

Two years experience with tunneled dialysis catheters in patients requiring haemodialysis

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Abstract

Objective: To look for survival rate and major reasons behind the failure of tunnelled dialysis catheters in patients on haemodialysis.

Methods: The retrospective study was conducted at the Department of Interventional Radiology, Shifa International Hospital, Islamabad, and comprised records of 100 consecutive subjects from a list of patients in whom tunnelled cuffed catheters were placed from February 2009 to January 2011 and were followed up for two years. Data was collected on a proforma from the hospital database and medical records of patients. SPSS 19 was used for statistical analysis.

Results: Of the total 122 catheters placed in 100 patients, 49(40.16%) were lost to follow-up. Of the remaining 73(59.83%) catheters, 38(52%) had achieved their desired function, while 35(48%) failed to achieve the target duration. Among the reasons of catheter failure, infection was the commonest at 13(37.14%) with infection rate of 0.24 per 1000 catheter days. According to Kaplan Meier analysis, catheter survival rates at 60, 90 and 180 days were 89%, 77% and 64% respectively. Mean effective duration of catheter was 129±117 days.

Conclusion: Tunnelled dialysis catheters can be safely used as vascular access till the maturation of fistula and may be an alternative to Arterio-Venous Fistula or graft for long-term vascular access if indicated.

Keywords: Catheters, Dialysis, Survival rate, Arterio-venous fistula. (JPMA 64: 758; 2014)

Introduction

Tunnelled dialysis catheter was introduced in 1985.¹ Since then it has passed through various designs and insertion techniques to what we are practising currently. Different tunnelled catheters are now available including cuffed and non-cuffed, double lumen or single lumen twin catheters made of silicon or polyurethane. Tunnelled catheters are used as temporary access when permanent form of vascular access, such as fistula, needs time to mature or patient is waiting for renal transplant. This is also used as permanent access in conditions such as decompensated cardiac diseases, systemic vasculitis or patient who has utilised all four limbs for fistulae.^{2,3} A large majority of tunnelled catheters are placed in interventional radiology department using fluoroscopy and ultrasound for guidance.^{4,5} Though catheter can be placed in all major veins, the right internal jugular vein is preferred and the subclavian vein should be considered last to prevent stenosis of subclavian vein and failure to form fistula subsequently.⁶ There are many reasons for the removal of catheters, including infection, catheter malfunction due to venous thrombus or formation of

fibrin sheath and stenosis of vein.⁶ There is limited data available about practising tunnelled dialysis catheters in the subcontinent, including single-centre experience from India.⁷ There is no data about tunnelled catheters, in literature from our own country. We present our experience with tunnelled dialysis catheters to improve our practising standards and create awareness among our health personnel and patients.

Material and Methods

The retrospective study was conducted, after approval from institutional review board, at the Department of Interventional Radiology, Shifa International Hospital, Islamabad, and comprised records of 100 consecutive subjects from a list of patients in whom tunnelled cuffed catheters (Hemo-flow TM Medcomp, USA) were placed from February 2009 to January 2011 and who were followed up for two years. All catheters had been placed by interventional radiologists having more than one-year experience in interventional radiology. The veins patency was assessed by doppler ultrasound. The area for insertion of catheter was properly cleaned and draped. Local anaesthesia and sedation with midazolam and pethidine were used. The vein was punctured under ultrasound guidance with 19G needle attached to a 10cc saline filled syringe. J wire was advanced up to Inferior Vena Cava (IVC) through needle which was then removed. Tunnel was made with tunneller provided with the kit.

