The entrapped central venous catheter

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The central venous catheter (CVC) is associated with numerous complications more so during the process of insertion. We report for the first time how an indwelling catheter was entrapped by a replacement catheter on the same side, after being speared by the introducer needle and guidewire. The diagnosis was made when there was difficulty in removing the old catheter. Subsequently, interventional radiology services were used to define the problem and help in removal of the entrapped catheter. The mechanism of entrapment and the actual procedure used for removal of the catheter is described. The dangers of insertion of a CVC on the same side as a pre-existing one are highlighted.


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The use of central venous catheters (CVC) is common in the setting of the intensive care unit for monitoring of central venous pressures, fluid administration and drug infusions. In the United States, 5 million CVCs are reported to be inserted every year.1 In our unit by current estimates, 1300 catheters are inserted per year. Complications of this procedure are well documented in the available literature2–5 and can arise during the insertion, maintenance or removal of the CVC. Mechanical complications such as breakage and subsequent embolization of distal fragments have been described2–5.

We describe the first ‘entrapped catheter’ and its successful removal.

Case report

A 48 yr female was admitted with polytrauma after a motor vehicle accident. She had extensive injuries including bilateral haemothoraces. She developed post-admission complications of ventilator-associated pneumonia and multi-organ dysfunction with acute renal failure needing continuous renal replacement therapy.

On day 7 of admission a 20 cm long, 7.5 Fr triple lumen CVC (Cook Spectrum) was placed in right subclavian vein using the infraclavicular approach and a Seldinger technique. Anatomical landmarks were used to guide placement. The catheter was inserted to the 15 cm mark at the skin insertion site with the position checked by a chest radiograph.

Seven days later, replacement of the CVC was planned as a result of an unsourced inflammatory response and clinically suspected catheter-related sepsis.

Using the Seldinger technique via a supraclavicular approach to the right subclavian vein a CVC of the same type was inserted. However, it was noticed that although the line was inserted with a single pass, some resistance was encountered while advancing the catheter over the guidewire. Blood was aspirated from all three lumens, and a chest roentgenogram (CXR) confirmed an adequate position.

Some time later, the nurse caring for the patient reported resistance while attempting to remove the original (first) catheter. Despite gentle traction and clavicular manoeuvring, the medical staff also could not remove the catheter and interventional radiology was asked to assist in the removal of the trapped catheter.

Initial fluoroscopy demonstrated the two catheters in close approximation. No kinking or knotting was evident. Aspiration of each lumen of the triple lumen central line due for removal was attempted but was unsuccessful. A Terumo stiff guide wire (Terumo; Watertown, MA) was passed down the lumen of this CVC. But when the CVC was pulled on, the newer CVC appeared to move along with it at the
point where the two intersected and appeared to pinch the new CVC. The wire was removed and contrast instilled via each of the lumens of the original CVC. This demonstrated some contrast leakage at the point of intersection and back along the subcutaneous tract. Contrast also flowed from the end of the CVC confirming its intravascular location. Contrast was then injected down the new CVC to confirm it was intact.

As both CVCs were the same size it was noticed the original CVC entrapped the new CVC such as a vice, this being demonstrated when traction was applied (seen in Fig. 1A). Rotating the original catheter allowed release of the entrapment and easy withdrawal of the original CVC, as demonstrated in Figure 1B.

Post-removal, inspection of the line confirmed entrapment (Fig. 2). It was seen that the catheter wall had a slit-like opening at the site where the new CVC would have gone through it as per the radiological images. The new CVC was left in situ. No documented complications arose from the procedure.

**Discussion**

Since the beginning of its use, the CVC has been associated with numerous complications of varied severity broadly classified as mechanical, infective and thrombotic.

Mechanical complications and the management thereof have been studied and documented. Shear/fracture of the CVC is also a recognized complication with incidence of 2.5% over a 5 yr period at one centre.

In our case, we surmise the cutting edge of the introducer needle to have caused the initial fracture and the subsequent insertion of the guide wire directing the new CVC into the fracture. The second CVC had speared the original catheter, thus preventing its removal (Figs 1 and 2). A catastrophic complication in the form of complete fracture and embolization of the distal fragment of CVC could have resulted if there had been excessive traction on the original CVC.

The possible causes of the difficulty in removing the original CVC could have been a "pinch off", fibrin sheath or entanglement/knotting.

Direct imaging by interventional radiology allowed the complication to be accurately diagnosed with successful line removal (see Fig. 1).

Various methods of dealing with fractured CVC have been explored. For incomplete fractures: (i) slow gentle traction and (ii) cutaneous cut-down followed by distal venotomy for incompletely fractured catheters. For complete fractures: (i) radiological loops, snares, coils—the use of more sophisticated devices such as grasping forceps, baskets or balloons rarely overcome the failure of a loop snare and (ii) surgical exploration.

The role of radiology in the diagnosis and management of complications related to central venous access is well described. Diagnosis of catheter fragmentation is usually made on the basis of a chest radiograph in two views. Therapy consists of interventional radiological removal of the CVC fragment.

At one centre 95% successful retrieval of embolized fragment by interventional radiological procedures has been reported.

Hazards and caution during multiple cannulation of the same vein have been described. Mahadeva and
colleagues\(^3\) reported shearing and partial fracture of the old CVC making removal difficult after repeated attempts at a new CVC insertion. A venotomy was required.

Our case and previous reports caution the insertion of CVC on the same side as an existing CVC. Once shearing of the catheter is suspected, the method of removal should be determined by the institutional resources. Resistance during CVC insertion from the introducer needle, guide wire or the catheter itself, should caution to cease further attempts at same vessel before the existing cannula is removed unless imaging is available to guide the insertion.

If entrapment is suspected then accurate diagnosis and appropriate management is essential in preventing catastrophic complications such as fragment embolization. Hence, a low threshold for referral to interventional radiology should be maintained. If necessary, referrals to appropriate centres should be made.

Figure 3 shows the algorithmic approach towards the diagnosis and management of an entrapped CVC.

**Conclusion**

In summary, we describe an unusual case of entrapped catheter by a pre-existing catheter and a safe and effective means to remove it and also an algorithm for the diagnosis and management of the entrapped CVC (Fig. 3). Careful observation and immediate attention to the problem can prevent more serious sequelae such as embolization of the fragmented catheter tip. We recommend caution during the insertion of a CVC on the same side as a pre-existing CVC. When resistance is encountered at any stage of CVC insertion the procedure should either be abandoned or re-attempted with imaging assistance. Clinicians need to be aware of this rare complication and its correction by interventional radiology.\(^9\) We propose an algorithm for the diagnosis and management of the entrapped CVC (Fig. 3).

**References**