

Removal of a retained intracardiac radiolucent guidewire fragment using an Atrieve™ vascular snare using combined fluoroscopy and transesophageal echocardiography guidance in an infant

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ABSTRACT

Retained intravascular foreign body is a well-known complication of central venous access placement in children as well as adults. Most of these foreign bodies are radio-opaque and hence are removed under fluoroscopy guidance. In our case, we describe the removal of an intracardiac radiolucent foreign body in an infant utilizing a combination technique - transesophageal echocardiogram and fluoroscopy.

Keywords: Foreign body, intervention, pediatric, retrieval

INTRODUCTION

The use of vascular access lines in both central venous and arterial sites has significantly increased in the past decades. Indwelling central venous and arterial catheters are used for indications such as dialysis,^[1] apheresis,^[2] chemotherapy,^[3] total parenteral nutrition^[4] or in cases of difficult peripheral access for administration of medications or intravenous fluids.

Several complications associated with central vascular access have been described. These include bleeding, infection, air embolism, cardiac arrhythmias, vascular damage, and embolization of catheter or guidewire fragments.^[5,6] Guidewire fracture and intravascular retention are well-described complications during central venous access placement in both adult and children.^[7] These retained fractured elements are usually removed under fluoroscopy guidance since the catheter and guidewire material are generally radio-opaque and are easily visualized under fluoroscopy.^[7] We report a case of removal of a radiolucent, uncoiled, fragmented portion of the guidewire using both fluoroscopy and ultrasound guidance.

CASE REPORT

A 1.5-month-old term, male infant weighing 3.0 kg, was transferred to our institution for intensive management of bronchiolitis. One week before the transfer, the patient had undergone endotracheal intubation and unsuccessful attempt at the right subclavian central venous access. During the attempt, the guidewire (Cook 035" diameter, Teflon straight tipped) became entrapped inside the access needle. The wire was sheared off at the needle tip during attempts to remove the wire. Chest X-ray and ultrasound scan of the neck showed a radio-opaque foreign body in the neck at the level of right clavicle, consistent with retained wire fragment in the right internal jugular vein [Figure 1]. The fragment measured 1 cm in length.

Under fluoroscopic guidance using a right femoral venous approach, the removal of the retained wire fragment was attempted with a 5 mm Amplatz GooseNeck® snare by the interventional radiology team. The retained fragment was captured with the snare, but while attempting to

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pull it out through the snare catheter, the wire fragment “uncoiled” and became radiolucent and no fragment could be retrieved [Figure 2a and b]. An echocardiogram demonstrated a linear echo-bright material extending from the superior vena cava (SVC) to the right atrium and into the right ventricle across the tricuspid valve [Figure 3]. The patient remained asymptomatic without cardiac arrhythmias or hemodynamic instability. The patient was then referred to the catheterization laboratory for the removal of the uncoiled fractured guidewire.

Retrieval technique

Since the fractured segment was no longer radio-opaque, the procedure was performed with both transesophageal and transthoracic echocardiographic guidance along with biplane fluoroscopy and cine [Figure 4].

Under general anesthesia, a 6-Fr central venous sheath was inserted percutaneously into the right femoral

vein. Initially, a 5 mm EV3 Amplatz GooseNeck® snare catheter assembly was inserted through the right femoral venous sheath and advanced to the SVC to attempt to remove the retained guidewire. Despite multiple attempts, the fractured segment of the guidewire could not be securely held with the snare. Subsequently, a 6-Fr Atrieve™ 9–15 mm vascular snare assembly was used. With transesophageal echocardiographic guidance, the retained guidewire was snared and removed through the right femoral vein [Figure 5]. The snare technique required the wire fragment to be pressed against the right atrial wall before it could be grabbed by the snare. Examination of the retrieved guidewire fragment confirmed the original speculation that the guidewire uncoiled during the previous retrieval attempt rendering it longer and radiolucent. After the removal, the fragment measured 11 cm in length compared to the original length of 1 cm.

