CASE REPORT

Endovascular extraction of right atrial thrombus with the Angiovac System. *cor absque anima nigrum* Case Report

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The approach of a right atrial thrombus could be challenging, there is a delicate balance risk/benefit between the thrombolytic therapy and mechanical or open thrombectomy. The AngioVac System (Vortex Medical, Norwell, MA) provides an innovative mechanical thrombectomy with promising results. The circuit typically includes a right internal jugular cannula for aspiration, distal venous access for reinfusion, extracorporeal tubing, and a filtration canister. We present a case of a right atrial thrombus, empyema and no pulmonary embolism, treated with the AngioVac Aspiration System.

Key words: **AngioVac System; Atrium; Right atrial thrombus; Thrombus.**

El abordaje del trombo de la aurícula derecha puede ser un verdadero reto, hay un delicado balance riesgo/beneficio entre la terapia trombilitica, la trombectomía mecánica percutánea o la cirugía. El sistema Angiovac ofrece un innovadora técnica de trombectomía mecánica con resultados prometedores. El circuito incluye una canula de aspiración insertada a través de la vena yugular interna, un canula distal accesoria para reinfusion sanguínea, tubería extracorpórea y un filtro/reservorio. Presentamos un caso de un trombo atrial derecho, sin embolismo pulmonar, con empiema , tratado con el sistema de aspiración Angiovac (Vortex Medical, Norwell, MA) .

***Palabras clave*: AngioVac System; Aurícula; Trombo auricular derecho; Trombo.**

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Although there are multiple etiologies for a right atrial thrombus, once diagnosed, an assessment of patient-specific factors will dictate the appropriate management. Thrombolytic therapy might not result in complete resolution of the clot burden and could lead to embolic events, specially in chronic cases. A careful evaluation of the balance between the risks of each procedure versus specific advantages should be considered on an individual basis. Accordingly, we present a case of a right atrial thrombus associated with empyema, not amenable to medical therapy that was succesfully removed with an AngioVac Aspiration System (Vortex Medical, Norwell, MA).

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CLINICAL CASE

A 55-year-old male presented with dyspnea on exertion and right sided chest pain to an outside hospital. He was hypoxic on presentation requiring supplemental oxygen but was otherwise hemodynamically stable. His past medical history included alcohol abuse, hepatitis B, chronic pancreatitis, pancreatic pseudocyst and hypertension. EKG revealed normal sinus rhythm at 75 bpm. A large right-sided loculated pleural effusion was seen on chest X-ray. Laboratory tests revealed leukocytosis 26,000 per microliter of blood, normocytic anemia with hemoglobin of 10.6 gm/dL, lipase of 5.9K, amylase of 1.5K.

Echocardiogram was significant for ejection fraction >55%, a large right atrial mass measuring 4 x 0.9 cm. Thoracentesis drained 1.5 L of turbid fluid with cultures unrevealing of any growth, fluid amylase was elevated to 30140 raising a concern for pancreato-pleural fistula. He was treated with broad spectrum antibiotics to cover for possible infection.

Figure 1. Transesophageal echocardiogram with large right atrial thrombus attached to the right atrial wall

In the interim, he also tested positive for heparin induced thrombocytopenia.

Transesophageal echocardiogram revealed large right atrial thrombus attached to the right atrial wall without involvement of coronary sinus, superior vena cava or tricuspid valve (**Fig. 1**). Cardiac CT revealed a stellate shaped persistent filling defect within the right atrium with multiple arms extending into the right atrial appendage, tricuspid valve orifice and partial extension into the inferior vena cava, most consistent with right atrial thrombus (**Fig. 2**) along with loculated right sided pleural effusion. He underwent extraction of the clot using AngioVac catheter under fluoroscopy and TEE guidance. More than 90% of the clot was evacuated (**Fig. 3**) (**Fig. 4**). Pathology was consistent with fibrin rich thrombus. He underwent video assisted thoracoscopic washout and decortication for loculated pleural effusion.

On repeat echocardiogram 8 months after procedure, no right atrial thrombus could be visualized.

