Permanent catheters for hemodialysis is not ideal but sometimes considered a necessity: a prospective study

Ibrahim Awad

Department of Vascular Surgery, Mansoura University Hospital, Mansoura, Egypt

Correspondence to Ibrahim Awad, MD, Department of Vascular Surgery, Mansoura University Hospital, Mansoura, 335111, Egypt
Tel: +20 0100 5207142; fax: 0502267016;
e-mail: dr_awad_i@yahoo.com

Received 02 August 2014
Accepted 18 September 2014

The Egyptian Journal of Surgery
2014, 33:228–231

Background
It is not always easy to achieve an adequate arterio venous fistula in long-term dialysis patients; hence, permanent cuffed tunneled central venous catheters represent necessity in some ESRD patients like those with advanced age and/ or comorbid conditions.

Purpose
To report the technique and the results of the permanent tunneled catheters as a vascular access .

Patients and methods
This report describe the technique and the results of the permanent tunneled catheters as a vascular access for hemodialysis at Mansoura University Hospitals. Catheter was inserted by seldinger percutaneous technique with the use of radioscopic guidance by an experienced vascular surgeon.

Results
The study included 33 patients for whom 38 catheters were inserted (17 males,16 females), nine of whom were hypotensive, with a mean age of 48,9 years.The cumulative primary patency rate at 1 year was 52.6% and at 2 years, 21.05%. Complications developed including ,tunnel haematoma, thrombosis, and infection.

Conclusion
Permanent cuffed, tunneled catheters play a larger role, particularly among those in whom finding a vascular access can be challenging.

Keywords:
bactremia, hemodialysis, thrombosis, tunneled catheters

Egyptian J Surgery 33:228–231

1110-1121

Introduction

Creation of functional native or prosthetic arteriovenous fistula (AVF) is desirable according to the NKF/DOQI [1] guidelines, as it is more durable and has reduced complication rate. However, it is not always easy to achieve an adequate AVF in long-term dialysis patients [2,3], as most of these patients will lack adequate vein for creation of AVF [4].

Adequate superficial veins may be exhausted owing to repeated cannulation or previously failed arteriovenous vascular access [5]; hence, permanent cuffed tunneled central venous catheters represent necessity in some end-stage renal disease (ESRD) patients such as those with advanced age and comorbid conditions such as peripheral vascular disease, diabetes, and/or the cardiac status [6].

In this study, we report the technique and the results of permanent tunneled catheters as a vascular access for hemodialysis in patients who have inadequate conditions for creating an AVF or graft.

Patients and methods

This was a prospective clinical study conducted on 33 patients at Mansoura University Hospitals, which are a tertiary referral center, from April 2011 to April 2013.

Patients chosen for this technique were those with ESRD requiring hemodialysis with failure of previously established AVF and for whom there were no availability of vascular access. Routine duplex examination of the neck and femoral veins was performed before de-novo catheter placement, but duplex examination was not performed before catheter exchange. All patients signed written consent. Those with thrombosed femoral and neck deep veins were not chosen for this technique.

Technique

The skin was draped in the usual sterile manner with betadine, then the planned venotomy site and subcutaneous tunnel area was anesthetized with 1% lidocaine. Standard tunneled cuffed, silicone, double-lumen catheters were used.

Hemodialysis catheters (Medcomp, Harleysville, PA, USA) were tunneled using tunneling instrument, inserted by Seldinger percutaneous technique with the use of radioscopic guidance by an experienced vascular surgeon. Provided its tip at the right atrium, the peel-away sheath was then removed after verification of the

 DOI: 10.4103/1110-1121.147613

localization of the catheter by C-arm. Bleeding from the venotomy site or the tunnel was managed with manual compression. After insertion of a single dose of 500 mg vancomycin, the catheter was locked with heparinized saline. The patient was discharged from the hospital on the same day. A card of instructions, antibiotic, and oral anticoagulant were given to the patient. Patients were recruited within week of catheter insertion and were prospectively followed up. Patency was defined as ability to successfully dialyze through the catheter. No secondary procedures were performed to extend patency of thrombosed catheters; hence, no secondary patency rate but only primary patency was calculated. Bacteremia or catheter thrombosis was considered malfunction.

Statistical methods

Patency rate was assessed with the Kaplan–Meier method for survival analysis.

