Case Reports

En Bloc AngioVac Removal of Thoracic Aortic Mass

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The AngioVac system, designed for suction during extracorporeal bypass, is used to aspirate masses, thrombi, and other undesirable material from the cardiovascular system. To date, it has been used extensively in the venous system and right side of the heart; however, its use in the arterial system has been limited because of smaller vessel sizes and the requirement for a 26F sheath.

We report the case of a 45-year-old woman with a history of angiosarcoma who presented with acute embolic events that affected her spleen and lower extremities. We removed a large mobile mass en bloc from her distal thoracic aorta by using the AngioVac system as an alternative to surgical resection. The patient recovered with no recurrence. We discuss the benefits and challenges of using the AngioVac within small vessels of the arterial system. ***(Tex Heart Inst J 2020;47(4):315-8)***

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The AngioVac system (AngioDynamics, Inc.) is used to extract undesirable material from the cardiovascular system. A percutaneously inserted catheter is connected to a centrifugal pump that generates suction at the catheter tip. Two percutaneous vascular cannulation sites are needed, one for aspiration and one for reperfusion. Blood and débris drain through a filtration system that captures solid material while blood returns to the body through the reperfusion cannula. Since receiving United States Food and Drug Administration approval in 2009, the AngioVac has been used in the venous system and right side of the heart to treat right atrial masses, endocarditis, inferior vena cava thrombi, massive pulmonary emboli, infected pacemakers and implantable cardioverter-defibrillator leads, thrombosed conduits, and central catheter–associated thrombi.[1-10] To date, it has been used in the arterial system only once.[11] We report using it to remove a large thoracic aortic mass en bloc from a patient who presented with acute embolic events.

Case Report

A 45-year-old woman presented at a hospital with acute-onset abdominal pain, bilateral foot pain, and left foot weakness. Her medical history included surgical excision of an angiosarcoma from her left leg 3 years earlier and subsequent radiotherapy. Her medical history also included systemic lupus erythematosus, chronic obstructive pulmonary disease, and tobacco use. Physical examination revealed discolored distal toes on her left foot and nonpalpable dorsalis pedis and posterior tibial pulses. The result of a complete hypercoagulability evaluation was negative. Computed tomographic angiograms (CTAs) showed a nonocclusive mobile mass in her distal thoracic aorta, and emboli in her spleen and legs (Fig. 1).

The patient was transferred to our institution for possible surgery to remove the thoracic mass. After consulting with a multidisciplinary team of vascular surgeons, cardiothoracic surgeons, and interventional cardiologists, we chose to remove the mass with the AngioVac system because of the patient's history of angiosarcoma and possible recurrent malignancy. Furthermore, the nature of the mass was unknown, so neither anticoagulation nor pharmacologic thrombolysis was considered.

We obtained CTAs and other images of the patient's abdominal and pelvic vessels to determine the appropriate site for arterial access, using axial images to measure minimal luminal vessel diameters as though for transcatheter aortic valve replacement (Fig. 2).[12] The patient's common femoral arteries (CFAs) were small, so we anticipated

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vessel dissection and perforation from sheath placement. Therefore, as a precaution, we obtained covered stents, self-expanding stents, and a Coda balloon (Cook Medical Inc.). We considered distal protection and balloon occlusion of the distal aorta and iliac arteries as potential methods to lower the risk of embolization, but ultimately decided to advance the AngioVac catheter slowly toward the aortic mass under direct guidance by transesophageal echocardiography (TEE).

In the cardiac catheterization laboratory, the patient was placed under general anesthesia and intubated. We inserted 6F sheaths into the left CFA and left common femoral vein. The left common femoral vein was progressively dilated, and a 17F cannula (Medtronic) was inserted. Under angiographic and fluoroscopic guidance, the right CFA was punctured and a 6F sheath inserted. Two Perclose ProGlide devices (Abbott Vascular) were placed. A 0.035-in SupraCore 35 Guide Wire (Abbott Vascular) was inserted, the subcutaneous tissues were dilated gradually, and a 26F Gore DrySeal Flex Introducer Sheath (W.L. Gore & Associates, Inc.) was inserted. Unfractionated heparin was given to achieve a target activated clotting time of 250 seconds. The AngioVac system was prepared, and its arterial and venous cannulas were de-aired. Under fluoroscopic and TEE guidance, the AngioVac catheter was advanced just distal to the mass (Fig. 1). Pump speed was progressively increased to flow rates of 4.5 to 5 L/min, and the catheter was advanced toward the mass. On first pass, the mass was no longer apparent on TEE, and a large amount of débris was seen in the AngioVac filter. Two additional passes were made, and the AngioVac catheter was removed. The 26F sheath and Perclose devices were removed. Angiography showed a flow-limiting dissection in the right external iliac artery, which was repaired with use of 2 Absolute Pro Vascular Self-Expanding Stents (Abbott Vascular). The venous cannula was removed, and figure-of-8 sutures were placed. The procedure lasted 60 minutes.

