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CASE REPORT

Percutaneous Removal of an Old Calcified Free-Floating Harmful Thrombus in a Patient with Severe Pulmonary Embolism and at Risk for Surgical Treatment

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Abstract

We present a case of a 53-year-old male patient with recurrent pulmonary embolism due to a free-floating right atrial thrombus formation. While thrombolysis was contraindicated due to previous intracranial hemorrhage, and the patient was at high risk for surgical thrombectomy, interventional removal using a percutaneous thrombus aspiration system (AngioVasc) was considered. Despite it's calcified, free- floating and vulnerable nature, the thrombus aspiration could be carried out safely and the patient feels well. This case highlights the complexities associated with managing high-risk patients with recurrent embolism and the importance of considering modern interventional approaches in cardiac thrombus removal discussions.

Keywords:

- High-risk patient
- Right heart thrombus
- Calcified thrombus
- Pulmonary embolism
- AngioVac
- Catheter-based intervention.

Introduction

Pulmonary embolism (PE) following thrombosis is a life-threatening condition that requires urgent medical and / or interventional treatments [1]. In terms of intracardiac thrombus formations, choosing of appropriate removal strategies might be additionally challenging. According to present guidelines, thrombolysis as well as surgical removal might be considered with respect to several considerations [2]. This case report illustrates the successful use of interventional removal systems in patients with calcified free floating thrombi and at high risk for surgical treatment.

Case Presentation:

observed (PESI Score 152, risk stratification: very high risk). Transthoracic echocardiography revealed corresponding D-sign appearance and mild to moderate tricuspid valve insufficiency; furthermore, there was suspicion of an atrial free-floating mass in the right atrium (RA). Transesophageal echocardiography (TEE) confirmed the structure as an old calcified atrial thrombus measuring 5.1 x 2.0 cm (Figure 1; A), located at the lateral atrial wall near the tricuspid annulus and floating towards tricuspid valve and inter-atrial septum, which furthermore revealed a patent foramen ovale.

Despite anticoagulation therapy, cor pulmonale with acute right ventricular ballooning persisted, while recurrent embolism from the RA thrombus formation -

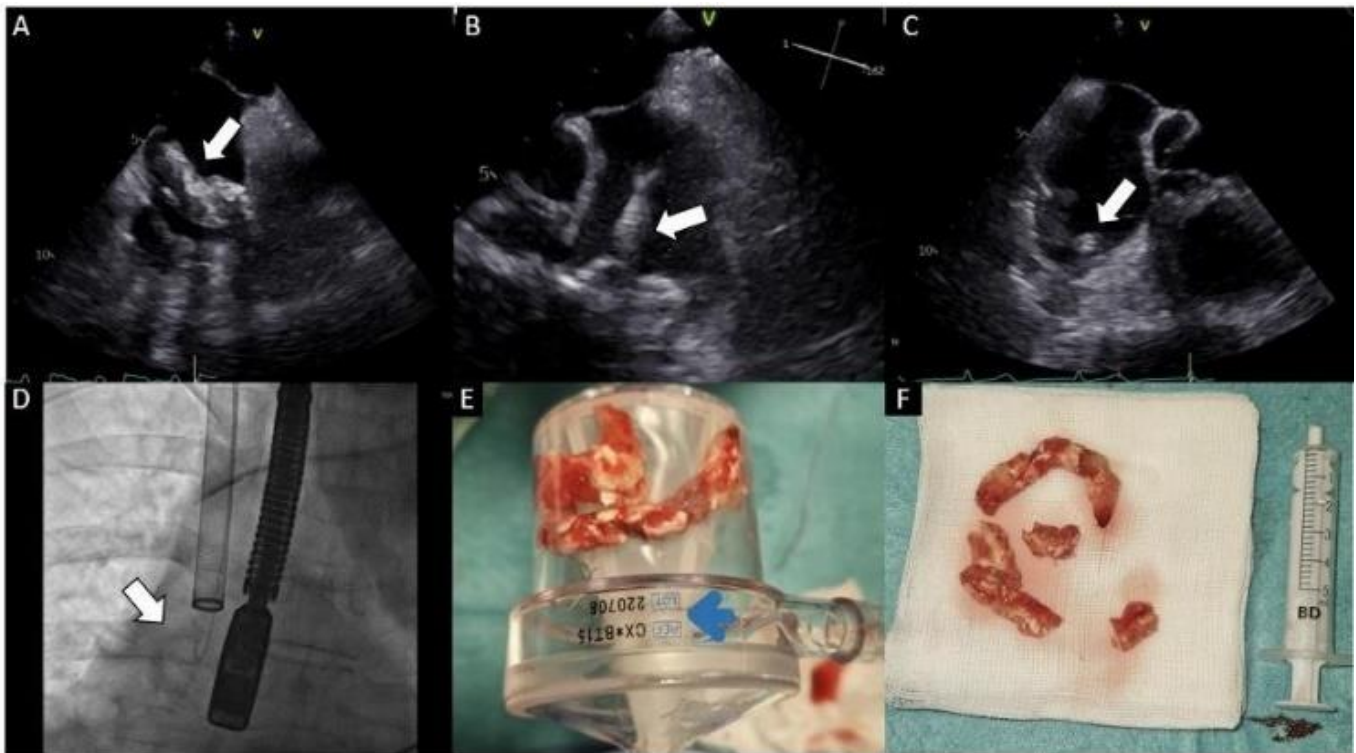


Figure 1. A: A transesophageal echo cardiography (TEE) showing a mobile structure (arrow) in the right atrium (RA) of 5.1 x 2.0 cm in size posing a risk for pulmonary artery embolization; **B:** An expandable funnel-shaped distal tip of the AngioVac Cannula (arrow) aspirating the RA structure with the suction forces generated by the extracorporeal circulation; **C:** The TEE showing the remaining pedunculated structure in the RA; **D:** Fluoroscopy Showing the introduction of the AngioVac Cannula (arrow) to the RA structure via left femoral vein and the TEE; **E:** An extracorporeal circulation filter showing removed thrombus; **F:** Thrombotic materials removed by AngioVac.

