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Conversion of Temporary (Uncuffed) Hemodialysis Catheters to Permanent (Cuffed) Hemodialysis Catheters

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Abstract

Background: To estimate the feasibility and clinical outcomes of conversion of temporary to permanent hemodialysis catheters using the same venous insertion site. *Methods*: The data of patients who underwent conversion of central venous catheter (CVC) from temporary to permanent type from November 2104 to December 2016 at EMS memorial co-operative hospital & research center, Perinthalmanna, Kerala, was analyzed. The conversion of catheter was performed at the existing venous access site under local anesthesia in operation theater with the guidance of C-ARM. Technical success, procedural complications, hemodialysis records and clinical outcomes were evaluated. *Results*: The study group consisted of 26 patients (14 males and 12 females)with age of 56.61 ±10.13 years. All 26 temporary catheters were successfully converted to permanent or tunneled hemodialysis catheters with 3 patients having minor oozing and no major procedure-related complications. The duration on temporary catheters ranged from 3-296 (mean: 53.42) days prior to their conversion to permanent type, after failure of multiple attempts at arterio-venous (AV) fistula creation. Heparin (5000 U/ml) along with Cefazoin (10 mg/ml) in ratio of 1:1 were used as locking solution and Mupirocin ointment was applied at exit site for both temporary & permanent catheters(PC) after each dialysis to reduce the incidence of catheter related blood stream infections (CRBSI). The total number of follow-up days with permanent catheter (PC) was 6730 (range:33-768, mean: 258.85, SD: 199.47). There were 8 events of culture proven sepsis, yielding a catheter infection rate of 1.2/1000 catheter days, one among them required PC removal due to unresponsive septicemia (0.14/1000 catheter days).None of them had exit site infection, tunnel infection requiring catheter removal. The patency rate was 96.15% at 30 days after insertion, with 9 catheters functioning at the end of the study period. One patient needed repostioning of PC due to poor blood flow within one week after insertion. Thirteen patients died with working catheters of causes unrelated to catheter. The catheters removed in 4 patients when they were no longer needed (access changed to AV graft in 2, AV fistula in 1, and 1 patient had improvement in renal parameters). Two patients required replacement with new PC (PC related septicemia in one and due inadvertent removal in another). *Conclusions*: Thus conversion of a temporary HD catheter to a tunneled catheter using the same venous insertion site is safe, does not increase the risk of infection, and allows conservation of other central venous access sites. The conversion also avoids complications associated with venotomy and allows conservation of other central venous access sites. Use of Heparin (5000 U/ml) along with Cefazoin (10 mg/ml) in ratio of 1:1; as locking solution and Mupirocin ointment for application at exit site for both TC & PC is an effective strategy to reduce the incidence of catheter related infections.

Keywords: Hemodialysis; Temporary Catheter; Permanent or Cuffed Catheter.

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Introduction

Hemodialysis (HD) or peritoneal dialysis (PD) is a life-saving and life-sustaining procedure in those with end stage renal disease (ESRD), who are unable to undergo renal transplantation. The need for vascular access is an ever increasing challenge to the care providers. The majority of patients begin hemodialysis treatment with a central venous catheter (CVC) as their initial vascular access in India and elsewhere in the world [1-4]. The majority of patients who begin hemodialysis treatment using a temporary CVC (TC) in India will undergo creation of an arteriovenous (AV) fistula or AV graft as their permanent vascular access [3,4]. The tunneled or cuffed or permanent catheter (PC) is one of the vascular access options in patients with either poor vasculature leading to multiple failed attempts at AV fistula creation or those expected shorter life span or elderly age [5,6]. A study from Iran showed an increasing trend towards use of permanent catheters for hemodialysis [7]. The cuffed or permanent catheter (PC) may be inserted de-novo or may be converted later over guide-wire using peel away sheath with same venotomy site [5-11]. There is limited published data regarding the use of PC as permanent access for HD from India [8]. This study was done to estimate the feasibility and clinical outcomes of conversion of temporary to permanent hemodialysis catheters using the same venous insertion site.

