Intravascular ultrasound is a key diagnostic tool in subclavian vein varicosity

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ABSTRACT

Varicose veins of the neck are far less common than lower extremity varicosities. Often, neck varicosities can be a sign of a more central venous obstruction. Here, we describe a patient with no risk factors for central venous obstruction who presented with a recurrent left subclavian vein (LSV) varicosity causing significant pain and discomfort that was recalcitrant to repeated phlebectomy. Venography revealed a dilated LSV with no significant venographic stenosis in the LSV or brachiocephalic vein. Intravascular ultrasound subsequently revealed a culprit hypertrophied valve that was successfully treated with valvuloplasty, resulting in durable resolution of the patient's symptoms, suggesting that intravascular ultrasound was essential in the diagnosis and treatment of this hypertrophied valve. (J Vasc Surg Cases and Innovative Techniques 2019;5:488-91.)

Keywords: Intravascular ultrasound (IVUS); Varicose veins; Hypertrophied valve; Valvuloplasty

The prevalence of an isolated varicosity in the upper extremity or neck is exceedingly rare. The diagnosis, symptoms, and treatment of primary varicosities above the lower extremities, specifically neck varicosities, are poorly described.[1]

The imaging evaluation of venous varicosities ordinarily includes duplex ultrasound.[2] More advanced cross-sectional imaging, such as computed tomography venography (CTV) or magnetic resonance venography, may be considered in cases of equivocal ultrasound findings to evaluate for deep or central venous occlusion or to provide preoperative planning.[3] Finally, catheter-based venography may be performed to further evaluate the deep venous system or central veins of the chest to potentially treat the underlying pathologic process. Increasingly, intravascular ultrasound (IVUS) is being used to uncover deep venous disease that may be missed by multiplanar catheter venography and to assist with stent sizing.[4] In addition, IVUS has previously been used to characterize the cause of thoracic outlet syndrome in a number of patients.[5]

The purpose of this study was to describe the usefulness of intraoperative IVUS in the diagnosis and treatment of a hypertrophied venous valve in the neck.

CASE REPORT

This report was carried out in full compliance with the Health Insurance Portability and Accountability Act and was exempt from Institutional Review Board review. The patient was informed about and consented to all diagnostic and interventional procedures and this publication.

The patient, a 56-year-old woman, presented with a single recurrent, tender, large, and palpable varicosity on the left side of the neck. The varicosity first manifested at the age of 20 years, shortly after her neck was injured from pulling a drowning victim out of a pool. The varicosity underwent phlebectomy by a general surgeon but subsequently recurred. It was again excised by a plastic surgeon, and the patient experienced no symptoms for more than three decades. However, in November 2015, symptoms of chronic pain, tenderness, and pressure recurred, after she reinjured the left side of her neck while being jerked by a dog's leash. She began conservative management including warm compresses and oral analgesics without relief. When she would bend over or perform yoga, the varicosity would bulge and become more painful and tender. She presented to an otorhinolaryngologist for surgical evaluation of the neck varicosity and was then referred to our interventional radiology practice for a possible "vascular neck mass."

Her medical history was otherwise noncontributory. She denied any history of miscarriage, venous thrombosis, central venous catheters, or previous intervention in the neck other than surgical excision of the neck varicosity. The findings on review of systems were normal. Physical examination revealed a large, palpable, and tender varicosity on the left side of the neck coursing from the left sternoclavicular joint over the left internal jugular (LIJ) vein without any skin findings. In-office ultrasound examination revealed a varicosity coursing nearly parallel with the LIJ vein. Although the origin of the LIJ vein could not be adequately visualized with ultrasound, there was suggestion of LIJ stenosis near its origin. CTV of the neck and chest was

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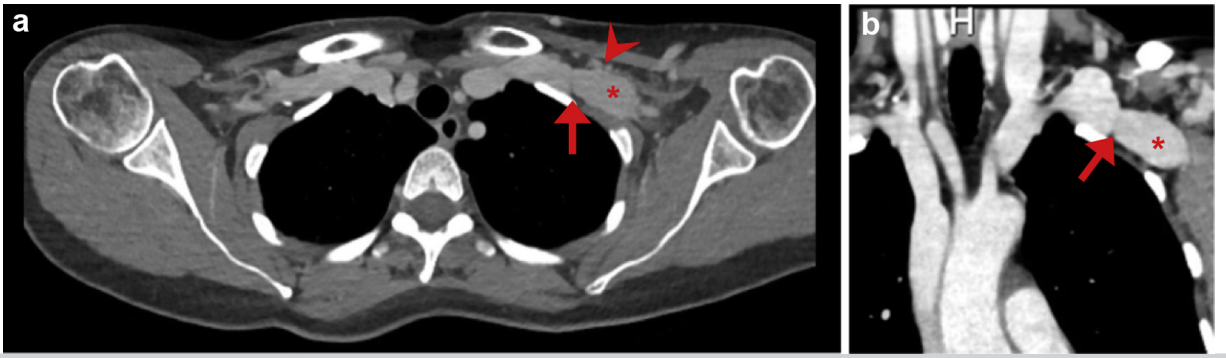

