



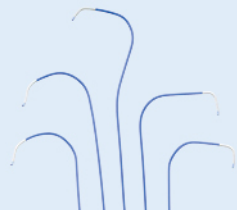
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CASE REPORT

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Right atrial thrombus removal with use of the $\bar{O}\bar{N}\bar{O}$ retrieval device

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Abstract

Intracardiac masses and specifically right atrial thrombi can be difficult to manage and carry a high mortality rate. Typically, surgical removal or mechanical thrombectomy can be performed though may not be suitable for all patients. We present a unique case of a sickle cell patient with a large pedunculated right atrial thrombus that was successfully extracted using the novel $\bar{O}\bar{N}\bar{O}$ Retrieval Device.

KEYWORDS

RHC—right heart catheterization, THRM—thrombosis, THRO—thrombectomy

1 | INTRODUCTION

Right atrial masses can be difficult to manage and successful removal is most commonly performed either surgically or via mechanical thrombectomy. There is a high rate of mortality associated with these lesions and early, expeditious removal is key.¹ We present a unique case of a pedunculated right atrial thrombus that was successfully extracted utilizing the $\bar{O}\bar{N}\bar{O}$ Retrieval Device ($\bar{O}\bar{N}\bar{O}$ COR LLC).

2 | CASE REPORT

A 19-year-old female with sickle cell disease and two previous episodes of pulmonary emboli managed on rivaroxaban presented to our institution with new onset chest pain and hypoxemia. Computerized tomography angiogram demonstrated chronic thromboemboli in both lungs (no acute emboli), an evolving right lower lobe pulmonary infarction, and a filling defect in the right atrium. Subsequent echocardiogram demonstrated a large right atrial mass, presumed to be a thrombus, measuring 38 × 19 mm,

with a pedunculated attachment near the inferior cavoatrial junction, and prolapsing across the tricuspid valve (Figure 1). Laboratory analysis demonstrated chronic anemia, normal platelet counts, and significant allo- and autoantibodies which made it difficult to crossmatch for blood. She was initially treated with systemic tPA and heparin but had no reduction in the size of the mass. After multidisciplinary case discussion between cardiology, hematology, and cardiothoracic surgery, the decision was made to proceed with transcatheter thrombectomy utilizing the novel $\bar{O}\bar{N}\bar{O}$ retrieval device. Due to her blood crossmatching difficulty, she was deemed a better transcatheter versus surgical candidate.

Access was obtained in the right femoral vein and the right internal jugular vein (RIJV). A 26Fr DrySeal sheath (Gore) was placed in the RIJV after the vessel was pre-closed. We then created a coaxial retrieval system per the $\bar{O}\bar{N}\bar{O}$ COR instructions for use [**Onocor Instructions For Use— $\bar{O}\bar{N}\bar{O}$ COR Vascular** (onocorvascular.com)], consisting of a 20 mm Amplatz Gooseneck snare (Medtronic Inc.) in a 5Fr MPA catheter, advanced through the central lumen of the $\bar{O}\bar{N}\bar{O}$ retrieval device, then through a 12Fr Mullins sheath; this retrieval assembly was then inserted

