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An unusual indication for a bypass

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Abstract

Coronary subclavian steal syndrome (CSSS) is caused by retrograde or insufficient blood flow through the internal mammary artery graft which can lead to myocardial ischaemia. It is a well-recognised but uncommon complication of coronary artery bypass grafting surgery (CABGs).

A 66 year old man, with a history of CABGs performed ten years ago, was admitted for an elective graft study for research purposes. He had no reported symptoms of angina or congestive cardiac failure. His exercise tolerance was good. His angiogram showed severe triple vessel native disease and patency of all five grafts. However, significant competitive flow was seen from the native left anterior descending artery up the LIMA graft and subsequently a severe left proximal subclavian artery stenosis of 90% was diagnosed on the angiogram. On examination, he was found to have diminished pulses in the left upper limb compared to the right and absent radial pulses bilaterally. The patient complained of feelings of fatigue and of altered sensation in the left hand but was found to have normal power. A subsequent Technetium sestamibi scan showed a moderate amount of distal anterolateral wall reversible ischaemia and a left ventricular ejection fraction of 54%. A left common carotid to subclavian bypass via a transverse left supraclavicular incision was performed using a knitted prosthetic graft. The procedure and recovery were uncomplicated.

This case describes a CSSS as an uncommon indication for subclavian artery revascularization by carotid-subclavian bypass. Subclavian revascularization for CSSS has excellent long-term patency and possible survival benefits in patients with reversible cardiac ischaemia.

Keywords

coronary subclavian steal syndrome; coronary artery bypass; carotid; cardiac surgery

Introduction

Coronary-subclavian steal syndrome (CSSS) was first described in 1974 by Harjola and Valle [1] and is caused by retrograde or insufficient blood flow through the internal mammary artery (IMA) graft which can lead to myocardial ischaemia [2]. It is a well recognised although uncommon complication of coronary artery bypass grafting surgery with an incidence varying between 0.07-3.4% [2-4]. Retrograde blood flow away from the coronary territory through the IMA to the upper limb occurs as a result of significant atherosclerotic disease in the proximal subclavian artery. The left subclavian artery is

occluded in over 70% and the right subclavian artery in 10-12% of cases [5] . We describe a case of CSSS that was diagnosed using coronary angiogram and Technetium (^{99m}Tc) sestamibi scan and was treated with a left carotid-subclavian bypass.

Case Report

A 66 year old male patient was admitted to our hospital for an elective graft study for research purposes (long term angiographic results of radial artery grafts). His cardiovascular risk factors included hypertension, hyperlipidaemia, non-insulin dependent diabetes mellitus, current smoking (60 pack years) and a history of five CABGs ten years ago when the left internal mammary artery (LIMA) was grafted to the left anterior descending, radial artery to posterior descending artery, saphenous vein conduit to posterior left ventricular branch, second radial artery to obtuse marginal and intermediate arteries. He also had a previous acute myocardial infarction in 1995 which was treated with angioplasty.

Prior to admission, he had been well with no reported symptoms of angina or congestive cardiac failure. He had good exercise tolerance up to 6km and was NYHA Class I. No cardiovascular interventions or investigations had been performed prior to admission for this study. On admission there was no suspicion of left subclavian stenosis, no bilateral measurements of blood pressure were taken, and no ultrasound or other investigations were performed. The patient underwent coronary angiography, which showed severe triple vessel native disease and all five grafts patent (LIMA-LAD, RA-OM-Ix, SVG-PLV, RA-PDA). However, significant competitive flow was seen from native LAD up the LIMA graft and subsequently a severe left proximal subclavian artery stenosis of 90% was diagnosed on the angiogram (Figures 1-3). A vascular surgical opinion was obtained. On physical examination, the right arm blood pressure was 160/70 mmHg and the left arm blood pressure 100/71 mmHg. Carotid arteries were palpable with no audible bruits. Heart sounds were dual with a soft ejection systolic murmur and no adventitious sounds in both lungs. The right upper extremity and bilateral lower extremity pulses were easily palpable. Left upper extremity pulses were present but diminished with absent radial pulses bilaterally. The left hand was warm to touch with normal power but the patient complained about feelings of fatigue and “pins and needles” in the left hand. A subsequent Technetium sestamibi scan showed a moderate amount of distal anterolateral wall reversible ischaemia and a left ventricular ejection fraction of 54%. For a projected long-term survival benefit of a functional LIMA-LAD graft, the decision was made to treat the LIMA steal in a multidisciplinary meeting with radiologists, cardiologists and vascular surgeons.

