

Coronary – Subclavian Steal Syndrome Treated with Carotid to Subclavian Artery By-pass

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Rezumat

Sindromul de furt coronaro-subclavicular tratat prin by-pass carotido-subclavicular

Sindromul de furt coronaro-subclavicular reprezintă o entitate clinică rară datorată afectării aterosclerotice a originii arterei subclavii la pacienții coronarieni operați la care s-a utilizat artera mamară internă. Această complicație determină apariția fluxului retrograd la nivelul arterei mamare și reparația ischemiei miocardice. Opțiunile terapeutice sunt angioplastia și stentarea arterei subclavii, sau, în cazuri de ocluzie a acesteia, tratamentul chirurgical. Acest caz prezintă realizarea unui by-pass carotido-subclavicular pentru tratamentul sindromului de furt coronaro-subclavicular, datorat ocluziei arterei subclaviculare stângi.

Cuvinte cheie: stenoză arteră subclavie, sindrom de furt coronaro-subclavicular, by-pass carotido-subclavicular

Abstract

Coronary-subclavian steal syndrome is a rare clinical entity, which results from the atherosclerotic disease of the origin of the subclavian artery in patients in which the internal mammary artery was used as a conduit for coronary artery by-pass. This complication causes reversal of the flow in the

internal mammary artery and the recurrence of myocardial ischemia. The therapeutic options are angioplasty and stent of the subclavian artery or, in a rare case of occlusion, surgical treatment. This case report describes the use of the carotid to subclavian artery by-pass for the treatment of coronary-subclavian steal syndrome due to the occlusion of the subclavian artery.

Key words: subclavian artery stenosis, coronary-subclavian steal syndrome, carotido-subclavian by-pass

Introduction

Coronary-subclavian steal syndrome (CSSS) consists in recurrence of angina pectoris in a patient who has priorly undergone prior bypass surgery using the left internal mammary artery. In this case, the recurrence of cardiac symptoms is due to a retrograde flow in the IMA as a consequence of the atherosclerotic disease (stenosis or occlusion) at the origin of the left subclavian artery.

The incidence of this pathology was described initially with a frequency of 0.1-3.4% (1,2,3). Occurrence of this syndrome is due to lack of acknowledgement of the subclavian stenosis, before using the IMA for the bypass, or to missing the progression of atherosclerosis of the subclavian artery after myocardial revascularization.

Angioplasty and stenting of the subclavian artery represent the first therapeutic option for stenosis and sometimes occlusion, delivering good results (4,5,6). If interventional procedures can not be applied – rare cases – the treatment must be surgical: reinsertion of the IMA in the aorta or a carotid subclavian bypass (2,7,8,9,10).

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We present the case of a patient who underwent a carotid subclavian bypass for occlusion of subclavian artery 1 year after myocardial revascularization, and for the recurrence of anginal symptoms.

Because of the high incidence of this pathology, we consider a preoperative assessment of subclavian artery lesions and the recognition of postoperative lesions to be very important, and if the cardiac symptomatology reappears, the treatment must be immediate, interventional or surgical.

Case report

A 53-year-old female patient was admitted with repeated chest pain at rest for 10-15 minutes, relieved with nitroglycerin, 1 year after myocardial revascularization.

Initially the patient underwent triple bypass using the IMA for revascularization of LAD and two saphenous vein grafts to an intermediate branch and the posterior interventricular artery. At the moment, there was no suspicion of the left subclavian artery stenosis, no bilateral measurements of blood pressure were taken, no Doppler or other investigations were performed and intraoperatively the flow through the IMA was considered acceptable.

Her past medical history included: anterior myocardial infarction, severe hypotension, insulin dependent diabetes mellitus, obesity, hypercholesterolemia.

Her physical examination revealed a blood pressure of 145/70 mmHg, a regular pulse in the right arm and the absence of the pulse along the entire trajectory of the limb.

A 12-lead ECG showed ischemic changes in the antero-lateral territory. Cardiac enzymes were not increased.

