

CORONARY, PERIPHERAL, AND STRUCTURAL INTERVENTIONS

CASE REPORT: CLINICAL CASE

Thrombus vs Tumor

Use of AngioVac in a RV Mass



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ABSTRACT

This paper presents a challenging case of a right ventricular mass in a patient who was at high surgical risk for open removal. The minimally invasive AngioVac device has been used with a successful 50% reduction in mass burden. This report illustrates AngioVac as a safe alternative to invasive surgery. (JACC Case Rep. 2024;29:102600)

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HISTORY OF PRESENT ILLNESS

A 69-year-old man presented with acute onset of shortness of breath for the past 2 days. He denied any other associated symptoms. He was taken to the local hospital by paramedics.

PAST MEDICAL HISTORY

Prior medical history included hypertension, tobacco dependence, coronary artery disease for which he had undergone percutaneous coronary intervention in the recent past, hypothyroidism, and recurrent squamous

cell carcinoma of the head and neck post chemotherapy and radiation therapy and had completed his last cycle of chemotherapy with 5-fluorouracil and leucovorin 4 months prior to this presentation. He had undergone percutaneous endoscopic gastrostomy tube placement 6 months prior to presentation.

DIFFERENTIAL DIAGNOSIS

The presentation of acute shortness of breath in the setting of a known malignancy raised the possibility of an acute pulmonary embolism.

TAKE-HOME MESSAGES

- This case illustrates methods for making a differential diagnosis of intracardiac masses using echocardiography and catheterization.
- This case helps to understand the role of AngioVac system in the treatment of any intracardiac masses or thrombi in venous circulation.

INVESTIGATIONS

His initial laboratory investigations revealed an elevated troponin level of approximately 0.16 ng/mL, thrombocytopenia at 48,000/ μ L, and international normalized ratio of 1.3. The presenting electrocardiogram revealed normal sinus rhythm with evidence of right ventricular (RV) strain with S1Q3T3 sign and incomplete right bundle branch block (**Figure 1**).

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ABBREVIATIONS AND ACRONYMS

RIJ = right internal jugular

RV = right ventricular

MANAGEMENT

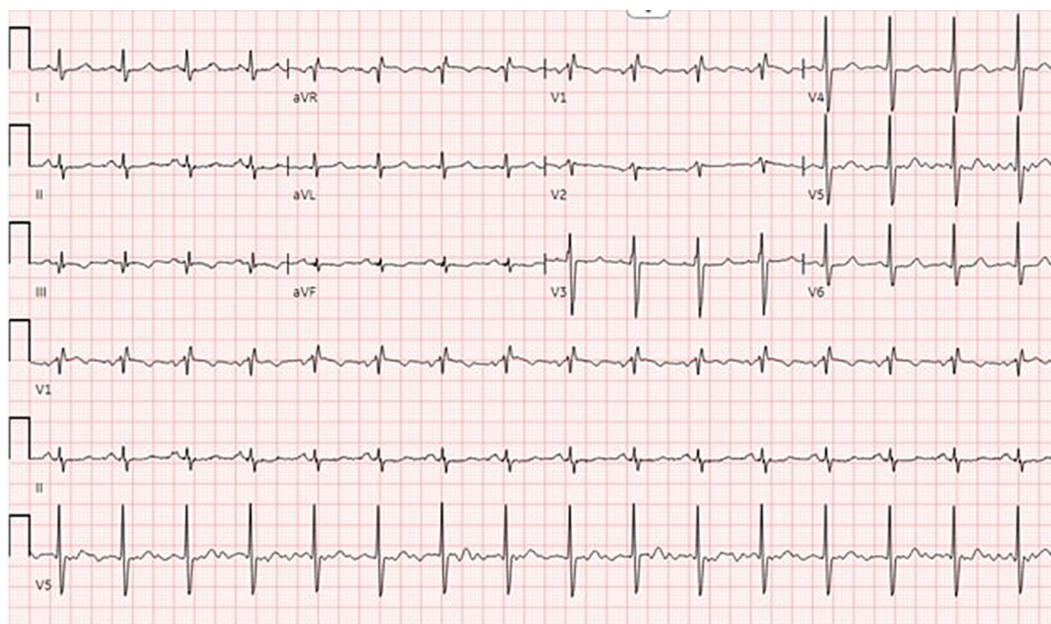
The patient was referred to our center for further evaluation and management. On arrival, he was afebrile with a temperature of 36.8 °C, hemodynamically stable with a blood pressure of 155/104 mm Hg, and hypoxic with an oxygen saturation of 87% on room air. His COPD, malignancy, and moderate frailty placed him at high risk for venous thromboembolism (Caprini score of 8).¹ Computed tomography pulmonary angiography revealed evidence of chronic pulmonary thromboembolism in the right lower lobe, consistent with a previous examination performed 10 months prior. Additionally, acute filling defects were noted in the segmental pulmonary arteries of the right and left upper lobes, indicating acute pulmonary embolism (Figure 2). Transthoracic echocardiography revealed a very large mobile echo density (5 × 3.6 × 2.2 cm) in the right ventricular outflow tract, prolapsing through the pulmonic valve in systole with a small attachment to the RV septum, more consistent with thrombus than a tumor metastasis (Figure 3, Video 1). Systolic and diastolic flattening of the interventricular septum, indicative of significant RV pressure and

