

SHORT REPORT

“Raking-in Technique:” Removal Of Brachiocephalic Vein Thrombus Using AngioVac[®] Device Within A Stented Venous Segment

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Introduction: A case is reported of left brachiocephalic vein thrombus removal using the Angiovac device within a stented venous segment via a through-and-through access technique.

Report: This novel technique involves obtaining through-and-through access from the left basilic vein to the right femoral vein, which then facilitates the advancement of the Angiovac device to successfully remove in a stepwise fashion the thrombus present within a stented region of the left brachiocephalic vein.

Discussion: The Angiovac device has been shown to be very useful and effective at removing large amounts of thrombus, tumor, and foreign bodies within arterial and venous systems successfully. This novel technique uses the through-and-through venous access approach to allow for this device to remain close to the targeted area of thrombus burden and prevent damage of the already existing stents in this region.

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Since its Food and Drug Administration (FDA) approval in 2009 for removal of soft thrombus or embolic material, the AngioVac cannula (AngioDynamics, Lathan, NY, USA) has been successfully used in the United States with multiple case series and reports available in the literature.^{1–3} The versatility of this device has helped broaden the indications to include cardiac vegetations, tumor thrombus, and foreign body extractions.^{4–6} However, its main indication continues to be the removal of right atrial, saddle pulmonary and ilio caval emboli.^{7–9} A novel technique is described of left brachiocephalic vein thrombus suction by using a through-and-through venous access in a stented segment of this vessel in an acutely symptomatic patient with left neck, chest, and breast edema.

CASE REPORT

A 50-year old female patient with a history of superior vena cava (SVC) syndrome and previously stented SVC using a kissing stent technique presented to the institution for the second time with symptomatic left brachiocephalic vein

stent thrombosis while on subtherapeutic (INR 1.5) anti-coagulation (Fig. 1). The distal one-third of the stent in the left brachiocephalic vein was patent and allowed for venous drainage through multiple tributaries as demonstrated in the figure. Although drainage was provided through these tributaries, the patient was admitted after 48 hours of acutely developing edema of the left neck, chest, and breast. The patient was started on a heparin infusion upon admission and prepared for mechanical thromboembolectomy using the AngioVac device.

TECHNIQUE

The operative intervention was performed under general anesthesia and systemic heparinization to an activated clotting time (ACT) > 300 ms. Owing to known potential difficulties cannulating the occluded kissing stent in the SVC through a femoral vein approach and a patent distal left brachiocephalic vein stent, access was initially obtained through the left basilic vein. This initial approach assured us that the angled-glidewire (Terumo, Somerset, NJ, USA) remained within the lumen of the stents and not either outside of the stents or through the stent-struts. Once within the stents, the glidewire easily traversed the acute thrombus of the stented area and was then maneuvered to the inferior vena cava. This wire was then retrieved through the right femoral vein using an Ensnares (MeritMedical, South Jordan, UT, USA), thus obtaining through-and-through venous access from the left basilic vein to the right femoral vein.

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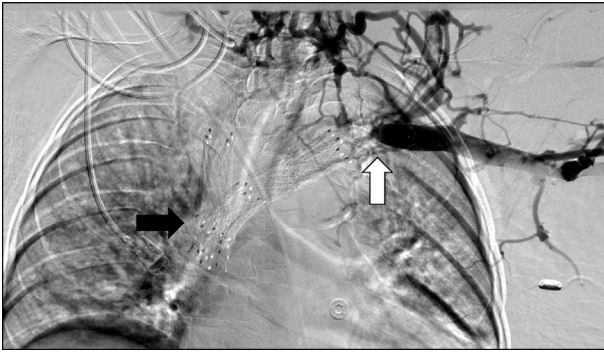


Figure 1. Venogram demonstrating occluded left brachiocephalic vein stent (white arrow) and kissing stents in the superior vena cava (black arrow).

The AngioVac device was inserted via the right femoral vein over the guidewire and advanced to the area proximal of the kissing stents in the SVC. Then, a 10 mm in diameter by 20 mm in length balloon was used to sequentially “rake-in” the thrombus proximally towards the AngioVac device (Fig. 2), which was concurrently suctioning the venous drainage and thrombus through the extracorporeal circuit. All thrombus pieces were caught in the filter reservoir of the AngioVac system (Fig. 3). After several passes with the balloon, venography demonstrated stenosis of the left brachiocephalic vein stent, which was angioplastied with an excellent venographic end result (Fig. 4).

