CORONARY-SUBCLAVIAN STEAL SYNDROME AS A CAUSE OF UNSTABLE ANGINA. CASE REPORT

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ABSTRACT

Introduction: Coronary-subclavian steal syndrome is a rare condition associated with patients undergoing coronary artery bypass graft surgery. In this context, it presents itself as a differential diagnosis of angina, which when correctly diagnosed and treated can improve the outcome and avoid potential complications.

Case report: Male patient, 65 years old, hypertensive, dyslipidemic, peripheral and coronary artery disease who underwent myocardial revascularization surgery in 2000 with mammary graft in an anterior descending artery. He was undergoing regular cardiological follow-up, asymptomatic from a cardiovascular point of view. In this first moment, ischemic test exams were performed, whose scintigraphy showed an 8% ischemic load and indicated catheterization with subclavian lesion with 70% in the origin and breast graft with preserved patency. About 6 months after this consultation, the patient returns with a complaint of stable angina. A new scintigraphy was performed whose ischemic load had increased, now by 12%. At this point, percutaneous treatment of the subclavian lesion was indicated, using a 9.0x25mm balloon-expandable stent successfully, with angiographic control performed with a PigTail catheter showing good results. On outpatient return, the patient showed a substantial improvement in anginal symptoms, confirmed on scintigraphy with a reduction in ischemic load to 5%. Conclusion: The above report describes a classic picture of subclavian theft syndrome, with presentation of precordialgia, showing that the rapid diagnosis of this rare condition and due treatment have the potential to improve the clinical scenario and myocardial perfusion.

KEYWORDS: CORONARY ARTERY BYPASS GRAFT; CORONARY SUBCLAVIAN STEAL SYNDROME; LEFT INTERNAL MAMMARY ARTERY; SUBCLAVIAN ARTERY STENOSIS; SUBCLAVIAN STEAL SYNDROME.

INTRODUCTION

Myocardial revascularization (MRV) surgeries have been widely performed in patients with coronary artery disease, who present a three-vessel pattern with complex stenotic lesions, or in patients with lesions in the left main coronary artery or in a region close to the anterior descending coronary artery. Myocardial bypass surgery can be performed using both a saphenous vein graft as well as a left internal mammary artery (LIMA). The latter is preferably used for revascularization of the anterior descending artery, as it has greater permeability and durability when compared to saphenous vein grafts [1, 2, 3, 4].

In MRV, the proximal portion of the LIMA is usually left connected to the left subclavian artery, while the distal portion is removed and anastomosed in the bed distal to the diseased coronary artery stenosis. The phenomenon resulting from the previous presence or development of a significant stenosis of the left subclavian artery causing a functional failure of the LIMA graft is known as Coronary-Subclavian Steal Syndrome (CSS). The clinical consequences of this anatomical condition are: myocardial ischemia leading to an anginal condition, heart failure with recurrent decompensation, malignant ventricular arrhythmias, among others [5, 6, 7, 8].

In view of these possible negative outcomes, it is necessary to screen for subclavian artery stenosis (SAS) before MRV, as well as active and continuous surveillance for the development of SAS after MRV [9]. SAS is present in approximately 2% of the general population, reaching a prevalence of 11.8% in patients with peripheral arterial occlusive disease (PAOD) and coronary artery disease who need MRV [10]. PAOD is the strongest predictor, with a 5-fold increased risk of having SAS. Other factors associated with SAS include smoking, high blood pressure, and lower levels of high-density lipoprotein cholesterol (HDL) [11]. However, not all patients

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with SAS resulted in CSS. It is estimated that CSS develops in 0.2% to 6.8% of patients who underwent MRV with LIMA graft [12].

The aim of this study is to report a case of a patient previously submitted to MRV associated with coronary artery disease (CAD) who evolved with unstable angina, with a high ischemic load resulting from a CSS in which percutaneous treatment was performed with conventional stent implantation in the left subclavian artery.