Follow-up evaluation with ultrasound and cine of the SVC, heart, inferior vena cava, iliac, and femoral veins showed no evidence of any retained foreign body.



Figure 1: The chest X-ray shows retained guidewire fragment in the right neck measuring 1 cm in length

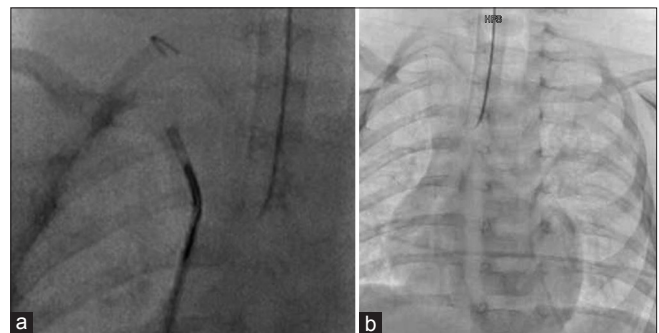


Figure 2: (a) Stored fluoroscopic image shows that the guidewire fragment has been modified after attempted removal with a goose neck snare. (b) Stored fluoroscopic image after attempted removal of the guidewire fragment shows that the guidewire has become radiolucent

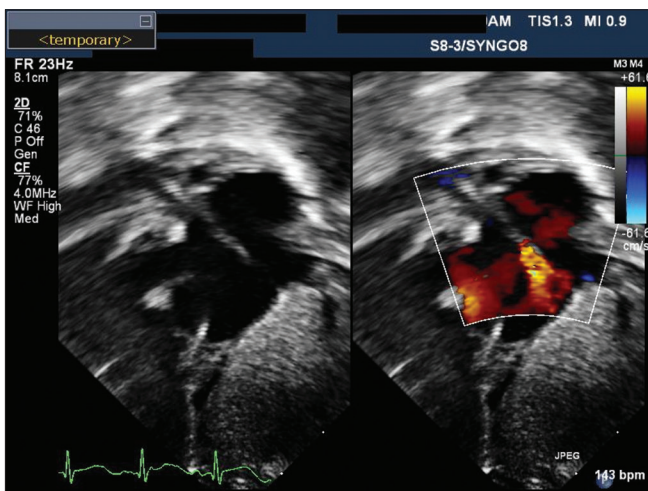


Figure 3: Echocardiographic image shows the guidewire fragment extending from the superior vena cava across the tricuspid valve

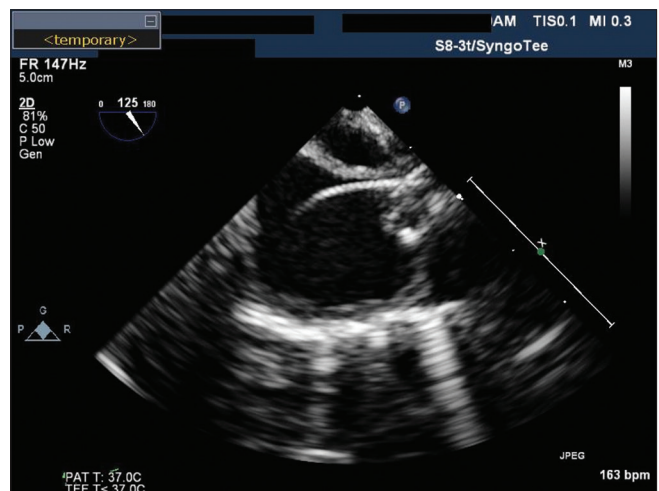


Figure 4: Transesophageal echocardiogram shows the guidewire fragment extending from the superior vena cava to the right atrium

