Management of Subclavian Vein Thrombosis With Mechanical Thrombectomy

A case description of a young athlete treated with mechanical thrombectomy and low-dose thrombolytics in a single session.

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Subclavian vein thrombosis secondary to thoracic outlet syndrome (TOS) is an increasingly common complication in competitive athletes and can result in significant swelling, pulmonary embolism, and, rarely, death. Venous TOS occurs in about 10% to 15% of all cases of TOS[1] and is most common in young, active individuals involved in repetitive upper extremity movement, which causes venous intimal damage that promotes thrombogenesis. Other common etiologies of venous TOS are the presence of bony protuberances, primarily the first rib or clavicle that compress the vein, and obesity or tumors in the chest with external compression of the vein. The most common symptoms that develop in the arm, neck, and shoulder are extremity swelling, poikilothermia, pallor, dull pain, cyanosis, and occasionally pulselessness when associated with arterial thrombosis. Mortality rates for upper extremity deep vein thrombosis (DVT) can be as high as 11%.[2] Subclavian vein thrombosis is treated with venous thrombolysis. Although results are good, thrombolysis is associated with bleeding complications, prolonged dwell times, and increased cost. In this article, we present the case of a 19-year-old lacrosse player with right upper extremity swelling and right subclavian vein DVT.

CASE PRESENTATION

A 19-year-old man presented with new-onset right upper extremity swelling and pain (Figure 1). He was a competitive college lacrosse player and had played for several years. He was admitted to the hospital for anticoagulation and thrombolysis through a right brachial approach. After 12 hours of thrombolysis, the clot was cleared, and the underlying stenosis of the vein at the thoracic out-

Figure 1. A 19-year-old man presented with upper extremity swelling and cyanosis.

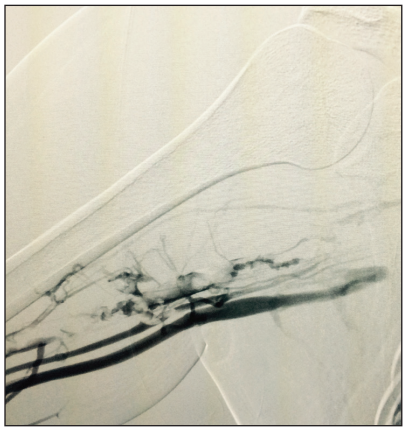

Figure 2. Initial venography of the right subclavian vein showed severe stenosis.

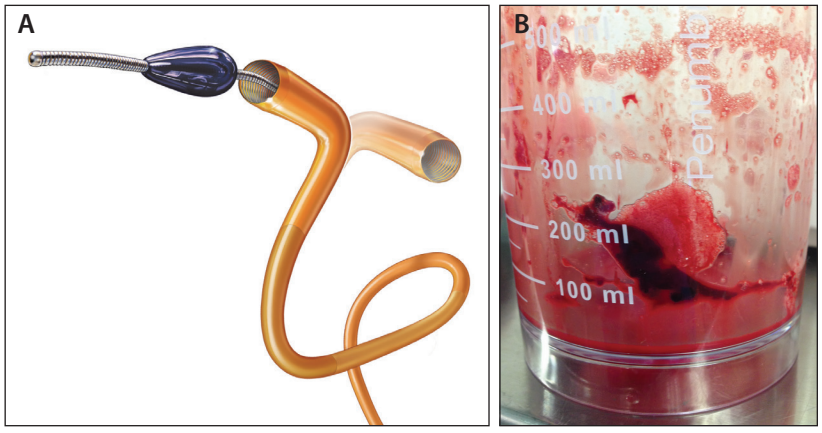

Figure 3. The Indigo CAT8 device with separator (A). Extracted clot from the case patient's right subclavian vein (B).

let was treated with percutaneous transluminal balloon angioplasty.

Because the patient wished to resume playing lacrosse as soon as possible, we proceeded with a first rib resection, which was performed through a right supraclavicular approach without complication. Twenty-four hours after the rib resection, right upper extremity swelling recurred, and an ultrasound showed subclavian vein thrombosis. Repeat venography confirmed the findings (Figure 2). Given the recent first rib resection, we were concerned about the risk of postoperative bleeding with use of catheter-directed thrombolysis; therefore, 10 mg of tissue plasminogen activator (Roche Pharmaceuticals) was delivered to the clot. Access was gained via the basilic vein, and an 8-F, 11-cm-long sheath was placed. We then utilized the Indigo catheter CAT8 (Penumbra, Inc.), a mechanical thrombectomy device recently cleared by the US Food and Drug Administration for thrombus removal in arterial and venous systems, to aspirate the clot (Figure 3). A reinforced catheter is tracked to the lesion and then connected to the continuous vacuum pump to allow for large lumen aspiration of the thrombus. This catheter also has a directional component for circumferential aspiration of thrombus. Aspiration thrombectomy of the vein resulted in > 70% clot aspiration and resolution of the DVT (Figures 4 and 5). Repeat percutaneous transluminal angioplasty of the venous stenosis was again performed. The patient was anticoagulated, and a repeat ultrasound 3 weeks postintervention demonstrated a widely patent vein (Figure 6).