A left common carotid to subclavian bypass via a transverse left supraclavicular incision was performed using a knitted prosthetic graft. The procedure and recovery were uncomplicated. At the first postoperative follow-up visit, the patient had bilateral equal blood pressures (150/70 mmHg) and palpable brachial pulses. His left hand symptoms had disappeared. Finally, repeat Technetium sestamibi scan demonstrated a small amount of reversible ischemia in the anterolateral wall.

Discussion

The internal mammary artery, or internal thoracic artery, is the graft of choice in over 90% of patients undergoing coronary artery bypass grafting surgery [6]. It has several advantages described in the literature including higher patency rates, better size match with the coronary artery and has also been

identified as an independent predictor of survival [7] and confers significantly better long-term survival rates than the use of saphenous vein grafts alone [8,9].

The prevalence of left subclavian artery (LSA) stenosis mostly found in the proximal segment (85% of cases) ranges from 3% to 4% [10] in the general population and as high as 11–18% in patients with known peripheral vascular disease [11].The left subclavian artery is four times more likely to be affected than the right or innominate arteries [12].

Coronary subclavian steal syndrome (CSSS) was first described in the 1970 and is considered an uncommon complication of myocardial revascularisation. However, many authors have cautioned that its incidence may be higher than suspected due to the widespread use of LIMA grafts and the similarity in risk factors for coronary disease and LSA stenosis [13]. The aetiology of CSSS is almost invariably atherosclerosis with other causes such as Takayasu's arteritis and radiation arteritis also described [2,14]. Subclavian artery narrowing which leads to coronary subclavian steal syndrome can occur during CABG surgery or years after due to progression of atherosclerotic disease [2,7]. Its pathophysiology is similar to that of subclavian steal syndrome, described in 1961 by Reivich [15] in which the vertebral artery has reversal of flow towards the subclavian artery in the presence of stenosis in the proximal LSA. In CSSS, retrograde LIMA flow results from decreased vascular resistance and blood pressure in the arm compared with the myocardial territory supplied by the LIMA. Vasodilation of peripheral vessels or increased physical activity of the affected limb can lead to aggravation causing symptoms of limb claudication, vertebrobasilar symptoms (dizziness, vertigo, ataxia and syncope) [16] but also recurrent angina [13,17,18], myocardial infarction [19,20] and cardiac insufficiency [2]. Occasionally, the patient is asymptomatic as was in our case [21].

Physical examination should look for pulse asymmetry, supraclavicular murmurs and most significantly, a difference of more than 20 mmHg in the arterial blood pressure of the upper limbs. Investigations include duplex ultrasonography, computed tomography angiography (CTA) or magnetic resonance angiography (MRA). Proximal aortic arch digital subtraction angiography remains the gold standard for this diagnosis (Figure 3). After contrast injection in the left anterior descending artery, retrograde flow in the LIMA graft towards the subclavian artery is seen. In addition, direct measurement of pressure gradients and flow inversion can be obtained [22].