Echocardiography revealed non-dilated LV, mild hypokinesia of the interventricular septum and lateral wall, EF=45%, without other abnormalities.

Carotid ultrasound Doppler showed no lesions, but a spontaneous reversal flow in the left vertebral artery was detected.

The coronary angiography showed severe stenosis in the left anterior descending artery second segment with retrograde flow in the left IMA until the mid-segment (Fig. 1).

The other coronary arteries were less than 1 mm diameter, with severe stenosis, not adequate for bypass; visualization of venous grafts was not possible. The left subclavian artery presented ostial occlusion (Fig. 2).

The left common carotid artery presented retrograde flow with the overload of the subclavian artery and of the IMA until the mid-segment.

According to all these findings, the case reveals: instable angina after CABG caused by subclavian artery occlusion and coronary subclavian steal syndrome.

Due to the left subclavian artery obstruction the use of multiple guide wire with interventional method was not possible and the optimal therapeutic option remained carotid subclavian bypass.

After a subclavicular incision and dissection of the muscle layers, the approach of the left subclavian artery was made at 1-2 cm from the origin of the vertebral and left mammary arteries; the phrenic nerve was carefully protected.

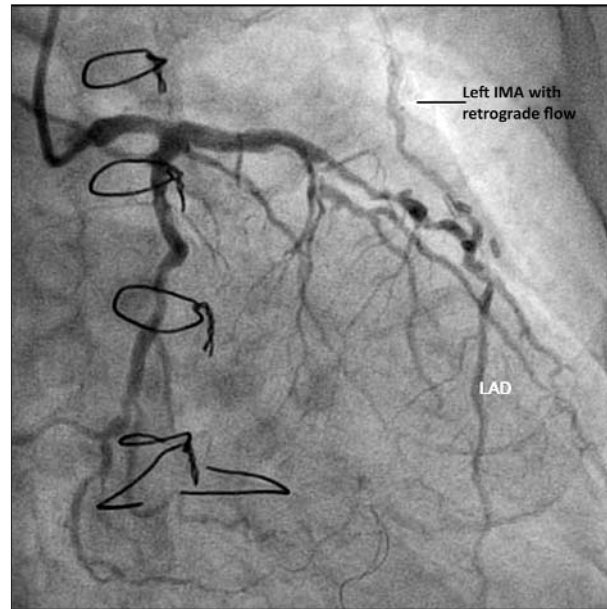


Figure 1. Coronarography (caudal oblique projection view): significant serial stenoses of the left anterior descending artery with reverse flow of the left IMA

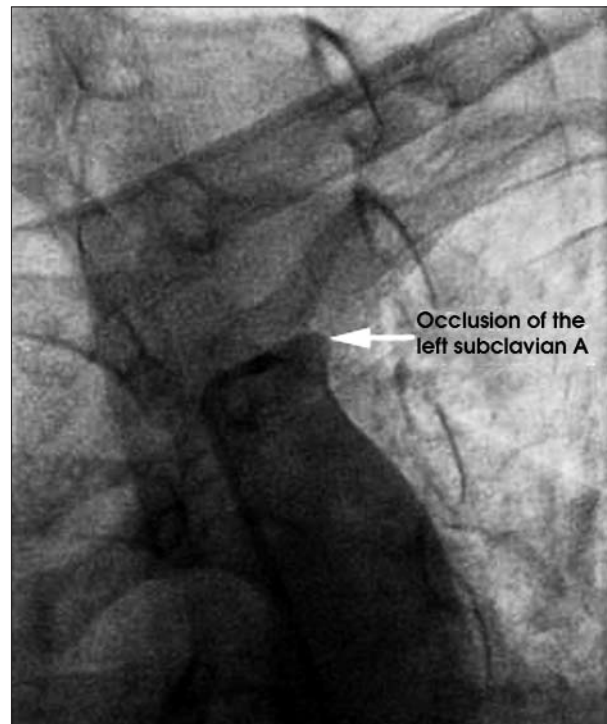


Figure 2. Aortic arch angiography: occlusion of the left subclavian artery

Through an incision parallel to the sternocleidomastoid muscle the approach of the left common carotid artery was achieved.