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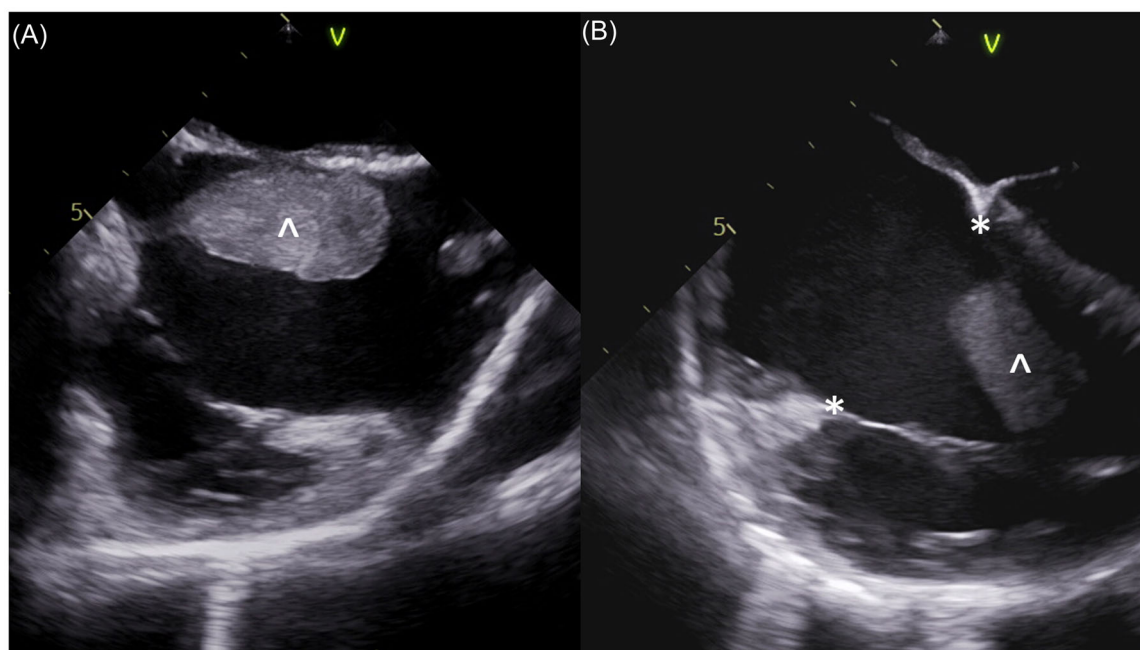


FIGURE 1 Pre-procedural transesophageal echocardiogram, with (A) a bicaaval view of the large pedunculated thrombus (^) measuring 38 × 19 mm, and (B) a four-chamber view of the thrombus (^) prolapsing across the tricuspid valve during diastole (annulus marked by *). [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/ccd.30877)]

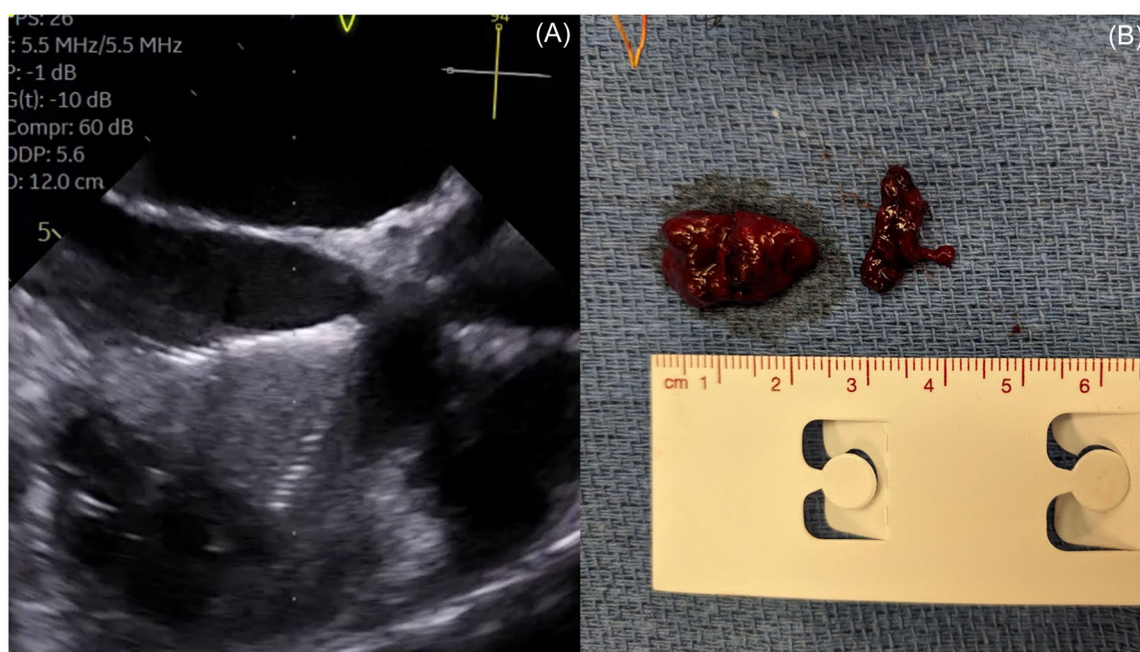


FIGURE 2 (A) Transesophageal echocardiogram depicting the ÖNÖ basket covering the mobile thrombus to secure it for removal and (B) the portion of thrombus removed during the first extraction. [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/ccd.30877)]