Results

From April 2011 to April 2013, 33 patients with ESRD underwent this technique (17 male patients, 16 female patients, age range 12–84 years, mean age ± SD 48.9 ± 19.7). Nine patients (27.3%) were hypotensive (systolic pressure>90), eight patients (24.2%) had no suitable veins for access, six patients (18.7%) had hypercoagulable state (five systemic lupus erythematosus and one nephrotic syndrome), and eight patients (24.2%) were diabetic.

The follow-up period ranged 2–24 months, with a mean of 12.6±8. The patients in this study had undergone AVF reconstruction 2.09 times on average. Access was right internal jugular in 25 catheters (65.79%), left internal jugular in five catheters (13.16%), left subclavian in four catheters (10.53%), right subclavian in two catheters (5.26%), and left femoral in two catheters (5.26%) (Tables 1 and 2) (Figs. 1–4).

The cumulative primary patency rate at 1 year was 52.6% and at 2 years was 21.05% (Fig. 4b and c).

Complications developed in 17 of 38 catheters. Thrombosis developed in seven catheters and resulted in catheter malfunction. Nine catheters were infected, and bacteremia developed in six patients, which required catheter removal. A repeated procedure was performed for five patients (15.2%); hence, for the 33 patients, 38 catheters were inserted. Only two patients (6%) used this access as temporary line before successful transplant. No early thrombosis, catheter malposition, or early postoperative infection was noted. No pneumothorax, hemothorax, or operative deaths occurred, but two patients (6%) died during follow-up with functioning catheters because of nonrelated causes. One patient developed intraoperative tunnel hematoma that improved by compression (Table 3).

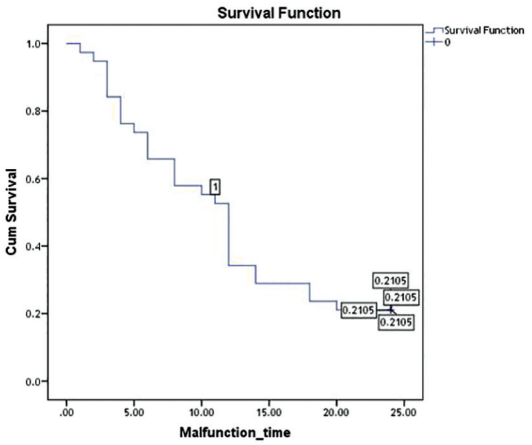
Discussion

Successful dialysis is mandatory for patients with ESRD, and the lack of it may become life limiting. Permanent catheters may serve as a critical permanent access when all other options have been exhausted [7].

Table 1 T ype of access for the permanent catheters

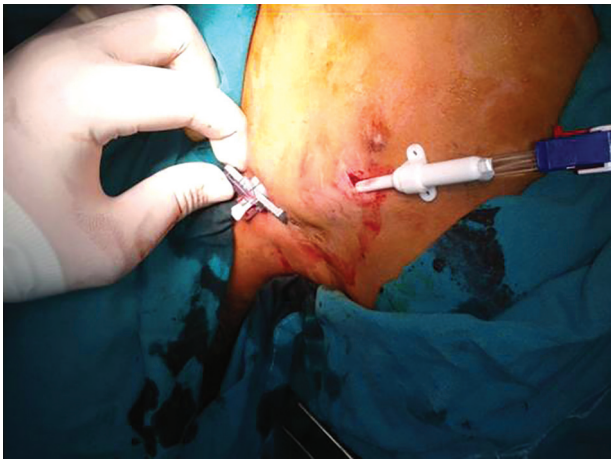
Type of access	Number of cases [*n* (%)]
Right internal jugular	25 (65.79)
Left internal jugular	5 (13.16)
Left subclavian	4 (10.53)
Right subclavian	2 (5.26)
Left femoral	2 (5.26)

Figure 1



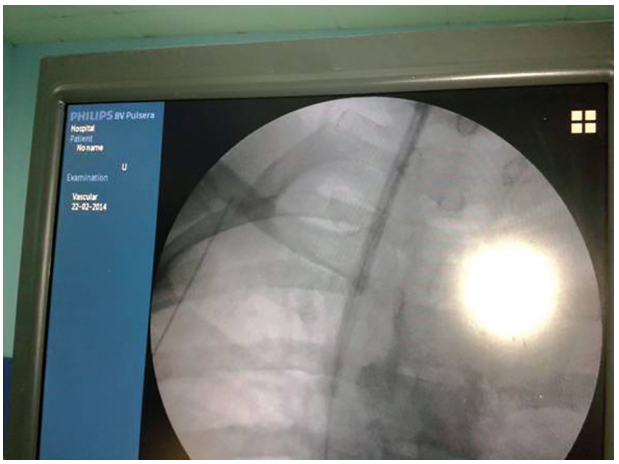
Survival curve of the catheters.

