

# The long-term use of a tunnelled central venous catheter for haemodialysis

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## Abstract

Maintaining a functioning vascular access for haemodialysis remains a significant challenge for patients with end-stage renal disease and access complications contribute to a large proportion of hospital admissions in this population. Australian guidelines recommend fistula first; however, there are cases where due to prohibitive circumstances such as poor vasculature a long-term tunnelled central venous catheter is the only viable option for maintenance haemodialysis. The use of these lines in the long term is fraught with danger given the high incidence of catheter-related bacteraemia that can contribute to higher morbidity and mortality. The introduction of standard guidelines for the care of central venous catheters for haemodialysis can lead to a reduction in the episodes of bacteraemia and we present here a case study of a prevalent haemodialysis patient receiving thrice-weekly maintenance haemodialysis through a single, long-term central venous catheter for three years and nine months without an episode of catheter-related infection.

## Keywords

Haemodialysis, central venous catheter, vascular access.

## Background

Approximately 0.9% of the Australian population will develop end-stage renal disease (ESRD) and in 2009 there were 18,000 Australians receiving renal replacement therapies (RRT) accounting for 1.1 million hospital admissions (Kidney Health Australia, 2010). The provision of a functioning vascular access for haemodialysis can in some cases be challenging and although the recommendations of the CARI (Caring for Australians with Renal Impairment, 2008) guidelines promote the use of a fistula first there exists a growing number of patients in whom an arteriovenous fistula (AVF) or arteriovenous graft (AVG) cannot be placed. This is largely due to the increasing age of incident haemodialysis patients and the prevalence of diabetes, leading to poor vasculature, which then hinders attempts to establish a well-functioning AVF (Konner, 2003). However, there are also a small number of cases in which fistula placement is refused. A study (n=1573) that canvassed patients' reasons for refusal of fistula placement found that the leading cause was a previous negative surgical experience (Axley & Rosemblum, 2012).

The use of a tunnelled central venous catheter (CVC) for haemodialysis is considered a short- to medium-term access solution (Hassan *et al.*, 2006). Although tunnelled catheters have a lower risk of infection than other CVCs, they are not without complication. Short-term vascular access catheters in our renal

facility are removed after a maximum of seven days to minimise the risk of infection and there is an expectation that after placement of a tunnelled CVC a more permanent access would be placed within three months. Infection prevalence in catheters is reported at nine times higher than with an AVF and five times higher than with an AVG, with the main reasons for this being nasal colonisation with staphylococcus, other infections, being older and having diabetes (Lincoln, 2011). The incidence of catheter-related bacteraemia is estimated to be between 1.4 and 2.8 episodes per 1,000 catheter days and catheter salvage has in a number of studies been demonstrated to be about 30% (Whitenberger *et al.*, 2012). This is likely due to the formation of a biofilm in the catheter lumen produced by fibrin and microbial products which plays a role in resistant catheter infections and is a process which begins within 24 hours of catheter insertion (KDOQI, 2006). Successful treatment of catheter-related bacteraemia most often requires the removal of the device and antimicrobial therapy (Schinabeck & Ghanoum, 2003). Although cardiac disease is the leading cause of mortality in ESRD sepsis remains the second leading cause of death in patients on haemodialysis (Bakke, 2010). The most likely source of infection of a CVC is from skin contamination at the insertion site and standardised catheter exit site care is one of the most important factors in the prevention of catheter-related infection (CRI) (Young *et al.*, 2005).

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Our dialysis centre lies within a major metropolitan teaching hospital in South Australia and caters for approximately 24 chronic and acute haemodialysis episodes per day. We have a formalised nephrology nurse training program and have nursing students placed with our experienced staff for up to 12 weeks. The prevalent haemodialysis patients with a CVC in January 2011 was 26% in our haemodialysis population and our rates of incident patients presenting with an AVF/AVG was 65.7%, the remainder requiring a short-term line insertion. With the introduction of a vascular access coordinator, early referral from the CKD population and the development of coordinated care approach with the vascular access team to promote the use of a fistula first, the rate of prevalent patients dialysing with a CVC in our unit currently stands at 5.1% (January 2013) which is well below the estimated Australia-wide prevalence of 13% (ANZDATA, 2011).

