CASE REPORT

Carotid to subclavian bypass, rare but rewarding surgery: A case report

Robin Man Karmacharya*, Satish Vaidya, Binay Yadav, Sanjay Sharma, Soniya Maharjan, Swechha Bhatt, Kajol Kunwar

Department of Surgery, Dhulikhel Hospital, Dhulikhel, Nepal

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ABSTRACT

Different treatment options are available for subclavian stenosis (SS). Carotid to subclavian bypass surgery (CSBS) is an increasingly used effective treatment strategy when stenting is impossible. However, in Nepal, little is known about SS and its management. A 58-year-old man with a history of aortic valve replacement surgery complained of progressive left arm weakness for the past 6 months associated with pain on exertion and blood pressure discrepancies in both arms. A computed tomographic scan confirmed near-complete subclavian artery stenosis and a Doppler ultrasound showed decreased blood flow and systolic velocity. CSBS was selected as stenting was not feasible. Post-CSBS, all hemodynamic parameters returned to normal, lasting even after 2 years. CSBS appears to be a viable, safe, and promising treatment for symptomatic SS. However, additional studies need to be conducted to analyze the benefits of CSBS relative to other interventions.

Key Words: Carotid arteries, Subclavian artery, Subclavian steal syndrome, Vascular surgical procedures

1. INTRODUCTION

Subclavian Stenosis (SS) is an uncommon condition that affects 1.9% of the population and 7.1% of those with vascular diseases.[1] SS is usually asymptomatic; symptoms may appear if the artery is stenosed greater than 50%.[2] Patients may experience symptoms of vertebrobasilar insufficiency or vascular symptoms of the arm and hand, such as colder hands on the ipsilateral side and, in the worst cases, even ischemia.[3] Physical examination may demonstrate a weak pulse on the ipsilateral side and a difference in systolic blood pressure of 10 millimeters of mercury (mmHg) between the sides.[1]

For symptomatic SS, less invasive procedures- angioplasty and stenting are considered the treatment of choice because of their durability and satisfactory outcomes.[4] However, when stenting is not possible, extrathoracic revascularization, particularly carotid subclavian bypass surgery (CSBS), is proven to be a reasonable alternative.[3] The procedure was first initiated by Diethrich et al. in 1967,[5] and later, many retrospective studies found it to be safe and have long-term benefits beyond 20 years.[3,6] Moreover, compared to angioplasty and stenting, a survey by Aburahma et al. showed CSBS to be more durable with minimal operative complications and no symptom recurrence.[7]

A recent study by Basukala et al. reported a case from Nepal that intervened with endovascular stenting for subclavian steal syndrome resulting from atherosclerosis but lacked information on the procedure and follow-ups.[8] In the present study, we aim to report a case with 2-year follow-ups who underwent carotid to subclavian bypass, which is, to our

*Correspondence: Robin Man Karmacharya; Email: reachrobin773@gmail.com; Address: Dhulikhel Hospital, Dhulikhel, 45210, Nepal.

knowledge, rare surgery done in Nepal for near-to-complete subclavian artery stenosis after aortic valve replacement.

2. Case presentation

We present the case of a 58-year-old man visiting the Department of Surgery, Dhulikhel Hospital, complaining of progressively increasing weakness of the left upper limb for six months, which was associated with pain on exertion. No history of fever, trauma, chest pain, palpitation or loss of consciousness, and symptoms pertaining to vertebrobasilar insufficiency were reported. However, the patient had undergone an aortic valve replacement three years back for rheumatic heart disease involving the aortic valve. The relief was done via open heart surgery on cardiopulmonary bypass, and the patient was on warfarin therapy. He was under regular follow-up to ensure that INR was in the therapeutic target range.

On general examination, there was absent pulsation on the left radial and ulnar arteries, with a feeble pulse noted on the brachial artery. The blood pressure on the right arm was 110/70 mmHg; however, that on the left arm couldn't be recorded. The left upper limb was cold compared to the right side but showed no other ischemia. No other abnormalities were found on the chest, cardiovascular and abdominal examinations. Echocardiography was done, which didn't reveal any intra-atrial thrombus.

Doppler ultrasonography showed monophasic flow with 20 cm/s peak systolic velocity in the left subclavian artery. Then, to confirm the diagnosis, a computed tomography (CT) angiogram was done (see Figure 1), which revealed a near-total occlusion of the left subclavian artery, probably attributable to chronic thrombus. Good contrast flow was noted in the left common carotid artery. Peripheral angiogram done with cannulation from the left brachial artery also revealed a complete occlusion of the left subclavian artery (see Figure 2).