CASE REPORT

Male patient, 65 years old, with a previous history of myocardial revascularization in 2000 with anterior descending mammary graft, hypertension, dyslipidemia, PAOD with femoral angioplasty in 2016 and endovascular treatment of an infrarenal aortic artery aneurysm with endoprosthesis. In an outpatient evaluation in the first half of 2020, he was asymptomatic from a cardiovascular point of view. Scintigraphy was performed in February of the same year to evaluate residual lesions in previous catheterization, which showed ischemia of a moderate transient component in the apical, anterolateral and inferolateral regions (small peri-infarction ischemia) with an ischemic load of 8%. In that same month, Doppler of carotids was performed whose vertebral were patent with bilateral antegrade flow; evidence of fibrocalcific plaques on the left in the common carotid, carotid bifurcation, and internal carotid with obstruction, respectively, of 35%, 45%, and 45%; and on the right with 30% obstruction of the bifurcation and 40% of the internal carotid artery. A new catheterization was requested on 05/26/2020, he presented a 70% lesion at the origin of the left subclavian artery and mammary graft with preserved patency without indication for angioplasty.

In May 2020, the patient presented a sudden onset of dyslalia, mental confusion and paresthesia in the left side, confirmed minor stroke in the left frontal lobe area involving the middle and lower turns. In the etiological investigation of the stroke, an angiotomography of cervical vessels was performed and mixed atheromatous plaques were noted, with a predominance of calcified in the origin of the left vertebral artery, determining significant stenosis/subocclusion, with consequent thinning of the segments V1, V2 and V3, which are refilled by collaterals . The acute neurological condition lasted 24 hours, with complete recovery from deficits. It is noteworthy that 07 days before, due to mesenteric angina, the patient had undergone angioplasty of the celiac trunk and left renal artery, requiring a secondary intervention to approach the right renal artery.

New appointment in November 2020, the patient was symptomatic, reporting precordialgia for about 6 months and dyspnea on slight exertion, with limitation of daily activities. A new ischemic research was carried out, whose scintigraphy on 11/20/2020 showed an increase in the ischemic load to 12%, involvement of 29% of the total LV muscle mass with perfusion defects and a reduction in the LV ejection fraction (EF) after stress (EF rest 31%; EF post-stress 21%) ; 11/21/2020 carotid and vertebral Doppler showed stenosis of the left vertebral artery with high-resistance inverted flow (critical and hemodynamically significant stenosis at the origin of the ipsilateral subclavian artery). Due to clinical worsening and imaging tests confirming subclavian steal syndrome, the patient was referred for left subclavian angioplasty with balloon and 01 stent implant, performed on December 3, 2020. This procedure was performed under local anesthesia and sedation, via catheterization of the common femoral artery (7F), with angiographic series performed with non-ionic contrast. Pre-angioplasty angiography showed critical stenosis in the left subclavian artery ostium (Figure 1). The lesion was transposed with a 0.035" guide wire through a 6Fr guide catheter. A 5.0x20mm balloon was then insufflated at 8 atm of pressure. Afterwards, a 9.0x25mm balloon-expandable stent was successfully placed. Angiographic control with PigTail catheter demonstrated good results (figure 2).

On return after angioplasty in February and March 2021, the patient reported substantial improvement in complaints, with preserved daily activities, without limitations. Control scintigraphy showed improvement when compared to the previous exam, demonstrating an ischemic load of 5% and normal LV global function (EF at rest 50%; EF post-stress 54%), proving not only the clinical improvement but also the perfusional improvement after the proper treatment (figures 3 and 4).

DISCUSSION

The use of left internal mammary artery graft to bypass obstructions of the anterior descending has its application established given its superiority compared to the use of the saphenous vein. Among the benefits, we highlight the greater durability of this graft, which is due to its continuous elastic lamina that inhibits smooth muscle migration and, therefore, arteriosclerosis, and the functional endothelium that produces vasodilators and potent inhibitors of platelet function. This allows for a graft with greater permeability leading to longer survival. [1]

When used for MRV, the LIMA has its proximal bed preserved in the subclavian artery while its distal end is dissected and reimplanted in the affected coronary artery. Because of this close relationship, stenosis of the proximal portion of the LSA have functional hemodynamic repercussions on the irrigated coronary artery, even though the graft has no structural lesions, leading to a retrograde flow from the LIMA to the LSA. This rare condition is called subclavian steal syndrome. [2,3]

The consequences of this syndrome are numerous, such as angina, acute coronary syndrome, emergence and/or decompensation of heart failure, malignant ventricular arrhythmias. In most cases, these symptoms are attributed to graft dysfunction, which makes the diagno-

sis of CSS difficult and delays its treatment.

