

STRUCTURAL INTERVENTIONS

ADVANCED

CASE REPORT: CLINICAL CASE

A Retained Intracardiac Catheter Contributing to Worsening Heart Failure and Atrial Fibrillation

Investigation and Management



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ABSTRACT

A retained intracardiac catheter fragment left in situ for 2 years was incidentally found in a patient presenting with worsening heart failure and atrial fibrillation. This case describes the diagnostic evaluation of this rare event, with successful endovascular retrieval and resolution of his symptoms. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2021;3:1849-1854) © 2021 Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

HISTORY OF PRESENTATION

A 71-year-old man presented with worsening shortness of breath and increased lower extremity swelling. He had an irregularly irregular rhythm with a grade II/VI holosystolic murmur, jugular venous distention in the mid-neck, faint inspiratory crackles bilaterally, and bilateral 3+ pitting edema of the lower extremities. His blood pressure was 120/80 mm Hg, heart rate 93 beats/min, respiratory rate 17 breaths/min, and oxygen saturation 84% on room air,

up to 100% on 3 L given by nasal cannula. An electrocardiogram (ECG) showed atrial fibrillation (AF) with controlled ventricular response to 90 beats/min. High-sensitivity troponin-T was 58 ng/L and 54 ng/L on repeat (normal <22 ng/L). NT-proBNP was 10,780 pg/mL (previously 1,994 pg/mL).

MEDICAL HISTORY

The patient had received a diagnosis of heart failure with reduced ejection fraction in 2013 secondary to a nonischemic cardiomyopathy. A transthoracic echocardiogram (TTE) from 2018 showed a left ventricular ejection fraction (LVEF) of 30%. His home cardiac medications included metoprolol succinate 50 mg, lisinopril 2.5 mg, furosemide 40 mg, aspirin 81 mg, rosuvastatin 10 mg, and apixaban 5 mg. His medical history included AF, well-controlled human immunodeficiency virus infection, hypertension, and chronic obstructive lung disease (not using home oxygen).

LEARNING OBJECTIVES

- To understand the differential diagnosis for coiled intracardiac foreign bodies.
- To recognize the long-term risks of retained intracardiac catheter fractures and embolization.
- To discuss the management strategy of removing intracardiac foreign bodies.

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ABBREVIATIONS AND ACRONYMS

AF = atrial fibrillation
CVC = central venous catheter
ECG = electrocardiogram
LVEF = left ventricular ejection fraction
MAUDE = Manufacturer and User Facility Device Experience
RA = right atrium
RHC = right heart catheterization
RV = right ventricle
TR = tricuspid regurgitation
TTE = transthoracic echocardiogram

DIFFERENTIAL DIAGNOSIS

His presentation was suggestive of acute decompensated heart failure secondary to uncontrolled AF, dietary or medication noncompliance, or disease progression. Acute coronary syndrome and infectious causes were of low suspicion given the lack of ischemic changes on ECG with stable troponins, and lack of leukocytosis and negative procalcitonin.

INVESTIGATIONS

A chest radiograph showed pulmonary vascular congestion and an incidentally found intracardiac foreign body (Figure 1).

Computed tomography of the chest confirmed a radiodense foreign body coiling from the right atrium (RA) into the right ventricle (RV) (Figure 2). The patient was informed of this finding and reported no prior knowledge of any indwelling catheters or devices. He recalled an admission to the intensive care unit requiring intubation in 2019, but he did not recall prior intracardiac procedures or need for long-term intravenous access.

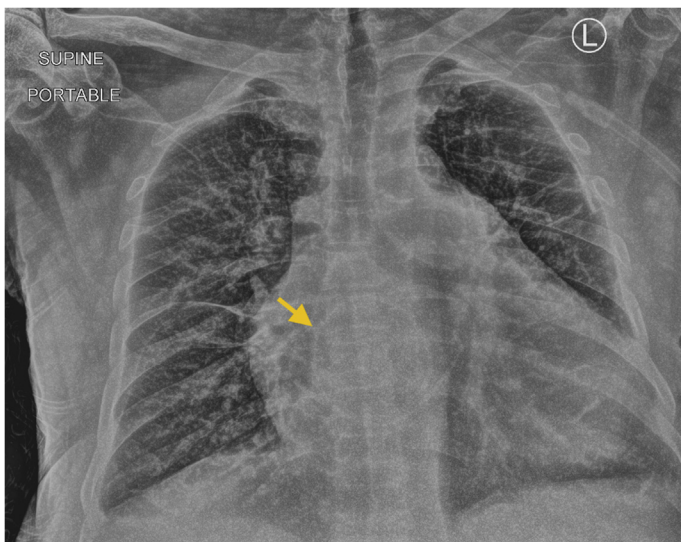
A TTE showed an LVEF of 30%, bi-atrial enlargement, and moderately increased RV size with moderately reduced RV systolic function (Figure 3, Video 1). The RV systolic pressure was at least 34 mm Hg. Color flow Doppler demonstrated moderate tricuspid regurgitation (TR), which was worse in comparison with a previous study (Video 2).