As the stenosis was near-total, further endovascular treatment was not opted for due to technical difficulties and costs. So, the patient was planned for a carotid to subclavian bypass surgery. Under general anesthesia, a longitudinal incision along the medial aspect of the left sternocleidomastoid muscle, the left common carotid artery, was identified and secured with loops. Access to the left subclavian artery was made via the left supraclavicular incision. The subclavian artery, external jugular vein, internal jugular vein, and vagus nerve were identified and secured with loops. Subclavian and common carotid arteries were prepared for graft placement. Stump pressure of 50 mmHg was noted in the left shared carotid lane warranting safe clamping of the left common carotid artery. A poly tetra fluoro ethylene (PTFE) graft was anastomosed to the subclavian artery and then to the left shared carotid lane creating a tunnel underneath omohyoid and sternocleidomastoid muscles (see Figure 3). For both end-to-side anastomoses, 7'O proline was used.

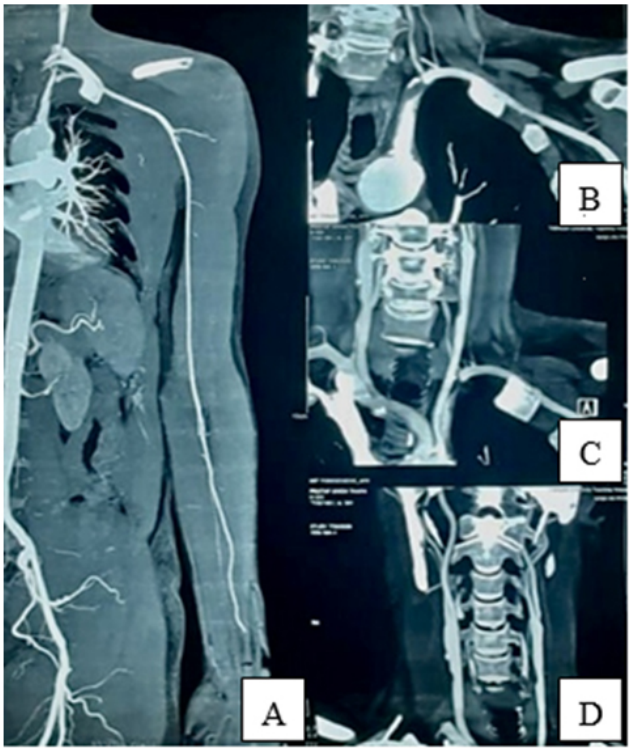

Figure 1. CT angiogram showing near-total occlusion of the left subclavian artery

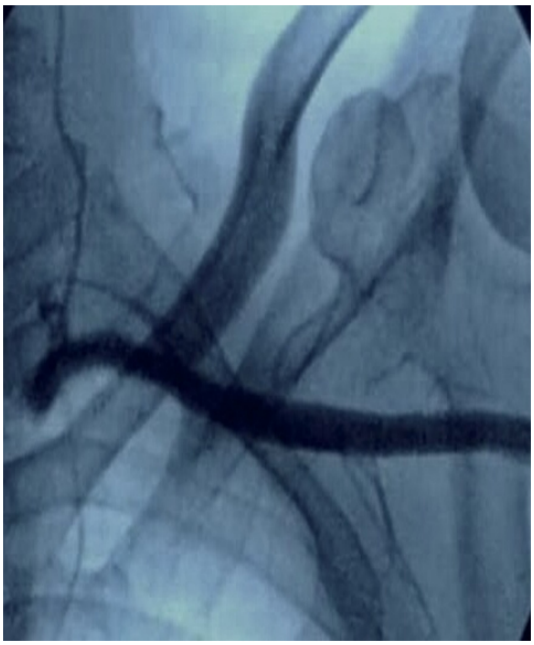

Figure 2. Peripheral angiogram showing complete occlusion of the left subclavian artery

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During the operation, no complications were reported. Postoperatively, radial and ulnar artery pulses were appreciated with increased warmth on the left arm. The patient's symptoms of weakness and pain had subsided.

