Case report

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Clavicular hook: Cuffed haemodialysis catheter insertion using a paramedian tunnel in patients with recurrent tip migration

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Julian Yaxley[1,2], Catherine Wilkinson[1], Shaun Davidson-West[1] and Murty Mantha[1,3]

Abstract

Tunnelled, cuffed central venous catheters are commonly used for the provision of haemodialysis. Internal jugular vein catheters are generally tunnelled subcutaneously to the anterolateral chest wall. However, the lateral subcutaneous tract may increase the risk of catheter migration, particularly in the setting of obesity or large breast tissue. Catheter tip migration is an important cause of catheter failure. We describe two cases in which a paramedian tunnel was fashioned in patients experiencing recurrent catheter migration.

Keywords

Haemodialysis, catheters, dialysis access, interventional, tunnelling, central venous catheter

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Introduction

Tunnelled, cuffed catheters (TCCs) are currently used by 19% of prevalent long-term haemodialysis (HD) patients in Australia and New Zealand.[1] TCCs are pliable, large-bore, central venous catheters capable of high flow rates, with a surrounding polyester cuff that provides adhesion within a subcutaneous tunnel. This design permits chronically reliable HD with a lower risk of mechanical and infective complications than non-tunnelled catheters. However, catheter migration is a recognised complication resulting in premature catheter loss in approximately 5% of all TCCs.[2–4] Migration is characterised by displacement of the TCC such that its subcutaneous cuff is at risk of externalisation and the catheter tip is retracted to a suboptimal position. The majority of TCCs are placed in the internal jugular vein (IJ) and tunnelled subcutaneously to exit from the anterolateral chest wall. We describe two cases using a paramedian method of catheter tunnelling, which we term the 'clavicular hook', as an alternative in patients with repeated catheter migration.

Case descriptions

A 72-year-old female on maintenance HD via TCC was found to have an exposed polyester cuff during routine treatment. Her medical history was notable for end-stage kidney disease (ESKD) secondary to renovascular disease, obesity, and rheumatoid arthritis on disease-modifying therapy. This was the patient's second IJ vein TCC in 4 months; her first was exchanged after a similar episode. The TCC was removed and a new device placed using a parasternal-region paramedian subcutaneous tunnel (Figures 1–3); this functioned effectively for more than 2 years until the patient developed line-associated *Staphylococcus capitis* bacteraemia necessitating removal.

A 60-year-old female on chronic HD due to polycystic kidney disease presented with a painful, erythematous TCC exit site. Dialysis was hindered by unusually poor blood flows. Chest radiograph demonstrated cephalad tip displacement into the proximal superior vena cava. This was the patient's fourth TCC in 12 months; her previous IJ

[1]Department of Nephrology, Cairns Hospital, Cairns, QLD, Australia
[2]School of Medicine and Dentistry, Griffith University, Southport, QLD, Australia
[3]School of Medicine and Dentistry, James Cook University, Cairns, QLD, Australia

Corresponding author:
Julian Yaxley, School of Medicine and Dentistry, Griffith University, Cairns Hospital, 165 The Esplanade, Cairns, QLD 4870, Australia.
Email: julianyaxley@yahoo.com.au

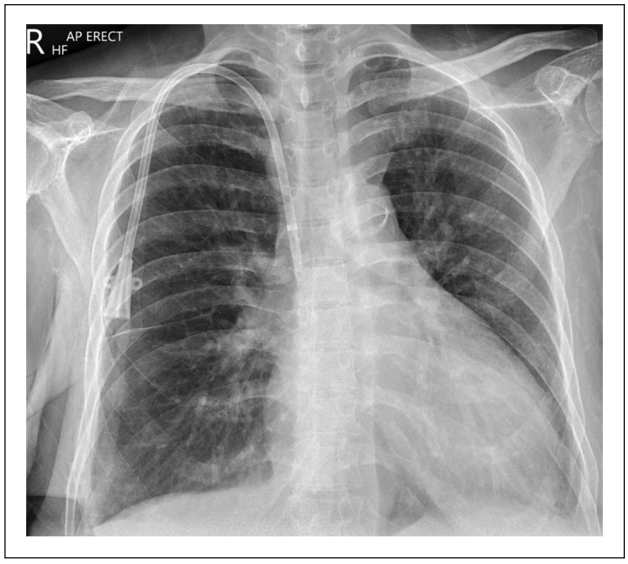

Figure 1. Chest radiograph of the right-sided tunnelled internal jugular vein catheter in 'Patient 1' which had slightly migrated and required replacement; illustrative of a typical appearance of catheters placed using the posterior approach.

