

**CASE REPORT**

# A Rare Complication: Anchoring Sleeve Embolization During Lead Extraction Procedure

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## Summary

The number of cardiac implantable electronic device (CIED) implantations has increased over recent years as a result of increasing life expectancy, population growth, and better access to healthcare. Even with improvements in CIED implantation and extraction methods, problems can still arise during these types of procedures. However, loss of the anchoring sleeve during this procedure is extremely rare. Here, we report a case of embolization of the anchoring sleeve into the left pulmonary artery during the extraction procedure and successful removal of the embolized material using the goose-neck snare technique.

**Keywords:** extraction; infection; sleeve embolization

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## Introduction

As the implantation rate of cardiac implantable electronic devices (CIEDs) continues to rise, CIED or procedure-related complications, such as lead failure or infection, are increasing at an even faster rate. Complications related to CIEDs commonly necessitate transvenous lead extraction (TLE), which may be a complex and challenging procedure. Despite the developments in CIED implantation and extraction techniques, complications can still occur during these procedures. The complications associated with TLE are classified into minor or major categories. Any complication considered

life-threatening, causing a disability, or requiring a significant intervention is classified as major (e.g., death, vascular laceration, hemothorax, thromboembolic events), while a minor complication (e.g., bleeding requiring transfusion, pocket hematoma requiring evacuation, pneumothorax necessitating chest tube placement) is an undesired event that may require a minor intervention and does not lead to disability or death.<sup>1</sup> Despite the complexity of the procedure, large series have reported a major complication rate of 1–1.7% in TLE, while procedural mortality has been found to be between 0.18 and 0.5%.<sup>2</sup> However, loss of the anchoring sleeve during the pacemaker extraction procedure is extremely rare. Herein, we present a case of embolization of the anchoring sleeve into the left pulmonary artery during a manual extraction procedure and the successful retrieval of the embolized sleeve using the goose-neck snare technique in a patient with an implantable cardioverter-defibrillator (ICD).

## Case Report

A 46-year-old male patient presented to the emergency department with complaints of fever and cough. At the time of admission, C-reactive protein (CRP) was 360 mg/dl and white blood cell (WBC) count was 14.500 10<sup>3</sup>/mm<sup>3</sup>. The patient, whose infection parameters were found to be high, was admitted to the general intensive care unit with a diagnosis of COVID-19 pneumonia. The patient

had a history of chronic kidney failure and heart failure. Due to the persistence and worsening of his symptoms, a cardiology consultation was requested, and then transthoracic echocardiography (TTE) was performed. His TTE revealed a vegetation attached to the ICD lead. His left ventricular ejection fraction was 25%. It was learned from the patient's anamnesis that ICD implantation was performed for secondary prevention approximately five years ago, and lead extraction and a new ICD implantation from the contralateral side were performed one year ago due to infective endocarditis. During the first three days of hospitalization, a total of four blood culture sets were positive for staphylococcus epidermidis. Intravenous therapy with meropenem was initiated according to the antibiotic sensitivity profile of the pathogen. After the patient's antibiotic therapy was completed, he was taken to the coronary angiography catheter laboratory for the TLE procedure. An informed consent form was obtained from the patient. Fluoroscopy was performed before the procedure and the anchoring sleeve was visualized in the left pectoral region. Additionally, a persistent left superior vena cava was detected on the fluoroscopy (Figure 1). Then, the lead extraction was performed in the supine position under local anesthesia and light sedation with fluoroscopy guidance via the left subclavian vein. After the skin incision, the device battery was removed. Then, extraction of the ICD lead was performed via the simple traction method. Following this procedure, the anchoring sleeve was not detected on the right ventricle lead. The anchoring sleeve was detected in the left pectoral region on fluoroscopy. Despite simple dissection of the tissues, the anchoring sleeve could not be found. Then, fluoroscopy was performed again and revealed that the anchoring sleeve had embolized to the left pulmonary artery via the venous system (Figure 2A) (Video 1). Percutaneous retrieval of the anchoring sleeve was considered to prevent potential infection and thrombosis risk.