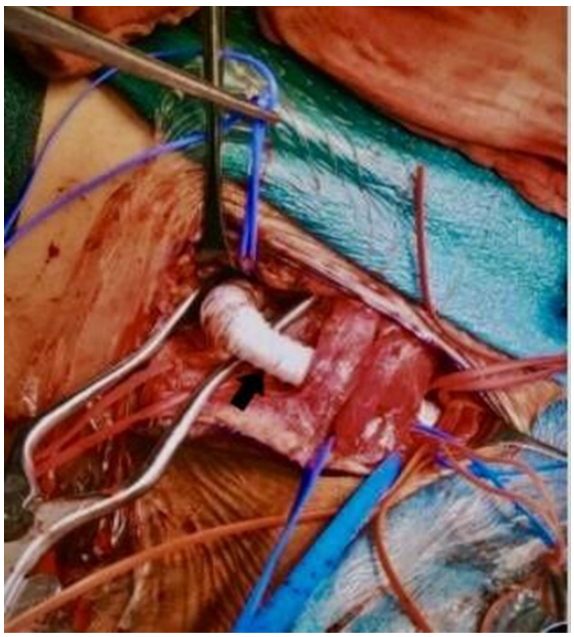

Figure 3. Subclavian graft (black arrow) tunneled underneath omohyoid and sternocleidomastoid muscles

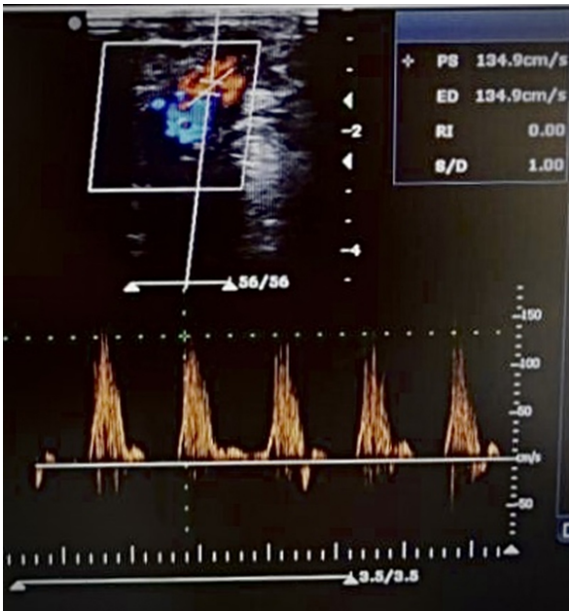

Figure 4. Doppler ultrasonography of the left subclavian artery reveals adequate flow distal to anastomosis

On a two years follow-up, adequate pulse was noted in the left axillary, brachial, radial, and ulnar arteries. All these vessels showed triphasic flow with 40-50 cm/s of peak systolic velocity. In the left subclavian artery, just distal to the anastomosis, the flow was triphasic with 135 cm/s velocity (see Figure 4). Also, the graft was patent. The patient doesn't give a history of any intermittent recurrence of symptoms, even with neck rotation.

3. Discussion

Our study is the first in Nepal to describe the case of SS in detail, which is infrequent and, importantly, underreported.[8] Only one study to date has reported a case of subclavian steal syndrome treated with endovascular stenting. However, it lacked adequate information on operation procedures and follow-ups.[8]

In this study, we opted for CSBS for SS over angioplasty and stenting. Although angioplasty and stenting are described as the first line of treatment by Salman et al.,[4] restenosis and complication rates are higher. They can cause intraluminal hyperplasia instead of extrathoracic surgery.[4,7,9] Further, in circumstances where stenting is impossible, extrathoracic surgery is chosen.[3–7] Hence, the patient in our study underwent CSBS for near-complete subclavian artery occlusion resulting from chronic thrombus.

Extra thoracic surgery can be done by transposing the subclavian to the carotid artery, CSBS using a synthetic graft, or by subclavian–axillary bypass.[4] A previous study found satisfactory hemodynamic parameters and symptom relief in all of those procedures immediately and in the long term but relatively better technical feasibility in the transposition of the subclavian to the carotid artery.[10] However, amongst the three methods, we preferred CSBS in our patient and found no issues postoperatively and at a 2-year follow-up, consistent with the previous study's findings.

Our patient had a history of aortic valve replacement surgery (AVRS). Presence of any cardiovascular events is a risk factor for peripheral artery disease.[11] However, the surgery in our patient was secondary to rheumatic heart disease of the aortic valve and not atherosclerosis. So, what could have caused the formation of a chronic thrombus? Evidence suggests the occurrence rate of thromboembolic events to be 0.7 per year after AVRS.[12] Even though such circumstances are unusual, and the patient was on warfarin therapy, this could still explain the development of a thrombus around the valve that might have eventually passed to the subclavian artery occluding the artery.