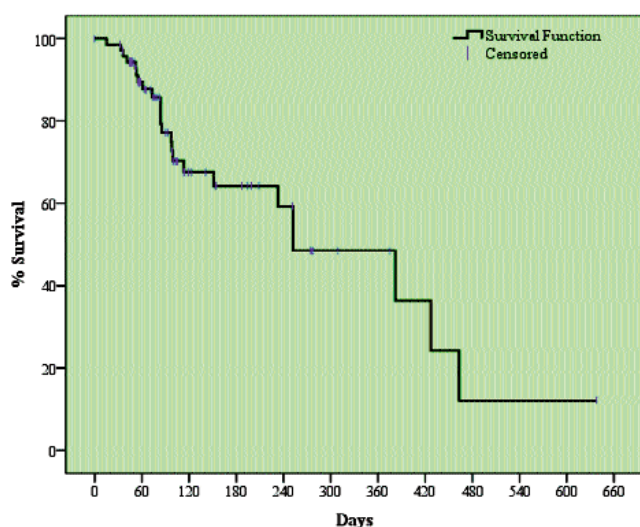
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Catheter was passed through tunnel and venotomy site was dilated and peelaway sheath placed. Catheter was passed through the peelaway sheath. The catheter was secured with its tip at the junction of Superior Vena Cava (SVC) and right atrium. Adequate flow through the ports was assessed and catheter was locked with appropriate amount of heparin. A total of 122 catheters were placed in these patients. The follow-up data was collected on a proforma from the hospital record. Data was entered into SPSS version 19.0 and was analysed for age and gender of patients, indication of tunnelled catheter, veins used, different reasons of catheter removal and failure, and type of organism in case of infected catheters. The infection rate was calculated by dividing the total number of infected catheters over number of catheters (whose follow-up data was available; n=73) times cumulative duration of study (n=730 days). The value obtained was then multiplied by 1000 to get the infection rate. Mean \pm standard deviation (SD) was calculated for quantitative variables, while frequency was calculated for qualitative variables. The survival rate of catheter was calculated using Kaplan Meier Analysis.

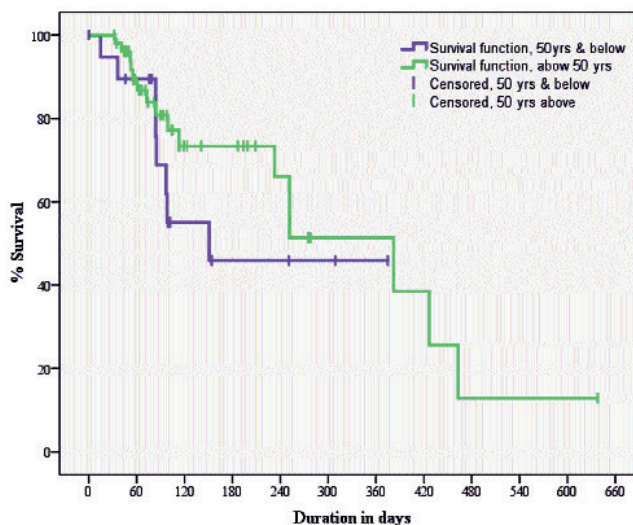
Results

A total of 122 tunnelled catheters were inserted in the 100 dialysis dependant patients in the study. The median number of catheters per patient was 1 (interquartile range=0) with maximum of 4 catheters per patient. Of the 100 patients, 65(65%) patients were female and 35(35%) were male. The overall mean age of the patients was 56.8 \pm 16 years.



The black stepped line is survival function and the intersecting vertical lines show censored data.

Figure-1: Kaplan Meier survival for catheters.



The green stepped line shows the survival function curve for age group >50 while the blue line is for age group \leq 50 years. The log rank test shows no statistical significance between the two groups (p=0.26).

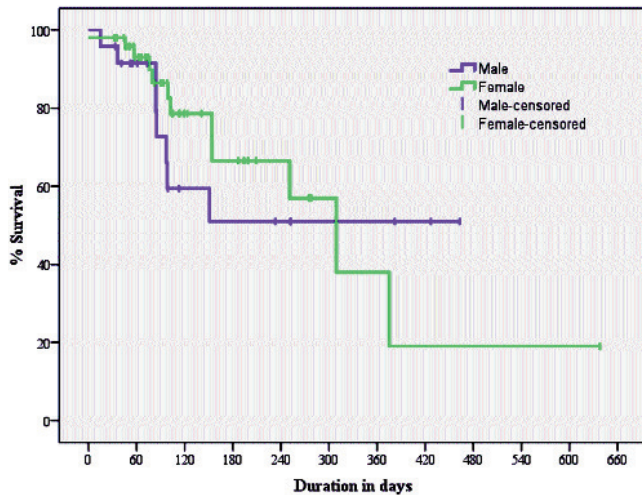
Figure-2: Comparison of survival function for two different age groups.

The commonest cause of end-stage renal disease (ESRD) was found to be diabetes which was found in 46(46%) patients, followed by hypertension 25(25%). In 11(11%) patients, the cause of ESRD could not be identified, while 7(7%) patients had no record available. Glomerulonephritis was seen in 6(6%) patients, 3(3%) had obstructive nephropathy, 1(1%) had Laurence Moon Biedl Syndrome and 1(1%) had reflux nephropathy.