Figure 2



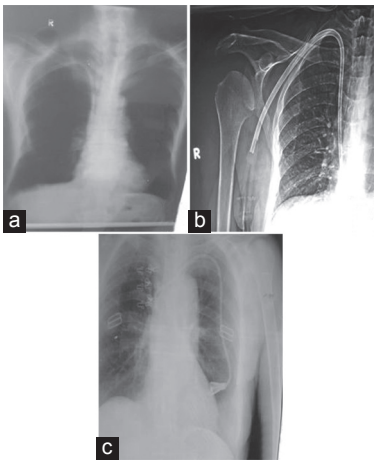
The catheter within the peel-away sheath (right internal jugular access).

Figure 3



Intraoperative C-arm use.

Figure 4



Postoperative radiographs: right subclavian access (a), right internal jugular access (b), and left subclavian access (c).

In this study, we decided to insert tunneled catheter for hemodialysis in patients who have inadequate conditions for creating an arteriovenous access, which is not common; this may explain the small study sample.

In this study most of our practice is catheter exchange (over a wire replacing temporary or malfunctioning – permanent catheters) than de novo catheter placement this is accepted by Oliver and Garofalo [8,9]. This technique is successful; in addition, it uses the same venotomy site, has low complication rate, and spares future access sites; this is in agreement with the study by Schwab and Beathard [10].

In this study, the internal jugular vein is preferred to other access veins on the basis of decreased rate of venous thrombosis (<5%) [11,12]. Subclavian site access was only used when the ipsilateral extremity can no longer be used for permanent access and when there is fear of venous hypertension. Femoral site access was only used when the other options do not exist [13]. This study indicates that there is no difference in the rate of catheter-related bloodstream infections between these three sites [14].

Here, we report that the patients who received permanent catheters represent a worst selection, as most of them had a history of multiple failed vascular access, were elderly, hypotensive, and/or had hypercoagulable state. In these patients, an increased risk for catheter thrombosis was assumed; hence, postoperative warfarin was routinely applied and titrated to an international normalized ratio target of 2–2.5, as the literature to date suggests that an international normalized ratio target of 1.5–2.5 should suffice [15].

Catheter salvage procedures such as thrombolytic therapy can improve patency rate [16]. We consider thrombosis as malfunction due to lack of recent lytic therapy agents, and the catheter is shortly lived after lytic therapy than exchange.

Table 2 Comorbid conditions

Comorbid conditions	Number of patients [*n* (%)]
Hypotension	9 (27.3)
No suitable veins for access	8 (24.2)
Hypercoagulable state	6 (5 SLE, and 1 nephrotic syndrome) (18.7)
Diabetes mellitus	8 (24.2)

SLE, systemic lupus erythematosus.

Table 3 Complications

Complications	Number of cases [*n* (%)]
Thrombosis	7 (18.42)
Infection	9 (23.68)
Intraoperative tunnel hematoma	1 (2.63)
Total number of complicated catheters	17 (44.73)

Our data indicate decreased placement-related complication as most of the cases are catheter exchange than *de novo*, whereas infection and thrombosis are the main long-term complications with high incidence [17,18].

McIntyre and colleagues[19,20] proved that antibiotic/anticoagulant treatment can improve infection rate. However, when we used this treatment, six of the nine infected catheters in this study necessitated catheter removal and did not respond to antibiotic treatment even based on blood culture; this may be due to delayed referral until bacteremia developed.

At our center, permanent catheter placement procedures are performed on an ambulatory basis; this has an impact on the cost and the burden for the hospital.

These catheters can be used immediately after insertion; no vein puncture is required three times weekly, and they are associated with relatively little cosmetic disfigurement and easy removal when complication occurs. Although that seems very logical, they must be weighted against the risk for thrombosis and infection with potentially life-threatening complications such as endocarditis. These values indicate the need for further improvement in the development of dialysis catheters. Failed permanent catheter does not preclude subsequent use of peritoneal dialysis.

Conclusion

Permanent cuffed, tunneled catheters play a larger role, particularly among those in whom finding a vascular access can be challenging. Catheter exchange shows less placement complications than *de novo*. Thrombosis and catheter-mediated bacteremia are still the primary reasons for catheter removal.

Acknowledgements

Conflicts of interest

None declared.