Indications for treatment of CSSS include critical limb ischaemia of the upper limb, vertebrobasilar insufficiency and angina or reversible ischaemia in the myocardium. Options for intervention range from medical therapy alone to surgical revascularisation (either percutaneous or open). There are no randomised trials comparing the efficacy of one strategy versus another. While some argue that conservative management with medical therapy is appropriate in asymptomatic patients, most agree that in the setting of symptoms, surgical or endovascular intervention is indicated. Traditionally, symptomatic patients were treated with a carotid-subclavian bypass. Recently, percutaneous angioplasty and stenting are becoming more common due to their less invasive nature and comparable procedure success rates with short term patency rates between 93-96% [3,23] and long term patency rates between 80-90% [24]. However, endovascular recanalization can be technically demanding and lead to potentially life-threatening intrathoracic complications. Moreover, the restenosis rate for angioplasty is reported as high as 40.7% [11,25] and in stenting about 16% over 5 years in

patients with CSSS [26]. Surgical therapeutic methods for CSSS include carotid-subclavian artery bypass which is the standard surgical treatment for occlusive disease of the proximal LSA [27], and other alternatives such as aorto-subclavicular bypass, axilo-axillary bypass and re-insertion of LIMA into ascending aorta. Carotid-subclavian bypass has been reported to have superior patency results with acceptable mortality and morbidity rates. The improvement of symptoms following surgery has been reported to reach 75% [28,29]. Possible complications of surgery include stroke, cervical lymphatic fistula, phrenic nerve paralysis and Horner syndrome [25]. Graft patency rates have been reported between 96-98% over a mean follow up of 4 years [24,29,30].

Conclusion

Our case describes a coronary subclavian steal syndrome (CSSS) as an uncommon indication for subclavian artery revascularization by carotid-subclavian bypass. Subclavian revascularization for CSSS has excellent long-term patency and possible survival benefits in patients with reversible cardiac ischaemia.