### Case study

We present here a case study of a 65-year-old gentleman with ESRD as a result of diabetic nephropathy who commenced haemodialysis in 2004 via an AVG, which was placed in the first instance due to poor native arm veins. The graft subsequently failed and dialysis was continued via a tunnelled CVC inserted on 4 June 2007. An attempt was made to establish a second AVG in December 2007 which was unsuccessful and subsequent vein mapping was regarded as unlikely to result in a functioning long-term access. This patient continued to have haemodialysis three times per week via the line inserted in June 2007 for three years and nine months without a single episode of bacteraemia. In March 2011 the patient developed severe infective tenosynovitis of the right hand, which was surgically debrided and the patient became systemically unwell at this time. Despite antibiotic therapy the patient remained unwell and had blood cultures persistently positive for *Staphylococcus epidermidis* (coagulase negative). The decision was made to remove the tunnelled CVC under suspicion of colonisation and the subsequent culture of the catheter tip was positive for a coagulase negative staphylococcus.

Our principal philosophy regarding accessing long-term lines for haemodialysis is that the CVC is the patient's lifeline and must be treated with utmost respect. Our unit policy for the management of CVCs is based on the South Australian Government Public Hospitals Dialysis Unit Clinical Procedure which is formulated to be in line with current best practice guidelines (KDOQI, 2006). This includes face masks for the nurse and the patient, good hand hygiene and aseptic technique, the use of sterile drapes and gloves and the use of Chlorhexidine 2% and alcohol 70% for cleaning of the hubs before commencing dialysis. To provide the most effective protection against the introduction of bacteria to the CVC site nursing staff are educated on the preparation of a CVC for access using an aseptic technique with a minimum three-minute hand wash as recommended by the manufacturers when using a Medisponge™, drying hands with a sterile hand towel, donning sterile gloves and placing a sterile towel under the CVC hubs. Our guidelines recommend actively cleaning the hubs for three–

five minutes and then allowing to dry for 60 seconds and this process should not be rushed. We use multi-access bungs which are accessed without removal and changed once per week. The CVC dressing is observed before each haemodialysis to ensure the dressing is secure and dry and free of blood or exudate. Our dressing regime includes Chlorhexidine and alcohol to the site and the application of a Biopatch™ broad spectrum antimicrobial and antifungal dressing impregnated with Chlorhexidine which is changed weekly or more frequently if it becomes loose or moist. Biopatch™ is commonly used in some haemodialysis units as a prophylactic device (Mokrzycki *et al.*, 2006, Onder *et al.*, 2008) and the manufacturer lists a CVC or dialysis catheter as an indication for use to reduce the incidence of local infection and CRI. Since the introduction of this procedure and formalised data collection from January 2011 we have had two blood stream infections that were catheter-related and have been CRI free since August 2011.

Patients are taught that their role in caring for a long-term line is equally important and that they must shower with a piece of plastic taped over the catheter to ensure it remains dry at all times. Haemodialysis catheters in our unit with inadequate flow are treated with Alteplase™ under strict protocol guidelines. The patient presented here received this on one occasion for poor flows in March 2010 with resolution of the problem. With regard to the exit site skin integrity no exit site infection occurred; however, the patient was treated with oral antibiotics in June 2008 for a small blistered area about 2 cm above the exit site, likely the result of a long-term dressing which healed well and no further complications developed.

### Discussion

Considering the frequency with which the blood stream is accessed via a catheter for maintenance haemodialysis, stringent aseptic technique amongst nursing staff is an essential element of preventing CRI. It has been well demonstrated that the use of masks for both staff and patients, cleaning with Chlorhexidine and the use of drapes and sterile gloves must form the basis of any catheter care protocol (Whitenberger *et al.*, 2012). The three most likely occasions that a CRI can occur is from colonisation of the exit site, contamination of the catheter hubs, or when carried 'haematogenously' to the device from the site of another infection (Young *et al.*, 2005). The prophylactic use of an antibiotic ointment at the insertion site remains controversial due to the potential increase in colonisation with candida (Bakke, 2010). A staphylococcal blood stream infection carries a high risk of endocarditis and 12–15% of patients can develop bacteraemia after the removal of a colonised CVC (Munoz *et al.*, 2011). Another unusual but occasionally reported complication is being unable to remove the CVC when in situ for a long period of time. One centre reported six cases of retained CVCs for hemodialysis that had been in situ for three to seven years, four of which could not be removed. These catheters were cut and the protruding component buried under fascial layers and there is consequently an increased risk of infection with colonisation of the embedded portion of the catheter (Hassan *et al.*, 2006).