Materaial and Methods

This is a retrospective study involving data of patients who underwent conversion of CVC from temporary to permanent type from November 2104 to December 2016 at EMS memorial co-operative hospital & research center, Perinthalmanna, Kerala. The patients were started on HD initially after insertion of TC (14F x 15cm, polyurethane, pre-curved or Raulerson internal jugular double lumen catheter by Medcomp®, Harleysville, PA,USA) in right internal jugular vein (IJV) as they were unfit or unwilling for PC insertion or if lacking mature AV fistula. The The conversion of temporary to permanent catheter (14.5 F x 36 cm, hemo-flow ®, polyurethane, by Medcomp®, Harleysville, PA,USA) was performed at the existing venous access site under local anesthesia in operation theater with the guidance of C-ARM, if attempts to create AV fistula failed due to poor vasculature. Technical success, procedural complications, hemodialysis records and clinical outcomes were evaluated. Statistical analysis was done using SPSS 17 for Windows, by SPSS Inc. IL, USA. The quantitative variables (age) have been described as mean ± SD and range. Theconfidence interval was 95%, and a two tailed $P < 0.05$ was used for statistical significance.

Techniques of Catheter Conversion

All procedures were performed by a Nephrologist and an assistant to Nephrology in operation theater and under sterile conditions, with assistance of C-ARM under local anesthesia. An cutaneous incision measuring 4-5 cm, was made at site of TC to expose the subcutaneous plane. A subcutaneous tunnel was created with one end below the clavicle and other-end exiting at the site of TC insertion. The PC passed through the tunnel using the tunneler provided with the catheter kit with Dacron cuff about 2 cm from the exit site and its position is secured. The guidewire is advanced through venous lumen of existing TC and TC was removed after confirming the position of guidewire in right atrium. The next step consisted of placing a peel-away sheath/dilator combination over the guidewire. The dilator and guidewire were removed and the catheter was inserted centrally through the sheath, which was peeled away. The PC was positioned so that its tip is in right atrium under guidance of C-ARM. All patients were given Amoxicillin-clavulanate 625 mg twice daily for 3 days after the procedure. The patient was monitored in ICU for 12 hrs after the procedure.

Results

The age, duration on temporary and permanent catheter and its relation with gender are presented in **Table 1** and comorbidities are shown in **Table 2**.

The study group consisted of 26 patients (12 females and 14 males)with age of 56.61 ±10.13 (range 40-79) years. All 26 TC were successfully converted to permanent or tunneled hemodialysis catheters with 3 patients having minor oozing and nomajor procedure-related complications. The duration on temporary catheters ranged from 3-296 (mean: 53.42) days prior to their conversion to permanent type, after failure of multiple attempts at arterio-venous (AV) fistula creation.

The diabetes mellitus was the commonest cause of ESRD in the study with majority of the patients having macrovascular complications involving coronary, cranial and peripheral arteries. The total number of follow-up days with permanent catheter

(PC) was 6730 (range: 33-768, mean: 258.85, SD: 199.47). Heparin (5000 U/ml) along with Cefazoin (10 mg/ml) in ratio of 1:1 were used as locking solution for both temporary & permanent catheters (PC) after each dialysis to reduce the incidence of catheter related blood stream infections (CRBSI). The Mupirocin ointment was applied at catheter insertion site of temporary CVC or exit site of PC for prevention of exit site infection.

There were 8 events of culture proven sepsis, yielding a catheter infection rate of 1.2/1000 catheter days, one among them required PC removal due to unresponsive septicemia (0.14/1000 catheter days).None of them had exit site infection, tunnel infection requiring catheter removal.Two patients required replacement with new PC (PC related septicemia in one and due inadvertent removal in another). The patency rate was 96.15 % at 30 days after insertion, with one patient requiring re-positioning within one week of procedure due to poor blood flow. Thirteen patients died with working catheters of causes unrelated to catheter, and it was major cause of dropout in the study followed by catheter removal. The catheters removed in 4 patients when they were no longer needed (access changed to AV graft in 2, AV fistula in 1, and 1 patient had improvement in renal parameters). Nine patients were undergoing HD functioning catheters at the end of the study period. The Kaplan-Meier survival graph of permanent catheter is shown in **Figure 1**.