through the DrySeal sheath. The ÖNÖ basket was exposed and intentionally advanced around the thrombus first, under TEE guidance, to sequester it during attempts to ensnare it (Figure 2A). With the thrombus contained in the basket, the

snare was passed around the body of the thrombus and tightened on the peduncle (Video S1) after which the entire system was withdrawn from the body via the DrySeal sheath. A single large piece of red, gelatinous thrombus was present (Figure 2B), but



FIGURE 3 The pedunculated portion of the mass removed with the second pass, note the tannish coloration consistent with fibrocollagenous changes of a chronic, organizing thrombus. [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

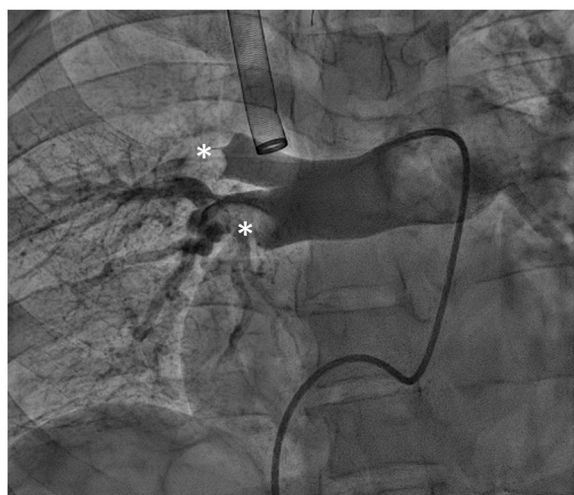


FIGURE 4 Right pulmonary artery angiogram in a straight AP projection demonstrating filling defects in the right upper and lower lobes (*) consistent with chronic pulmonary arterial thrombi. The 26Fr DrySeal sheath is visualized with the tip in the SVC.

the stalk remained attached to the right atrial wall on follow-up echocardiography. The process was repeated again with removal of the stalk, which had a firmer texture and tan coloration, on the second extraction (Figure 3 and Video S2). Post-thrombectomy pulmonary angiograms depicted significant filling defects consistent with chronic emboli (Figure 4); no mobile defects suggesting acute pulmonary emboli were visualized. Given the extensive defects, we opted to end the procedure and potentially have her return for pulmonary arterial thrombectomy.

She was extubated to nasal cannula oxygen after the procedure and was initially anticoagulated with systemic heparin. She remained hospitalized for 12 days, was transitioned to warfarin, and ultimately discharged on nasal cannula oxygen. Histopathologic analysis of the

extracted specimens was consistent with thrombus of varying ages, including younger gelatinous and organizing fibrocollagenous thrombus tissue.

3 | DISCUSSION

Cardiac masses present a unique challenge in terms of diagnosis and treatment. Surgical extraction has been the mainstay for treatment and diagnostic confirmation. Though many transcatheter mechanical aspirations and thrombolytic systems have been developed, transcatheter extraction of large pedunculated masses has significant risks given the lack of an appropriate device. Though initially designed to extract embolized cardiac devices, others teams have extracted cardiac tumors and a leadless pacemaker utilizing the novel $\bar{O}\bar{N}\bar{O}$ Retrieval Device.^{2,3} To our knowledge, this is the first reported case of successful extraction of a large thrombus utilizing this device, highlighting how it has expanded our ability to successfully extract such masses.