MANAGEMENT

An initial attempt at retrieval of the foreign body was made by interventional radiology, but the patient experienced AF with rapid ventricular rate peri-procedurally, and the procedure was aborted. After discussion with multiple consultants, the overall impression was that the foreign body might have been too fibrosed to remove and that the patient would require cardiothoracic surgery, for which he was deemed to be at high risk. Therefore, a repeated attempt at percutaneous retrieval with preparation for arrhythmia and other complications was performed.

The patient underwent right heart catheterization (RHC) with removal of the foreign body. The initial RHC demonstrated elevated biventricular filling pressures. When the catheter was advanced into the RA, it interacted with the foreign body and was confirmed to be free floating in the RA. A 25-mm gooseneck snare catheter was advanced through the right common femoral vein and, upon the second pass, snared the proximal segment of the foreign body and was withdrawn without resistance through the RA into the inferior vena cava (Figure 4). The RHC was repeated and demonstrated modestly reduced filling pressures and improvement in the degree of TR (Figure 5). On initial inspection, the foreign body appeared to be more likely a fractured central venous catheter (CVC) and less likely a pulmonary artery wedge catheter, given the lack of multiple lumens and balloon tip (Figure 6). It was then confirmed to be a fractured CVC after collateral data were obtained with the outside hospital, where in April 2019 a CVC had been inserted during an intensive care unit admission for alcohol withdrawal requiring intubation, sedation, and vasopressor agents. He did not undergo RHC or placement of a peripherally inserted central catheter. The outside hospital was not able to provide further information regarding knowledge of the retained catheter on any subsequent imaging. Repeated TTE several months after removal of the foreign body demonstrated an improved LVEF

FIGURE 1 Chest Radiograph



Chest radiograph identified a catheter-shaped foreign body projecting over the pericardium.

of 40% (from 30%), with mildly reduced RV systolic function (from moderate) and mild TR (from moderate) (Videos 3 and 4). The patient was informed about these findings and gave explicit permission for us to write this case report.

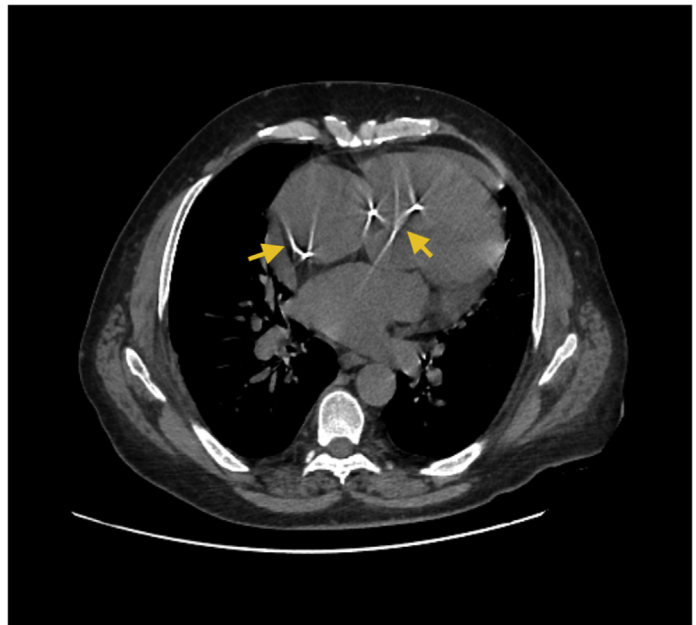
DISCUSSION

We report a rare case of a retained intracardiac catheter fragment, which likely contributed to uncontrolled tachyarrhythmias (AF) and resulted in progressive and decompensated biventricular heart failure. This case highlights the diagnostic and therapeutic dilemma of the retrieval of intracardiac foreign bodies.