The patient demonstrated improvement of her symptoms within the first 24 hours after the procedure; the left neck, chest, and breast edema had all resolved. She will remain on anticoagulation therapy to prevent re-thrombosis of the stents. At the 3-month ultrasound follow-up, all stents were patent. This procedure may be required to be repeated as long term durability is unknown.

DISCUSSION

This is the first documented case in which this device has been used to successfully retrieve thrombus within a stented region via a through-and-through venous access to maintain intraluminal position of the balloon performing

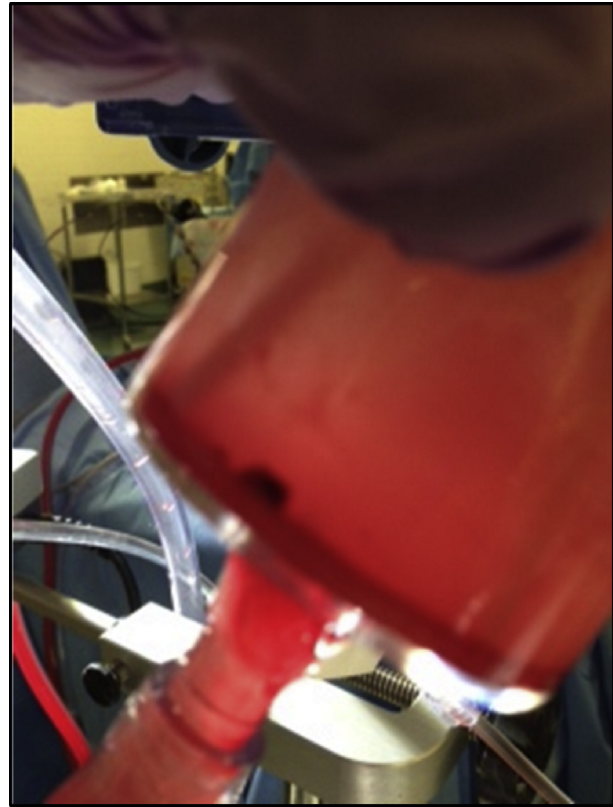


Figure 3. Photograph of the filter reservoir from the AngioVac system demonstrating small pieces of thrombi.

the “raking-in” of the thrombus within the stented region of the vessel.

It is understood that there could be questionable durability of the current procedure when this patient presented to the institutions on her second episode of stent thrombosis. The first event was presumed to be due to subtherapeutic anticoagulation treatment. Therefore, during the current hospitalization, the patient underwent a hematologic consultation for a possible pro-thrombotic state and further cardiac surgery consultation for counseling regarding the necessity of a future open procedure to

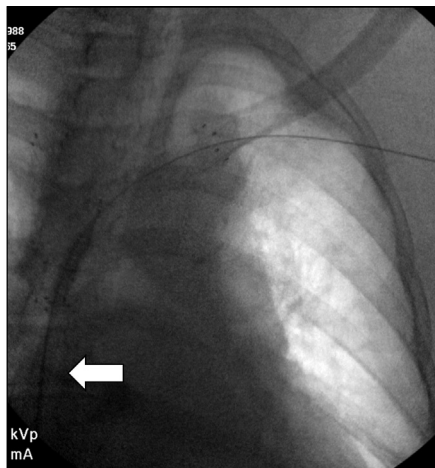
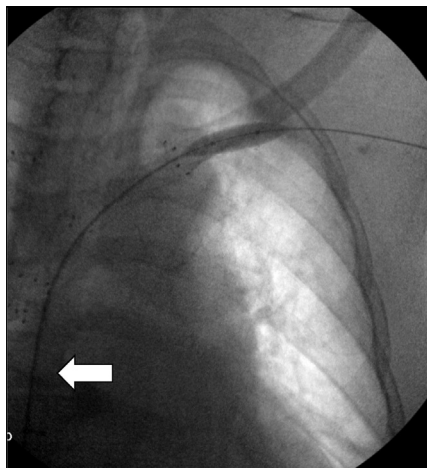


Figure 2. Actual “raking-in” of the thrombus burden towards the AngioVac device (white arrow) using a 10 mm × 20 mm balloon.