A 6 Fr sheath was advanced via the right femoral vein. As the first step, pulmonary angiography was performed with a multipurpose catheter and confirmed the location and position of the embolized anchoring sleeve in the distal branch of the left pulmonary artery (Figure 2B, C). A 0.035" standard wire was then inserted into the left pulmonary artery and a 6 Fr right Judkins catheter was inserted over the wire. Then, a 20 mm goose neck snare kit

(Amplatz Goose Neck Kit, ev3, Medtronic, USA) was introduced through the 6 Fr right catheter from the right femoral vein. The embolized anchoring sleeve was grasped from the mid-portion with the goose neck snare in the left pulmonary artery and pulled until it reached the right femoral vein (Figure 2D-F) (Video 2-3). After several attempts, the anchoring sleeve was taken into the introducer sheath without complication. The entire system was removed from the femoral vein and the bleeding was controlled with manual compression.

## Discussion

The anchoring sleeve protects the lead body from the stresses and damage caused by a suture tied directly around it and also holds the lead securely in position when tied down.<sup>3</sup> The leads should be fixed to the fascia, not to subcutaneous fat, with anchoring sleeves using non-absorbable sutures. In addition to being friable, the subcutaneous plane is mobile and may result in lead dislodgment in obese patients, particularly in women with large breasts. It is important to use an anchor knot technique (i.e., first tie a non-slip knot on the muscle and transverse to fiber orientation) under the sleeve and then tie a loop in the groove of the suture sleeve. This technique offers the most traction resistance and also prevents dislodgement from "ratchet" or "reel" syndrome, which can result from loosening of the tie due to tissue shrinkage if the muscle and sleeve are taken together. However, when this fixation process is not done properly, the anchoring sleeve or lead can move from its place. In our case, it was thought that migration occurred due to the advancement of the anchoring sleeve into the venous structure during the fixation process in the first implantation procedure. Then, surgical trauma during simple dissection in the extraction procedure caused its embolization into the distal branch of the left pulmonary artery.

In lead extraction procedures, the location of the anchoring sleeve must be visualized after simple dissection and pulse generator removal. Then, the sutures around the anchoring sleeve should be removed. After the anchoring sleeve is released, the TLE procedure should be continued with simple traction. As in our case, if we pull the lead with simple manual traction without seeing and releasing the anchoring sleeve, we may predispose the patient to sleeve embolization.



**Figure 1.** At the beginning of the procedure, the anchoring sleeve (arrow) was visualized in the left pectoral region. Additionally, a persistent left superior vena cava was detected.

Foreign body embolization is a rare complication of the lead extraction procedure, with an incidence of 0.1-0.2%.<sup>4</sup> Due to the inherent risks of infection and thrombosis related to embolized foreign objects such as fixation sleeves or lead fragments, the retrieval procedure should be attempted. Surgery should be considered only if percutaneous techniques fail. The successful percutaneous retrieval of foreign objects can prevent the patient from long-term poor consequences. In our patient, acute percutaneous retrieval was considered since the patient already had an infective endocarditis clinic.

Transvenous retrieval of embolized CIED system components using a variety of endovascular devices has been successfully performed in both acute and chronic periods.<sup>5,6</sup> Many tools have been described for the endovascular retrieval of lost foreign bodies, such as snares, wires, and basket catheters. Snare techniques have high success and low complication rates.<sup>7</sup> The goose neck snare catheter is the most commonly used device for foreign body retrieval procedures.<sup>8</sup> In our case, the anchoring sleeve was removed easily using the goose neck snare catheter technique.

In conclusion, although the loss of the anchoring sleeve during a CIED extraction procedure is extremely rare, it can lead to serious morbidity or mortality. To avoid this life-threatening complication, the electrodes should not be removed without visualizing and releasing the anchoring sleeve during the dissection process in TLE procedures. Furthermore, the anchoring sleeve should be correctly secured to the fascia with the appropriate technique.