Indwelling CVC fracture and embolization is a rare complication and is likely underreported. Catheter fatigue from prolonged use or occlusion of the line can contribute to in situ fracture, fragmentation, and distal embolization (1). Upon fracture, the distal portion of the catheter migrates along the bloodstream until it lodges into the vena cava, the RA, the RV, or the main pulmonary artery. Whereas catheter malfunction and transient arrhythmias are the most commonly reported clinical manifestations, when these catheters are retained they can become a nidus for infection and thromboembolism. Infectious complications include endocarditis, pulmonary abscesses, and mycotic aneurysms. Thromboembolic complications include pulmonary embolism and stroke (2,3). Although our patient did not have these complications, this case illustrates a rare presentation of worsening heart failure and tachyarrhythmia. Likely the length and position of the catheter coiling from the RA into the RV created a unique hemodynamic profile that both perpetuated the worsening TR and atrial and ventricular ectopy burden and thus led to chronic adverse remodeling over time. Review of the U.S. Food and Drug Administration's MAUDE (Manufacturer and User Facility Device Experience) database found no similar reports.

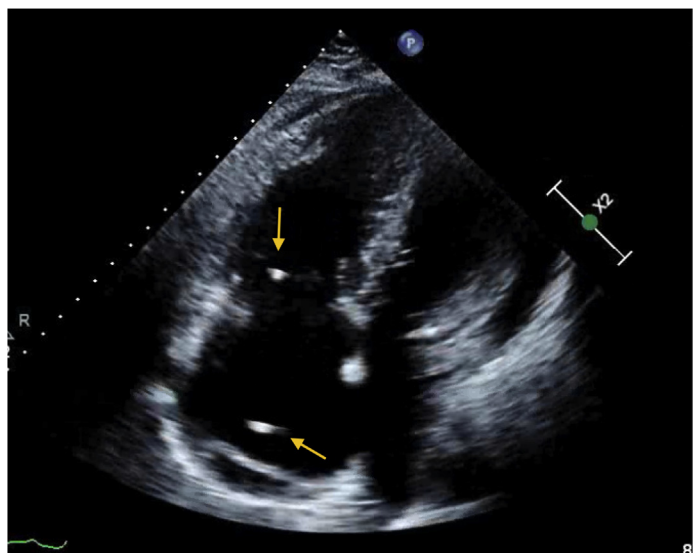
Intracardiac foreign bodies should ideally be removed to prevent these complications. Depending upon the risk to the patient, minimally invasive approaches are likely desirable to avoid the perioperative morbidity and mortality risk of cardiac surgery. Increasingly, endovascular removal has emerged as the treatment of choice (4). As shown in this case, despite chronicity that might have resulted in dense fibrosis, our patient underwent a successful foreign body retrieval with improvement

FIGURE 2 Computed Tomography of Chest



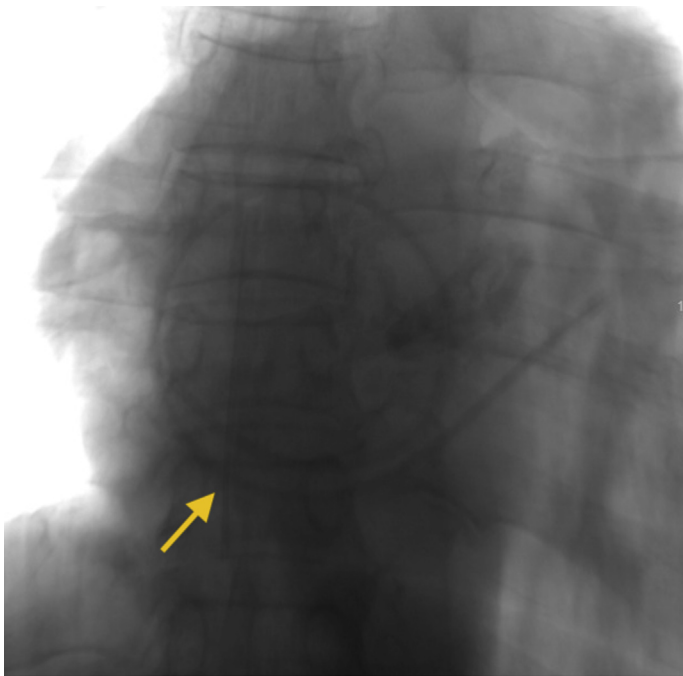
Computed tomography of the chest visualized a radiodensity coiling from the right atrium into the right ventricle.

FIGURE 3 Transthoracic Echocardiogram



Transthoracic echocardiogram showed a hyperechoic structure in both the right atrium and the right ventricle.