Figure 2. Chest X-ray of 'Patient 1' depicting the internal jugular haemodialysis catheter inserted using a paramedian tunnel. Note how on frontal view the line appears unacceptably kinked at the puncture site in the supraclavicular region.

vein catheters had been removed due to migration. Prior attempts at surgical arteriovenous fistula creation were unsuccessful. The patient was overweight with a large volume of breast tissue. Catheter migration and soft tissue infection were diagnosed and the line was removed. A new right-sided IJ TCC was placed along a paramedian tunnel (Figure 4), which functioned well until successful kidney transplantation 5 months later.

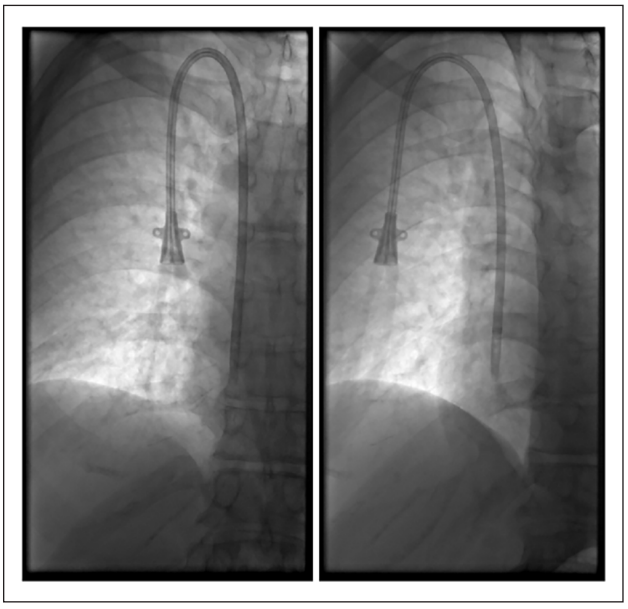

Figure 3. The same catheter from 'Figure 2' viewed in a lateral-oblique direction, illustrating smooth curvature wrapped along a single plane, satisfactory for haemodialysis.

Discussion

Migration remains a relatively common reason for catheter failure. Displaced TCCs warrant replacement because of their association with dysfunction and infection. Purported risk factors for IJ TCC migration include obesity, large breast size, female gender and conduct of strenuous movement or activity.[5–7] It is unknown whether anti-inflammatory drugs inhibit adherence of the implanted polyester cuff and increase the likelihood of migration.

IJ TCCs are typically placed with a subcutaneous tunnel exiting the anterolateral chest wall. From the IJ vein the catheter passes the sternocleidomastoid and courses obliquely over the deltopectoral groove. This path allows a broad catheter arc which avoids kinking and improves blood flow, and is relatively comfortable and unobtrusive for patients. However, catheters tunnelled in this fashion may be affected by migration. TCCs inserted by a posterior IJ cannulation approach, in which the catheter runs posterior to the sternocleidomastoid, have a long subcutaneous tract that is vulnerable to tugging with gravity. TCCs inserted by classic central needle puncture, in which the catheter crosses Sedilot's triangle before traversing the sternocleidomastoid clavicular head, are subjected to pinching with muscle contraction.

