Subclavian Steal Syndrome Successfully Treated with a Novel Application of Embolic Capture Angioplasty

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Abstract

Keywords

- ▶ peripheral arterial disease
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Subclavian artery stenosis can lead to subclavian steal syndrome. Endovascular treatment of these lesions has become the preferred modality. We describe the successful use of embolic capture angioplasty for the treatment of a patient with subclavian artery stenosis resulting in subclavian steal syndrome.

Subclavian artery stenosis can lead to a myriad of symptoms, collectively referred to as subclavian steal syndrome. Subclavian artery stenosis can lead to flow reversal in the vertebral artery resulting in posterior circulation symptoms. Furthermore, as with arterial stenosis in any vascular bed, subclavian artery stenosis can lead to effort ischemia- claudication. Endovascular treatment of such lesions has evolved into the standard of care. Herein we describe the use of embolic capture angioplasty with the Angioslide (Herzliya, Israel),

Proteus balloon to successfully treat a patient with subclavian steal syndrome.

Case

A 57-year-old man with a history of dizziness and left arm claudication presented for evaluation. He was found to have a 20 mmHg difference in upper extremity blood pressures. Noninvasive imaging demonstrated increased left subclavian

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Figure 1 Left subclavian artery stenosis with marker catheter.

Figure 3 Angiogram after Proteus angioplasty.

artery velocities on duplex and a positive Dieter test. A diagnostic catheterization was performed which demonstrated a left 70% subclavian artery stenosis.

The lesion was engaged with a VTK (Cook Medical, Bloomington, IN) catheter and successfully crossed with a supra-core wire. A 7Fr sheath was advanced to the origin of the subclavian artery. Intravascular ultrasound was performed for precise diameter measurements and a marker catheter for length determination (→Fig. 1). A 6 × 20 Proteus balloon was used for predilation (→Figs. 2 and 3). The lesion was then stented with a 8 × 18 balloon expandable stent. Final angiography demonstrated excellent results (→Fig. 4).

Discussion

Subclavian artery stenosis is associated with advancing age, hypertension, tobacco use, and dyslipidemia—particularly low high-density lipoprotein cholesterol.^{1,2} Up to 10% of patients with cardiovascular disease have concomitant subclavian artery stenosis. The treatment of subclavian artery stenosis is driven by symptoms of upper extremity claudication, posterior circulation symptoms, or coronary ischemia (coronary subclavian steal).

Endovascular treatment has replaced surgical revascularization as the standard initial approach for the treatment of

Figure 2 Proteus angioplasty of the subclavian artery.

Figure 4 Final angiogram after stent.

subclavian stenosis.^{1,3} Success of endovascular treatment for stenotic lesions approaches 100% and 50 to 75% for complete occlusions. One of the most devastating complications of percutaneous revascularization of the subclavian artery is distal embolization. Embolization can occur to the vertebral circulation or to the arm. If present, the flow reversal in the vertebral artery is thought to persist from seconds to minutes after revascularization, potentially protecting from vertebral embolization.⁴ However, this flow reversal does not protect the upper extremity nor is it protective if there is no vertebral steal at rest.

A variety of techniques have been suggested to limit complications, including direct stenting or the use of stent grafts for the treatment of the subclavian artery. Herein, we describe the use of embolic capture angioplasty with the Proteus balloon. This balloon has a unique protective mechanism. While the balloon remains occlusive, it is invaginated upon itself. This infolding “sucks” debris within the balloon, minimizing that which could embolize. The balloon is then deflated and removed. Currently, the Proteus balloon is Food and Drug Administration approved for lower extremity applications.

Conclusion

Subclavian artery stenosis can result in upper extremity claudication and posterior circulatory symptoms. Herein, we describe the use of embolic capture angioplasty for the treatment of a patient with subclavian steal syndrome. This is a novel use of this device.

References

- 1 Fergus T, Pacanowski JP Jr, Fasseas P, et al. Coronary-subclavian steal: presentation and management: two case reports. *Angiology* 2007;58(3):372–375
- 2 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):618–623
- 3 Norsa A, Gamba G, Ivic N, et al. The coronary subclavian steal syndrome: an uncommon sequel to internal mammary-coronary artery bypass surgery. *Thorac Cardiovasc Surg* 1994;42(6):351–354
- 4 Ringelstein EB, Zeumer H. Delayed reversal of vertebral artery blood flow following percutaneous transluminal angioplasty for subclavian steal syndrome. *Neuroradiology* 1984;26(3):189–198