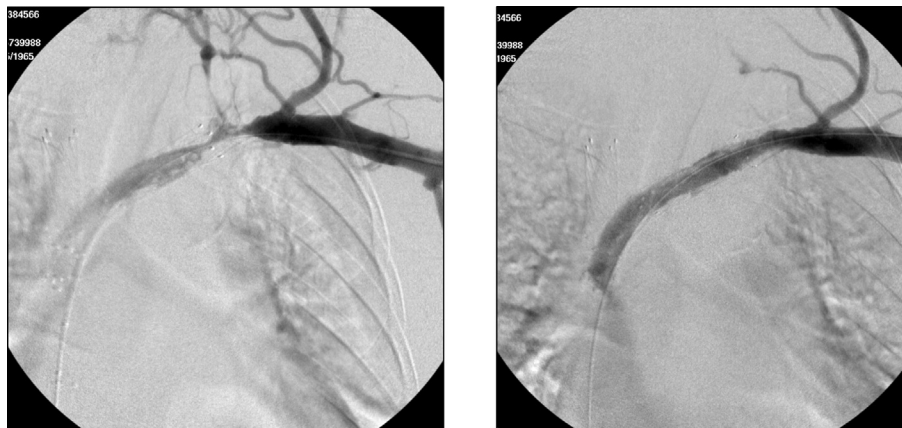


Figure 4. Venogram before and after angioplasty of the left brachiocephalic vein stent.

patch/bypass the stenotic/stented area. However, with the myriad possibilities and continued progress/advancement in the endovascular world, the AngioVac device proved to be safe and feasible in the treatment of this patient. If recurrence should occur, the open option will be revisited, especially in light of the patient's young age.

The AngioVac device has clearly demonstrated safety and effectiveness at removing all sorts of foreign material within the arterial and venous system (thrombus, tumor, filters).^{2,4-6} The currently presented novel technique, demonstrates its safety within thrombosed stented vascular regions with an excellent immediate venographic and clinical outcome.

CONCLUSION

This novel technique uses the through-and-through venous access approach to allow for this device to remain close to the targeted area of thrombus burden and prevent damage of the already existing stents in this region.

CONFLICT OF INTEREST

None.

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REFERENCES

- 1 Donaldson CW, Baker JN, Narayan RL, Provias TS, Rassi AN, Giri JS, et al. Thrombectomy using suction filtration and veno-

venous bypass: single center experience with a novel device. *Catheter Cardiovasc Interv* 2015;**86**(2):E-81–7.

- 2 Monastiriotis S, Gonzales C, Kokkosis A, Labropoulos N, Bilfinger T, Tassiopoulos AK. The use of AngioVac for symptomatic aortic thrombus complicated by mesenteric ischemia. *Ann Vasc Surg* 2016;**32**:129.e1–6.
- 3 Hosoba S, Mori M, Furtado AD, Lattouf OM. Extraction of right-sided vegetation with use of an aspiration catheter system. *Innovations* 2015;**10**:357–9.
- 4 Makdisi G, Casciani T, Wozniak TC, Roe DW, Hashmi ZA. A successful percutaneous mechanical vegetation debulking used as a bridge to surgery in acute tricuspid valve endocarditis. *J Thorac Dis* 2016;**8**(1):E137–9.
- 5 Scher D, Nghiem W, Aziz S, Rahbar R, Banks W, Venbrux A, et al. Endometrial stromal sarcoma metastatic from the uterus to the inferior vena cava and right atrium. *Tex Heart Inst J* 2015;**42**(6):558–60.
- 6 Sticco A, Worku B, Gulkarov I, Tortolani AJ, D'Ayala M. Endovascular treatment of a thrombosed intracardiac vena cava filter. *J Vasc Surg Venous Lymphatic Disord* 2014;**2**(4):455–7.
- 7 Renew JR, Wittwer ED, Robb TM, Fritock MD. AngioVac removal of a saddle pulmonary embolus using TEE guidance and venoarterial ECMO support. *J Cardiothorac Vasc Anesth* 2016;**30**(3):749–52.
- 8 Johnson AM, Bjarnason H, Shields R, Shih H, McBane R, De Martino RR. Removal of floating inferior vena cava thrombus with the AngioVac device. *Vasc Med* 2015;**20**(2):190–2.
- 9 Grimm JC, Parsee A, Brinker JA, Birenbaum I, Biewer JE, Sheinberg RB, et al. Utilization of AngioVac and snare for eradication of a mobile right atrial thrombus. *Ann Thorac Surg* 2015;**99**(2):698–700.