Fig 1. Diagnostic computed tomography venography (CTV) in **(a)** axial and **(b)** coronal formats. The *arrows* indicate the hypertrophied venous valve, the *arrowhead* indicates the origin of the symptomatic varicose vessel, and the *asterisk* indicates the dilated left subclavian vein (LSV) distal to the hypertrophied valve.

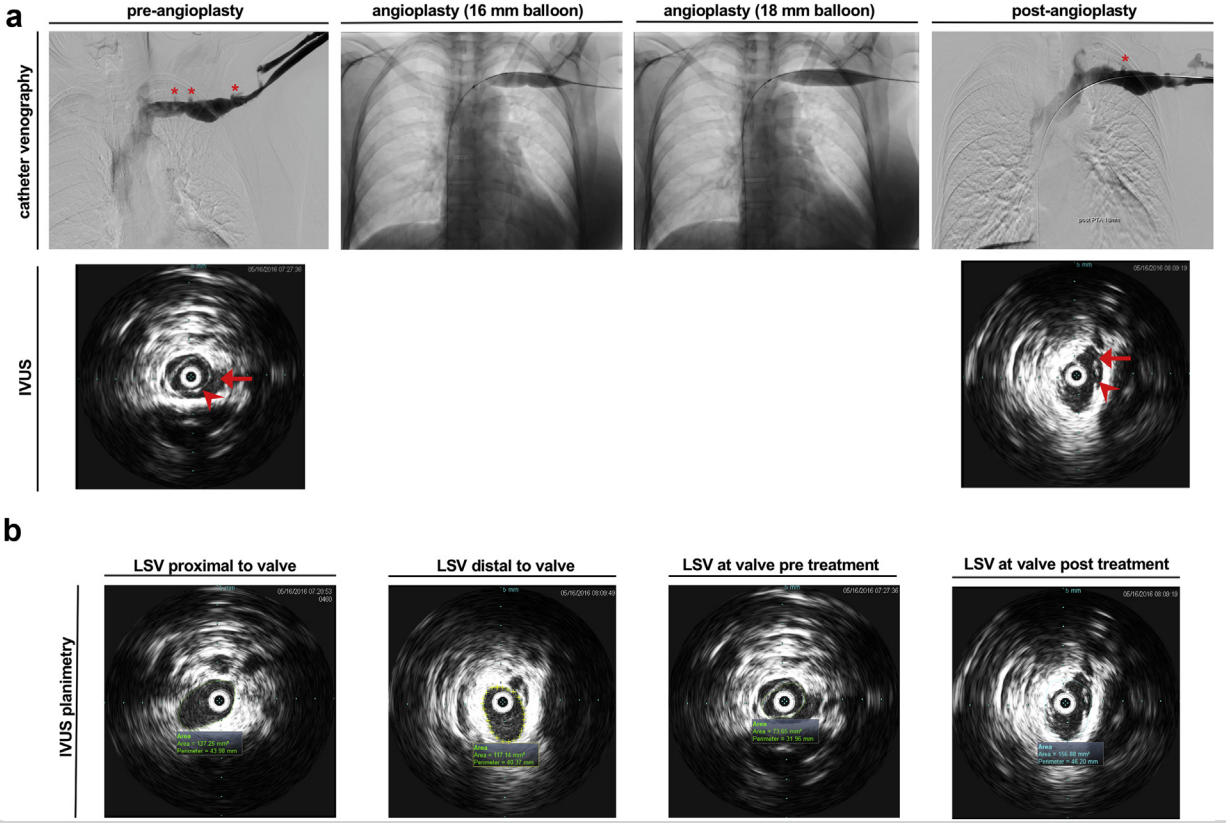

Fig 2. a, *Top*, Catheter venography images of the dilated left subclavian vein (*LSV*) before, during, and after angioplasty. A marked reduction in retrograde filling of tributaries is seen after angioplasty (*asterisk*). *Bottom*, Intravascular ultrasound (*IVUS*) images of the intact hypertrophied, calcified valve (*arrowhead*) before angioplasty and the disrupted valve (*arrow*) after angioplasty. **b,** Measurements of the LSV by IVUS planimetry proximal to the valve, at the valve, and distal to the valve.