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## Informed consent

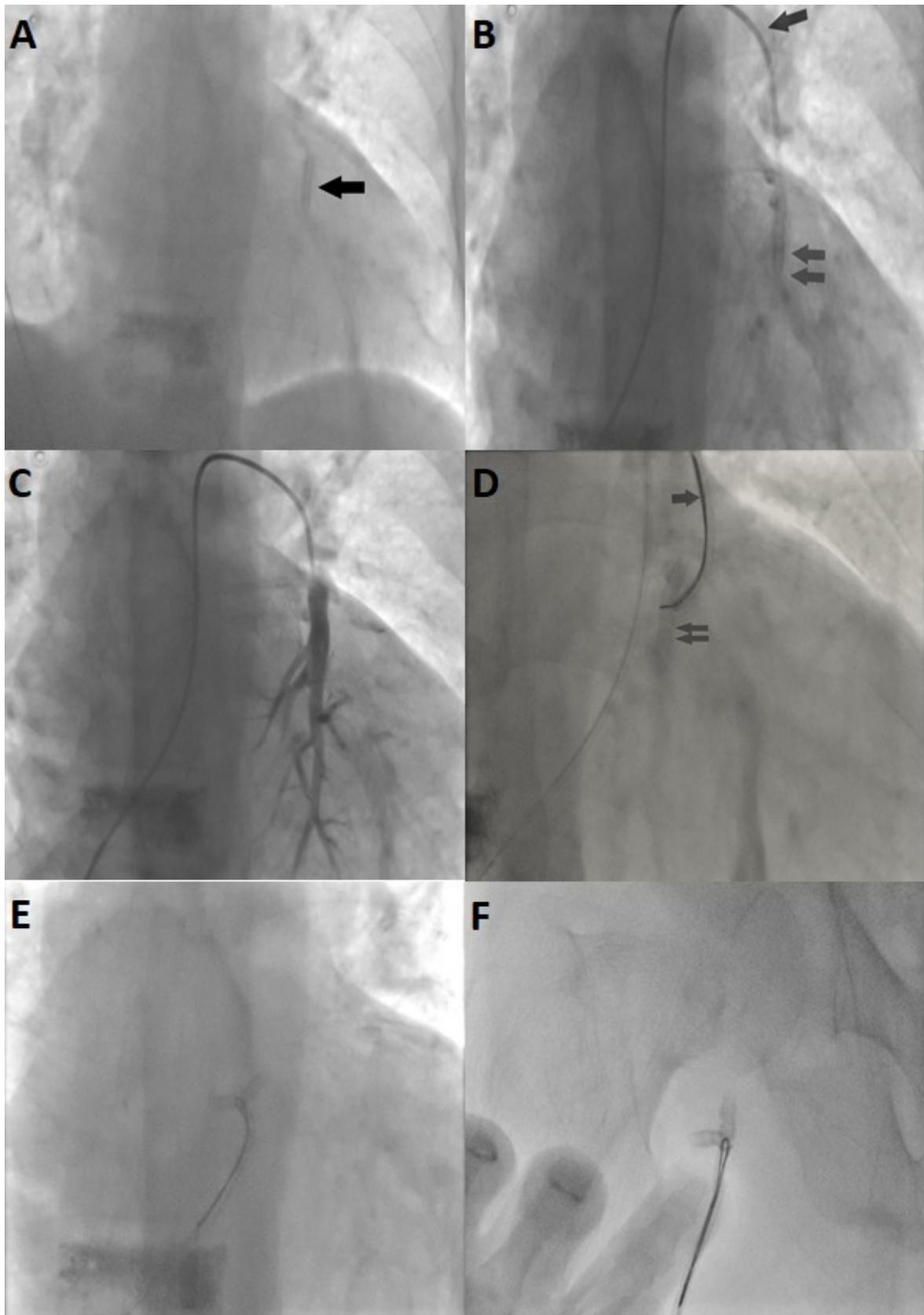
Written informed consent was obtained from the patient for the publication of the manuscript.

## Conflict of Interests

None

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**Figure 2.** A. The anchoring sleeve (arrow) was detected on fluoroscopy. B-C. Pulmonary angiography with a multipurpose catheter (arrow) confirmed the location and position of the embolized anchoring sleeve (double arrow) in the distal branch of the left pulmonary artery. D-F. The embolized anchoring sleeve (double arrow) was grasped from the mid-portion with the goose neck snare (arrow) in the left pulmonary artery and pulled until it reached the right femoral vein.