Overall, 89(89%) patients had been recently started on dialysis. Of these 89 patients, 70 (78.65%) were waiting for their fistula to mature or have renal transplant done, while the remaining 19(21.34%) had no plan for fistula or transplant. Ten (10%) patients presented with failed arteriovenous fistula (AVF) or graft, out of which 4(40%) had no plan for next fistula/graft or transplant, 2(20%) were planning for renal transplant, and the remaining 4(40%) were waiting for the next fistula or graft. One (1%) of the 100 patients had failed renal transplant.

There was no morbidity or mortality due to insertion of catheters. Right internal jugular vein was preferred for placement, using it for 90 (73.8%) catheters. Left internal jugular vein was second most commonly chosen vein, 23(18.9%). Three (2.45%) catheters were placed in the right external jugular vein, 3(2.45%) in right subclavian vein, 2(1.63%) in the right femoral and 1(0.81%) in the left femoral vein.

Of the total 122 catheters placed in 100 patients,



The green stepped line shows the survival function curve for female patients while blue line is for the males. The log rank test shows no statistical significance between the two groups ($p=0.66$).

Figure-3: Comparison of survival function between males and females.

49(40.16%) were lost to follow-up. Of the remaining 73(59.83%) catheters, 38(52%) had achieved their desired function, while 35(48%) failed to achieve the target duration. Among the reasons of catheter failure, infection was the commonest at 13(37.14%) with infection rate of 0.24 per 1000 catheter days. The second most common reason of failure was blockage of catheter in 12(34.28%). Other reasons of failure were inadequate flow in 5(14.28%), breakage of catheter 2(5.71%), bleeding from tunnel 1(2.85%), catheter malposition 1(2.85%) and patient's death 1(2.85%).

Of the 13 infected catheters, 6(46.15%) had localised infection while the remaining 7(53.84%) catheters were removed due to bacteraemia. Out of 7 patients with bacteraemia, Enterobacter SPP was seen in 2(28.57%) cases, while Pseudomonas, Methicilin Resistant Staph Epidermidis (MRSE), Methicilin Sensitive Staph Epidermidis (MSSE), Methicilin Sensitive Staph Aureus (MSSA) and combination of organisms were found in 1(14.28%) each.

According to Kaplan Meier analysis, catheter survival rate at 60, 90 and 180 days was 89%, 77% and 64% respectively (Figure-1). No statistically significant difference was observed in the survival rate of different age groups ($p=0.26$) and gender of patients ($p=0.66$) after applying the log rank test (Figure-2,3). The mean effective duration of catheter was 129 ± 117 days. The median effective duration was 85 days with interquartile range

(IQR) of 98, and maximum effective duration of 637 days.

Discussion

Tunnelled catheters are used for both short- and long-term vascular access in dialysis dependant patients.⁸ Despite continuous effort by the National Kidney Foundation (NKF) and Fistula First National Vascular Access Improvement Initiative, the tunnelled catheters are still used as primary access in developed countries in large number of patients requiring dialysis.⁹ The tunnelled catheters have lower complication rate than non-tunnelled catheters, but the latter are still used in more than 80% patients at initiation of dialysis.¹⁰ The reasons are easy availability, requiring relatively less expertise and its usage in emergency settings when immediate vascular access is required. We expect this frequency to be even higher in our population due to lack of expertise in placing tunnelled dialysis catheters. We started placing these catheters in dialysis patients in our interventional radiology in 2007. Since then, referral for catheter insertion is increasing day by day.

Catheters are discouraged as primary vascular access due to increased mortality associated with catheters. A recently published study on dialysis patients showed that one-year survival of patients on haemodialysis through tunnelled catheter was 74.5% compared to 96.6% and 97.6% for haemodialysis with AVF and peritoneal dialysis respectively.¹¹ It correlated lower survival rate of patients in the first group with high infection rate. Procedure-related complications and mortality has significantly decreased due to availability of imaging guidance.¹² Possible complications are tearing of vein, bleeding, catheter kink/malposition, air embolism, arterial puncture and pneumothorax. Using ultrasound and fluoroscopy, no procedure-related complication was observed in 122 catheters placed by our interventionists.

Survival rate of catheters is not uniform and varies from centre to centre. Maya et al. described catheter survival rates of 43% and 81% at 60 days, 33% and 78% at 90 days, and 14% and 67% at 180 days for femoral and internal jugular veins respectively.¹³ Similarly, Sampathkumar et al. showed survival rates of 80% and 55% for 3 months and 6 months respectively.⁷ The values are not far different from ours i.e. 89%, 77% and 64% for 60, 90 and 180 days respectively. The small difference may be due to practising standards at different places. For example, we used majority of our catheters in those patients who needed time for their fistula to mature compared to those who needed tunnelled catheter for long-term access. The effect of age of the patient on survival of catheter is variable. We divided our patients into two age groups i.e.

patients with age ≤ 50 years and >50 years. The idea was to check whether the decreasing immunity with advancing age of patients affects the catheter survival adversely or not. However, no significant difference was observed between the two groups which is contradictory to the result of Sampathkumar et al.⁷ Similarly, there was no significant difference in catheter survival between male and female patients of our study.