FIGURE 4 Fluoroscopy



Fluoroscopy showed a freely mobile foreign body that interacted with the catheter.

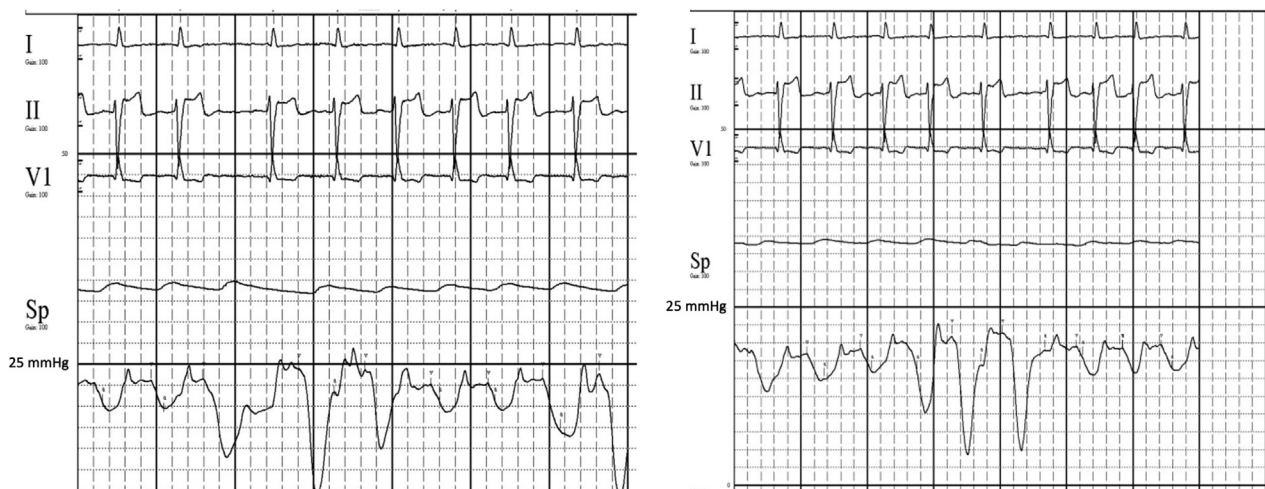
in his heart failure and AF. The use of apixaban for AF and surface coating on the catheter may have prevented the catheter from adhering to the myocardium.

Strategies for transcatheter retrieval of intracardiac foreign bodies include a guide wire, a loop snare, a balloon, grasping forceps, and a basket catheter. Of these, the loop snare has high rates of success with minimal reported complications and is familiar to most endovascular interventionalists who perform inferior vena cava filter retrieval or endovascular aortic aneurysm repair (5,6). An ex-vivo demonstration of how this was performed in our case using a loop snare and a 5-F glide catheter is shown in Figure 7.

FOLLOW-UP

The patient underwent further diuresis and was weaned to room air upon discharge. At the 1-month follow-up visit he reported no shortness of breath and improved exercise tolerance. To date, he has not required any further hospitalizations for acute decompensated heart failure in our electronic medical records.

