Use of AngioVac in the Removal of Deep Venous Thrombi

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The AngioVac aspiration system (AngioDynamics) is a vacuum-operated thrombectomy apparatus designed for en bloc removal of large clot burdens. It employs a 22 Fr suction cannula together with a venous return cannula connected to an extracorporeal veno-venous bypass circuit. The vacuum-operated design is intended to reduce the risk of bleeding and hemolysis associated with fibrinolytic and rheolytic systems, respectively. Here, we discuss four cases where AngioVac was used to treat deep venous thrombosis.

The first case was a 73-year-old male who presented with persistent abdominal pain and was found to have a gastric neoplasm with concomitant left lower extremity (LE) deep vein thrombosis (DVT) on initial workup. A Meridian inferior vena cava (IVC) filter (Bard Peripheral Vascular) was placed prior to undergoing complete gastrectomy. After the surgery, extensive thrombosis involving the external iliac veins (EIV) bilaterally and the IVC, including thrombosis within and 2 cm cranial to the filter, was discovered (Figure 1A). Mechanical thrombectomy using AngioVac was undertaken.

First, a 16 Fr FemFlex reinfusion cannula (Edwards Lifesciences) was placed into the left internal jugular vein (IJV) under ultrasound guidance. Next, a 26 Fr Gore DrySeal sheath (Gore & Associates) was advanced over a 0.035” Amplatz guidewire in the right IJV. The 22 Fr AngioVac cannula was then placed through the sheath and advanced into the IVC under fluoroscopy. The thrombus component cranial to the filter was first aspirated.

The AngioVac cannula was then placed in the supra-renal IVC under continuous suction as the IVC filter was removed through a separate ipsilateral IJV access.

Figure 1. Digital subtraction angiography with the catheter positioned in the left external iliac vein shows thrombus throughout the iliofemoral system (A). The AngioVac cannula is guided to the left external iliac vein over an Amplatz guidewire placed in the left common femoral vein (B). Completion venogram shows patency of the inferior vena cava and common iliac veins (C).
The infrarenal IVC thrombus was subsequently aspirated; removal was confirmed with sequential venograms. Following this, a Cleaner mechanical thrombectomy device (Rex Medical) was advanced through bilateral common femoral vein (CFV) access sites to macerate thrombi in bilateral EIVs and internal iliac veins (IIV) using 10 mm x 4 cm and 15 mm x 4 cm balloon catheters. A 0.035˝ guidewire was then advanced through femoral access into the AngioVac cannula to guide it to the distal EIV for thrombus aspiration (Figure 1B). This was repeated on the opposite side. Completion venogram demonstrated minimal residual mural thrombus in the infrarenal IVC (Figure 1C); removal was Grade 2 (50% to 95% elimination) as per the Society of Interventional Radiology (SIR) grading system. The only complications were hematomas of the neck which cleared within a week.

Case 2 was a 68-year-old male with a past medical history of HIV, HCV, and treated prostate cancer who presented with acutely worsening bilateral LE edema and pain after 9 months of treatment with IVC filter and anticoagulation for IVC thrombosis. Imaging on presentation revealed total iliocaval thrombosis. After the decision to use the AngioVac, a 26 Fr DrySeal sheath was placed in the right IJV; a venogram confirmed thrombus in the IVC and left common iliac vein (CIV), and demonstrated deformity of the right CIV from chronic thrombosis. The AngioVac was advanced through the right IJV and into the IVC and left CIV for thrombus aspiration. It could not be advanced through the right CIV because of the aforementioned irregularity. Instead, a right CFV access was created for angioplasty of the right CFV, EIV, and CIV using a 10 mm x 4 cm Conquest balloon catheter (Bard Peripheral Vascular) with the AngioVac turned on for suctioning of dislodged thrombi. Thrombus removal was Grade 2. There were no complications.

Case 3 was a 66-year-old female with a superior vena cava (SVC) thrombus discovered on staging CT for bladder cancer (Figure 2A). Further analysis revealed a possible thrombus pedicle extending into the tip of a left-sided PICC line catheter. She was placed on anticoagulation, but she subsequently developed significant hematuria which precluded further anticoagulation. Furthermore, SVC thrombus prevented
bladder surgery under general anesthesia; therefore, SVC thrombectomy was performed with AngioVac. A right IJV venogram showed floating filling defect of the SVC, which was also seen on transesophageal echocardiogram (TEE) performed by the anesthesia team (Figure 2B). AngioVac was placed into the right CFV and advanced into the SVC for thrombectomy monitored via fluoroscopy and TEE. The TEE showed significant reduction of the clot with minor residual mural thrombi. Subsequent superior venacavogram showed improvement in vessel patency with elimination of the initial free-floating filling defect (Figure 2C and 2D). Thrombus removal was Grade 2. There were no complications.

The last case was a 63-year-old man who presented with lightheadedness and was found to have a 3.1 cm x 2.1 cm x 1.8 cm thrombus of the posterior right atrial wall in close proximity to the Eustachian valve on 2-D echocardiogram and cardiac computed tomography. Numerous smaller thrombi along the tunneled hemodialysis catheter were also seen. The AngioVac cannula was inserted in the right CFV after first steaming and then cooling the tip to impart a smooth curve, and then guided along the dialysis catheter. Upon entering the right atrium, there was reduction of the thrombus as per TEE. The thrombus was not fully removed with AngioVac. An endoscopic snare (Sensation; Boston Scientific) was then advanced via the Y slide arm of the AngioVac cannula with the pump off and guided to the thrombus using TEE and fluoroscopy, but it failed to remove residual thrombus. Thrombus removal was Grade 1 (0% to 50%). The patient remained on anticoagulation with no complications from the procedure.

Overall, the AngioVac system was successfully implemented without serious complications from bleeding or hemolysis in every case. However, this may be secondary to a scrupulous selection of AngioVac candidates rather than a reflection of its safety. With regards to its efficacy, the AngioVac system removed >50% of clot burdens in all vascular beds except for the right atrium. It is also worth noting that the AngioVac system was not able to remove clot burdens in the iliac beds without the use of ancillary devices. As a whole, the findings imply that AngioVac is efficacious as a primary thrombolysis device in the IVC and SVC, effective as an ancillary device in the iliac bed, and inadequate in the atrial bed.

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