The filtered débris, sent en bloc for pathologic evaluation, was confirmed as a nonmalignant thrombus. The patient was discharged from the hospital in stable condition after a 6-day stay. Eleven months after the procedure, CTAs showed a normal thoracic aorta and no recurrent thrombus.

Discussion

The AngioVac catheter requires a 26F sheath, which in turn requires a vessel diameter of approximately 9.5 mm. This has limited the use of the AngioVac to the venous system. However, Monastiriotis and colleagues[11] used it in the arterial circulation of a patient with mesenteric ischemia who had a paravisceral aortic thrombus involving the celiac and superior mesenteric arteries. Arteriovenous bypass was achieved through the right

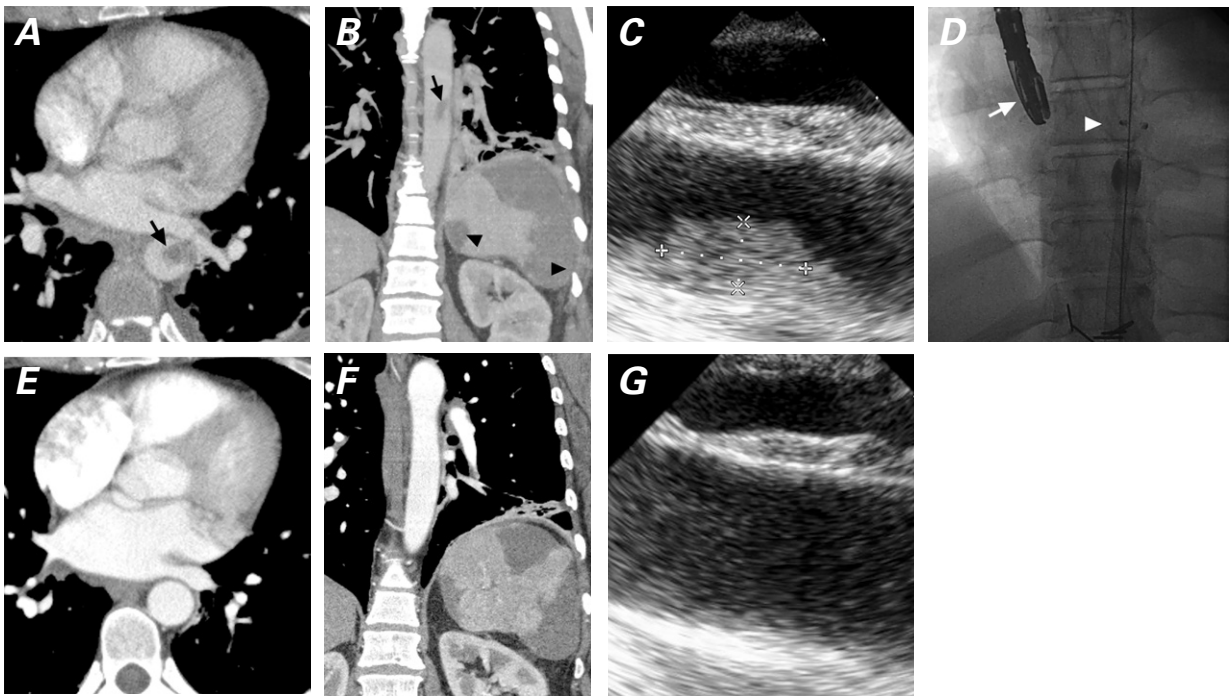

Fig. 1 *Preprocedural computed tomographic angiograms (CTAs) of the descending thoracic aorta show* ***A****) a noncalcified mass (arrow) (length, 22 mm; cross-sectional diameter, 11 × 15 mm), in the axial view, and* ***B****) the mass extending into the lumen of the thoracic aorta (arrow), as well as multiple splenic infarctions (arrowheads), in the sagittal view.* ***C****) Transesophageal echocardiogram (TEE) shows the mass.* ***D****) Fluoroscopic view shows the TEE probe (arrow) and AngioVac catheter (arrowhead) in the descending thoracic aorta. Eleven months later, CTAs show no residual mass in the* ***E****) axial and* ***F****) sagittal views.* ***G****) Postprocedural TEE shows no residual mass.*

CFA and left common femoral vein. The AngioVac partially extracted the aortic thrombus as it was advanced into the superior mesenteric artery. The procedure was complicated by right external iliac artery dissection that necessitated stent-graft repair.

When large-bore arterial access has been needed for procedures such as transcatheter aortic valve replacement and thoracic endovascular aortic repair, vascular conduits and various forms of advanced angioplasty and stenting have been applied.[13-15] Using an internal endoconduit with controlled iliac artery rupture may be one way to maneuver through small femoral vessels.[16] In this technique, covered stents are placed within the common iliac artery, extended into the CFA, and aggressively dilated with 10- and 12-mm noncompliant balloons to expand vessels to diameters of 10 or 11 mm. Using noncompliant balloons results in controlled rupture of the iliac and femoral vessels, creating proximal seals in the common iliac arteries and distal seals in the CFAs through use of the covered stents. To our knowledge, these advanced techniques have not been applied during AngioVac procedures.