The $\bar{O}\bar{N}\bar{O}$ retrieval device consists of a wire basket, fused to a 7.5Fr catheter, that can be advanced through a 12Fr sheath. The concept is that the target object is ensnared and retracted into the basket which then translates the linear force generated by withdrawing the $\bar{O}\bar{N}\bar{O}$ catheter into radially compressing forces on the object, facilitating withdrawal of the captured device into the 12Fr sheath. This is accomplished through a coaxial system, with a catheter/snare—up to 7Fr—introduced through the $\bar{O}\bar{N}\bar{O}$ retrieval device, which is inserted through a 12Fr (or larger) sheath to create the extraction system (Figure 5). We chose to introduce this extraction system through a 26Fr DrySeal which allowed for easy introduction/removal and re-use of the $\bar{O}\bar{N}\bar{O}$ system.

Multiple case reports have described the removal of atrial thrombi using mechanical thrombectomy systems such as the AngioVac and AlphaVac (Angiodynamics).^{4–6} Those systems often result in significant blood loss and may not be able to reliably extract such a large thrombus, both of which were particularly problematic for our patient. In our case, with the patient already chronically anemic and the challenge of blood crossmatch, we elected to use the $\bar{O}\bar{N}\bar{O}$ system, as it allowed us to surround the thrombus before snare attempts given the risk of a life-threatening saddle embolus in the event of embolization, the lack of blood-loss related to aspiration, and the ability to remove the peduncle which was presumed to be tightly adherent to the atrial floor.

4 | CONCLUSION

Diagnosing and treating large cardiac masses can be particularly challenging and most often require surgical removal. We present a unique case using the newly developed $\bar{O}\bar{N}\bar{O}$ Retrieval Device to extract a large pedunculated right atrial thrombus.

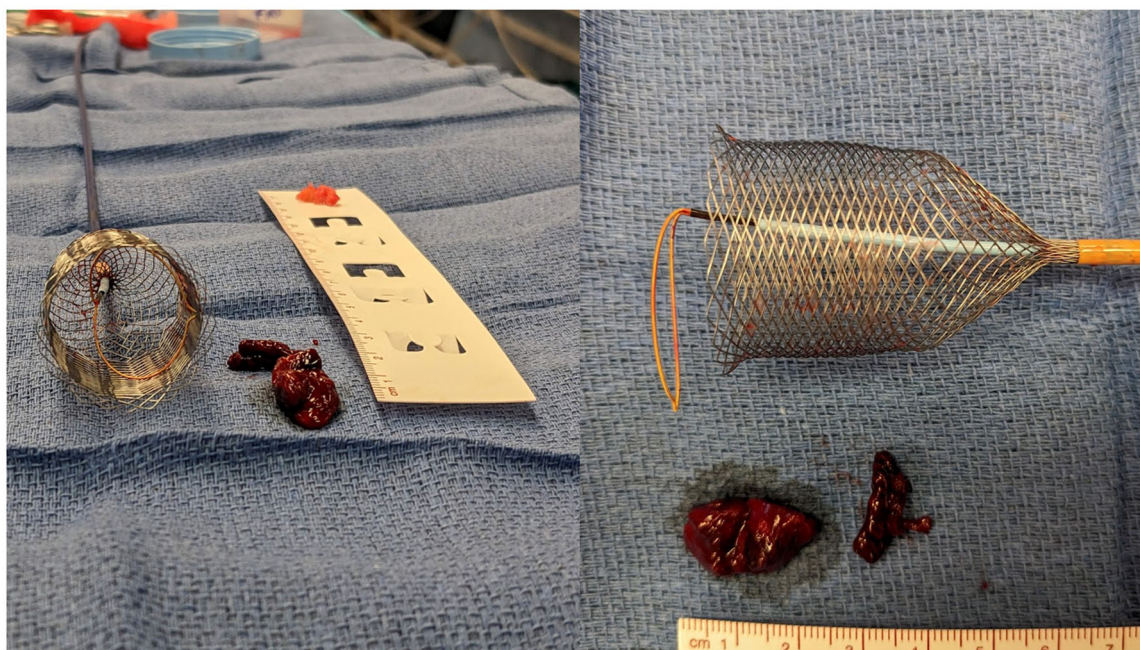


FIGURE 5 The coaxial system consisting of the ÖNÖ retrieval device with a directional catheter and gooseneck snare advanced through the center of the ÖNÖ device. [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/ccd.30877)]

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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