Primary Stenting of Right-Sided Subclavian Artery Stenosis Presenting as Subclavian Steal Syndrome: Report of 3 Cases and Literature Review

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Background: Right-sided subclavian artery stenosis (SAS) is a rare cerebrovascular disease involving the upper extremities. Considering an endovascular approach for its management requires increased endovascular and catheterization skills when compared with the left side, due to the close approximation of the right subclavian artery origin, vertebral, and common carotid arteries.

Methods: Three patients suffering from proximal right-sided SAS were treated in our center through primary stenting. Percutaneous transfemoral and transbrachial approaches were used for vascular access, whereas in 2 cases an additional carotid protection device was deployed intraoperatively.

Results: Technical success was met in all 3 cases, with no intraoperative or postoperative complications being observed. All patients resumed ambulation and were uneventfully discharged the next day with dual antiplatelet medication. No recurrent stenosis was reported in duplex ultrasound scan during 6-month follow-up, with all patients reporting resolution of their symptoms.

Discussion: Subclavian artery stenosis is an uncommon vascular disease, showing a 4-fold left, rather than right-sided predisposition. Although a low-grade stenosis is usually asymptomatic and may remain unobserved, a severe stenosis may cause retrograde blood flow in the ipsilateral vertebral artery, leading to a medical condition with various clinical symptoms, known as subclavian steal syndrome. A number of open surgical techniques exist for management of subclavian artery stenosis, although a paradigm shift in the 21st century has led to the introduction of minimally invasive techniques for its treatment, with available modalities including angioplasty, stenting, and the kissing stent technique.

Subclavian artery stenosis (SAS) is an uncommon cerebrovascular disease, with its prevalence in the general population being approximately 2–3%.[1,2] It is highly associated with tobacco abuse and elevated cholesterol levels, whereas patients suffering from peripheral vascular disease may develop subclavian stenosis in up to 20% of cases.[3] For yet undefined reasons, SAS is more commonly

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established on the left, rather than the right side, with a ratio of 4:1.[1]

Although usually nonsymptomatic, patients may exhibit upper extremity symptoms or symptoms associated with an established subclavian steal pathology.[4] Treatment of SAS offers a number of open surgical and endovascular options, with the latter being the treatment of choice in most cases. Although treatment of left-sided SAS is relatively straightforward, considering an endovascular approach for a right-sided stenosis requires careful preoperative planning, due to the close anatomic relations between the innominate, common carotid, subclavian, and vertebral arteries. We present the cases of 3 patients who underwent successful primary stenting of proximal right-sided SAS in our center. This article also aims to highlight the technical aspects and various modalities when considering an endovascular approach for treatment of this uncommonly presented vascular disease.

CASE PRESENTATION 1

A 46-year-old male patient was referred to our department due to ophthalmic disorders for the past 6 months. He experienced no other symptoms, whereas his medical history included hyperlipidemia and heavy tobacco abuse for the past 20 years. Physical examination revealed a difference of 21 mm Hg between upper extremity systolic blood pressures. Laboratory examinations were within normal limits. Further evaluation with color duplex scan of the cervical region was significant for a stenosis of the right subclavian artery >90%, located in the bifurcation of the innominate artery, with additional retrograde blood flow on the ipsilateral vertebral artery, findings indicating the development of subclavian steal syndrome (SSS). After written consent, patient was admitted for endovascular treatment of symptomatic SSS due to right-sided SAS. Through percutaneous transfemoral approach, arch aortography was performed, depicting a stenosis of the proximal right subclavian artery. An 8 × 19 mm balloon expandable stent (Isthmus Logic, Alvimedica, Saluggia, Italy) was carefully deployed between the right vertebral and common carotid arteries, with final aortography demonstrating excellent patency of all vessels (Fig. 1). Patient was discharged the next day with dual antiplatelet medication. No in-stent restenosis was observed in duplex ultrasound scan during 6-month follow-up, whereas the patient was symptom free.

CASE PRESENTATION 2

A 68-year-old male presented in the emergency department after a syncope episode. He was a moderate smoker for at least 30 years, while he was receiving medication for hypertension and hyperlipidemia. During physical examination, left extremity systolic blood pressure was 137 mm Hg, whereas right extremity systolic blood pressure was 110 mm Hg. Laboratory examinations were unremarkable, while he additionally underwent radiological investigations, including color duplex scan and magnetic resonance angiography (MRA). Findings were consistent with subclavian steal pathology, revealing a significant stenosis (>95%) situated in the origin of the right subclavian artery, and reverse blood flow in the ipsilateral vertebral artery. As an incidental finding, an occlusion of the left common carotid artery was demonstrated, with the internal carotid artery receiving its blood supply from the external carotid artery (Fig. 2). Due to severe stenosis and symptoms, the patient was admitted for surgery. Under local anesthesia, transfemoral access was obtained, through which aortography was performed, demonstrating the right SAS. Primary subclavian access through the femoral artery proved difficult, so additional percutaneous right brachial artery access was obtained. A carotid protection filter was deployed inside the ipsilateral common carotid artery (CCA) lumen through the femoral wire. Through the arm, an 8 × 17 mm balloon expandable stent (Visi-Pro, Covidien, Athens, Greece) was inserted and deployed in the subclavian artery, covering the stenosis and maintaining vessel patency of the ipsilateral vertebral and CCA (Fig. 3). The patient tolerated the surgery well, while he was discharged the next day receiving dual antiplatelet medication. At 6-month follow-up, no restenosis was observed, while patient reported resolution of his symptoms.

CASE PRESENTATION 3

The case pertains to a 57-year-old previously healthy female patient, who was admitted after progressive development of right upper extremity muscle weakness for the past 4 months. She featured a difference of 32 mm Hg between upper extremity systolic blood pressures during physical examination, whereas she reported pain of her right upper extremity after prolonged elevation. Color duplex scan demonstrated turbulent blood flow and increased blood velocity of her right subclavian artery, with additional retrograde blood flow of her ipsilateral vertebral artery. Further evaluation with computer tomographic angiography (CTA) uncovered a stenosis located on the origin of her right subclavian artery (Fig. 4). Endovascular recanalization was decided for treatment of her right-sided SAS, during which an 8 × 19 mm balloon-expandable stent (Isthmus Logic, Alvimedica) was carefully deployed in her proximal right subclavian artery through transfemoral catheterization, covering the entire length of the vessel lumen between her vertebral and CCA. An additional carotid protection filter was deployed intraoperatively. She was discharged after 2 days uneventfully with dual antiplatelet medication, while at 6-month