Case Report

Coronary Subclavian Steal Syndrome Causing Myocardial Infarction

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ABSTRACT

Coronary subclavian steal syndrome (CSSS) is a rare complication of the internal mammary artery (IMA) grafting in coronary artery bypass surgery. The technical definition is myocardial ischemia due to the reduced flow of blood, or flow reversal in the IMA graft. This in most cases results from hemodynamically significant proximal subclavian artery stenosis. The clinical presentation is variable and ranges from unstable angina to myocardial infarction, and in some cases, sudden cardiac arrest. CSSS is an entity that is hard to diagnose if one is not actively looking for it. The clinical diagnosis is often complicated, and the prevalence of the disorder is frequently underestimated. In this case presentation, we report a case of myocardial infarction that resulted from significant proximal subclavian artery stenosis.

Keywords: Coronary artery disease, coronary subclavial steal, myocardial infarction

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INTRODUCTION

Coronary subclavian steal syndrome (CSSS) is a rare complication of the internal mammary artery (IMA) grafting in coronary artery bypass surgery. The technical definition is myocardial ischemia due to the reduced flow of blood, or flow reversal in the IMA graft. This in most cases results from hemodynamically significant proximal subclavian artery stenosis. The clinical presentation is variable and ranges from unstable angina to myocardial infarction, and in some cases, sudden cardiac arrest. CSSS is an entity that is hard to diagnose if one is not actively looking for it. The clinical diagnosis is often complicated, and the prevalence of the disorder is frequently underestimated. In this case presentation, we report a case of myocardial infarction that resulted from significant proximal subclavian artery stenosis.

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CASE PRESENTATION

A 62-year-old male with a history of coronary artery disease (CAD) with Coronary Artery Bypass Grafting × 4 (10 years back), Peripheral Arterial Disease, Essential Hypertension, and chronic smoker who presented for evaluation of burning chest pain concerning for acute coronary syndrome. 12 Lead EKG did not show any ST elevation [Figure 1]. Serum cardiac Troponin T trend was 0.4-->0.8-->0.9 ng/ml. The dynamic rise and fall of cardiac biomarkers was consistent with myocardial infarction. Transthoracic Echocardiogram showed preserved EF 55–60% but basal and inferolateral wall hypokinesis transthoracic echocardiogram. This confirmed acute myocardial infarction.

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Coronary Angiography was done via the femoral artery and showed a lesion in Left Subclavian Artery Proximal subsection with 95% stenosis and 22 mm in length. The lesion was tubular and eccentric with irregular contour, moderate angulation, and mild tortuosity [Figure 2 and Transthoracic Echocardiogram].

The lesion was stented using an 8.0 × 38 mm iCAST stent graft with excellent angiographic result. The stent graft was dilated using a 9.0 mm noncompliant balloon. The initial angiogram showed no significant flow in the left vertebral artery due to retrograde flow in the presence of critical left subclavian stenosis. The final angiogram showed 0% residual with the brisk distal flow, and a large left vertebral artery antegrade flow was reestablished [Figure 3].

CLINICAL OUTCOME

The patient tolerated the procedure well, without any neurologic or hemodynamic changes. Dual antiplatelet therapy was recommended for 12 months, along with risk factor reduction like heart-healthy diet, smoking cessation, and lipid control. Patient recovered well and was discharged uneventfully.

DISCUSSION

The most common cause of CSSS is atherosclerosis induced ipsilateral subclavian artery stenosis. However, other vascular conditions like including Takayasu arteritis, radiation arteritis, and hemodialysis AV fistula can also cause this. A history of peripheral vascular disease and interarm blood pressure difference >20 mm Hg is postulated as a clinical predictor of subclavian artery stenosis.[1]

Supraclavicular bruit and symptoms of vertebrobasilar insufficiency like dizziness, syncope, ataxia, blurry vision, drop attacks, upper extremity claudication, and numbness are useful clues in diagnosing the condition.

