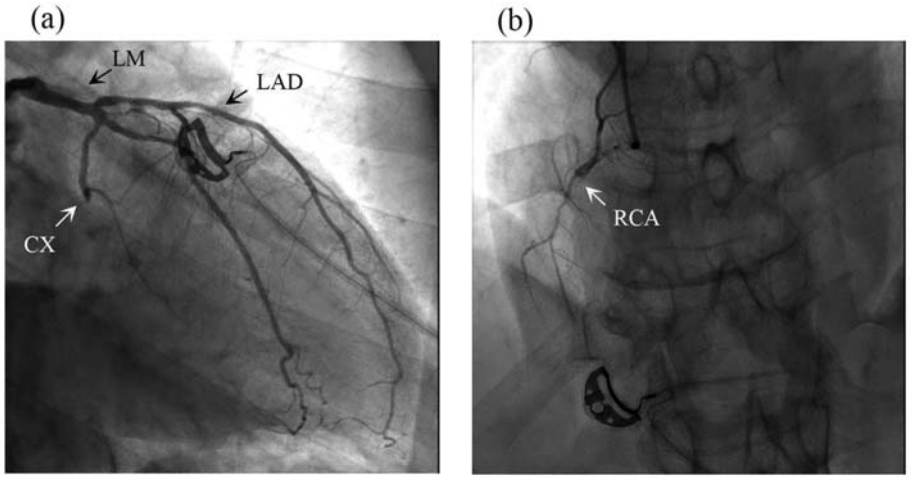

Fig. 2. Coronary angiography showing 50% stenosis of the left main coronary artery (LM), 60% proximal stenosis of the left anterior descending coronary artery (LAD), occlusion of the circumflex artery (CX) (a); occlusion of the right coronary artery (RCA) (b).

risk population in the current practice of cardiovascular surgery. Implementing wrong tactics in sequencing carotid and coronary artery interventions can increase the number of incidents of strokes and/or myocardial infarctions after surgeries. Therefore, placing emphasis on the assessment of prevailing risks of developing each of these complications is essential to a choice of strategy for surgical treatment in patients with significant concomitant lesions in carotid and coronary arteries. The existing approaches to surgical treatment of this category of patients remain controversial and vary from staged interventions in different sequences to simultaneous operations [1,2].

In the current practice, there are several strategies for surgical treatment of patients with combined lesions of the coronary and brachiocephalic arteries: carotid endarterectomy before CABG; simultaneous carotid endarterectomy and CABG; stenting of brachiocephalic arteries before CABG; and interventions on the carotid arteries after CABG. Nonetheless, there is no standardized approach to making decisions as to a choice of preferred strategies [1–3].