A 53-year-old male patient presented with severe respiratory insufficiency at our emergency department. In the computed tomography (CT), an extensive bilateral central pulmonary embolism with consequent severe signs of acute right heart strain and post-infarctional pneumonic infiltration in the ventral left upper lobe was

- was suspected due to distribution patterns in the CT controls. Furthermore, thrombolysis was not feasible due to the previous history of intracranial hemorrhage. However, considering patient's young age and the acute right ventricular decompensated heart failure, the interdisciplinary HEART team didn't recommend

primary open thrombectomy due to increased operative risk. As an alternative approach, an interventional removal was discussed. After explaining the therapy alternatives, a shared decision in favour of interventional removal was made with the patient.

The procedure was performed with angiographic and TEE guidance (Figure 1D) under general anesthesia. Initially we performed a veno-venous ECMO cannulation using a 26 Fr right internal jugular and a 17 Fr left femoral vein reinfusion access. The 22 French (Fr) AngioVac cannula was introduced to the RA through the 26 Fr sheath (Figure 1B) and connected to the arterial arm of the ECMO. The ECMO circulation was carefully increased, up to $3-4 \times 10^3$ rates per minute (rpm). The free-floating and tortuous nature of the thrombus made it difficult to aspirate the total clot, which was, however, finally possible under angiographic and TEE guidance and defragmentation. Under ECMO resistance monitoring, the thrombus was carefully mobilized using gentle movements of the aspiration device and up- and down regulation of ECMO circulation rates. After repeating this maneuver for 2-4 minutes, the thrombus could be aspirated, while a residual non-floating basis of the thrombus, measuring 2.1×0.7 cm, attached to the right atrial wall remained (Figure 1C). In order to avoid further perforation risks, we decided to end the procedure. The patient showed clinical improvement following the procedure. The ECMO decannulation could be carried out at time and the length of stay in the intensive care unit was relatively short. He didn't required further oxygen therapy or inotropic support, while lifetime anticoagulation therapy was recommended as further treatment of the existing thrombus. Upon thorough investigation, no tumor, myxoma, coagulation disorders, systemic inflammatory disease, structural heart disease, or atrial fibrillation were detected, and histological evaluation confirmed the calcified thrombus without any evidence for underlying cause.

Discussion:

Managing right heart thrombus formations poses a significant challenge due to their association with cardiac arrest and alarmingly high mortality rates in untreated patients, despite being observed in only 4% of pulmonary embolism cases [3,4]. The absence of consensus on the optimal approach to manage concurrent pulmonary embolism and large right heart

thrombus-in poses substantial challenges in the care of these frequently complex patients with high risk of mortality [4]. Surgical thrombectomy carries a reported operative mortality risk of up to 3.6% in stable patients with pulmonary embolism, and a higher risk of 10 % in unstable patients. On the other hand, pharmacologic thrombolysis is associated with major bleeding rates of 9-11% and a 2% risk of intracranial hemorrhage, leaving one-third of patients being ineligible for this treatment option [4-7]. In this case, the decision to use a percutaneously approach with ECMO assisted thrombus aspiration was based on the patient's high-risk status and the unavailability of other conventional treatment options [8]. While the ECMO technique is an established therapy in various cardiovascular interventions, such as supporting failing hearts or assisting with lung function during surgeries [9] their use in thrombus removal is less commonly reported and always an individualized therapy decision especially in older calcified structures. The decision to proceed with this modality required careful multidisciplinary consideration of the potential risks and benefits, taking patient's specific clinical profile and patient's choice into account. The percutaneous catheter-based removal is a minimally invasive procedure, that involves accessing the thrombus through small incisions, reducing the risk of complications and promoting faster recovery [6,8,10]. On the other hand, percutaneous catheter-based options may not be suitable for all cases. However, reflecting our case experience, we can report that the interventional technique is safely applicable despite unfavorable conditions such as challenging anatomical location and calcification. Even if total removal was not achieved, reducing of free floating thrombus mass and subsequent decrease of recurrent embolism risk, might be graded as successful interventional result, particularly when considering the acute right ventricular decompensation in advance.

As a relatively newer technique, there is yet long-term data missing with regard to efficacy, therapy safety and durability of percutaneous catheter-based removal techniques. Our case shows that shared interdisciplinary decision making should consider interventional techniques in this regard. Under careful handling during the procedure and appropriate interventional cardiac imaging, interventional removals could be a useful therapy option in cases with severe hemodynamic impairments and complex thrombus formations. However, more multicenter and controlled data, case experiences and trials are necessary in this regard.

Conclusion:

The utilization of ECMO assisted removal of older calcified high-risk intracardiac thrombus formations presents a viable and potentially life-saving option for patients with severe pulmonary embolism who are deemed unsuitable for conventional treatment modalities. While further research and clinical data are necessary to ascertain the applicability and effectiveness of this approach, our experience in this case highlights the value of a multidisciplinary approach in optimizing patient outcomes.

Consent: The authors have received informed consent from the patient to publish information and images in accordance with COPE guidelines.

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Conflict of Interest: None

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