Surgical procedures in subclavian steal syndrome: A retrospective analysis

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Abstract

Objectives: Patients diagnosed with subclavian steal syndrome present with claudication in the upper extremity, vertigo, blurred vision, dizziness and myocardial ischemic symptoms after coronary artery bypass grafting. Surgery is still a good option with good long-term patency rates and symptom-free survival. We aimed to present our results on surgery for subclavian steal syndrome.

Materials and Methods: This study is a retrospective study involving 16 patients undergoing surgery for subclavian steal syndrome from January 2005 to December 2012. Postoperative follow-up consisted assessment of graft patency and resolution of symptoms.

Results: There was only 1 in-hospital mortality. The mean follow up period was 28.58 ± 26.92 months. Nine patients were symptom-free. Doppler ultrasonographic examination of 11 patients revealed patent grafts.

Conclusion: Choice of surgical procedure in subclavian steal syndrome depends on the patient characteristics and the preference of the surgeon. Surgical procedures are safe and durable in patients with subclavian steal syndrome who are not eligible for angioplasty. Consideration of the age, stenosis and comorbidities will aid making the correct surgical strategy with satisfactory long-term results.

Introduction

Stenosis or occlusion of the proximal part of the subclavian artery causes a steal phenomenon from the ipsilateral vertebral artery. Patients present with different types of symptoms. One is claudication in the upper extremity that arises from stenosis and occlusion. Other one is vertebrobasilar insufficiency symptoms such as vertigo, blurred vision, dizziness and sometimes transient ischemic attacks as a result of steal phenomenon [1]. Patients with coronary artery bypass grafting (CABG) may present with symptoms of myocardial ischemia due to steal of blood from the internal thoracic artery to the subclavian artery and cerebral circulation [2].

Smoking is the most common risk factor (74%) followed by hypertension (42%), coronary artery disease (30%), hyperlipidemia (17%) and diabetes mellitus (8%) [3]. Aortic arch aortography, computed tomography angiography (CTA) or magnetic resonance imaging demonstrates the stenotic segment. It is also possible to see the retrograde flow in the vertebral artery by color Doppler ultrasonography [4].

Nowadays, suitable lesions can be treated by endovascular techniques. Nevertheless, surgery is still a good option with good long-term patency rates and symptom-free survival [1]. In this study, 16 patients undergoing surgery for subclavian steal syndrome were evaluated retrospectively.

Materials and Methods

A total of 16 patients who underwent surgery for subclavian steal syndrome in our hospital between January 2005 and December 2012 were involved in this study. The patient files were collected, and demographic data, as well as operative characteristics, were recorded. The Hospital Ethics Committee approved the study based on retrospective data retrieval, waiving for individual consent. This study complies with the Declaration of Helsinki.
Statistical analysis

The data were analyzed using software SPSS version 17.0 (version 17.0, Statistical Package for the Social Sciences Inc, Chicago, IL, USA). Continuous variables were presented as “mean ± standard deviation,” median (min, max) and categorical variables were presented as “numbers and percentages.”

Results

There were 11 male (68.75%) and 5 female (31.25%) patients with a mean age of 55.8 ± 9.9 days (min: 32, max: 72). The risk factors were; hypertension in 6 (37.5%), smoking in 6 (37.5%), hyperlipidemia in 5 (31.25%), history of CABG in 5 (31.25%), diabetes in 4 (25%) and Takayasu arteritis in 2 patients (12.5%).

10 patients presented with claudication of the left arm, 3 patients with numbness of the left arm, 2 with angina pectoris and 1 with presyncope. Both of the patients presenting with coronary steal syndrome had history of CABG of the internal thoracic artery to the left anterior descending artery 7 and 14 years previously. The other three patients with previous CABG have presented with claudication of the left arm.

Physical examination revealed absence of the pulse on the affected extremity and significant systolic blood pressure difference between the two arms. In all cases, the diffuse or segmental occlusion of the proximal subclavian artery was diagnosed with Doppler ultrasonography followed by digital subtraction angiography. Doppler ultrasound also revealed retrograde flow in the left vertebral artery. The coronary angiography of the two patients with CABG revealed retrograde flow from left internal thoracic artery toward to the distal part of the subclavian artery. Left carotico-subclavian bypass was performed in 5 patients, aorto-left subclavian bypass in 5, subclavian-subclavian bypass in 3, aorto-bisubclavian bypass in 1, aorto-brachiocephalic-left common carotid artery bypass in 1 and left subclavian artery transposition was performed in 1 patient. Dacron grafts were used in 9 patients, PTFE in 6 patients and 1 patient had transposition of the subclavian artery to left common carotid artery.

There was only 1 in-hospital mortality occurring in a patient with the previous history of coronary bypass grafting who underwent carotico-subclavian bypass. The patient died on fourth postoperative day due to myocardial infarction. Another patient who underwent aorto-left subclavian bypass underwent revision for excessive bleeding. All patients showed symptomatic improvement following surgery and systolic blood pressure difference between the arms disappeared.

The mean follow-up period was 28.58 ± 26.92 months (min: 7, max: 95 months). Three patients were lost to follow-up. Telephone interview was done with 12 patients who was recalled to the outpatient clinic for clinical assessment, Doppler ultrasonographic examination and further investigations such as CTA where required (Figure 1). Nine patients were symptom-free. The patient with Takayasu arteritis who underwent aorto-brachiocephalic-left common carotid artery bypass had claudication on the left arm (unoperated side) and was diagnosed of stenosis of the left subclavian artery. Doppler ultrasound of 11 patients revealed patent grafts. Until date, one patient continues to complain of mild headache and 2 patients have pain of the forearm and elbow which are thought to be not vascular in origin.

