

Endovascular Removal of Long-Term Hemodialysis Catheters

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Abstract Central venous catheters that have been in place for a long time can become fixed to the vein wall, making them impossible to pull out. Leaving them in situ is undesirable because of the risk that they could act as a nidus for thrombosis. Moreover, inserting new catheters alongside the old ones might compromise flow in the superior vena cava, further predisposing to thrombosis. Surgical removal is likewise undesirable, as this would necessitate thoracotomy with the attendant risks. We describe a novel technique, which we were able to use to remove retained long-term hemodialysis catheters in a patient who needed new catheters and who would have been a high-risk candidate for surgery. The right internal jugular vein was punctured adjacent to the site of insertion and a guide wire was used to form a snare, which was passed around the catheters and used to saw through the fibrous attachments to the vein wall. The midsection of one catheter could not be freed but the snare was used to cut off the proximal and distal ends, which could then be removed, the latter via the femoral vein. New catheters were then inserted via the left internal jugular vein. This technique enabled successful catheter extraction and replacement in a patient who would have been a poor candidate for cardiothoracic surgery.

Keywords Central venous catheters · Complications · Removal

Long-term central venous access is well established in the management of a variety of conditions—for hemodialysis in chronic renal failure as in this case, for parenteral nutrition in patients with intestinal failure, for antibiotics in patients with cystic fibrosis, and for blood products in those with hemophilia, among others. A variety of products and available for these various purposes. Complications of insertion or those resulting from the presence of the devices are well described but there is much less literature on the complications of removal or on how they can be managed. We describe a novel technique for removing indwelling central venous catheters that have become incorporated into the vein wall through a fibrotic reaction.

Case Report

A 67-year-old woman with chronic renal failure was referred from the renal unit with twin Tesio hemodialysis catheters (Medcomp, Harleysville, PA, USA) that had been in place for 7 years. The catheters had been inserted via the right internal jugular vein. They had been in regular use but had begun to malfunction over the previous weeks. The renal physicians had attempted to remove the catheters on the ward with a localized cut-down but failed. Plain films did not show any calcification around the catheters.

The options were discussed with the patient, who was adamant that she wanted the catheters removed due to the theoretical risks of venous occlusion and infection if they were left in situ, particularly as she was going to need new catheters inserted.

The left internal jugular vein was punctured initially, to provide access for new Tesio catheters, which would be needed in any case. A preliminary venogram via this route demonstrated that the left internal jugular and left brachi-

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Fig. 1 The improvised snare is in place around the first catheter



Fig. 2 The first catheter has been freed up and divided with the snare

ocephalic veins and the superior vena cava were patent. The tips of the catheters were in the right atrium.

The right internal jugular vein was punctured immediately cranial to the catheters under ultrasound guidance, as close to the insertion site as possible. Venography demonstrated that the right internal jugular vein, right brachiocephalic vein, and superior vena cava were patent. A 7F

sheath (Cordis, Warren, NJ, USA) was therefore inserted via this access.

A cut-down was performed at the skin insertion site of the catheters and they were dissected free up to the point at which they entered the right internal jugular vein. The tissue ingrowth cuffs were freed by sharp dissection. The catheters still could not be withdrawn and it was apparent that they were attached by fibrous tissue to the lateral wall of the internal jugular and brachiocephalic veins.

Stiff Terumo (Terumo Europe, Leuven, Belgium) wires were passed through the catheters to stiffen them. A snare was then formed using a 0.21-in. straight wire (Merit Medical, South Jordan, UT, USA) and a 4F multipurpose catheter (Cordis), by passing the wire through the end of the catheter and back through a side-hole. This was passed down through the 7F sheath and the loop passed over the tip of one of the hemodialysis catheters. The catheter was then withdrawn, leaving the snare in place around the hemodialysis catheter (Fig. 1).

A sawing to-and-fro motion was then exerted on the wire to cut the catheter free from the sidewall of the right brachiocephalic vein. To aid with this, the right common femoral vein was punctured and a 7F bright tip sheath (Cordis) was inserted. A snare (ev3 Inc., USA) was passed up from this access. The tips of the hemodialysis catheters were snared to steady them.