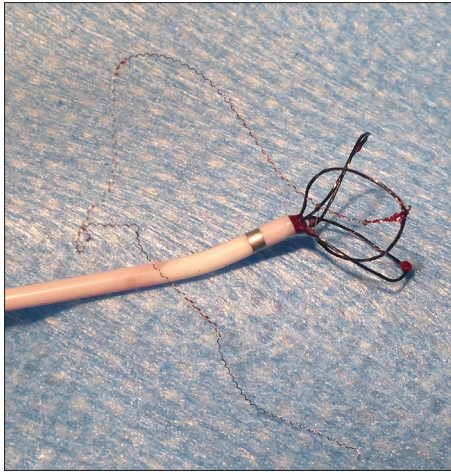


Figure 5: The vascular snare is shown with the retrieved guidewire. Uncoiling of the guidewire coil spring has resulted in thinning and lengthening of the guidewire fragment

Postprocedure echocardiogram showed no injury to intracardiac or vascular structures and no pericardial effusion.

DISCUSSION

This case report describes the utility of combining transesophageal echocardiography and fluoroscopy for the removal of a radiolucent intracardiac guidewire fragment. The retained wire segment was initially radio-opaque but had been rendered radiolucent by “uncoiling” during the initial retrieval attempt.

The structure of guidewires consists of central ribbon wire and core wire surrounded by a coil spring [Figure 6]. Guidewires with diameter over 0.032" usually have both ribbon wire and core wire but guidewires with lesser diameter have only core wire inside the coil spring. The wire used to manufacture the coil spring has a diameter of 0.001" making it radiolucent once uncoiled.

Retention of a fractured guidewire segment during central venous access placement is a well-documented complication.^[7] Chow *et al.* reported an incidence of catheter fracture and embolization of 6.7/1000 PICC insertions.^[8] The techniques described, mainly in the interventional radiology literature for removal of these retained foreign bodies involve use of fluoroscopy as the mainstay of image guidance since the majority of the retained foreign bodies are radio-opaque.^[9] The reported success rate is 71%–100%, with fluoroscopy alone for guidance.^[7,10,11] This standard technique alone is insufficient when the retained fragment becomes uncoiled, making it radiolucent as in our patient. Despite the radiolucency, the fragments remain echogenic. Thus, the fragment could be removed only with a combined image guidance technique - fluoroscopy to guide the

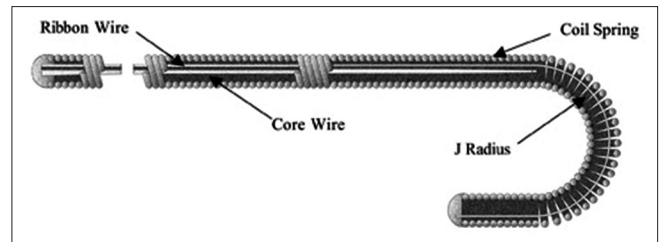


Figure 6: The cartoon depicts the structure of a typical guidewire. The inner ribbon wire and core wire support the outer coil spring

vascular snare movement and echocardiography to guide the precise intracardiac location.

Having access to a variety of vascular retrieval devices was crucial to the success of this case. A long narrow radiolucent wire that extended from the SVC to the right atrium and right ventricle is not amenable to retrieval by a standard Amplatz GooseNeck® snare. The Atrieve™ snare with its open flower-like configuration was the optimal device in this case.

Obtaining central venous access in neonates and infants can be challenging. Careful attention to various steps of the Seldinger technique is critical for a safe procedure. In this case, the original guidewire must have inadvertently entered the right internal jugular vein from the right subclavian vein and during attempts to reposition, became kinked at the needle tip. Attempting to remove the wire alone in this circumstance, results in the shearing off of the wire as happened in this case. The right step, once the wire cannot be removed smoothly is to remove both the wire and the needle together and start over.

CONCLUSION

Use of a combination imaging guidance technique with ultrasonography and fluoroscopy can be used to retrieve an intracardiac radiolucent retained foreign body.

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Conflicts of interest

There are no conflicts of interest.

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