

Utility of a percutaneous mechanical thrombectomy device in retrieval of an iatrogenic intravascular foreign body

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ABSTRACT

Intravascular foreign bodies can result from endovascular procedures and from other medical implants and devices. A wide variety of techniques and devices have been described for the retrieval of such intravascular foreign bodies in reported studies. In the present report, we have described the case of a patient with a symptomatic left innominate vein deep vein thrombosis who also had a retained catheter fragment from a fractured tunneled infusion catheter in the left innominate vein. Using the Inari ClotTriever system (Inari Medical, Irvine, CA), we were able to, not only restore venous outflow by treating the acute deep vein thrombosis, but also retrieve the fragments of the fractured catheter. (*J Vasc Surg Cases Innov Tech* 2022;8:506-9.)

Keywords: ClotTriever; Deep vein thrombosis; Intravascular foreign body; Intravascular ultrasound; Percutaneous mechanical thrombectomy

With the technological advancements during the past two decades, the number of endovascular procedures performed has increased exponentially.¹ Intravascular foreign body (IVFB) retention and embolization is a dreaded complication of such endovascular procedures. These IVFBs can also result from other medical implants and devices such as central venous catheters, tunneled dialysis catheters, Swan-Gantz catheters, Mediports, and so forth. The retrieval of IVFBs can be challenging in some cases.

The Inari ClotTriever system (Inari Medical, Irvine, CA) is a more recently developed mechanical thrombectomy device that has shown utility in the treatment of acute, subacute, and chronic deep vein thrombosis (DVT) by removal of the obstructive thrombus and restoration of venous outflow.²⁻⁴ Thrombolytic agents will generally not be required with the use of ClotTriever system and patients will not require monitoring in the intensive care unit afterward.^{3,5} More recently, our center has shown the utility of the ClotTriever system in the treatment of calcified in-stent restenosis in the iliofemoral venous system.⁶ In the present report, we have described the case of a patient with a symptomatic left innominate

vein DVT who also had had a retained catheter fragment from a tunneled infusion catheter in the left innominate vein. Using the Inari ClotTriever system, we were able to not only restore the venous outflow by treating the acute DVT but also to retrieve the fragments of the fractured catheter. The patient provided written informed consent for all the performed procedures and the report of her case details and imaging studies. The institutional review board approved the data collection and analysis for the present study.

CASE REPORT

A 41-year-old patient with a history of COVID-19 (coronavirus disease 2019) infection had recently presented to our tertiary care venous specialty clinic with symptomatic acute DVT of the left innominate vein. Her symptoms had been present for 2 weeks before her presentation. Several months previously, she had undergone attempted surgical removal of a Mediport infusion catheter from the left innominate vein, which was believed to be infected. However, the terminal portion of the catheter had broken off during the retrieval attempt and a retained fragment was left in the patient. She requested removal of this IVFB, if possible.

Our focused physical examination noted intact radial and ulnar pulses, grade ≥ 3 edema of the left arm, and tenderness to palpation. She also complained of central chest pain. Venous duplex ultrasound showed acute thrombosis of the left internal jugular vein, innominate vein, and subclavian vein. Computed venography was performed, which showed acute occlusion of the left internal jugular vein, innominate vein, and subclavian vein. Extensive stranding within the upper anterior mediastinum was also observed. This was most likely compatible with an inflammatory response secondary to the DVT, the catheter itself, or the maneuvers used to manipulate the catheter previously. Within the posterior aspect of the left innominate vein, a single, small tubular hyperdensity with rim calcification was seen (Fig 1).

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Fig 1. Coronal view of computed tomography venogram of the chest. The *white arrow* indicates a tract-like hyperdensity in the occluded left innominate vein, suggestive of a foreign body with rim calcification.

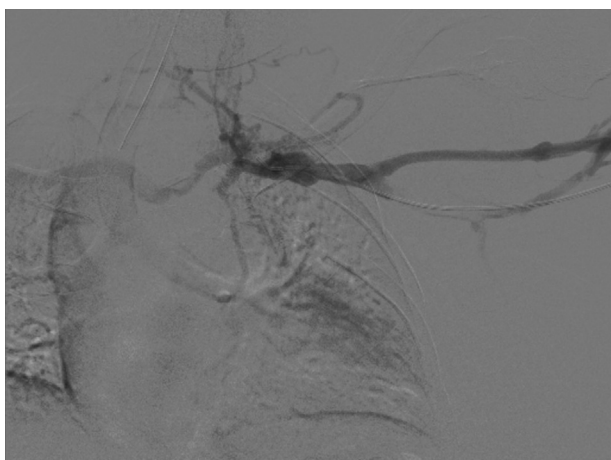


Fig 2. Venogram demonstrating left innominate vein occlusion and multiple thoracic collateral vessels.