FIGURE 5 Right Heart Catheterization

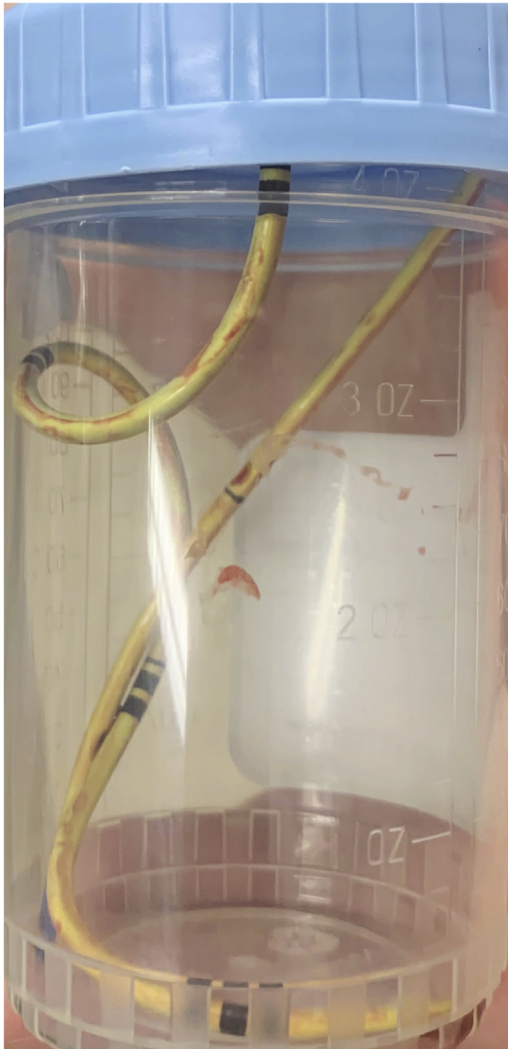


RA Pre-Intervention
Mean RA: 20, A wave: 19, V wave: 23

RA Post-Intervention
Mean RA: 17, A wave: 17, V wave: 19

Right atrial pressures improved modestly after retrieval of the foreign body.

FIGURE 6 Catheter



The catheter removed was a fractured central venous catheter.

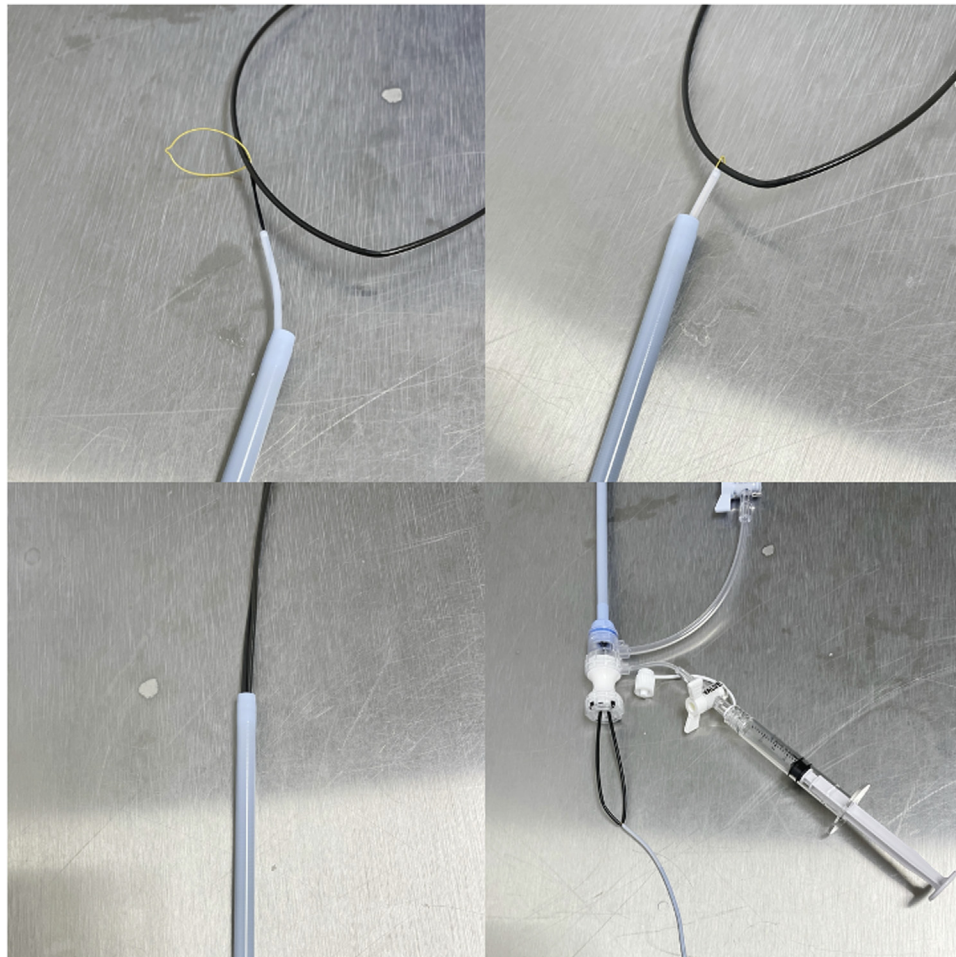
CONCLUSIONS

Intracardiac foreign bodies are associated with serious infectious and thromboembolic complications and, in our case, worsening heart failure and tachyarrhythmia. Endovascular removal should be attempted because it may be possible to retrieve these foreign bodies after years of embolization. Preparation for complications such as tachyarrhythmia, myocardial perforation, and cardiac tamponade should be compulsory.

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FIGURE 7 Ex-Vivo Demonstration

Ex-vivo demonstration using a loop snare and a 5-F glide catheter.

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KEY WORDS catheter fracture, central venous catheter, intracardiac foreign body, Swan-Ganz catheter

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