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Case Report

ACUTE ST ELEVATION MYOCARDIAL INFARCTION FOLLOWING BYPASS GRAFT SURGERY: A CASE OF CORONARY SUBCLAVIAN STEAL SYNDROME (CSSS) SUCCESSFULLY TREATED WITH PERCUTANEOUS INTERVENTION

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ABSTRACT – Coronary subclavian steal syndrome (CSSS) is an uncommon complication of coronary artery bypass graft (CABG) surgery when the left internal mammary artery (LIMA) is used in patients with underdiagnosed significant left subclavian artery stenosis (SAS). It is characterized by a retrograde blood flow from coronary to subclavian circulation through LIMA graft, causing the "steal" phenomenon and myocardial ischemia. The common presentation is stable angina years after surgery and acute presentation with ST elevation early after surgery is extremely rare. Here we present an unusual and unique presentation of CSSS in a setting of acute ST elevation myocardial infarction treated successfully with complex percutaneous intervention.

Key words: *coronary subclavian steal syndrome, subclavian artery occlusion, coronary artery bypass graft surgery, acute myocardial infarction with ST segment elevation, percutaneous intervention*

Introduction

Coronary subclavian steal syndrome (CSSS) is a rare complication of coronary artery bypass graft (CABG) surgery when the left internal mammary artery (LIMA) is utilized in patients with unrecognized significant left subclavian artery stenosis (SAS). CSSS results from a retrograde blood flow from coronary to subclavian circulation through LIMA graft, causing the "steal" phenomenon and myocardial ischemia. Stable angina years after surgery is the most common presentation and we present a rare case of acute postoperative myocardial infarction with ST elevation and hemodynamic complications.

Case report

A 62 –year –old male patient with a history of diabetes mellitus type 2 and hypercholesterolemia was admitted to a regional hospital due to an acute non-ST elevation myocardial infarction (NSTEMI). Car-

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diovascular examination revealed symmetric pulses in the upper and lower extremities and no inter-arm difference in blood pressure. ECG showed diffuse ST segment depression in inferior and lateral leads and discrete elevation in lead AVR, suggesting the left main or triple vessel disease. ECG findings correlated with significant rise of hs-troponin T up to 3107,00 ng/L (reference value < 14ng/L). Therefore, the patient was admitted to the coronary care unit and standard treatment for NSTEMI was administered with a resolution of symptoms and ECG changes.

Transthoracic echocardiographic exam (TTE) showed non-dilatated, moderately hypertrophic left ventricle with preserved ejection fraction (EFLV 55%). There was mild hypokinesia of the inferolateral wall with no valve or right ventricle pathology. Color Doppler of carotid arteries showed no stenosis. Coronary angiography verified a triple vessel disease with significant distal left main coronary artery (LMCA) stenosis, severe ostial left anterior descending artery (LAD) stenosis, significant large obtuse marginal artery (OM) stenosis, and collateral right coronary artery (RCA) occlusion. The patient was transferred to our Clinic for bypass surgery that went uneventful and triple CABG was performed with LIMA to LAD, VSM to OM, and RCA.

On the second postoperative day, due to patient hemodynamic instability and ECG changes (Figure 1), coronary angiography was performed showing unchanged native coronarogram, patent VSM to RCA, occlusion of VSM to OM (Figure 2.), and chronic occlusion of the left subclavian artery with "steal syndrome" present in LIMA to LAD (Figure 3 and 4).