References

1 National Kidney Foundation. Clinical practice guidelines for vascular access. Am J Kidney Dis 2006; 48 (Suppl 1):S248–S273.

2 Medkouri G, Aghai R, Anabi A, Yazidi A, Benghanem MG, Hachim K, *et al.* Analysis of vascular access in hemodialysis patients: a report from a dialysis unit in Casablanca. Saudi J Kidney Dis Transpl 2006; 17:516–520.

3 Ravani P, Marcelli D, Malberti F. Vascular access surgery managed by renal physicians: the choice of native arteriovenous fistulas for hemodialysis. Am J Kidney Dis 2002; 40:1264–1276.

4 Elwakeel HA, Saad EM, Elkiran YM, Awad I. Unusual vascular access for hemodialysis: transposed venae comitante of the brachial artery. Ann Vasc Surg 2007; 21:560–563.

5 Teruya TH, Abou-Zamzam AM Jr, Limm W, Wong L, Wong L. Symptomatic subclavian vein stenosis and occlusion in hemodialysis patients with transvenous pacemakers. Ann Vasc Surg 2003; 17:526–529.

6 Knuttinen MG, Bobra S, Hardman J, Gaba RC, Bui JT, Owens CA. A review of evolving dialysis catheter technologies. Semin Intervent Radiol 2009; 26:106–114.

7 Jindal K, Chan CT, Deziel C, Hirsch D, Soroka SD, Tonelli M, Culleton BF. Canadian Society of Nephrology Committee for Clinical Practice Guidelines: Hemodialysis clinical practice guidelines for the Canadian Society of Nephrology. J Am Soc Nephrol 2006; 17:S1–27.

8 Oliver MJ, Callery SM, Thorpe KE, Schwab SJ, Churchill DN: Risk of bacteremia from temporary hemodialysis catheters by site of insertion and duration of use: a prospective study. Kidney Int 2000; 58:2543–2545.

9 Garofalo RS, Zaleski GX, Lorenz JM, Funaki B, Rosenblum JD, Leef JA: Exchange of poorly functioning tunneled permanent hemodialysis catheters. Am J Roentgenol 1999; 173:155–158.

10 Schwab SJ, Beathard G: The hemodialysis catheter conundrum: hate living with them, but can't live without them. Kidney Int 1999; 56:1–17.

11 Trerotola SO, Johnson MS, Shah H, *et al.*.Tunneled hemodialysis catheters: use of a silver-coated catheter for prevention of infection — a randomized study. Radiology 1998; 207:491–496.

12 Agraharkar M, Isaacson S, Mendelssohn D, *et al.*. Percutaneously inserted silastic jugular hemodialysis catheters seldom cause jugular vein thrombosis. ASAIO J 1995; 41 :169–172.

13 Schwab SJ, Besarab A, Beathard G, *et al.* NKF-DOQI clinical practice guidelines for vascular access. National Kidney Foundation-Dialysis Outcomes Quality Initiative. Am J Kidney Dis.1997; 30 (Suppl 3):S150–S191.

14 Marik PE, Flemmer M, Harrison W. The risk of catheter-related bloodstream infection with femoral venous catheters as compared to subclavian and internal jugular venous catheters: a systematic review of the literature and meta-analysis. Crit Care Med. 2012; 40:2479–2485.

15 Willms L, Vercaigne LM. Does warfarin safely prevent clotting of hemodialysis catheters? A review of efficacy and safety Semin Dial 2008; 21:71–77.

16 Allon M: Dialysis catheter-related bacteremia: treatment and prophylaxis. Am J Kidney Dis 2004; 44:779–791.

17 US Renal Data System. USRDS 2008 Annual Data Report: atlas of end-stage renal disease in the United States. Bethesda, MD: National Institute of Health, National Institute of Diabetes and Digestive and Kidney; 2008. *http://www.usrds.org/adr.aspx*. [Accessed 30 December 2013]

18 Watnick S, Stooksbury M, Winter R, Riscoe M, Cohen DM. White thrombus formation in blood tubing lines in a chronic hemodialysis unit. Clin J Am Soc Nephrol 2008; 3:382–386.

19 McIntyre CW, Hulme LJ, Taal M, Fluck RJ: Locking of tunneled hemodialysis catheters with gentamicin and heparin. Kidney Int 2004; 66:801–805.

20 Petitjean P, Boeriu S, Ismer M, Kunz K, Hannedouche T: The dilemma of the last vascular access. Nephrologie 2001; 22:461–464.