Using this technique the distal parts of each catheter were freed from the vein wall and divided (Fig. 2). It took approximately 15 min to free up and divide each catheter using moderate force. The distal segments were removed via the femoral access. The proximal segment of one of the catheters was removed intact from the neck via the internal jugular vein entry point.

It proved impossible to free the midsegment of the second catheter completely from the vein wall. The wire from the improvised snare was therefore passed down again via the sheath in the right internal jugular vein around this catheter, snared, and pulled back up through the sheath. The improvised snare was then reformed as described above and used to divide this catheter at the point of attachment. The most proximal part was removed via the internal jugular vein entry point, leaving the midsection *in situ*.

Finally, new Tesio catheters (Bio-Flex Tesio; Med-comp,) were inserted via the left internal jugular route (Fig. 3). The whole procedure took approximately 2 h.

Discussion

Removal of intravascular foreign bodies has become well established as part of the interventional radiologist's repertoire; however, this usually involves retrieval of catheter

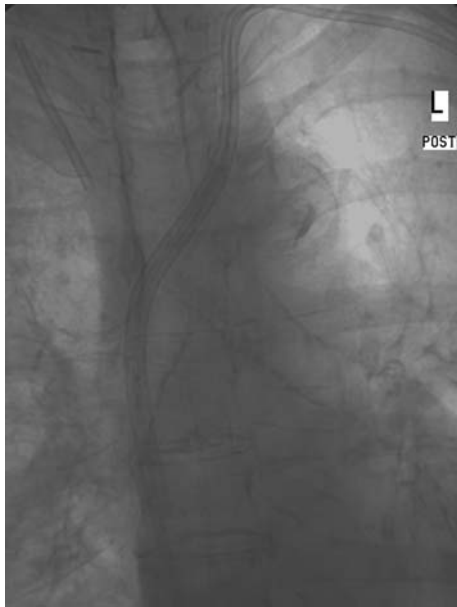


Fig. 3 The new Tesio catheters have been inserted via the left internal jugular vein. The midportion of the second catheter is still incorporated in the wall of the right internal jugular vein and has been left in situ

tips that have broken off and floated downstream to embolize in distal arteries or in the heart or pulmonary vascular tree. Several publications have detailed the techniques available in these situations [1–4]. However, we are unaware of any reported cases of endovascular retrieval of catheter fragments that have become fixed to the vein wall. The only publication we have found which makes reference to such a phenomenon is that of Jones and Giacomantonio, who described three such cases in children [5]. Their management was to leave the catheter fragments in place. They commented that retrieval would involve surgical venotomy and possible thoracotomy.

It is undesirable to leave intravascular foreign bodies in situ due to the risk that they can act as a nidus for the propagation of thrombus [6]. There is also a theoretical risk that they could act as a nidus for infection, though we have not found any reports of this phenomenon. In patients who will need central venous access in perpetuity, such as those with chronic renal failure who are unsuitable for transplant, it becomes particularly important to safeguard venous

access by limiting factors which could cause venous thrombosis. In our patient, inserting new Tesio catheters while leaving the old ones in situ would have predisposed to thrombosis by reducing flow in the superior vena cava.

However, if the alternative to leaving the catheters in situ is major surgery, then conservative management becomes more attractive, particularly if, as in this case, the patient is elderly with one-system failure and therefore an unattractive surgical risk. The ideal solution is to be able to remove the lines without surgery.

Although we were unable to remove both catheters completely, the residual fragment appeared to be incorporated into the vein wall and therefore was much less likely to act as a nidus for thrombus or infection.

We have described a method that can safely be used to retrieve catheter fragments that have become fixed to the vein wall. This technique could be attempted with all types of catheters. The main aim is to try and strip the catheter off the wall of the vein, with cutting as a last final resort if this does not work.

One possible complicating factor—that the fibrin sheath enclosing the catheter and attaching it to the vein wall could become calcified—was not present in this case. The presence of calcification could make this technique more difficult and hazardous.

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