volume overload, was observed. RV dilatation with moderately to severely reduced RV systolic function was noted. Free wall hypokinesis with apical sparring (McConnell's sign) was noted, suggestive of acute RV pressure overload (Figure 4, Video 2). Normal left ventricular systolic function was noted. Pulmonary artery systolic pressure was estimated to be 50 mm Hg, possibly underestimated due to severe tricuspid regurgitation and RV failure. Due to the underlying malignancy, COPD, and frailty, cardiac surgery determined that he was at very high risk for open cardiac surgery.

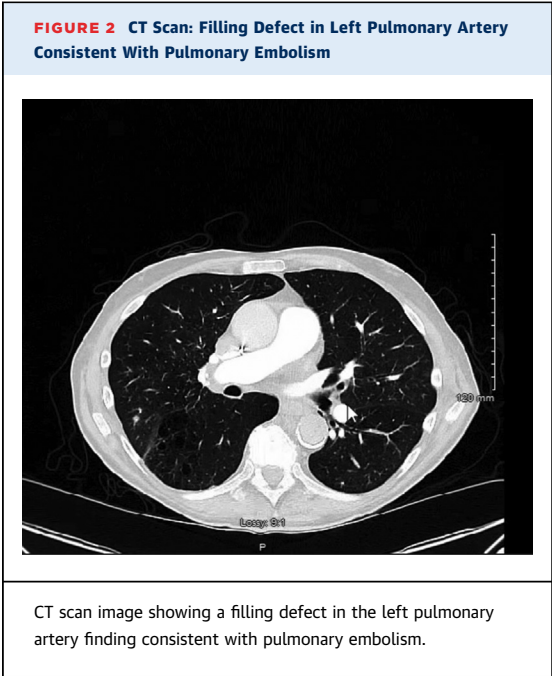
Cardiac catheterization revealed a mean pulmonary artery pressure of 24 mm Hg. A balloon-tipped wedge catheter was advanced from the right internal jugular (RIJ) into the left pulmonary artery. The wedge catheter was then exchanged with a 26-F cannula over a super stiff wire. The AngioVac device was advanced through the RIJ with blood return through the right femoral vein cannula through an extracorporeal circuit (Videos 3 to 5).

The AngioVac cannula could not be positioned from the RIJ access; hence, we switched to bilateral femoral access. The right femoral vein cannula was replaced with a new 26-F cannula, and a new 17-F return