The AngioVac can effectively remove suspicious masses for pathologic evaluation. This was particularly

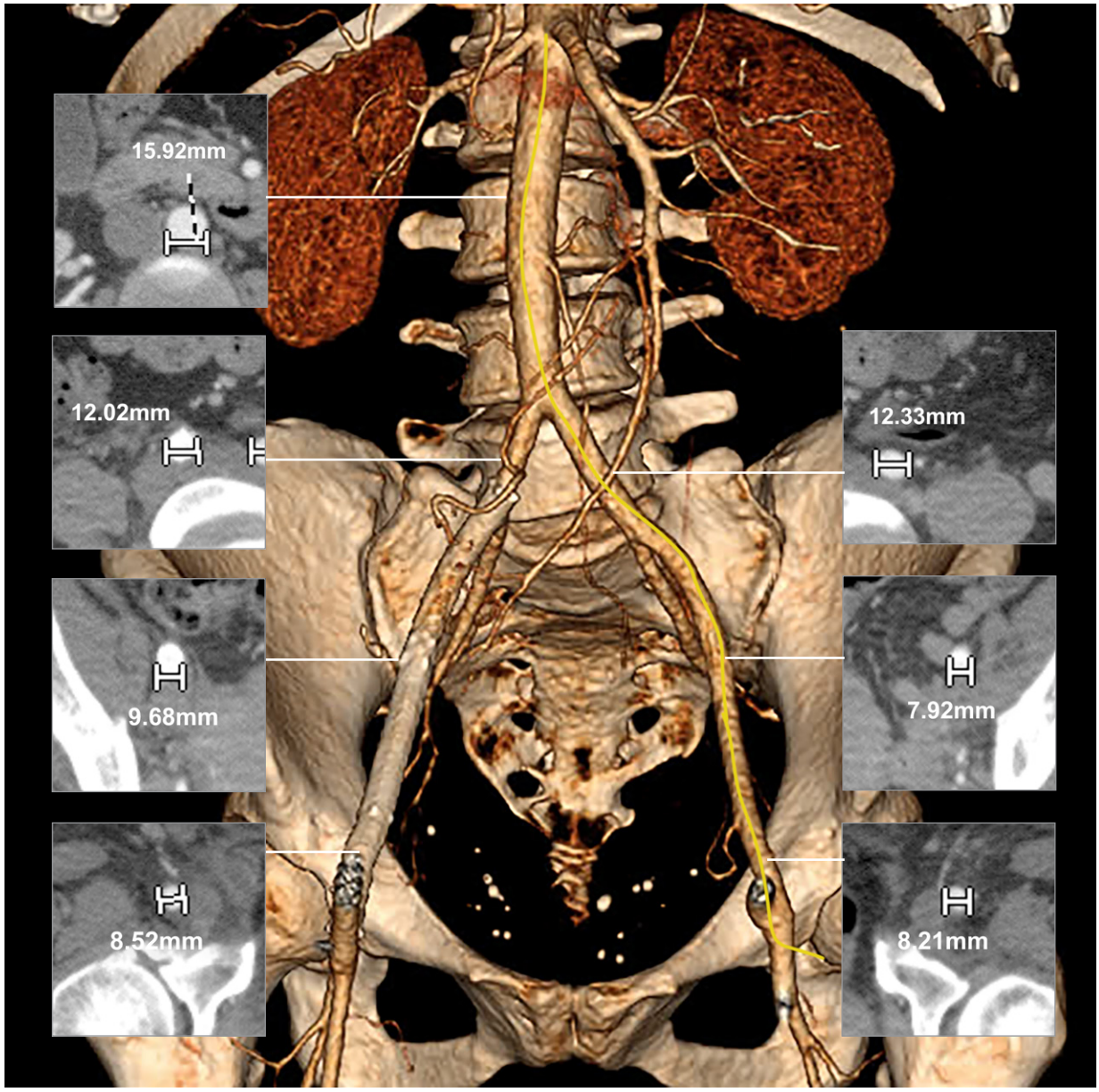

Fig. 2 *Preprocedural abdominal and pelvic computed tomographic angiograms, in 3-dimensional multiplanar reconstruction (main image) and axial views (insets) enabled evaluation of vessel size, disease status, tortuosity, and possible vascular disease. The planned access site, the right common femoral artery (diameter, 8.52 mm), had no substantial disease or calcification. Yellow line indicates the centerline of the aorta and the left common and external iliac and common femoral arteries.*

important in our patient's case, given her history of malignancy and the location of the mass within the thoracic aorta.

The AngioVac has proved safe and effective in a variety of clinical indications. With additional experience, extending its use in the arterial circulation may be possible.

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