The most accessible and economical screening method to assess SAS is the physical examination that includes auscultation of the supraclavicular fossa to detect murmurs, inspection to assess signs of hypoperfusion in the distal upper extremities with verification of pulse asymmetry, and especially bilateral measurement of the blood pressure to detect a systolic differential ≥15 mmHg [9]. The physical examination may have a low sensitivity to assess SAS, of approximately 50% [13]. However, it is a useful screening tool for asymptomatic patients and, therefore, should be performed in all routine consultations in patients with MRV who used the LIMA .

In asymptomatic patients with positive screening physical examination or in those with symptoms of angina, or with claudication in the upper limbs, several complementary tests can be performed to detect SAS, such as duplex ultrasound scan, CT angiography, angioresonance and subtraction angiography, considered the gold standard method for diagnosis.

Duplex scan is the most accessible, inexpensive, and non-invasive SAS screening complementary exam. Compared with digital subtraction angiography, it has a sensitivity of 73% and a specificity of 91%. The positive and negative predictive values are 96% and 97%, respectively, it has the limitation of being operator-dependent, in addition to the anatomical limitation offered by the curvature of the vessel and the constant movement of the heart, which make the non-invasive ultrasonographic assessment of flow directionality difficult. Both CT angiography and angioresonance have sensitivity above 90%, but there is the inconvenience of using contrast and the difficulty of availability. Angiography, in addition to being the gold standard to confirm the diagnosis, is the method to aid in percutaneous treatment [14].

Percutaneous angioplasty with stent implantation is the first-line treatment for stenosis or occlusion of the subclavian artery and brachiocephalic trunk, given its proven long-term efficacy, with reduced morbidity and mortality and cost-effectiveness [15]. Surgical revascularization should only be considered after failure of endovascular treatment in patients at low surgical risk [16]. When comparing surgical and endovascular treatment, the main advantages of percutaneous intervention are the avoidance of general anesthesia, the reduction in periprocedural mortality and shorter hospital stay. The primary patency rate is lower with endovascular techniques compared to surgery, but significantly improved with the introduction of stent support in addition to balloon angioplasty, Sixt et al. reported a primary success rate of 100% for the treatment of stenosis and 87% for occlusions, and when they compared stent implantation with balloon angioplasty they found a better primary patency rate one year after stent-supported angioplasty (89 vs. 79%) [17].

Although percutaneous treatment is preferable to surgical treatment, a good understanding of the cerebral flow anatomy and special attention to the proximity to the vertebral artery is essential. Surgical revascularization is restricted to failure in endovascular treatment or in cases of inadequate anatomy due to the proximity to the ipsilateral vertebral artery, in which case, stent implantation can compromise the flow of this artery. [18].

One study compared and demonstrated that balloon-expandable stent implantation is preferable to self-expanding stent placement to provide accurate stent placement, increasing radial strength and better restoring native vessel size [19]. The normal luminal diameter of the proximal left subclavian artery is 7 to 9 mm in an adult woman and 8 to 10 mm in an adult man, the fact that the left subclavian artery has a luminal diameter considered large, that is, above 6 mm, allows the implantation of conventional stents with excellent long-term results and, therefore, the implantation of drug-eluting stents is not used in the treatment of stenosis of the left subclavian artery. [19].

Despite the good long-term results, the prevention of restenosis in the implanted stent must be carried out with the control of risk factors associated with atherosclerosis, including the control of hypertension, diabetes, cholesterol levels, sedentary lifestyle, obesity and the smoking cessation, which are extremely important in preventing and limiting the progression of SAS.

SAS is underestimated and may not be considered at the time of differential/etiological diagnosis of anginal pain. In the presence of a significant difference in blood pressure values verified in the upper limbs, associated with symptoms of angina after MRV can lead to diagnosis and facilitate timely intervention. Those individuals submitted to percutaneous intervention with stent implants in the subclavian artery usually present expressive improvement, and the technical difficulties imposed by the challenging anatomy must be taken into account eventually, which may limit its usefulness, and therefore, surgical revascularization is necessary.

