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Case report

Subclavian atherectomy and angioplasty for coronary subclavian steal syndrome post CABG☆,☆☆

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ABSTRACT

Coronary subclavian steal syndrome is an uncommon complication occurring in patients with coronary artery bypass graft (CABG). We describe a case of a 69-year-old male with a remote history of CABG who presented with exertional left arm pain and angina. Computed Tomographic Angiography of the chest demonstrated a severe left proximal subclavian artery stenosis. The case demonstrates successful application of subclavian atherectomy with use of embolic protective device, alleviating the need of stent, for treatment of Coronary subclavian steal syndrome in patient with remote history of CABG.

Introduction

The left internal mammary artery (LIMA) is a frequently used conduit in patients undergoing coronary artery bypass graft (CABG), due to high long-term patency rate. In the presence of significant subclavian artery stenosis (SAS), defined as a difference of ≥15 mm Hg brachial systolic pressures between arms, retrograde flow in LIMA can manifest as coronary subclavian steal syndrome (CSSS) resulting in functional failure of the LIMA graft [1,2]. The graft itself is widely patent but the retrograde flow can result in decreased myocardial perfusion with symptoms ranging in severity from angina to myocardial ischemia. The prevalence of CSSS in patients who have undergone CABG with LIMA graft is estimated at 0.2%-6.8% [3,4]. Atherosclerosis is the most common etiology resulting in vast majority of SAS cases. Pathologies such as fibromuscular dysplasia, giant cell arteritis, radiation-induced arteritis are less common risk factors. The 2011 guidelines published by ESC and endorsed by ACCF/AFA recommend Percutaneous transluminal balloon angioplasty as a first line treatment for SAS [5]. There is very scant literature discussing the role of subclavian atherectomy in patients with CABG [6,7]. Atherectomy devices have been routinely used for debulking plaques in peripheral artery disease. Herein we describe our experience with successful usage of Boston Scientific Jetstream atherectomy device with simultaneous use of embolic protection devices for treatment of CSSS.

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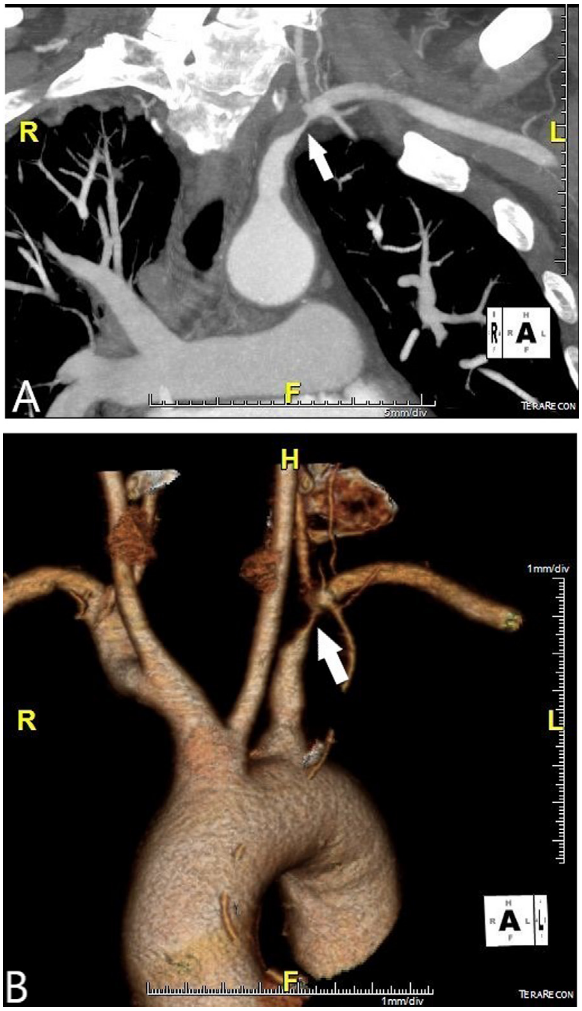

Fig. 1 – (A) Coronal CTA and (B) 3D reconstructed images of the aortic arch showing severe stenosis of the left subclavian artery (arrow).