Retrospective and observational studies over the past few decades has shown that LIMA is the preferred conduit for CABG involving the LAD. LIMA has demonstrated higher rates of patency and survival benefit as compared to saphenous venous grafts.[2,3]

The right internal mammary artery has shown similar advantages; however, it is technically challenging to salvage and has a protracted operation time. Ergo, this graft is less commonly used. The proximal feeding vessel for the LIMA graft is the subclavian artery. In cases where there is significant ipsilateral subclavian artery stenosis, the flow to the LIMA can become compromised. This phenomenon of functional IMA graft failure from

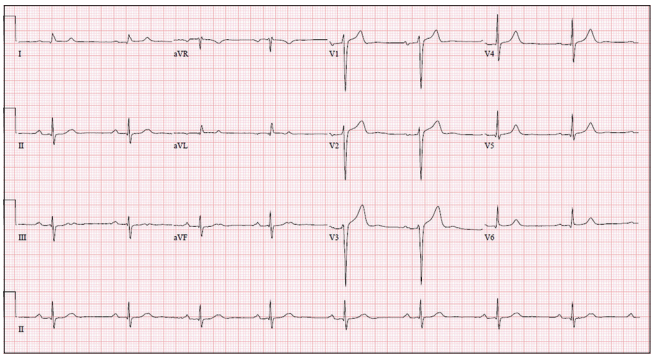

Figure 1: 12 Lead Surface EKG does not show any ST elevation

Figure 2: Coronary Angiography showed a lesion in Left Subclavian Artery Proximal subsection with 95% stenosis

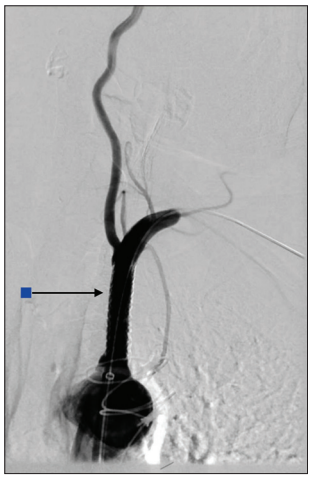

Figure 3: The final angiogram after stent placement, showed 0% residual with brisk distal flow, and a large left vertebral artery antegrade flow was reestablished

ipsilateral subclavian artery stenosis is called coronary subclavian steal syndrome.

The overall incidence of subclavian artery stenosis is 2% in the general population and 7% and peripheral arterial disease population. When CABG is indicated in a

patient with documented PAD, SAS incidence is as high as 11.8%. However, not every SAS case results in CSSS. Overall, the review of the literature shows that CSSS causes functional failure in 0.2-6.8% of LIMA grafts. However, there is some concern for the underestimation of this number.

Atherosclerosis accounts for over 90% of SAS, while arteritis, aortic dissection, radiation exposure, compression syndromes such as arteria lusoria (aberrant RSA) or right-sided aortic arch, fibromuscular dysplasia, and neurofibromatosis are uncommon etiologies. Curiously, the proximal section of the left subclavian artery is 4 times more susceptible to flow-limiting atherosclerosis as compared to other supra-aortic vessels. This is theorized to occur to more flow turbulence at the acute angle between the LSA and the aortic arch.[4]

Patients generally present with chest pain on exertion; however, they can have atypical presentations as well. Imaging studies like ultrasound, computed tomography angiography, magnetic resonance angiography, and coronary angiography are definitive.[5]

Suggestive signs on physical examination include a bruit, an interarm brachial blood pressure difference of >15 mmHg, or an inter-radial pulse delay. Therefore, we advocate bilateral blood pressure measurements and extensive auscultation (brachial, subclavian, and carotid bilaterally) in all patients undergoing a physical examination in follow-up after CABG.

CSSS can be diagnosed non-invasively using duplex ultrasonography of the supra-aortic vessels, computed tomography scanning, and magnetic resonance angiography. Flow reversal is a highly sensitive indicator of ipsilateral subclavian artery stenosis. Direct subclavian angiography (DSA_ gives the most definitive diagnosis. Routine performance of DSA before doing a CABG is controversial.

The definite treatment involves endovascular or surgical revascularization. Both the latest European Society of Cardiology and the American Heart Association guidelines recommend percutaneous balloon angioplasty with stent support as first-line treatment.[6,7]

Compared to the surgical approach, the endovascular approach has many advantages like shorter hospital stay, less morbidity, and avoidance of general anesthesia.[8,9]

CONCLUSION

Coronary-subclavian steal syndrome continues to be an underestimated consequence of internal mammary artery grafting. It is important to be mindful of this entity in any CABG patient who presents with chest pain. Imaging modalities are the gold standard for diagnosing and treating the condition. Endovascular revascularization has shown great outcomes consistently and is recommended.

Learning points

- Ipsilateral Subclavian Artery stenosis is an often underrecognized entity that causes compromised blood supply to the coronary artery bypass grafts.
- The condition if advanced, can cause unstable angina and myocardial infarction both.
- The subclavian artery stenosis is easily treated by angioplasty and stent placement, and results in resolution of chest pain.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initial s will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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