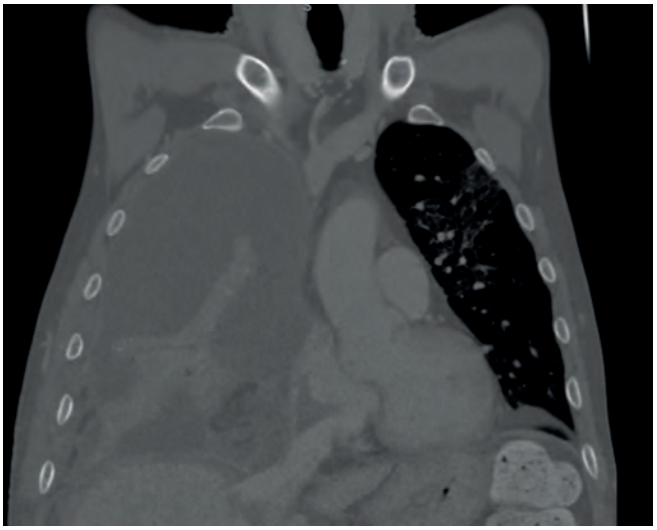

Figure 2. Loculated right sided pleural effusion. Stellate shaped persistent filling defect within the right atrium with multiple arms extending into the right atrial appendage, tricuspid valve orifice and partial extension into the inferior vena cava.

AngioVac System

The AngioVac System (**Fig. 5**) consists on 2 components:

an aspiration cannula (the AngioVac cannula) (**Fig. 6**) and an extracorporeal bypass circuit. The AngioVac cannula is a 22F coil-reinforced aspiration cannula with a balloon-actuated, funnel-shaped distal tip that is expandable and can open to 48F. The extracorporeal bypass circuit consists of an outflow line, a bubble trap with blood filter, Centrifugal pump with console, and a 16F-to-20F inflow line (reinfusion cannula).

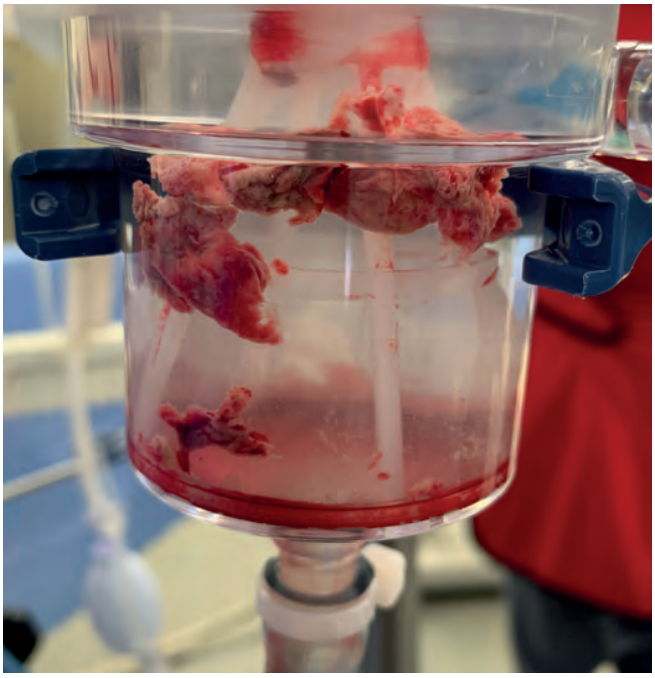

Figure 3. E Procedure result, demonstrating intravascular material trapped by the inline filter.

Surgical Technique

The site of cannula insertion depends on the site of intravascular material to be removed and on anatomic features of site selection. This may include any combination of the femoral vein and/or internal jugular vein. The AngioVac cannula is inserted through a sheath such that the tip of cannula lies in close proximity to the material intended to be removed either in the superior vena cava, inferior vena cava, right heart, or pulmonary artery. Also, placement of another sheath for the reinfusion cannula provides an option to flip the positions of AngioVac and reinfusion cannulae and allows for