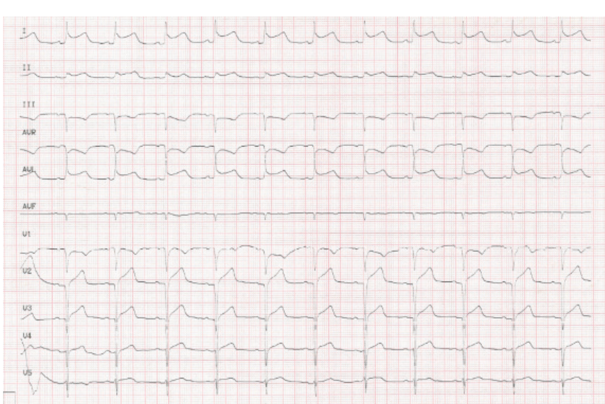

Figure 1 - ECG changes showing ST elevation in lateral and anteroseptal leads

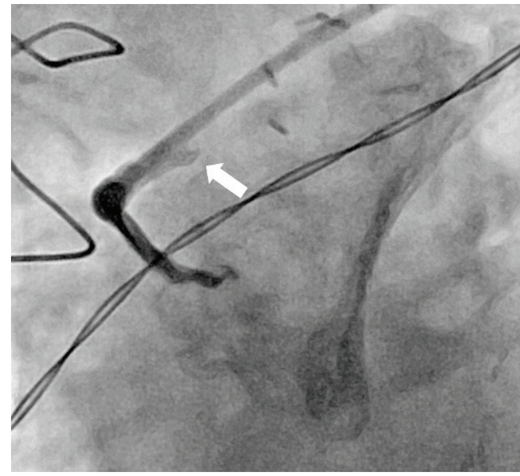

Figure 2 - Proximal occlusion of VSM to OM

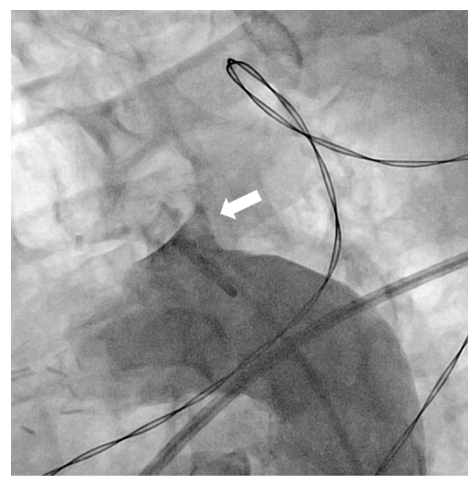

Figure 3 - Aortic arch angiography showing occluded left subclavian artery

Since the patient was hemodynamically unstable with diffuse ischemia on ECG, a decision was made to perform percutaneous transluminal angioplasty (PTA) of the left subclavian artery and percutaneous coronary intervention (PCI) of OM.

After the puncture of the right femoral artery, a 7-Fr long guiding sheath (Destination™ - Terumo Europe) was utilized as extra support for Judkins right guiding catheter. This facilitated advancement of the wire (Glidewire advantage® – Terumo) (Figure 5) followed by dilatation with a balloon and stent placement (Dynamic 8/25mm – Biotronik) (Figure 6). Next, PCI of large OM was performed with implantation of two drug-eluting stents. The procedure ended with no complications and a good angiographic result which correlated with the patient`s clinical improvement and res-

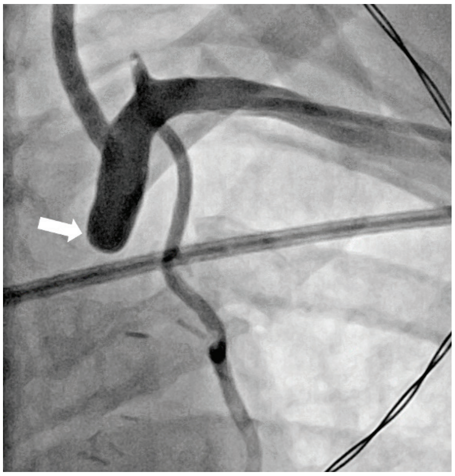

Figure 4 - Left subclavian artery angiography performed through the left brachial artery confirming occlusion and showing patent LIMA

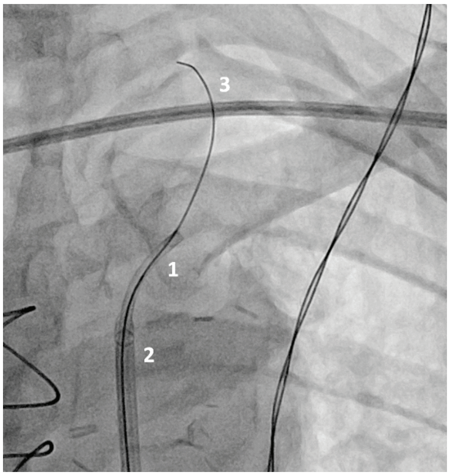

Figure 5 - 6-Fr Judkins right catheter (number 1) is seen in the 7-Fr long guiding sheath (number 2) with wire crossing the occlusion (number 3)

olution of ECG changes. The patient was discharged on the 9th postoperative day in stable condition.

On follow-up three months later, the patient was symptom-free while coronary angiography showed patent stents in OM and the left subclavian artery with functional LIMA to LAD graft.

Discussion

In the modern era, treatment of patients with coronary artery disease requiring surgical revascularization with LIMA graft is considered the gold standard due to improved long-term patency and low perioperative and postoperative mortality[1]. However, utilizing LIMA as the main conduit exposes patients to an increased risk of developing CSSS. Even though CSSS is a rare complication with an occurrence of 0.2% to 6.8%, it is becoming an increasing problem with the more frequent use of LIMA for CABG[2].