Other known complications from the use of a tunnelled CVC for haemodialysis are stenosis or occlusion of the subclavian vein (Karapolat *et al.*, 2005) and the increased risk of haemorrhage from inadvertent administration of heparin locks. A normal activated partial thromboplastin time (APTT) is expected after dialysis using unfractionated heparin; however, it has been demonstrated that a normal APTT at dialysis completion is abnormal 10 minutes after routine heparin locking of a CVC as the lock recommendations result in systemic spill-over (Karaaslan, 2001). There are also risks associated with thrombolytic agents such as Alteplase™ and Reteplase™ commonly used to treat thrombosed catheters and to maintain catheter patency and this practice is widespread despite the potential complication of haemorrhage (Castner, 2001).

AVF is the optimal vascular access for chronic haemodialysis patients and yet the DOPPS II study reported high use of CVCs of up to 40% in some centres, which is well beyond the KDOQI guidelines of less than 10% of prevalent haemodialysis patients (Graham *et al.*, 2008). In considering alternative options there have been a number of reported cases of innovative vascular access placements such as necklace grafts (Morsey *et al.*, 2008) and femoral artery to superior vena cava grafts (Suckling *et al.*, 2007). Our centre also reported the successful placement of a PTFE graft tunnelled from the right subclavian artery to the inferior vena cava, which was visible to cannulate across the abdominal area (Hill *et al.*, 2010). However, this practice remains quite rare and does not appear to have become a genuine alternative option in addressing the use of a CVC in the long term. Perhaps one of the reasons for this is a growing trend to acknowledge that the mortality and morbidity associated with attempts to create an AVF/AVG can exceed the benefits and a decision regarding access should take into account comorbid conditions and anticipated life expectancy (Lameire & Van Biesen, 2012). Some native fistulae, particularly brachiocephalic fistulae, can have very high flows and this can eventually lead to heart failure even in healthy individuals, and there will sometimes be cases where we need to avoid the “constant demonization of the CVC which is particularly unfortunate for those haemodialysis patients in whom they represent a life line” (Amerling, 2012).

### Conclusion

The use of a tunnelled CVC in the long term can be a poor choice for many reasons, the most serious of which is the risk of bacteraemia. Despite the risks, it is necessary to adopt an individualised approach to vascular access in haemodialysis and to accept that for some patients fistula placement cannot be achieved. In concluding, we actively promote in our unit the idea that a native fistula would be the first option for maintenance haemodialysis therapy, but believe that strict policies for accessing CVCs, managing exit sites and appropriate staff and patient training can contribute to line longevity and improved outcomes for the small minority of patients without fistula or graft options.

The authors have no conflict of interest to declare.