performed to further evaluate for vascular disease (ie, venous malformation) or masses leading to venous compression (Fig 1). CTV revealed numerous dilated veins within the left-sided chest wall and supraclavicular fossa and a markedly dilated left subclavian vein (LSV) with a stenosis in the mid LSV. Multiple phleboliths within the left supraclavicular fossa were also noted, measuring up to 1.2 cm. Neck veins were patent without occlusion or stenosis.

The differential diagnosis of the dilated LSV included a venous malformation and an arteriovenous fistula secondary to a traumatic shear injury. Further evaluation with computed tomography angiography disproved the diagnosis of arteriovenous fistula. With no clear explanation for the physical examination findings, the patient underwent catheter venography of the left upper extremity and central veins. Venography revealed multiple varicosities arising from the LSV coursing toward the

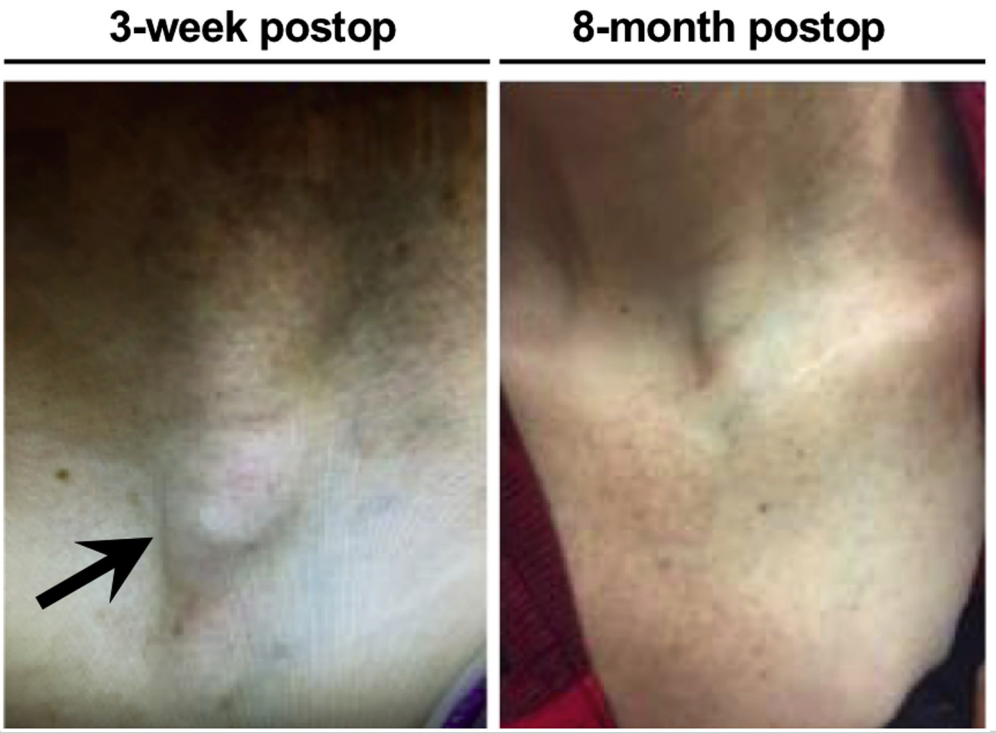

Fig 3. Photographs of the lesion at 3-week and 8-month follow-up visits demonstrate almost complete regression of the varicosity at 8-month follow-up. The *arrow* indicates the bulge of the varicosity.

left side of the neck (Fig 2, *a, top*). The remainder of the left upper extremity and central veins were normal. A focal stenosis in the mid LSV appeared to be <50% and was of unknown etiology.