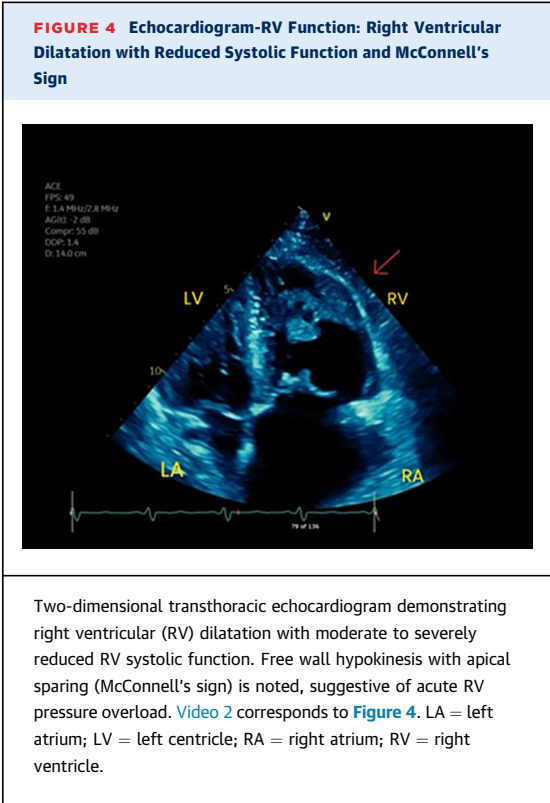
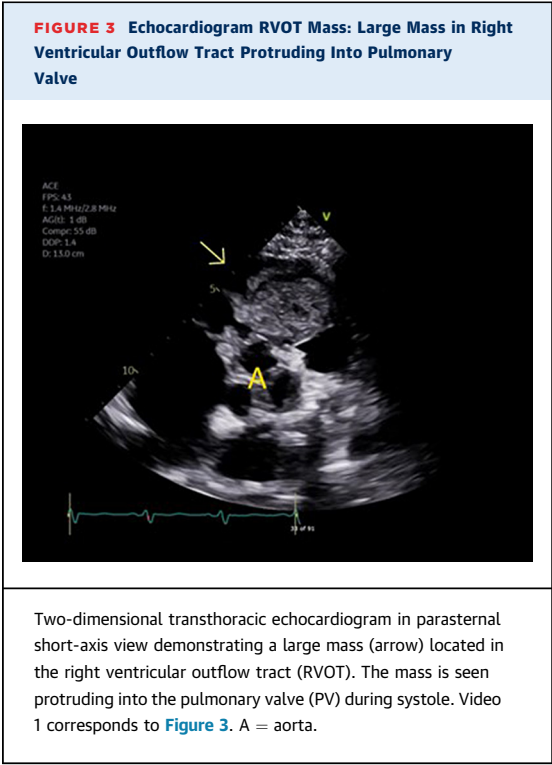
FIGURE 1 ECG S1Q3T3 Pattern: Right Ventricular Strain With Prominent S-Wave, Q-Wave, and Inverted T-Wave



Electrocardiogram (ECG) depicting the S1Q3T3 right ventricular strain pattern, including a prominent S-wave in lead I, a Q-wave in lead III, and an inverted T-wave in lead III.



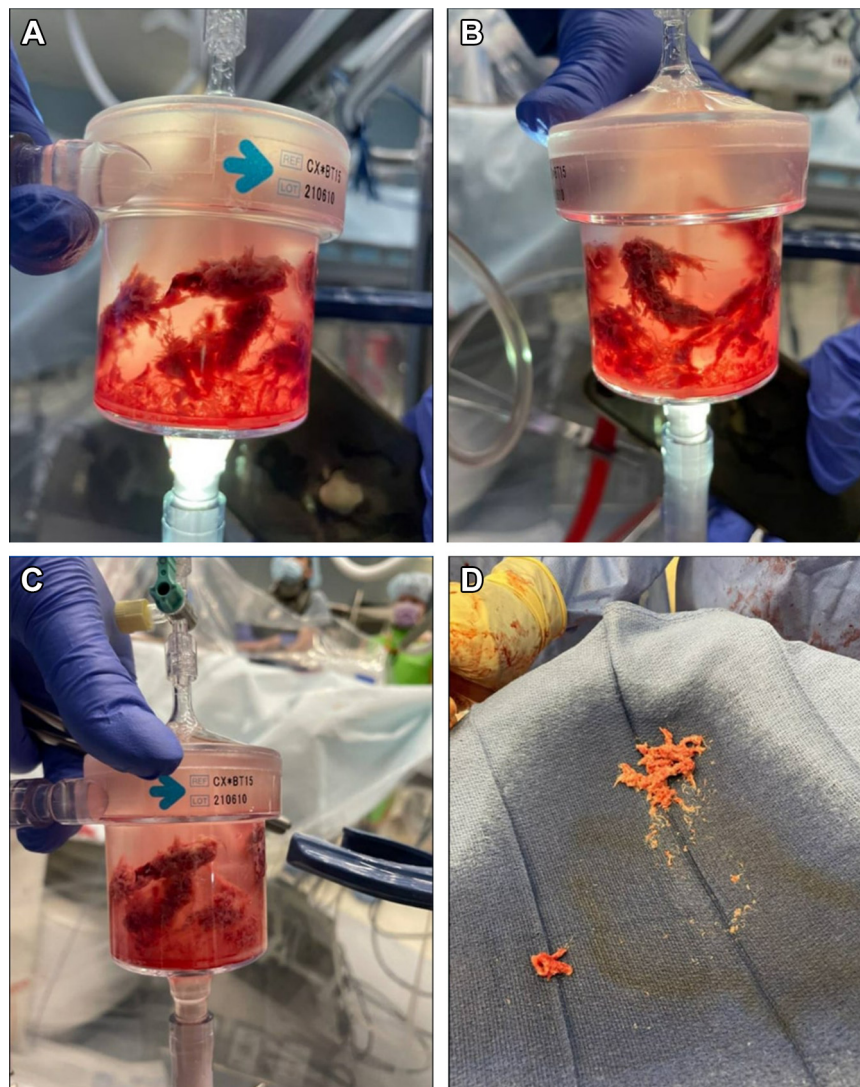
cannula was placed in the left femoral vein. The AngioVac clot retrieval procedure was then performed through bilateral femoral venous access under transthoracic echocardiographic and fluoroscopic guidance (Video 6). Multiple fronds of tissue-like substance