### References

- Australia and New Zealand Dialysis and Transplant Registry [www.anzdata.org.au](http://www.anzdata.org.au)
- Amerling, R. (2012): On cardiovascular outcomes and arteriovenous fistula: lesser of evils. *Nephrology Dialysis Transplantation* 27, 3756–3757.
- Axley, B. & Rosemblum, A. (2012): Learning why patients with central venous catheters resist permanent access placement. *Nephrology Nursing Journal*, 39(2), 99–104.
- Bakke, C. (2010): Clinical and cost effectiveness of guidelines to prevent intravascular catheter related infections in patients on haemodialysis. *Nephrology Nursing Journal* 37(6), 601–615.
- Caring for Australians with Renal Impairment [www.cari.org.au](http://www.cari.org.au)
- Castner, D. (2001): The efficacy of reteplase in the treatment of thrombosed haemodialysis venous catheters. *Nephrology Nursing Journal*, 28(4), 403–419.
- Graham, J., Hiremath, S., Magner, P., Knoll, G. & Burns, K. (2008): Factors influencing the prevalence of central venous catheter use in a Canadian haemodialysis centre. *Nephrology, Dialysis and Transplantation*, 23, 3585–3591.
- Hassan, A., Khalifa, M., Al-Akrra, A. L., Lord, R. & Davenport, A. (2006): Six cases of retained central venous haemodialysis access catheters. *Nephrology Dialysis and Transplantation*, 21, 2005–2008.
- Hill, K., Ye, H., Barbara, J., Passaris, K., & Spark, I. (2010): An innovative vascular access option for haemodialysis patients. *Journal of the Renal Society of Australasia*, 6(3), 103–105.
- Karaaslan, H., Peyronnet, P., Benevent, D., Lagarde, C., Rence, M. & Levoux-Robert, C. (2001): Risk of heparin lock related bleeding when using indwelling venous catheters in haemodialysis. *Nephrology Dialysis Transplantation*, 16, 2072–2074.
- Karapolat, S., Veliouglu, Y. & Unlu, Y. (2005): Venous hypertension in the upper limb: a complication of a permanent haemodialysis catheter. *Ejvs Extra*, 9(1), 1–3.
- Kidney Health Australia [www.kidney.org](http://www.kidney.org)
- Konner, K. (2003): Vascular access in the haemodialysis patient — personal experience and review of the literature. *Haemodialysis International*, 7(2).
- Lameire, N & Van Biesen, W. (2012): A Secular view on vascular access in haemodialysis. *Nephrology Dialysis Transplantation*, 27:3758–3761.
- Lincoln, M. (2011): Preventing catheter-associated bloodstream infections in Haemodialysis Centres — the Facility Perspective. *Nephrology Nursing Journal*, 38(5), 411–416.
- Mokrzycki, M., Zang, M., Cohen, H., Golestanch, L., Laut, J. & Rosenberg, S. (2006): Tunnelled haemodialysis catheter bacteraemia: risk factors for bacteraemia recurrence, infectious complications and mortality. *Nephrology Dialysis Transplantation*, 21, 1024–1031.
- Morsey, M., Khan, A. & Chemla, E. (2008): Prosthetic axillary-axillary arteriovenous straight access (necklace graft) for difficult haemodialysis patients: a prospective single-centre experience. *Journal of Vascular Surgery*, 49(4), 1091.
- Munoz, P., Fernandez Cruz, A., Usibillage, R., Zorzano, A., Rodriguez-Creixems, M., Guembe, M. & Bouza, E. (2011): Central venous catheter colonisation with *Staphylococcus aureus* is not always an indication for antimicrobial therapy. *Clinical Microbiology and Infection*, 18, 877–882.
- National Kidney Foundation KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations. (2006): *American Journal of Kidney Disease*, 48, S1–S3.
- Onder, A.M., Chandar, J., Simon, N., Diaz, R., Wobi, D., Abitbol, C. & Zilleruelo, G. (2008): Comparison of tissue plasminogen activator antimicrobial locks with heparin antibiotic locks in children with catheter related bacteraemia. *Nephrology Dialysis Transplantation*, 23(8), 2604–2610.
- Schinabeck, M. K. & Ghannoum, M.A. (2003): Catheter-related infections — diagnosis, treatment and prevention. *Clinical Microbiology Newsletter*, 25(15), 113–118.
- Suckling, R., Morsey, M., & Chemla, E. (2007): Right superficial femoral artery to superior vena cava graft using a polytetrafluoroethylene graft: a new technique in a complicated dialysis access patient. *Nephrology Dialysis Transplantation*, 22(3), 970–971.
- Young, E., Contreras, G., Robert, N., Vogt, N. & Courtney, M. (2005): Incidence and influencing factors associated with exit site infections in temporary catheters for haemodialysis and apheresis. *Nephrology Nursing Journal*, 32(1), 41–50.
- Whitenberger, C., Epaulard, O., Hinky-Vitrat, V., Brion, J.P., Recule, C., Francois, P., Stahl, J. P. & Pavese, P. (2012): Outcomes of central venous catheter-related bacteraemia according to compliance with guidelines: experience with 91 episodes. *Journal of Hospital Infection*, 80.

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