Case report

A 69-year-old man was referred to Interventional radiology for consultation regarding Left Subclavian artery stenosis causing angina, left arm pain with weakness and recent history of left MCA territory infarcts. Patient has a remote history of CABG procedure with creation of LIMA/LAD graft. CTA Chest imaging was performed which revealed a severe left subclavian artery stenosis just proximal to the LIMA/LAD graft which has progressed over time when compared to prior imaging (Fig. 1). The subclavian stenosis was from a low attenuation plaque which extended into the left vertebral artery origin with ostial stenosis. The LIMA/LAD graft was widely patent.

As the patient was reluctant for surgery, endovascular treatment option was considered. This primarily included left subclavian atherectomy with angioplasty and possibility of stenting. However, given the risk of shower emboli from the procedure which could result in fatal complications such as stroke or myocardial infarction, placement of filter wires was considered.

For the procedure, access was obtained to the left common femoral artery and left radial artery and angiogram revealed a significant left subclavian artery stenosis (Fig. 2A). An exchange length wire was then passed through femoral artery and snared through the radial artery. Filter wires were then appropriately positioned within the left vertebral and LIMA/LAD graft through the radial artery sheath (Fig. 2B) A Boston Scientific Jetstream atherectomy device was then appropriately positioned in the stenotic left subclavian artery and atherectomy was performed with simultaneous suctioning to prevent shower emboli. Post-atherectomy angiogram demonstrated improved luminal diameter. Angioplasty was then performed in the stenotic segment initially with a 7 × 40 mm Mustang Balloon followed by 8 × 40 mm Lutonix drug coated balloon. Post-angioplasty angiogram demonstrated a significant improvement in the lumen diameter (Fig. 2C).

At this point patient did report some chest pain. However, subsequent angiogram of the LIMA graft was widely patent along with a normal ECG. The filter wires were then carefully withdrawn which showed a chalky whitish material, likely to be plaque, within the filter wire that was positioned in the LIMA/LAD graft. Additionally, patient's chest discomfort improved significantly after removal of filter wires and administration of Nitroglycerin, most likely relating to spasm of the graft vessel. Patient was subsequently discharged in a stable condition.

Discussion

Coronary-subclavian steal syndrome in patients with CABG has been known for several decades with reports appearing as early as 1970s [8,9]. CSSS can be asymptomatic or develop spectrum of clinical symptoms ranging from upper extremity claudication and muscular fatigue to vertebrobasilar hypoperfusion resulting in vertigo, diplopia and syncope [1,2].

SAS can be diagnosed if there is significant discrepancy in blood pressure between right and left arm or few cases present with a left supraclavicular or cervical bruit which can then be further evaluated with Doppler ultrasonography, nuclear stress test, CT angiography (CTA), MR Angiography and conventional angiography. Doppler ultrasound is a readily available low cost, non-invasive diagnostic test for evaluation of blood flow in LIMA and SA [10]. Nuclear stress test has a high sensitivity (80%-90 %) and specificity (70%-80%) and is useful in evaluating ischemia of myocardium n regions that are perfused by LAD [11,12]. Digital subtraction angiography is considered as the gold standard for diagnosis of SAS.

Treatment choice for CSSS includes either endovascular repair or surgery. Endovascular management with percutaneous balloon angioplasty and stent placement is considered first line treatment due to avoidance of general anesthesia, reduced peri-procedural morbidity and mortality, and shorter hospital stay [5]. Surgical options such as carotid-subclavian bypass, carotid-to-carotid bypass, subclavian-to-