Figures

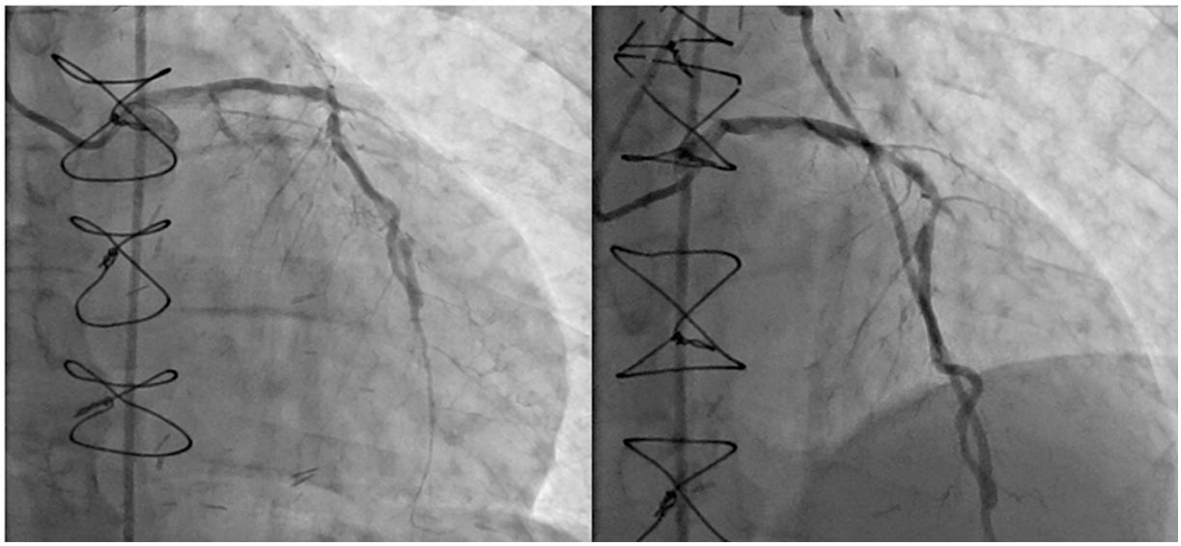

Figure 1: Left Coronary Angiogram – native LAD and LIMA graft

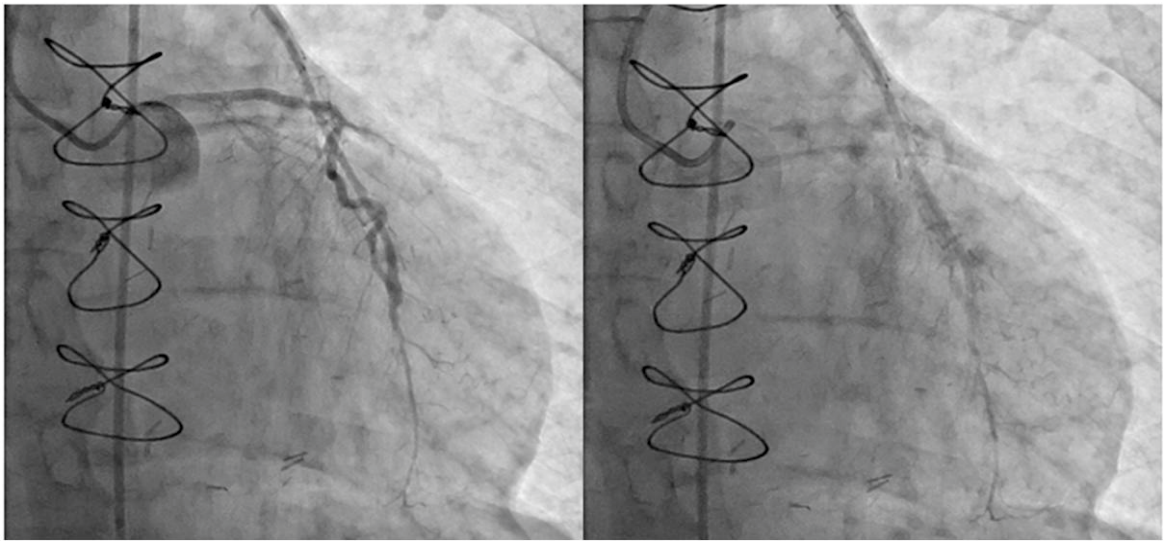

Figure 2: Angiogram showing competitive flow from LAD to LIMA graft

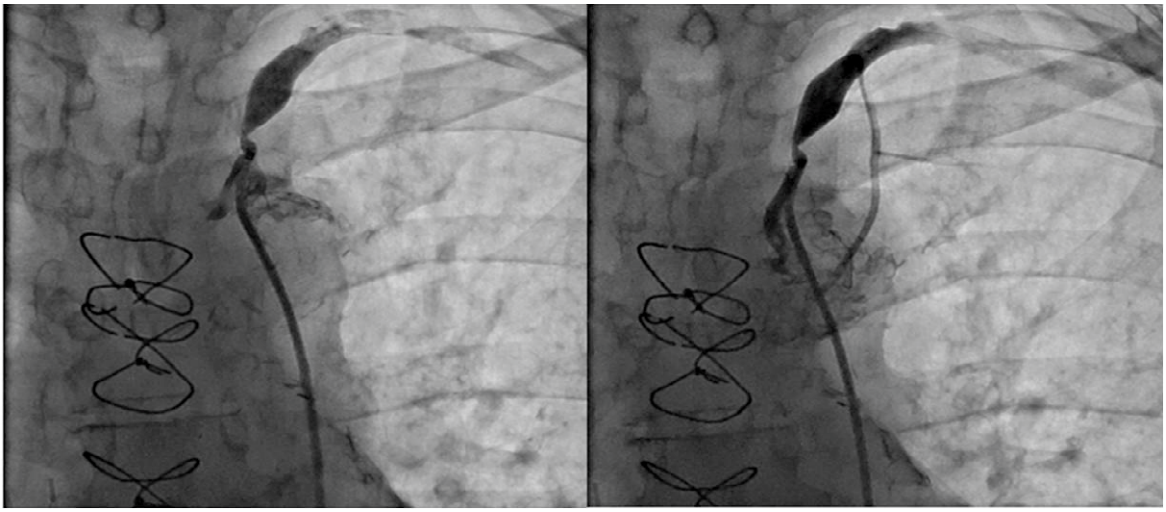

Figure 3: Angiogram of Left Subclavian Artery showing proximal stenosis

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