Discussion

Subclavian steal syndrome is a rare vascular disease. Nevertheless, it can cause a decline in life quality in symptomatic patients [5]. Surgical procedures performed for subclavian steal syndrome constitutes 1-2% of all the vascular surgical procedures. The most common etiology is hypertension followed by coronary artery disease, smoking, hyperlipidemia and diabetes [3]. In our patients, smoking and hypertension were the most common etiological factors followed by CABG and hyperlipidemia. The etiology, percutaneous intervention or type of surgical procedure and choice of graft material are the most important factors affecting the long-term patency following surgery.

Vasculitides such as temporal arteritis and Takayasu may result in subclavian steal syndrome [5]. Takayasu arteritis is a chronic inflammatory disease of unknown etiology, typically seen between the ages of 15 and 30. It mainly involves the aorta and its branches. Two of our female patients who underwent surgery for subclavian steal syndrome had been previously diagnosed with Takayasu arteritis. One of them was 51 years old who underwent aorto-left subclavian bypass and had patent graft on follow-up. The other one was 61 years old.
who underwent aorto-brachiocephalic-left common carotid artery bypass and presented with claudication of the left arm (unoperated side). A decision for the operation was made for this patient since she was severely symptomatic.

Proximal occlusive disease of the subclavian arteries may be treated by stenting as a safe and effective method for subclavian steal syndrome. Balloon angioplasty and stenting can be performed when stenting is unlikely to compromise the vertebral circulation. Technical success of the percutaneous approach is achieved in more than 90%, with 5-year patency rates of 85% [6]. Diffuse or distal occlusions may be better addressed surgically. Surgical revascularization consists of different vascular bypass procedures such as carotid-subclavian bypass and axillo-axillary bypass with patency rates higher than 70% at 5 years. However, the success rate increases up to 80% if the common carotid is used during bypass [7]. Surgical approach was the choice in our patients whose vascular lesion patterns were long segmental or diffuse.

Thoracic or extrathoracic approaches may be used during surgery. Thoracic approaches possess higher mortality and morbidity than extrathoracic ones which are more frequently employed [5]. We used extrathoracic approach in 9 patients and thoracic approach in 7 patients. Out of 16 patients in our study, 1 patient with a history of CABG who underwent carotico-subclavian bypass died on the fourth postoperative day due to myocardial infarction. This patient had undergone CABG 8 years ago, and control coronary angiography revealed occluded bypass grafts. The native coronary arteries were so poorly calibrated that he was neither suitable for percutaneous intervention nor CABG. The patient underwent angioplasty due to severe claudication of the left arm, but the procedure was ineffective. He then opted for carotico-subclavian bypass despite being made aware of the high mortality risk associated with this procedure due to the severity of his coronary artery disease. The patient died on the fourth postoperative day following a myocardial infarction.

The incidence of coronary-subclavian steal syndrome is between 0.5% and 2% in patients undergoing CABG [8]. The coronary-subclavian steal syndrome is a variation of the subclavian steal syndrome and is characterized by inversion of flow in the internal mammary artery that has been used as conduct in a myocardial revascularization. Due to the risk of myocardial infarction, the treatment must include either surgical bypass or transluminal angioplasty. Two patients in our study with a history of CABG who had myocardial ischemic symptoms due to the subclavian occlusion underwent carotico-subclavian bypass. In both cases, there was clinical improvement of symptoms after the procedure.

Patency following surgery is also related with the type of surgical procedures. Among the surgical procedures, carotico-subclavian bypass reveals better primary patency rates than other procedures like subclavian-subclavian bypass [9]. The 10-year patency rate was reported as 92% with minimal mortality and morbidity [10]. However, distal or proximal stenosis of the carotid artery is a contraindication for this surgical procedure [11]. We preferred this procedure in 5 patients with patent carotid arteries. One patient died due to myocardial infarction. Follow-up revealed patent grafts in 3 patients and 1 patient was lost to follow-up. In 5 patients with carotid artery stenosis, we chose to perform aorto-subclavian bypass. Four had patent grafts at long-term follow-up except one patient who was lost to follow-up. In 3 patients with co-morbidities, we performed subclavian-subclavian bypass that is simple and does not necessitate occlusion of the carotid arteries. One patient was lost to follow-up, however, the other 2 patients had patent grafts during long-term followup. 10-year patency has been reported as 89% in the literature for subclavian-subclavian bypass [12].

The choice of graft is another important issue for long-term graft patency. Dacron and PTFE grafts are superior compared with saphenous vein grafts [3]. We used Dacron grafts in 9 patients, and PTFE in 6 patients and 1 patient had transposition of the subclavian artery to the common carotid artery. There was no difference in the patency of the Dacron and PTFE grafts at long-term follow-up in our patients.

Conclusion

Choice of surgical procedure in subclavian steal syndrome depends on the patient characteristics and the preference of the surgeon. Surgical procedures are safe and durable in patients with subclavian steal syndrome who are not eligible for angioplasty. Consideration of the age, stenosis and comorbidities will aid making the correct surgical strategy with satisfactory long-term results.

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