Table 1: The age, duration on temporary and permanent catheter and its relation with gender

	Age (years)	Duration of Temporary catheter (days) Mean±Std. Deviation (range)	durationof permanent catheter (days)
Females	52.33±8.46 (40-67)	48.08±83.24 (3-296)	247.42±150.45 (102-736)
Males	60.29±10.28 (45-79)	58.00±56.79 (6-172)	268.64±239.03 (33-768)
Combined	56.62±10.13 (40-79)	53.42±68.93 (3-296)	258.85±199.46 (33-768)
p-value	0.23	0.59	0.35

Table 2: The comorbidities in patients undergoing permanent catheter insertion

Co-morbidity	Females (n-12)	Males (n-14)
Diabetes mellitus	10	13
Hypertension	12	14
Coronary artery disease	4	9
Cerebrovascular disease	4	0
Peripheral vascular disease	5	6

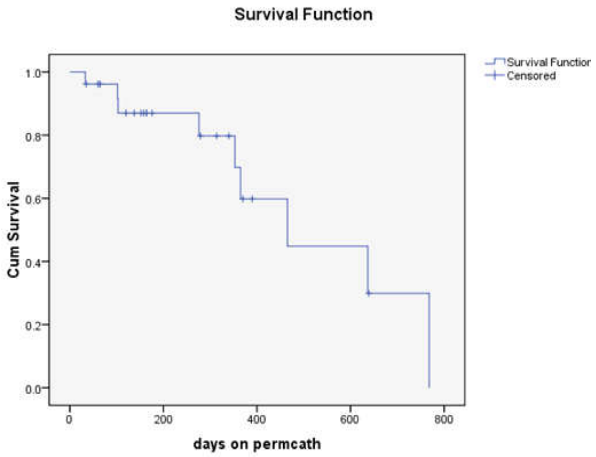

Fig. 1: The Kaplan-Meier survival graph of permanent catheter

Discussion

Successful dialysis is mandatory for patients with ESRD, and the lack of it due to improper vascular access is life threatening. Permanent catheters may serve as a critical permanent access when all other options have been exhausted. This retrospective study, included the patients who underwent conversion of temporary to permanent catheter over guide-wire and peel away sheath. This technique achieved 100 % technical success; in addition using same venotomy site with least complication rates, and also sparing other central venous sites for future use; similar to previous reports [8-12]. The age group of patients and male predominance was similar to other studies [8-12].

In this study, the right internal jugular vein was the initial access site in all the patients which was later converted to PC. The right IJV is also the preferred site for CVC insertion in other studies [8-12]. The duration on temporary catheters ranged from 3-296 (mean: 53.42) days prior to their conversion to permanent type; one of the highest reported till date. The median duration of TC in one of the published studies was 4 and 14 days in two study cohorts, respectively [12].

One the major concerns of the study was infections due longer duration of TC prior to its conversion to

PC. However, there were no documented cases of early CRBSI (< 30 days after procedure) probably due to use of Heparin (5000 U/ml) along with Cefazoin (10 mg/ml) in ratio of 1:1; as locking solution and Mupirocin ointment for application at exit site for both TC & PC. About 1.4% of the patients had early CRBSI needing catheter removal in an earlier study [12]. Falk et al, have reported even higher 30-day infection incidence (9.4%) and rate (3/1,000 catheter-days) [10].

Eight events of late CRBSI (onset >30 days after procedure) was observed in the study amounting to frequency of 1.2/1000 catheter days with one patient (3.84 %) requiring PC removal. Other studies have reported similar infection rates (per 1000 catheter days), ranging from 0.4 to 5.5 after denovo PC insertion and 0.8-3.0 after TC to PC conversion [5-12]. Therefore, overall infection risk after TC to PC conversion in the present study similar to that of denovo catheter placement.

The efficacy of prophylactic antibiotic administration to prevent infections in PC procedures is still controversial. The Cefazolin significantly reduced catheter-related infections, bacteremia, and catheter loss over placebo in one study [13] and there was no advantage of cefazolin over vancomycin in another study [12].

The PC related sepsis, change of access to AV fistula or AV graft, improvement in renal function were the indications for PC removal in the study similar to previous reports [8-13]. The 50 % patients died with working catheters of causes unrelated to catheter, and it was major cause of dropout in the study followed by catheter removal and 34.61 % were continuing HD through the PC.

Conclusions

Thus conversion of a temporary HD catheter to a tunneled catheter using the same venous insertion site is safe, does not increase the risk of infection, and allows conservation of other central venous access sites. The conversion also avoids complications associated with venotomy and allows conservation of other central venous access sites.

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