These two incisions were joined together for a better exposure, and a carotid subclavian bypass through a segment of 3 cm Interguard® (Maquet Getinge Group) prostheses was made. The anastomoses were latero-terminal at carotid level and termino-lateral at the subclavian level with Prolene®

5/0 wire (Polypropylene Ethicon) (Fig. 3).

The surgical wounds were drained and sutured.

The carotid clamping time was 12 minutes according to cerebral oximetry; initially the SaO₂ of the left cerebral hemisphere was 75%, decreasing to 62-65% during the carotid clamping and increasing after declamping. For the right cerebral hemisphere no abnormality was detected.

During the surgery the patient was haemodynamically stable, without any ECG abnormalities.

Postoperatively, the patient was asymptomatic and the left upper extremity pulses were present, the blood pressure being the same for both arms.

The 3 months postoperative coronarography and angio-scan showed the patency of the bypass and the IMA had a normal anterograde flow (Fig. 4, 5).

Angio-scan is the gold standard for supra-aortic branch pathology, providing excellent information regarding the carotid subclavian bypass permeability. We also conducted a coronarography assessment to evaluate the anterograde flow through IMA.

Discussions

First reported by Harjola and Valle in 1974 (11), CSSS is an unusual complication after coronary surgery using LIMA. This syndrome is due to subclavian artery stenosis, the main cause being atherosclerosis and less frequent pathologies: Takayasu arteritis, giant cell arteritis, post irradiation arteritis (2).

Subclavian artery stenosis after myocardial revascularization leads to myocardial ischemia, due to reverse flow through the IMA.

Usually CSSS presents as recurrent angina (12,13,14), myocardial infarction (15,16,17), cardiac insufficiency (1,2, 18), although occasionally the patient is asymptomatic (19). The symptoms have been reported to occur between 2-31

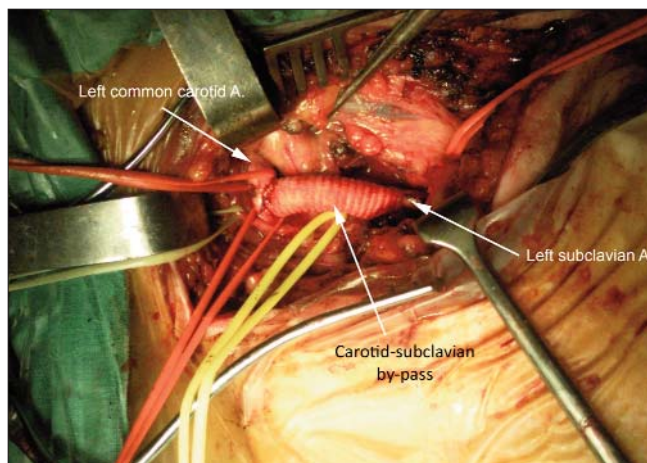


Figure 3. Intraoperative aspect: carotid to subclavian bypass with prosthesis

years after CABG, symptoms presenting recently after myocardial revascularization suggesting a subclavian stenotic lesion missed before surgery (10).

Preoperative screening is necessary: bilateral measurement of blood pressure, Doppler of subclavian artery, angiogram of the aortic arch concomitant with coronarography examination (2,20).

Arteriography of the aortic arch is the main investigation for CSSS diagnosis, because it can be performed at the same time with the coronarography. Also, the diagnosis of subclavian artery stenosis or occlusion is set through less invasive methods: angio-scan, angio-MRI.