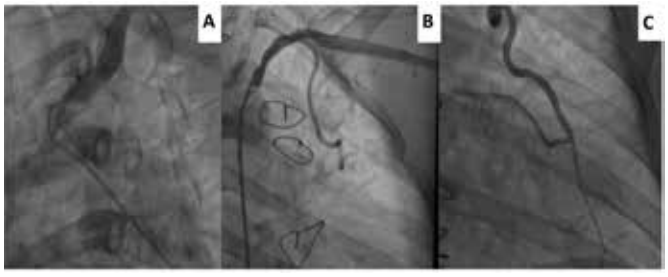

Figure 01. Subclavian artery angiography and mammary graft for CAD. Images A and B illustrate the subclavian artery with subocclusive calcification in the ostium. Image C depicts the pervious anterior descending mammary graft

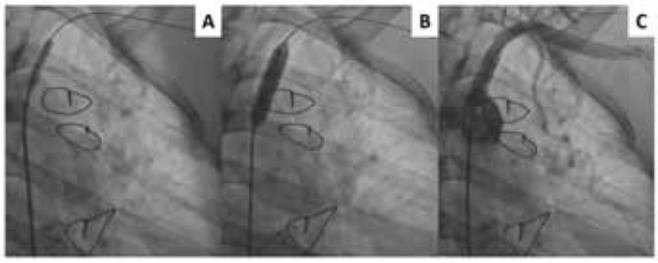

Figure 02. Subclavian artery angioplasty. A) Successful placement of the 9.0 x 25mm balloon-expandable stent; B) Dilation with a 5.0x20mm balloon with inflation at 8 ATM of pressure; C) Final result of angioplasty.

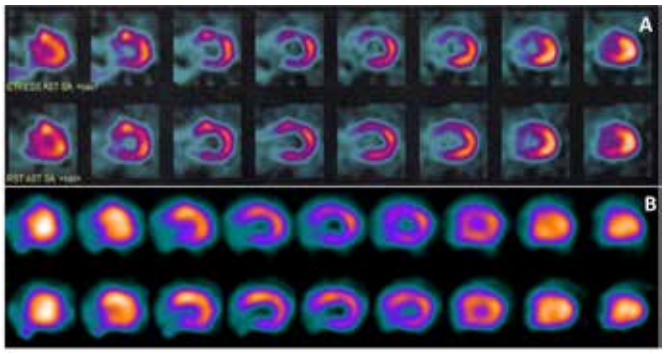

FIGURE 3: vertical long axis scintigraphic image. A) Pretreatment scintigraphy showing ischemia with a persistent hypoperfusion component associated in the anterior, anterolateral and inferior walls. Ischemic load estimated at 12%. B) Post-treatment scintigraphy showing mild to severe fixed hypoperfusion (scarring behavior) and medium extension (about 12%) involving the anterolateral and inferior regions, associated with a mild transient component (small peri-infarction ischemia). Ischemic load estimated at 5%.

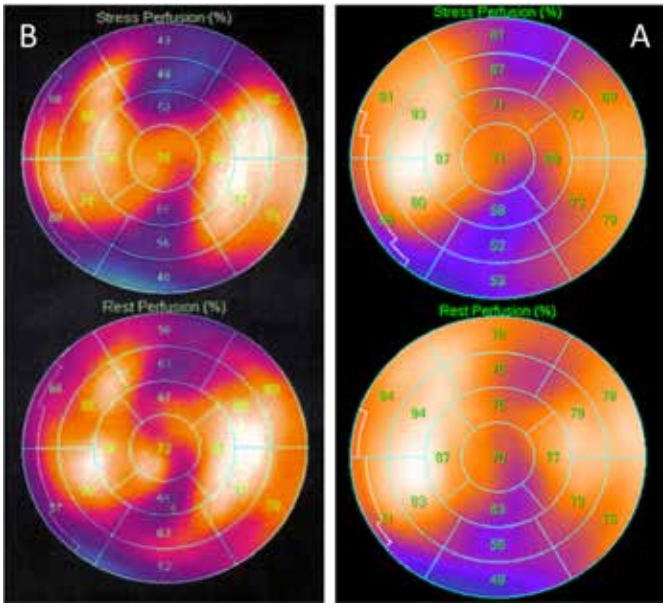

FIGURE 4: quantitative perfusion spect (QPS) scintigraphic image. A) Pre-treatment scintigraphy with ischemic load estimated at 12% B) Post-treatment scintigraphy with ischemic load estimated at 5 %

CONCLUSION

Although rare, CSS is a differential diagnosis of stable and unstable angina in patients who have already undergone MRV with a mammary-coronary graft, especially in those with a history of PAOD, hypertension and smoking. As presented in this case, when an adequate diagnosis and treatment of the stenotic lesion is performed, the patient tends to have remission of the symptoms, with improvement in myocardial perfusion.

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