There are a few limitations of this study. We followed up with the patients only for two years. Long-term follow-ups are necessary to monitor the graft's patency and symptom recurrence. The study design used cannot help establish cause and effect relationship and cannot show the superiority of one intervention over another.

4. Conclusion

Carotid to subclavian bypass surgery is feasible and safe with sustainable outcomes. Regular follow-up is necessary to note the patency of the graft. Future studies may explore the feasibility and efficacy of other available treatment options.

Conflicts of Interest Disclosure

The authors declare they have no conflicts of interest.

References

[1] Shadman R, Criqui MH, Bundens WP, et al. Subclavian artery stenosis: prevalence, risk factors, and association with cardiovascular diseases. J Am Coll Cardiol. 2004; 44(3): 618-23. PMid:15358030. https://doi.org/10.1016/j.jacc.2004.04.044

[2] Nishikii H, Kurita N, Kusakabe M, et al. [Successful management of primary immune thrombocytopenia with romiplostim during open heart surgery in a hemodialysis patient]. Rinsho Ketsueki. 2019; 60(1): 28-32.

[3] AbuRahma AF, Robinson PA, Jennings TG. Carotid-subclavian bypass grafting with polytetrafluoroethylene grafts for symptomatic subclavian artery stenosis or occlusion: a 20-year experience. J Vasc Surg. 2000; 32(3): 411-8; discussion 418-419. PMid:10957647. https://doi.org/10.1067/mva.2000.108644

[4] Salman R, Hornsby J, Wright LJ, et al. Treatment of subclavian artery stenosis: A case series. Int J Surg Case Rep. 2015; 19: 69-74. PMid:26722712. https://doi.org/10.1016/j.ijscr.2015.12.011

[5] Diethrich EB, Garrett HE, Ameriso J, et al. Occlusive disease of the common carotid and subclavian arteries treated by carotid-subclavian bypass. Analysis of 125 cases. Am J Surg. 1967; 114(5): 800-8. PMid:5603339. https://doi.org/10.1016/0002-9610(67)90151-1

[6] Vitti MJ, Thompson BW, Read RC, et al. Carotid-subclavian bypass: a twenty-two-year experience. J Vasc Surg. 1994; 20(3): 411-7; discussion 417-418. PMid:8084034. https://doi.org/10.1016/0741-5214(94)90140-6

[7] AbuRahma AF, Bates MC, Stone PA, et al. Angioplasty and stenting versus carotid-subclavian bypass for the treatment of isolated subclavian artery disease. J Endovasc Ther Off J Int Soc Endovasc Spec. 2007; 14(5): 698-704. PMid:17924737. https://doi.org/10.1177/152660280701400515

[8] Basukala S, Pathak BD, Rijal S, et al. Subclavian steal syndrome secondary to atherosclerosis: A case report and review of literature. Clin Case Rep. 2022; 10(4): e05740. https://doi.org/10.1002/ccr3.5740

[9] Schillinger M, Haumer M, Schillinger S, et al. Risk stratification for subclavian artery angioplasty: is there an increased rate of restenosis after stent implantation? J Endovasc Ther Off J Int Soc Endovasc Spec. 2001; 8(6): 550-7. PMid:11797967. https://doi.org/10.1177/152660280100800603

[10] van der Vliet JA, Palamba HW, Scharn DM, et al. Arterial reconstruction for subclavian obstructive disease: a comparison of extrathoracic procedures. Eur J Vasc Endovasc Surg Off J Eur Soc Vasc Surg. 1995; 9(4): 454-8. PMid:7633992. https://doi.org/10.1016/S1078-5884(05)80015-2

[11] Song P, Rudan D, Zhu Y, et al. Global, regional, and national prevalence and risk factors for peripheral artery disease in 2015: an updated systematic review and analysis. Lancet Glob Health. 2019; 7: e1020-e1030. PMid:31303293. https://doi.org/10.1016/S2214-109X(19)30255-4

[12] Van Dyck M, Glineur D, de Kerchove L, et al. Complications after aortic valve repair and valve-sparing procedures. Ann Cardiothorac Surg. 2013; 2(1): 130-9.