Several therapeutic methods concerning CSSS have been described: aorto-subclavicular bypass (1,20), carotid subclavian bypass (2,7,8,9,10), axilo-axillary bypass (21), reinsertion of IMA into the aorta (22), percutaneous angioplasty and stenting (3,4,5,6), laser ablation (23). Interventional methods

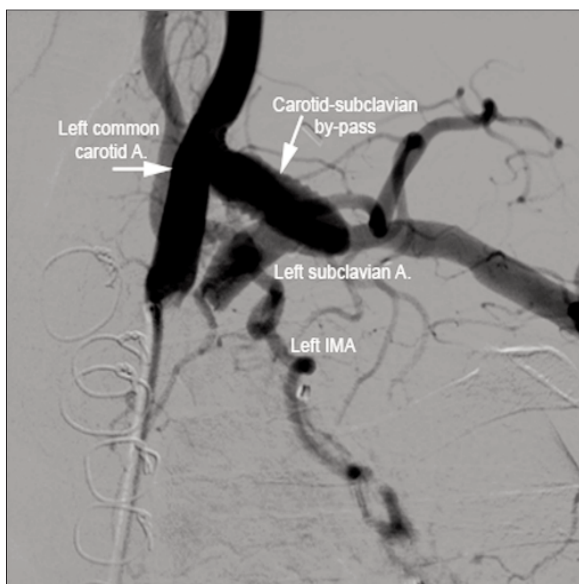


Figure 4. Control angiography: evident carotid to subclavian bypass and anterograde injection of left IMA

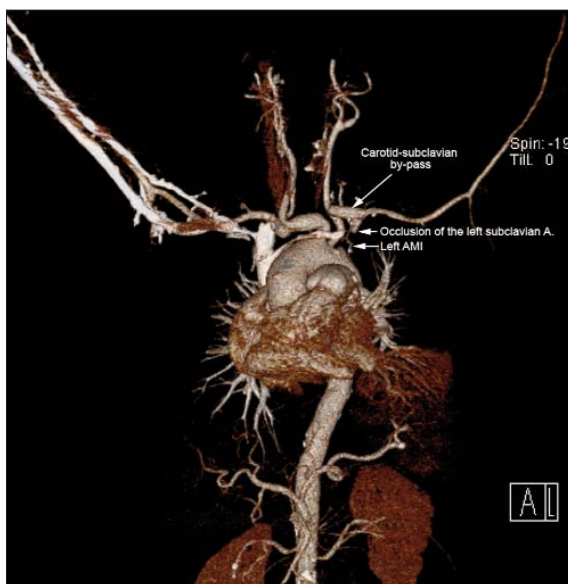


Figure 5. Check-up angio-CT: carotid to subclavian bypass and anterograde injection of left IMA detectable

are less invasive, associated with lower mortality and morbidity, having good short-term results (3,4,5,24). As an outcome (5,24), the rate of restenosis at 5 years is 16% (25,26). The patency of long term results is unknown.

Carotid subclavian bypass remains the procedure of choice with the best results of patency (90% at 10 years), with acceptable mortality and morbidity especially in patients with subclavian artery occlusion (24,27,28). Technical difficulties may be encountered due to atherosclerotic vessels and to important anatomical structures situated nearby (vessels, nerves, lymphatic system).

In our case, the patient developed symptoms 1 year after CABG, so we consider the possibility that the subclavian stenosis existed before. Preoperative evaluation (bilateral measurement of blood pressure, echo Doppler of subclavian artery, arteriography of the aortic arch at the same time with the first coronarography) could diagnose the stenosis, which could be treated before CABG.

Carotid subclavian bypass was the procedure of choice for the subclavian artery occlusion, with total remissions of the symptoms. The other two coronary arteries were not graftable due to their small diameter.

Conclusions

CSSS must be considered in case of recurrent angina in a coronarian patient who have undergone surgery using the IMA. Carotid subclavian bypass is the main therapeutic option when angioplasty and stenting are not possible.

To prevent CSSS, preoperative screening (especially the angiography of the aortic arch at the same time with the coronarography) is the method of choice for the diagnosis of subclavian artery stenosis.

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