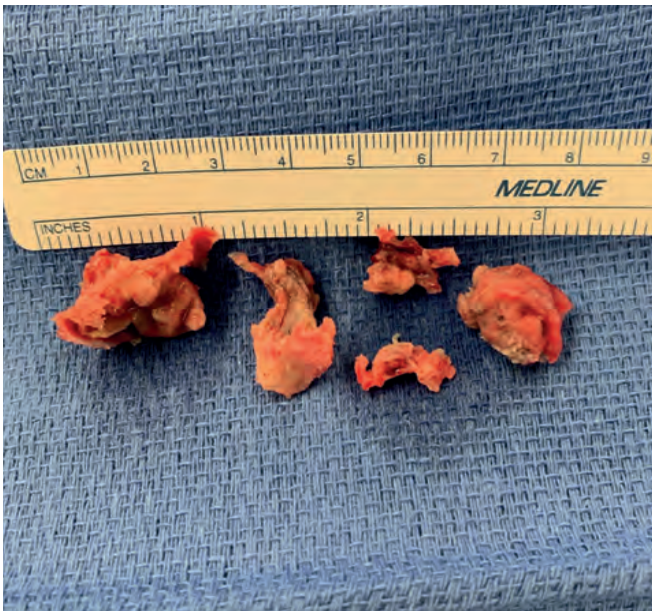

Figure 4. Macroscopic examination of the intravascular material.

reversal of flow in the circuit [1]. The catheter is advanced under fluoroscopy or transesophageal TEE guidance to the desired location. Concurrently, the pump circuit is primed with warm saline, connected to the AngioVac cannula and reinfusion cannula, suction usually is begun at 3,000 rpm (approximately 3 L/min). Once the catheter tip is confirmed to be in an appropriate position and in close approximation to the material intended to be aspirated, the balloon-actuated tip is deployed. Flow is initiated, and with controlled suction, the intravascular material is aspirated and subsequently trapped by the inline filter, before blood is returned to the patient. Removal of the intravascular material are confirmed with any combination of TEE or intravascular ultrasound. After the procedure is completed, the catheters are withdrawn and hemostasis is achieved [2].

COMMENT

Venous thrombosis occurring in the right atrium presents a real challenge, regarding the best approach to ensure clot extraction or resolution, avoiding propagation and possible embolization. While some recommend thrombolytic therapy