There are many reasons for catheter failure which ultimately leads to its removal and re-insertion if required. Catheter-related infection has to be mentioned first. It is divided into localised infection, including exit site and tunnel infection and catheter related bacteraemia. Infection was the leading cause of premature removal of catheter in our study group. The infection rate of tunneled catheter varies from centre to centre due to difference of practising standards. For example, Martín-Peña et al. described infection rate of 0.34/1000 catheter days.¹⁴ The infection rate in our study group was 0.24/1000 catheter days. The other two reasons of catheter failure are thrombosis and fibrin sheath formation around the catheters. Fibrin sheath forms around the catheter obstructs the holes or creates negative pressure by not allowing blood to come out of the vein. We could not document such complications in all patients and catheters were removed with inadequate flow.

Since this was a retrospective analysis on tunneled catheter use, a large number of patients were lost to follow-up. As such, reasons of catheter failure other than infection could not be properly investigated. A prospective study covering a larger sample size may be designed to elaborate different aspects.

Conclusion

The survival rates of tunneled dialysis catheters in the local population are similar to those recorded from other countries. These can be safely used as vascular access till

the maturation of fistula or an alternative way of vascular access in patients who have exhausted their veins in failed fistulae. Catheter-related infection is the main reason of its premature removal in dialysis dependant patients.

References

- Schwab SJ, Buller GL, McCann RL, Bollinger RR, Stickel DL. Prospective evaluation of a Dacron cuffed hemodialysis catheter for prolonged use. *Am J Kidney Dis* 1988; 11: 166-9.
- Baqul A, Brook NR, Kaushik M, Nicholson ML. Tunneled catheters for the haemodialysis patient. *Eur J Vasc Endovasc Surg* 2007; 33: 105-12.
- Schwab SJ, Beathard G. The hemodialysis catheter conundrum: hate living with them, but can't live without them. *Kidney Int* 1999; 56: 1-17.
- Lund GB, Trerotola SO, Scheel PF Jr, Savader SJ, Mitchell SE, Venbrux AC, Osterman FA Jr. Outcome of tunneled hemodialysis catheters placed by radiologists. *Radiology* 1996; 198: 467-72.
- Millner MR, Kerns SR, Hawkins IF Jr, Sabatelli FW, Ross EA. Tesio twin dialysis catheter system: a new catheter for hemodialysis. *AJR Am J Roentgenol* 1995; 164: 1519-20.
- Trerotola SO. Hemodialysis catheter placement and management. *Radiology* 2000; 215: 651-8.
- Sampathkumar K, Ramakrishnan M, Sah AK, Sooraj Y, Mahaldhar A, Ajeshkumar R. Tunneled central venous catheters: Experience from single center. *Indian J Nephrol* 2011; 21: 107-11.
- Gibson SP, Mosquera D. Five years experience with the Quinton Permcath for vascular access. *Nephrol Dial Transplant* 1991; 6: 269-74.
- Chan MR, Yevzlin AS. Tunneled dialysis catheters: recent trends and future directions. *Adv Chronic Kidney Dis* 2009; 16: 386-95.
- Vats HS. Complications of catheters: tunneled and nontunneled. *Adv Chronic Kidney Dis* 2012; 19: 188-94.
- Coentrao L, Santos-Araujo C, Dias C, Neto R, Pestana M. Effects of starting hemodialysis with an arteriovenous fistula or central venous catheter compared with peritoneal dialysis: a retrospective cohort study. *BMC Nephrol* 2012; 13: 88.
- Work J. Hemodialysis catheters and ports. *Semin Nephrol* 2002; 22: 211-20.
- Maya ID, Allon M. Outcomes of tunneled femoral hemodialysis catheters: comparison with internal jugular vein catheters. *Kidney Int* 2005; 68: 2886-9.
- Martin-Pena A, Luque Marquez R, Guerrero MJ, Espinosa N, Blanco Y, Ibeas J, et al. Tunneled hemodialysis catheter related bloodstream infections: a prospective multicenter cohort study from Spain. *J Vasc Access* 2012; 13: 239-45.