were subsequently aspirated (Figure 5). Post-procedural bedside ultrasound showed a stable trace pericardial effusion with normal left ventricular and RV systolic function and evidence of residual hypodensity in the right ventricle. After a few hours, the patient developed a disseminated intravascular coagulation pattern, the patient progressed into multiorgan failure and hypotension, and repeat echocardiography showed no major changes. After discussion with the patient's family, further active resuscitative efforts were discontinued. Subsequently, the pathology report revealed poorly differentiated squamous cell carcinoma. Immunohistochemically, the tumor cells were positive for p40, further supporting the diagnosis.

DISCUSSION

We report a rare case of metastatic squamous cell carcinoma presenting as a symptomatic, mobile intracardiac mass. Considering the increased likelihood of venous thromboembolism in the setting of malignancy, along with the appearance and location of the mass shown on echocardiogram, thrombus in transit with associated pulmonary embolism was a probable diagnosis. Most patients with tumor emboli present symptoms consistent with venous

FIGURE 5 Angiovac Retrieval: Tissue Fronds Extracted From Right Ventricle Post-Operation

(A to D) Postoperative AngioVac reservoir demonstrating multiple fronds of tissue-like substance retrieved from the right ventricle.

thromboembolism (eg, dyspnea, hypoxia).² Additionally, the presence of an active malignancy significantly raises the likelihood of developing thrombosis, which can act as a potential effect modifier.^{3,4} Correct diagnosis of tumor emboli is critical because the management significantly differs from that of venous thromboembolism.

The primary treatment modalities for intracardiac thrombus and masses include surgery, anticoagulation, and thrombolytics. More recently, catheter-based therapies have emerged as potential alternatives.⁵ In this case, AngioVac was

implemented as a minimally invasive alternative due to the high surgical risk.

The RAPID (Registry of AngioVac Procedures In Detail) registry is the first prospective, multicenter study aimed at evaluating the safety and success of the AngioVac System in 237 patients with intravascular and intracardiac tumors between March 2016 and August 2019. Successful retrieval of 70% to 100% of the mass burden was achieved in 58.5% of patients.⁶ Although AngioVac is effective in removing acute and soft materials, it is more appropriate to explore conservative methods for chronic (>21 days)

and distal deep venous thromboses located downstream of the common femoral vein, due to the availability of collateral vessels that help maintain circulation.⁷

There are potential caveats associated with using AngioVac for the management of venous thromboembolism. The need for large bore venous access, 26-F and 16-F, makes the subsequent thrombolytic therapy difficult, particularly in the submassive pulmonary embolism group. The current design of the cannula is suboptimal for reaching the pulmonary arteries, hence limiting its efficacy in treating pulmonary embolism. The INARI FlowTrieve and Penumbra Mechanical thrombectomy system, which are more recent devices, may more easily be able to navigate the vasculature, potentially facilitating the retrieval of masses in the pulmonary artery.⁸

The current spectrum of applications for AngioVac in undesirable intravascular material extraction includes deep venous thrombosis, inferior vena cava, right atrium, right ventricle, in renal cell carcinoma, and in the arterial system such as the aorta.

CONCLUSIONS

Catheter-directed aspiration is seen as an effective and less invasive alternative for open cardiac surgery, particularly in high-risk patients, reflecting the expanding field of minimally invasive transcatheter interventions. This case report demonstrates the effective utilization of such technology in achieving a substantial reduction in the intracardiac mass load and enabling the correct diagnosis in this patient.

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KEY WORDS cancer, right ventricle, thrombus

APPENDIX For supplemental videos, please see the online version of this paper.