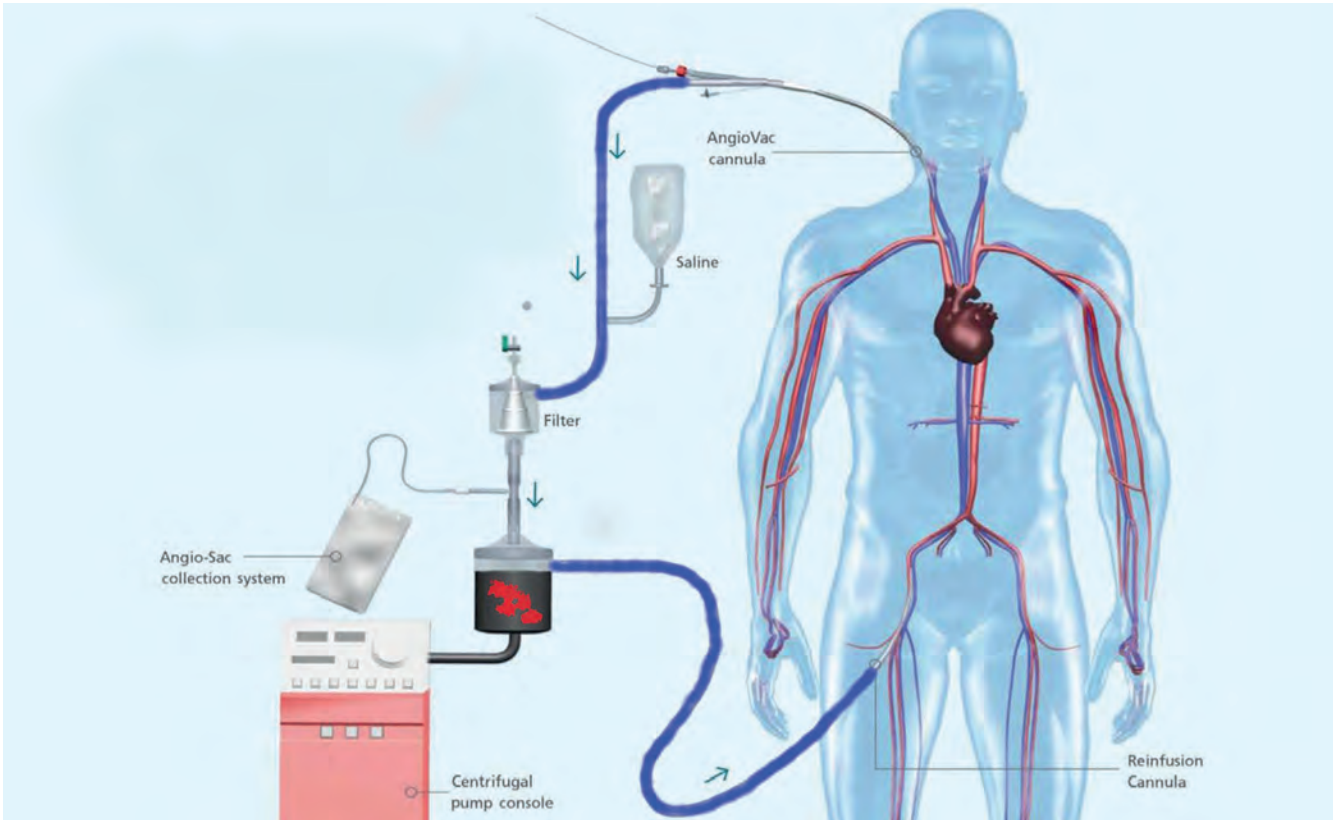

Figure 5. AngioVac System. A venovenous extracorporeal circuit with an AngioVac cannula draining the superior vena cava, the AngioVac circuit (centrifugal pump with console) and venous reinfusion cannula, draining into the femoral vein.

Figure 6. AngioVac (Vortex Medical, Norwell, MA) aspiration cannula.

over percutaneous or open thrombectomy, there is no a definitive guideline or universal consensus about the best intervention [3]. A careful evaluation of the balance between the risks of each procedure versus specific advantages should be considered on an individual basis. In patients with an acute thrombus, thrombolytic could represent a good option, although, on chronic thrombus, the benefit of thrombolytic therapy is unknown. Our patient, independently of this factor, the presence of empyema represent a relative contraindication to open surgery, making the endovascular option the best approach, Regardless of the strategy for removal of the clot, we should appreciate the potential consequence of manipulate a mobile intracardiac mass, as the risk of embolization to the pulmonary vasculature is not trivial [4].

The AngioVac device offers a less-invasive alternative to open surgical embolectomy for removal of intravascular material. There have been some reports regarding the successful application of the AngioVac Aspiration System to treat right atrial clot, some of them describe the use of a snare to release a mass adherent to a venous catheter or atrial wall [5-7].

Although the device is intended for removal of all kind of fresh thrombus [8-14], its use has expanded to removal of various materials, including vegetations and tumors. This has been recently published in a recent review of case reports and series [15]. The overall success rate of aspiration and clot removal with this device was 97% [15].

The AngioVac circuit typically includes a right internal jugular cannula for aspiration, distal venous access for reinfusion, extracorporeal tubing, and a filtration canister. Given that the tunneled port occupied the patient's superior central veins, our access differed slightly, as described above. It is our practice to mandate adequate visualization of the clot burden during all manipulations to prevent untoward embolization. This was achieved by the assistance of intraoperative transesophageal echocardiography, which afforded excellent real-time imaging of the thrombus and all of our instruments. Although this procedure is technically challenging and should not be universally advocated for all patients, it can provide a safe method for eradicating atrial thrombus in select cases, thereby avoid the morbidity associated with a median sternotomy.

The AngioVac device may carry some complications leading to possible morbidity and mortality. Potential complications may stem from iatrogenic damage to intracardiac structures (ie, valves and free walls of the RA and RV); distal embolization of thrombi, yielding cardiorespiratory compromise; and vascular-related injury secondary to AngioVac cannula insertion. Insertion of the cannulae into vascular structures appears to be the most common cause of complications. Another option for management of cardiorespiratory collapse during the procedure is initiation of ECMO for the remaining duration of the procedure and possibly during the postoperative period. This has been achieved with the addition of venoarterial ECMO by percutaneous insertion of an arterial cannula in the femoral artery and by placing a Y-connector to the reinfusion tubing to provide venous inflow to the ECMO circuit [16].

As a conclusion, the AngioVac System provides an innovative mechanical thrombectomy with promising results. It is a novel drainage system that has been used as a safe and effective alternative to open thrombectomy and embolectomy for the removal of right side thrombus.

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