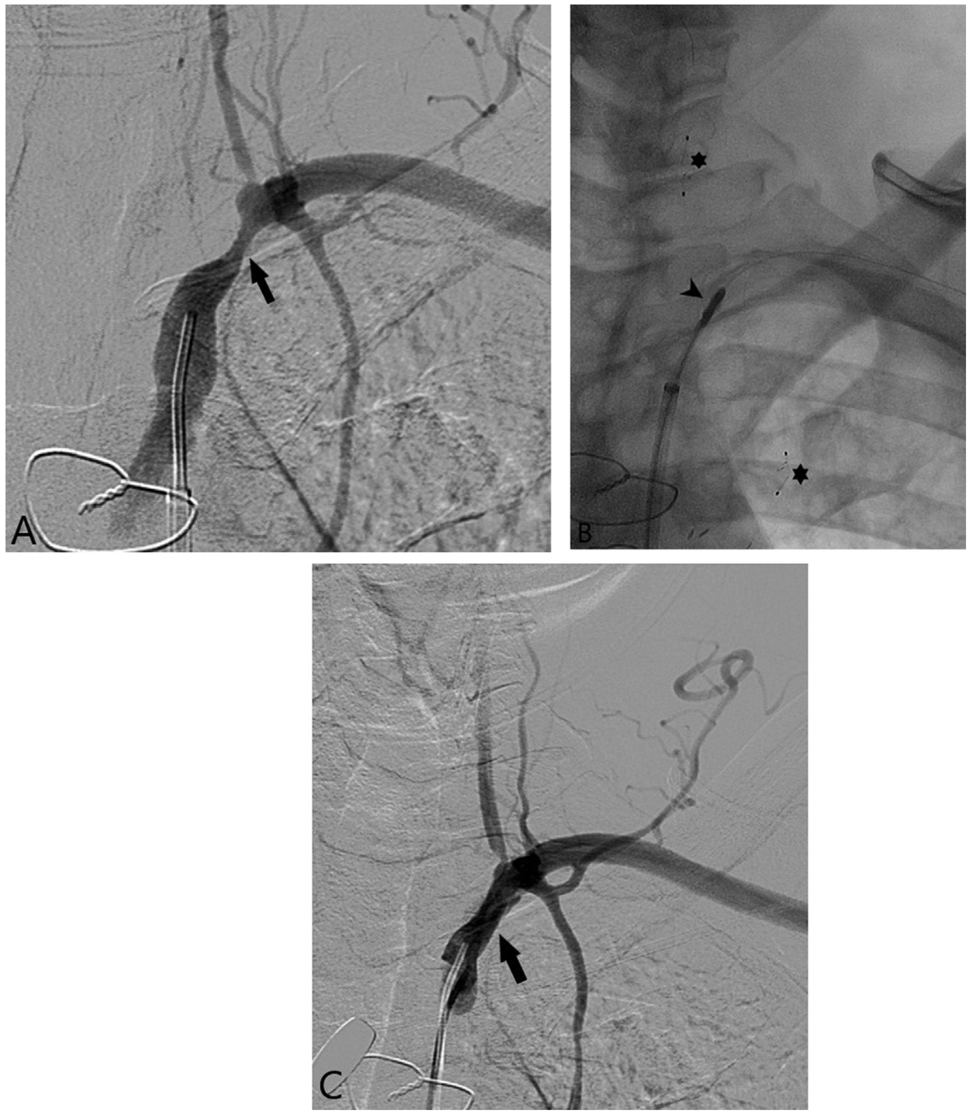

Fig. 2 – (A) Initial Digital subtraction angiographic images confirm the stenosis in the subclavian artery (arrow). (B) Intra procedural image showing filter wires (star) positioned in left vertebral artery, left internal mammary artery and Boston Scientific Jetstream atherectomy device (arrowhead) positioned in the stenotic left subclavian artery. (C) Post procedural angiographic image shows significantly improved lumen of subclavian artery (arrow).

subclavian bypass, subclavian-to-axillary bypass are usually reserved for patients who fail endovascular management. Only a few studies have compared percutaneous endovascular techniques to surgical revascularization and concluded that both treatments are safe and effective [13,14].

The role of endovascular subclavian atherectomy for treatment of SAS in CSSS is not clear. Our case highlights the potential of atherectomy in debulking the plaque which can also facilitate the delivery of the balloons and alleviate the need of stent. This is neither a conventional nor a standard of care treatment option for SAS, hence, more studies are needed in the literature. This technique can be considered as an endovascular option prior to more aggressive alternatives such as stenting or bypass. Further studies are need to be performed for evaluation of long-term patency rates before widespread application of this technique.

Author contributions

Conceptualization and idea: HG, HSG, VK; methodology: HG, HSG; literature search and data analysis: HG; HSG; writing—original draft preparation: HG, HSG; writing—review and editing: HG, HSG, VK; supervision: VK.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the

1964 Helsinki declaration and its later amendments or comparable ethical standards

Patient consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

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