This configuration was suggestive of a broken piece of catheter. The patient was prescribed oral rivaroxaban (15 mg twice daily), which had not been interrupted for the thrombectomy procedure.

Given the patient's acute symptoms and presentation, extirpation of the thrombus was considered. The patient was placed supine under general anesthesia. The left brachial vein was accessed under ultrasound guidance with a micropuncture needle, followed by placement of an 11F × 10-cm sheath. Selective venography was performed, which showed luminal filling defects, early collateralization, and occlusion of the left innominate vein (Fig 2). After the obstructive thrombus had been traversed with a glide wire, intravascular ultrasound was performed to confirm the presence of acute thrombus and true intravenous positioning of the wire in the left innominate vein (Fig 3) and superior vena cava. The access site was dilated with a 13F dilator before placement of the Inari ClotTrievers

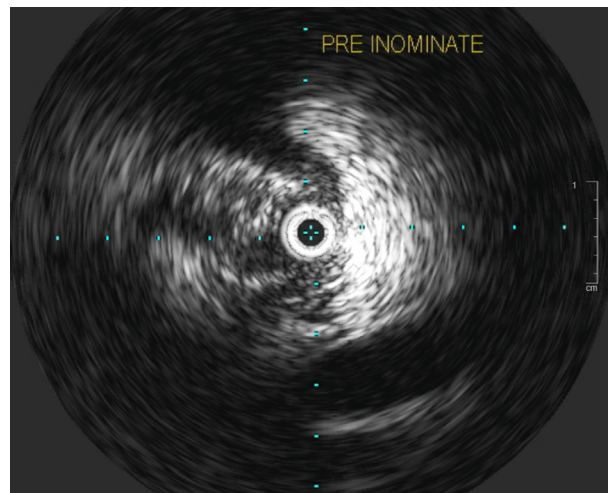


Fig 3. Intravascular ultrasound showing acute thrombus in the left innominate vein.



Fig 4. Acute and subacute thrombus retrieved with Inari ClotTrievers thrombectomy system. Also seen in the corner of the image (*white arrow*) are fragments of the infusion catheter retrieved with the Inari device.

sheath over an 0.035-in., 260-cm Amplatz guidewire (Boston Scientific, Marlborough, MA). Balloon maceration of the thrombus was performed using a 14 × 60-mm Atlas Gold angioplasty balloon (Becton, Dickinson, and Co, Franklin Lakes, NJ). After venoplasty of the axillosubclavian and innominate veins, four passes of the ClotTrievers device were performed from the superior vena cava to the brachial vein at the 3-, 6-, 9-, and 12-o'clock positions, with a 90° rotation with each pass, using a pullback technique. In addition to the acute and subacute thrombi, the Inari thrombectomy system was able to retrieve the retained catheter in two fragments (Fig 4). Completion imaging was then performed (Fig 5). No lytic agents were used during the procedure. No additional heparin was administered during the procedure. Manual pressure was held at the access site at the conclusion of the procedure for 15 minutes, followed by application of a compressive wrap over the left arm.

The patient tolerated the procedure well and was discharged on postoperative day 1 with a prescription for oral anticoagulation therapy. She reported significant improvement in her symptoms related to her obstructive DVT. Ultrasound at 2 months

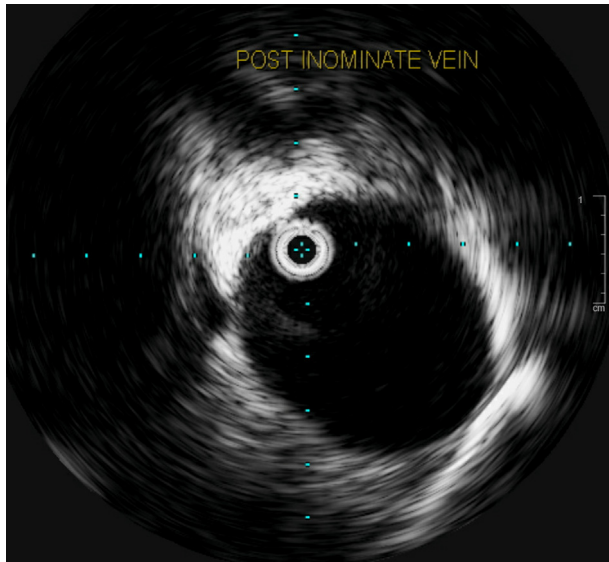


Fig 5. Intravascular ultrasound showing patent left innominate vein after intervention.