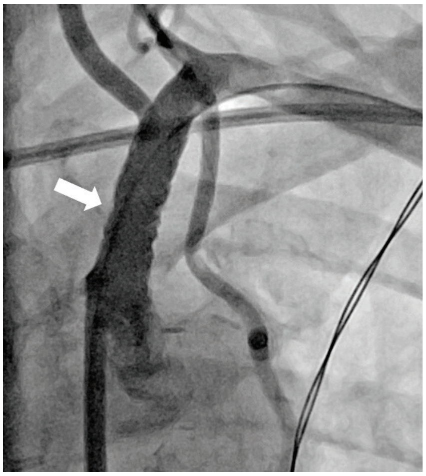

Figure 6 - Stent seen in left subclavian artery with good expansion and patent LIMA to LAD and vertebral artery

Atherosclerosis is the main cause of SAS, although infrequent conditions such as neurofibromatosis, fibromuscular dysplasia, or extrinsic compression have been described in literature[3]. The proximal segment of the left subclavian artery is more prone to atherosclerosis than any other supra-aortic vessel mainly due to the acute angle of origin between the aorta and subclavian artery, leading to increased blood turbulence and predisposition to atherosclerosis similar to the coronary arteries[4].

CSSS can present with various symptoms, stable angina being the most frequent one with more than 50% of all cases, and ST elevation myocardial infarction (STEMI) being the least common with only a few case reports published[5]. The mean time between CABG surgery and development of symptoms is 9.0±8.4 years and early symptoms of CSSS are probably a consequence of missed SAS in preoperative assesment[3].

The incidence of SAS depends on the study population and high-risk factors include peripheral artery disease, hypertension, diabetes mellitus, hyperlipidemia and smoking[6].

While digital subtraction angiography (DSA) is the current gold standard in the imaging of SAS, it has lately been replaced with duplex ultrasound (DUS), computed tomography angiography (CTA) or magnetic resonance angiography (MRA). However, current screening guidelines recommend further investigation only after an inter-arm blood pressure asymmetry of more than 15 mmHg is detected[7]. The issue with 15 mmHg cut-off is low sensitivity and consequently underdiagnosis, which can be explained by the presence of equal bilateral atherosclerotic changes, development of extensive collaterals on the diseased side or the presence of atrial fibrillation[3,8].

Current treatment options include PTA or surgical revascularization with PTA as the first option and surgical revascularization used after failed PTA attempt[3]. Even though the PTA success rate with SAS is remarkable with a 100% success rate in multiple studies, SA occlusion has a more variable success rate (47% to 82.1%), and failed revascularization is associated with higher mortality rate[9].

While CSSS presentation as an acute STEMI is very rare, it has been described earlier[1,5]. However, our case has some unique features. The first one is the presentation of acute STEMI and hemodynamic instability on the second postprocedural day. Although concomitant occlusion of VSM to OM facilitated ischemia, it cannot be solely accountable for this acute presentation, as there was no severe flow-limiting stenosis of OM. Furthermore, hemodynamic stability was achieved after PTA with stent placement in the occluded SA confirming it as a "culprit" lesion.

Secondly, PTA is currently the preferred option for CSSS treatment, especially in the acute phase given the high surgery risk. However, PTA treatment of occluded SA is not as successful as treatment of SA stenosis and many attempts fail. In our case, the use of a long guiding sheath for extra support enabled the procedure's success.

Conclusion

Our case presents an uncommon manifestation of CSSS as a STEMI in the early postoperative period as a consequence of missed SA occlusion. It emphasizes the need for better screening for SAS in the preoperative period, given the low sensitivity of inter-arm blood pressure asymmetry, especially in the population with high-risk factors. It also highlights the use of long guiding sheath while performing PTA for success facilitation, in particular with SA occlusion.

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Sažetak

AKUTNI INFARKT MIOKARDA SA ST ELEVACIJOM NAKON AORTOKORONARNOG PREMOŠTENJA: KORONARNI SINDROM KRAĐE KRVI POTKLJUČNE ARTERIJE USPJEŠNO LIJEČEN PERKUTANOM INTERVENCIJOM

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Koronarni sindrom krađe krvi potključne arterije je neuobičajena komplikacija nakon operacije koronarne srčane premosnice koristeći lijevu unutarnju mamarnu arteriju kod pacijenata s ranije neprepoznatom značajnom stenozom lijeve potključne arterije. Karakteriziran je retrogradnim protokom krvi iz koronarne u lijevu potključnu arteriju kroz lijevu unutarnju mamarnu arteriju što za posljedicu stvara miokardnu ishemiju. Tipična klinička slika je stabilna angina godinama nakon operacije dok je prezentacija rano nakon operacije u obliku akutnog miokardnog infarkta sa ST elevacijom ekstremno rijetka. Ovdje prezentiramo neuobičajenu i jedinstvenu prezentaciju CSSS-a u formi akutnog infarkta miokarda sa ST elevacijom uspješno liječenog kompleksnom perkutanom intervencijom.

Ključne riječi: *koronarni sindrom krađe krvi potključne arterije, okluzija potključne arterije, aortokoronarno premoštenje, akutni infarkt miokarda sa ST elevacijom, perkutana intervencija*