DISCUSSION

TOS is not as innocuous as previously thought and is diagnosed with increasing frequency. Acute symptoms can include venous gangrene and pulmonary embolism in 7%

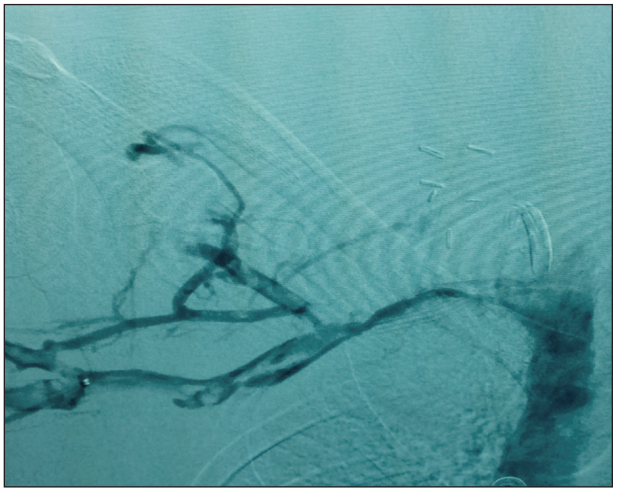

Figure 4. After initial use of the Indigo device, venography revealed residual stenosis present in the right subclavian vein.

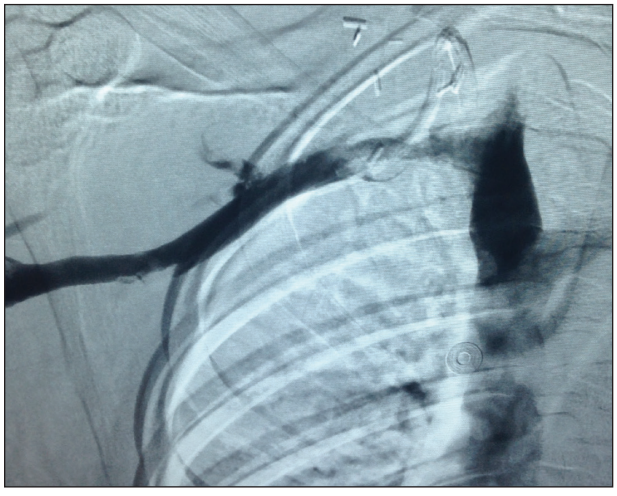

Figure 5. Completion venogram of the right subclavian vein demonstrated aspiration of > 70% thrombus burden.

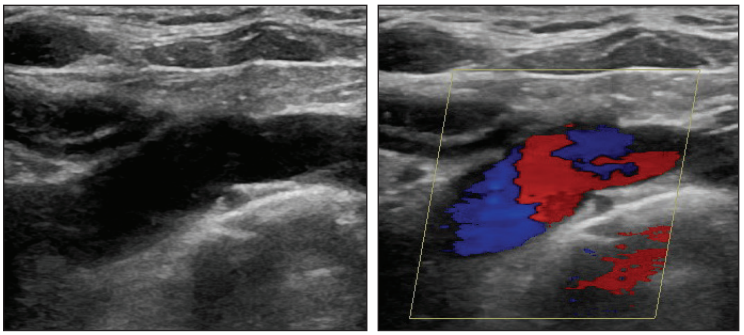

Figure 6. Follow-up ultrasound and duplex ultrasound demonstrating a widely patent vein.

to 20% of cases.[3-6] Long-term sequelae include postphlebitic symptoms in the upper extremity with functional disability in 25% to 40% of patients who are left untreated.[6,7] The long-term outcome depends on the extent of recanalization, underlying abnormality, collateral formation, activity level, and occupation.

This report highlights subclavian vein thrombosis and a potential new technique for rapid removal of acute clot in a single setting. Most patients experience severe symptoms with a poor response to anticoagulation, which is the mainstay therapy.[8] To prevent and minimize long-term complications, we intervene on most young active patients because we believe early removal of clot is important to decrease subsequent intimal scarring and fibrosis. Systemic thrombolysis has been largely abandoned due to the high incidence of bleeding complications.[9] However, the results of catheter-directed thrombolysis for upper extremity DVT are encouraging, regardless of etiology, with near-complete thrombus clearance in 72% to 88% of patients; the response is dependent mostly on the chronicity of the thrombus.[10-12] Current experiences support the safety profiles and efficacy of most of these treatments in patients with no contraindications to thrombolytic therapy. Unfortunately, the average duration of thrombolytic therapy is reported to be as high as 24 to 30 hours in the presence of extensive disease or large thrombus burden. In this case, the 19-year-old patient had extensive clot burden throughout the right subclavian vein and was treated well with catheter-directed thrombolysis in the first intervention.

The Indigo system consists of a catheter-separator device combination that is designed for thrombus removal in the peripheral arterial and venous systems. These catheters are reinforced to handle the continuous vacuum pump. The catheter construction consists of multiple material transitions that allow for pushability at the proximal end, while the distal end is soft and atraumatic. The Indigo catheters range from 3.4- to 8-F outer diameter and are sized based on vessel size and location of the clot. The separator technology allows for the catheter tip to remain unclogged for the duration of the procedure. This technology allows for mechanical thrombectomy with reduced and/or no lytic usage, thereby providing an option for patients with contraindications to or who are intolerant of overnight lytics, as in the case described.

CONCLUSION

The use of percutaneous mechanical thrombectomy followed by localized low-dose thrombolysis quickly and safely removed large clot burdens in upper extremity veins in a single procedure. This technique limited the amount and duration of thrombolytic agents required and was accomplished without complication. Additionally, as patients with subclavian vein thrombosis are typically contraindicated to thrombolytics after first rib resection, mechanical thrombectomy may be a viable option for these patients. ■

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