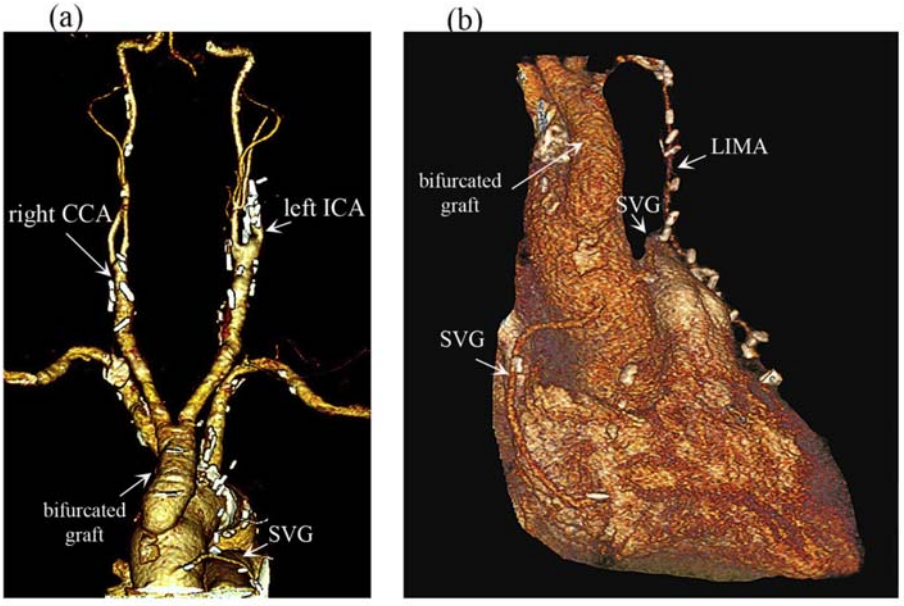

Fig. 3. Postoperative computed tomography reconstruction showing the patency of the aortic-bicarotid prosthesis, carotid arteries (a), and coronary grafts (b). CCA - common carotid artery, ICA - internal carotid artery, SVG – saphenous vein graft, LIMA - left internal mammary artery.

The decision to perform a simultaneous operation described in this case report was taken based on equivalent risks of a stroke and myocardial infarction. Cerebral embolism and cerebral hypoperfusion are the main causes of a stroke after a CABG in patients with confirmed carotid artery lesions. In cases of a unilateral lesion of the carotid artery, endarterectomy can be reasonably recommended. In the presented case, however, an isolated carotid endarterectomy cannot be a solution to the problem; rather, it may aggravate the patient's condition, becoming a high-risk procedure, given the absence of collateral circulation and the presence of a contralateral occlusion in the carotid artery. All these points were taken into account when choosing a method for the reconstruction of the brachiocephalic arteries.

Due to the small diameters of the target vessels, microsurgical technique and operating microscope were used for coronary artery bypass grafting. This method allows performing a high-precision coronary anastomosis while avoiding technical errors, regardless of how poor the condition of the distal coronary bed is. According to the literature, the use of a surgical microscope for CABG allows restoration of blood flow in the coronary arteries with diameters of less than 1.5 mm [4,5].

6. Follow-up

At the one-year follow-up, the patient was in a normal condition without episodes of transitory ischemic attacks or angina. He did not have any neurological symptoms, and he was completely asymptomatic.

7. Conclusion

It is worthy of note that the operative tactic described in this case report cannot be taken as the basis of the routine practice of surgery in patients with severe concomitant coronary and bilateral carotid arteries lesions. Clinical cases like that described above always require a personalized approach to each patient. Good team coordination of cardiologists, surgeons, and anesthesiologist is essential to choosing an appropriate tactic and performing a safe operation. Due to the absence of standardized recommendations with a high level of evidence, the choice of the sequence and type of surgery for patients with significant concomitant lesions in carotid and coronary arteries should be based on risk assessment, indications and contraindications, preoperative planning, and clinical experience.

Funding

No financial support.

Conflict of interests statement

Author has nothing to disclose with regard to commercial support.

References

[1] Keshelava G, Beselia K, Nachkepia M, Janashia G, Nuralidze K. Simultaneous approach of internal carotid artery revascularization at the base of the skull and coronary arteries bypass without extracorporeal circulation. Gen Thorac Cardiovasc Surg 2011 Jul;59(7):495–8. https://doi.org/10.1007/s11748-010-0725-5.

[2] Aramendi C, Cubero A, Cortés A, Rivas D, Crespo A, Aramendi JI. Complete carotid and coronary revascularization in brain malperfusion. Asian Cardiovasc Thorac Ann 2016 Sep;24(7):709–11. https://doi.org/10.1177/0218492316639940.

[3] Naylor AR, Mehta Z, Rothwell PM, Bell PRF. Carotid artery disease and stroke during coronary artery bypass: a critical review of the literature. Eur J Vasc Endovasc Surg 2002 Apr;23(4):283–94. https://doi.org/10.1053/ejvs.2002.1609.

[4] Semchenko A, Makarov A, Karpov I, Zharenkov M. Microscope-assisted coronary artery bypass grafting: technique and results. Braz J Cardiovasc Surg 2020 Oct;35(5):815–20. https://doi.org/10.21470/1678-9741-2019-0416.

[5] Kitamura S. Pediatric coronary artery bypass surgery for congenital heart disease. Ann Thorac Surg 2018 Nov;106(5):1570–7. https://doi.org/10.1016/j.athoracsur.2018.04.085.