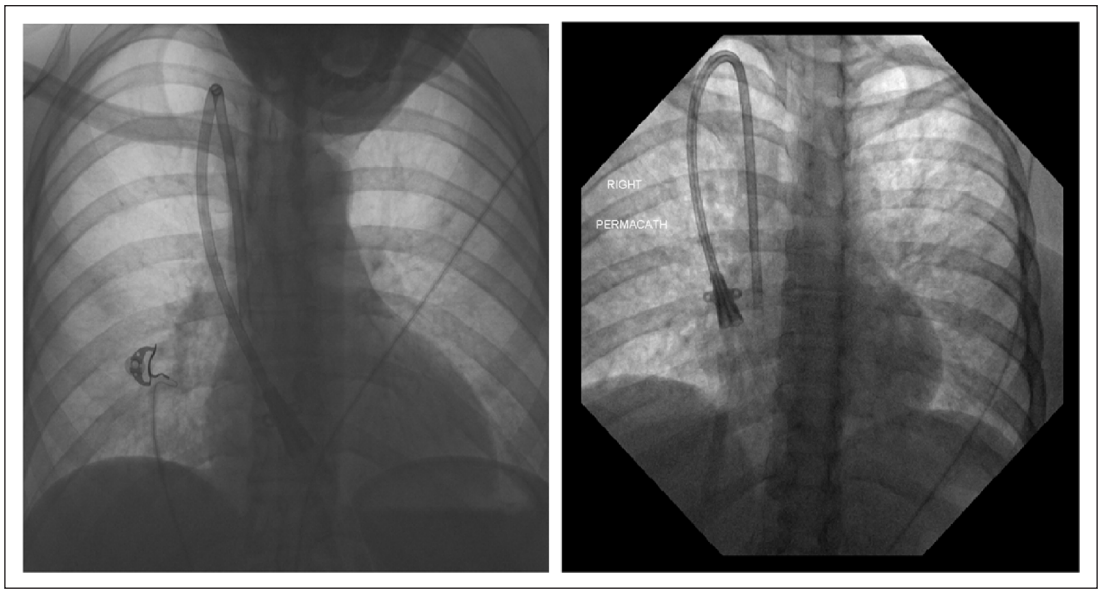

Figure 4. Chest X-rays of 'Patient 2' showing the haemodialysis catheter inserted with a paramedian tunnel, with frontal view (left) suggesting a catheter kink but lateral-oblique view (right) confirming a wider curve.

Formation of a paramedian tunnel is an alternative to anterolateral tunnelling. Few descriptions of this technique are available in the literature. The procedure is accomplished by firstly accessing the IJ vein anteriorly and low in Sedillot's triangle near the level of the clavicle. A subcutaneous tract is then formed immediately anterior to the venotomy site towards the parasternal area, such that the catheter 'hooks' smoothly around the clavicle in line with the point of cannulation. The exit site should be approximately three fingerbreadths inferior to the clavicle, ensuring the cuff is situated about 2 cm from the exit site and 10 cm from the venepuncture site. Such a catheter will appear kinked on frontal chest X-ray, but oblique and lateral views reveal a smooth curve projected over the clavicle.

Paramedian tunnelling presents several possible mechanistic advantages over a usual anterolateral approach for reducing catheter migration. A paramedian approach involves tunnelling through a single plane from Sedilot's triangle to the mid-upper chest, minimising contact with the sternocleidomastoid and traction with neck movement. By creating a tunnel directly in front of the neck access site this approach also orients the TCC vertically, generating less displacement when the catheter is pulled downwards by breast tissue under gravity than if it followed a diagonal anterolateral vector.

Other general benefits of a paramedian method include allowance for shorter catheters and technically easier IJ needle puncture. Potential disadvantages include unfamiliarity, greater noticeability with less patient acceptance and a sharper catheter angle than that of a conventional tunnel. Further research is required to assess catheter outcomes and to compare the paramedian tunnel to regular IJ TCC placement techniques.

We conclude that paramedian tunnelling provides an alternative to the standard method of IJ TCC insertion. We have successfully utilised this technique, which we refer to locally as the 'clavicular hook', on five occasions in the past 6 years, equivalent to 1.2% of TCCs inserted in our centre. The approach appears particularly useful for patients where catheter migration is problematic. It is uncertain whether a paramedian tunnel should replace the anterolateral tunnel in routine practice and comparative research is required.

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ORCID iD

Julian Yaxley https://orcid.org/0000-0002-0587-276X

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