Case Report

Early transection of a central venous catheter in a sedated ICU patient

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We report transection and embolization to the heart of a subclavian venous catheter in an immobilized and mechanical ventilated patient. The catheter tip was retrieved using a percutaneous method via the left femoral vein. Mechanical compression of the subclavian venous catheter at the costoclavicular area is termed pinch-off syndrome. It can be recognized by intermittent difficulties with drug injection, and chest wall swelling at the insertion site. The diagnosis can be confirmed by chest radiography with or without contrast administration. A more lateral approach of the subclavian vein is advocated to prevent compression.

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Central venous catheters are frequently used in ICU. The subclavian venous catheter is less likely to result in catheter-related infection than the internal jugular and femoral venous catheterization. However, the subclavian route is associated with serious mechanical complications such as arterial puncture (3.1–4.9%), haematoma (1.2–2.1%), pneumothorax (1.5–3.1%) and haemothorax (0.4–0.6%). Catheter transection has been described to be a rare complication of permanent subclavian catheters but have to our knowledge never been described in immobilized ICU patients. The distal part of the transected catheter may embolize to the heart and may cause complications such as arrhythmia, endocarditis, perforation of the heart and pulmonary embolism.

Case report

A 46-yr-old man was admitted to ICU for respiratory insufficiency and multiple organ dysfunction syndrome caused by alcoholic necrotizing pancreatitis. He was deeply sedated (Ramsey score 5 patient asleep, sluggish response to a light glabellar tap) with midazolam (10 mg h⁻¹), propofol (120 mg h⁻¹), morphine (4 mg h⁻¹), mechanically ventilated, and treated with i.v. antibiotics (ceftriaxone, gentamicin and amoxicillin/clavulanic acid) and haemodynamic drugs (dobutamine, dopamine and norepinephrine). The patient was treated in 30° dorsal elevation with regular change of position on a conventional ICU bed, and once daily moved to sitting position for radiography.

A left subclavian central venous catheter (Arrow-Howes, triple lumen, 7 French, 16 cm, Reading, PA, USA) was placed using a Seldinger technique without any complication. Correct position of the catheter was confirmed by chest radiography (Fig. 1A). A subcutaneous swelling surrounding the insertion appeared 6 days after placement of the catheter. Chest radiography revealed a fractured catheter with the proximal part (5 cm) of the catheter in situ and the distal end (10 cm) of the catheter in the heart contour. The proximal part of the catheter was removed without effort. The distal part of the catheter was retrieved using a percutaneous method via the left femoral vein puncture through a 10 French introducer sheath (Cordis J&J, Miami Lakes, FL, USA). The catheter was retrieved via selective antegrade catheterization of the right ventricle using the snare technique with a 5 Fr PIER catheter (Cordis J&J) and retrograde introduced and doubled 0.018” guidewire (Terumo, Tokyo, Japan) under fluoroscopic guidance.
The fractured segment of the catheter had a frayed aspect. There were no clinical sequelae related either to the catheter transaction or its retrieval. The patient recovered gradually and was transferred to a regular ward 2 weeks after catheter retrieval and discharged home 3 weeks later.

**Discussion**

Catheter transection is a rare (0.1–2.8%) complication of subclavian venous catheters with a long indwelling time, that is, in tunnelled or implanted systems. To our knowledge this is the first presentation of a case of transection and embolization of a subclavian venous catheter in a relatively immobilized ICU patient.

Transection of a central venous catheter can be caused by defects of the catheter itself, by trauma to the central venous catheter at the time of insertion or removal, or by needle-damage during the insertion of a second catheter at the same site. In the present situation catheter transection is thought to be caused by mechanical compression at the insertion site of the subclavian central venous catheter in the costoclavicular area (cervico-axillary canal). This area is bounded anteriorly by the clavicle, subclavius muscle and costocoracoid ligament (Fig. 2A). Posterior borders are

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**Fig 1** Chest radiograph (A) directly after placement of the catheter showing a catheter distortion Grade 1; the catheter shows any degree of bending or deviation from a single curved course but no luminal narrowing. (B) Grade 2 distortion 5 days after placement; some degree of luminal narrowing while passing beneath the clavicle.

**Fig 2** Schematic drawing of the position of the catheter in the right subclavian vein via the costoclavicular space. (A) If the catheter passes through the costoclavicular space outside the vessel lumen it is vulnerable to transection by the clavicle and the first rib. (B) In the more lateral approach the catheter passes the costoclavicular space inside the vein where it is protected from compression. Adapted with permission from Mazel et al.
defined by the first rib and anterior scalene ligament. A malpositioned catheter passes through this space outside the subclavian vein before it pierces the vessel medially (Fig. 2A). In mobile patients the weight of the shoulder further narrows the angle and impinges on the catheter. But also positional changes (raising the arm or rolling the shoulder on the ipsilateral side) by turning of position for radiography or physiotherapy, sedation or oedema formation, or both, can cause compression of the catheter. A more lateral insertion of the catheter into the subclavian vein, where the angle between the clavicle and the first rib is wider, should minimize compression of the vein, where the angle between the clavicle and the anterior scalene ligament is narrower.13

Intermittent mechanical compression of the catheter is called the pinch-off syndrome or sign. This pinch-off can be recognized on chest radiography by observing luminal narrowing as the catheter passes between the clavicle and first rib. Hinke developed a radiographic catheter distortion scale as follows: Grade 0, catheter follows a smooth curved course in the region of the clavicle and the first rib with no narrowing; Grade 1, catheter shows any degree of bending or deviation from a single curved course but no luminal narrowing; Grade 2, catheter shows some degree of luminal narrowing while passing beneath the clavicle (true pinch-off sign, Fig. 1B); Grade 3, catheter transected between the first rib and clavicle with embolization of the distal catheter. Early warning symptoms of catheter compression and transection are intermittent resistance and variable reaction to drug injection (particularly inotropic drugs), chest wall swelling at the insertion site, and premature ventricular contractions in case of embolization to the heart. The complications include arrhythmia, endocarditis, perforation of the heart and pulmonary embolism. Retrospective review of the vital signs of the presented patient showed unexplained varying haemodynamics, which could be caused by intermittent compression of the catheter at various positions of the patient. Furthermore, retrospective review of routine daily chest radiographs showed the progression of catheter deformation from Grade 1 after insertion (Fig. 1A) to Grade 2 on Day 5 (Fig. 1B) and eventually to Grade 3 on Day 6.

When the catheter tips embolizes it can be diagnosed by radiography or ultrasound. An embolized catheter should be removed as soon as possible. In most cases the catheter fragment can be retrieved by percutaneous transluminal approach.

In conclusion, catheter pinch-off, transection and embolization of the subclavian venous catheter also occur in immobilized ICU patients. Positional occlusion and intermittent effect to vasoactive drugs are early warning signs of catheter pinch-off. Prompt removal of the catheter should be reconsidered to avoid catheter transection. A more lateral puncture site for the subclavian vein is advocated.

References