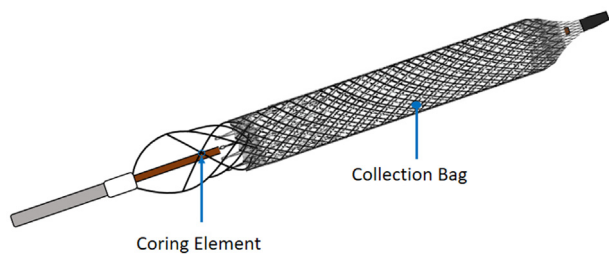


Fig 6. The Inari ClotTrievers thrombectomy system with the nitinol coring element and nitinol collection bag.

postoperatively demonstrated continued patency of the left innominate vein.

DISCUSSION

The Inari ClotTrievers thrombectomy system was developed for use in the venous system for thrombus removal in a single setting.^{3,6} It has an expandable nitinol coring element that provides wall-to-wall apposition.^{4,5} In our patient, this coring element was able to engage and retrieve the chronically retained IVFB, in addition to the thrombus. The second element of the Inari ClotTrievers system, in continuity with the coring element, is an integrated nitinol collection bag (Fig 6). This collection bag captures the thrombus and any other excised debris, preventing embolization.^{4,6} Minimal blood loss occurs with the use of this thrombectomy system.⁵ However, the principle disadvantage is the potential entanglement of its two elements (the coring element and the collection bag) with the tines of a preexisting inferior vena cava (IVC) filter or the struts of venous stents, especially Gianturco Zenith stents (Cook Medical Inc, Bloomington, IN).^{5,6} To prevent such problems, three potential solutions exist. One is to

start the thrombectomy below the level of the IVC filter or Zenith stent.⁶ The second option is to place the wire up and over the ilio caval bifurcation into the contralateral iliofemoral venous system and start the thrombectomy just before the ilio caval bifurcation. The third option is to place a large-bore protective sheath ($\geq 16F$) from the right internal jugular vein and place it below the level of the IVC filter. The Inari ClotTrievers thrombectomy system appears to be safe. We have not encountered any technical issues with the device during its use when these precautions were taken. In the CLOUT (ClotTrievers outcomes) registry, the rate of serious adverse events with the ClotTrievers through 30 days was 0.4%.³ We have not experienced events such as renal failure with the Inari ClotTrievers system—a complication we have observed with the AngioJet rheolytic thrombectomy system (Boston Scientific, Marlborough, MA).⁷ IVUS, which is more sensitive than venography, should be used throughout the procedure.⁸⁻¹¹

IVFBs can include catheters, guidewires, IVC filter elements, stents, angioplasty balloons, embolization coils, and fractured sheaths. Excessive force can be required at times to remove central venous catheters, primarily owing to the formation of a fibrin sheath around the catheter.¹ This can result in fracture of the catheter. These IVFBs have the potential to embolize to the cardiopulmonary vasculature. Various techniques have been described for the retrieval of such foreign bodies, including the use of a variety of snare types, reverse curve catheters, grasping forceps, tip-deflecting wires, and angioplasty balloons.^{1,12-15} Technical success with removal of IVFBs has been reported in $\geq 80\%$ of the cases.^{1,16,17} In one large series, two catheters that could not be retrieved were in the subclavian vein and innominate vein area of the body.¹ It is possible that the Inari ClotTrievers system could have a role in the removal of such stubborn IVFBs.

CONCLUSIONS

In the present report, we have demonstrated the utility of the Inari ClotTrievers thrombectomy system in the retrieval of an iatrogenic IVFB. Other interventionists could consider its use in the removal of similar venous foreign bodies. The results from a larger series would be helpful in confirming our findings.

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