Subclavian steal syndrome due to dialysis fistula corrected with subclavian artery stenting

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Subclavian steal syndrome (SSS) occurs when there is symptomatic vertebrobasilar flow reversal by the subclavian artery (SA) due to “steal” from the cerebral circulation. This phenomenon is most often due to steno-occlusive lesion of the SA proximal to the origin of the vertebral artery (VA).¹ SSS is infrequently symptomatic, with studies showing that patients who develop symptomatic SSS usually have additional intracranial or extracranial vascular abnormalities.² Treatment for symptomatic SSS usually involves angioplasty or stenting to restore antegrade blood flow in the vertebral artery. On extensive literature review, we found 4 case reports that described SSS in hemodialysis patients in whom the steal was attributed to the dialysis arteriovenous fistula (AVF). These patients were treated with either a revision of the AVF or fistula plication/ligation.

We present the case of a patient with symptomatic SSS due to a combination of proximal SA stenosis and high flow dialysis AVF that was corrected by stenting of the proximal SA stenosis.

PRACTICAL IMPLICATIONS

Consider stenting of the proximal subclavian artery to correct symptomatic subclavian steal syndrome due to dialysis arteriovenous fistula.

Case report

A 65-year-old man with a history of diabetes mellitus, hypertension, hyperlipidemia, coronary artery disease, and chronic kidney disease on dialysis presented with headaches, diplopia, blurry vision, left arm pain, weakness, and numbness during hemodialysis sessions. Physical examination revealed a palpable thrill over the left arm AVF with warm extremities and palpable bilateral peripheral pulsations. Neurologic examination revealed decreased motor strength and sensory deficit to touch on the left arm. He had multiple prior admissions with similar complaints, as well as gait abnormalities, imbalance, and slurred speech concerning for a stroke, but CT scans never supported the diagnosis. Workup for patient's recurrent symptoms was initiated with ultrasound duplex of the carotids revealing retrograde flow of blood in the left VA (LVA) and ultrasound arterial duplex of the left arm revealing left brachial artery–basilic vein AVF with a flow rate of 2,270 mL/min. Further investigation with magnetic resonance angiography demonstrated moderate stenosis of the left subclavian artery (LSA) proximal to the origin of the LVA and high-grade stenosis of the origin of the LVA. On LSA angiography, injection of LSA showed rapid shunting in left subclavian vein, no antegrade flow in LVA, and a pressure difference of 50 mm Hg across the proximal left subclavian stenosis. On cerebral angiography, injection of the right vertebral artery (RVA) revealed reverse flow in the LVA (figure 1A). However, on compression of the AVF with a blood pressure cuff, no reverse flow was observed in the LVA (figure 1B). Subsequently, proximal LSA was stented with a balloon-mounted stent, which resulted in restoration of antegrade flow in the LVA (figure 2A). On poststent angiogram, injection of the RVA revealed resolution of retrograde flow through the LVA (figure 2B) and the patient has not reported similar symptoms since then.

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Figure 1 Cerebral angiography

On injection of the right vertebral artery, (A) retrograde flow observed in the left vertebral artery and (B) disappearance of retrograde flow in the right vertebral artery on compression of the left dialysis arteriovenous fistula.

Figure 2 Balloon-mounted stent

Balloon-mounted stent of the proximal left subclavian artery shows (A) restoration of antegrade flow in the left vertebral artery (LVA) and (B) resolution of retrograde flow through the LVA.

Discussion

We describe the case of a patient with recurrent symptoms of vertebrobasilar insufficiency from SSS caused by a combination of LSA stenosis and a high flow left arm brachial artery–basilic vein AVF. The retrograde flow in the LVA was likely a combination from the above 2 factors because the flow was reversed on compression of the fistula during cerebral angiography, and stenting of the proximal LSA stenosis also corrected the steal.

Dialysis AVF is an extremely rare cause of SSS. It has been suggested that AVF flow speeds in excess of 2,000 mL/min can have major clinical effects on cardiac function,³ and these data can potentially be extrapolated to the subclavian–vertebral arterial system. We identified 4 prior case reports describing SSS in dialysis patients.^{4–7} Patients described in these reports presented with symptoms of vertebrobasilar insufficiency, similar to our patient, with evaluation revealing that these patients had a high flowing dialysis AVF (flow rates > 2,000 mL/min). These patients were treated with either a fistula revision or fistula plication/ligation to reduce fistula flow and correct the reversal of flow in the ipsilateral VA.

The AVF blood flow rate in our patient was high (2,270 mL/min, with normal arm AVF flow rate being $1,400 \pm 850^8$), which was possibly contributing to the steal as on fistula compression during cerebral angiography, the steal was reversed. Compared to the previous studies of symptomatic SSS due to dialysis AVF, where the patient's symptoms were reversed by correction of the fistula, the patient presented in our report was corrected by a less complicated stenting of the LSA lesion procedure.

Author contributions

S. Agarwal: corresponding author, study concept and design, acquisition of data, analysis and interpretation of data, generation of manuscript. L. Schwartz: study concept and design, acquisition of data. P. Kwon: study concept and design. G. Selas: analysis and interpretation of data. J. Farkas: acquisition of data, analysis and interpretation of data. K. Arcot: analysis and interpretation of data. A. Tiwari: study concept and design, analysis and interpretation of data, critical revision of manuscript.

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