IVUS was performed and revealed a calcified, hypertrophied valve at the site of the stenosis (Fig 2, *a, bottom*). The measurements of the LSV using IVUS planimetry were 137 mm^2, 73 mm^2, and 117 mm^2 proximal to the valve, at the valve, and distal to the valve, respectively (Fig 2, *b*). The patient underwent balloon valvuloplasty, given her symptoms and recalcitrance of the varicosity to previous surgical excision. Based on the IVUS measurements, 14-mm and 16-mm Atlas balloons (Bard Medical, Murray Hill, NJ) were inflated to the maximum pressure. Postdilation IVUS revealed an incompletely disrupted valve, so an 18-mm Atlas balloon was carefully inflated to the nominal pressure (Fig 2, *a, top*) to minimize the risk of rupture. If rupture had occurred, balloon tamponade would have been the initial therapy, followed by stent graft placement if necessary. Repeated venography revealed a significant improvement in the stenosis without evidence of rupture. Subsequent IVUS evaluation after valvuloplasty revealed complete disruption of the hypertrophic valve with luminal enlargement of the LSV at this level (Fig 2, *a, bottom*). Post-treatment IVUS planimetry revealed a subclavian vein area of 157 mm^2 (Fig 2, *b*). Final venography revealed no significant residual stenosis with persistent but decreased filling of venous collaterals (Fig 2, *a, top*). The patient tolerated the procedure without complication. Post-treatment anticoagulation was not given because the patient had a focal abnormality without scar tissue or suggestion of prior chronic venous thrombosis based on venographic and IVUS findings.

At the follow-up visit 3 weeks later, the patient noted that her symptoms had significantly improved despite no change in the appearance of the varicosity. At 8-month follow-up, her symptoms had completely resolved, and the varicosity was only minimally visible (Fig 3). The patient was now able to bend over and to perform yoga without pain in her neck. She also had a significant reduction in pain and tenderness at the location of the varicosity. In efforts to minimize cost and the patient's exposure to radiation from cross-sectional imaging, no postprocedural imaging was performed, given the improvement in symptoms. In-office duplex ultrasound was attempted but could not visualize the treated area. Because of the distance from our center, the patient was instructed to follow up only if she experienced recurrence of symptoms. To the time of writing, 3 years have elapsed since the procedure and the patient remains without symptoms and the varicosity has completely resolved. Should her symptoms recur, the intended plan is to re-treat with valvuloplasty as stenting in this region is not ideal and subjects the patient to risks of stent fracture and thrombosis. Whereas repeated phlebectomy can be performed, the patient preferred this minimally invasive approach with comparatively little to no recovery period.

DISCUSSION

Presented herein is a report of a healthy 56-year-old woman with recurrent neck vein varicosity that was manifested as a bulging, tender neck mass. Ultrasound

and CTV both indicated venous stenosis but were unable to reveal the underlying cause of the varicosity or the stenosis. Diagnostic catheter venography confirmed mild stenosis, and IVUS revealed that the cause of the abnormality was a hypertrophied valve leaflet in the distal LSV.

Central venous stenosis (CVS) is commonly secondary to hemodialysis catheter placement and the presence of implantable cardiac defibrillators and pacemakers.[6] Other causes of CVS can include extrinsic compression, peripherally inserted central catheters, prior upper extremity venous thrombosis, neoplasm, sequelae of radiation therapy, and thoracic outlet syndrome.[7] CVS secondary to traumatic injury, as presented here, is exceedingly rare but has been reported in arm hyperabduction.[8] In addition, we found one previously reported case of hypertrophied venous valves as the cause of venous stenosis.[7] This case is likely to be the result of a traumatic shear-type injury to a valve in the distal LSV that subsequently calcified and hypertrophied. Wilder et al[9] described a case of symptomatic subclavian vein stenosis due to hypertrophy of a subclavian vein, suggesting that hypertrophic valves may be a rare but possible cause of venous stenosis.

CONCLUSIONS

In the lower extremities, varicosities most often arise from the superficial venous system. However, varicosities can also be a sign of deep venous disease as exemplified in this case. Whereas ultrasound, CTV, magnetic resonance venography, and catheter venography are commonly used to evaluate the deep venous system, IVUS is increasingly being used to diagnose disease in both the arterial and venous systems. In particular, IVUS can be especially useful in assessment of the vessel wall, atheromatous plaque or venous synechiae, and valvular abnormalities.[10] In addition, it can be used to assess and to confirm successful intervention, as described in this report. Although use of IVUS may increase the cost of a procedure, the potential savings of avoiding unnecessary repeated procedures, such as repeated phlebectomy in this case, may economically justify it in certain cases. Finally, this report confirms previous evidence that hypertrophied valves may play a rare but important role in the development of venous stenosis and should be considered in the differential diagnosis.

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