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ORIGINAL ARTICLE

Long Term patency of Tunneled Catheters in End Stage Renal Disease patients for vascular access- A single center study

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ABSTRACT

Aim: To look for the success and survival rate of tunneled catheters in hemodialysis patients.
Design: Prospective study
Duration & place of study: Department of Nephrology, Shaikh Zayed Hospital, Lahore from January 2017 to January 2018.
Methodology: This study comprised of 71 consecutive subjects in whom tunneled catheters were inserted. The ESRD patients requiring permanent access for hemodialysis because of AVF failure, cardiomyopathy, waiting time for AVF maturation or renal transplantation were selected, those with previous permanent catheter insertions were excluded. The catheter was inserted in right internal jugular vein with doppler ultrasound.
Result: The study included 71 patients; average age was 41±13 years, of them 43 were males. The success rate to insert catheter in an ideal location was observed in 73.2% and in non-ideal place in 26.8%patients. It was removed in67.6% and remained in situ till end of study in 32.4% patients. Functional AV fistula, renal transplantation and resolving AKI were elective reasons to remove catheters in 40%, 29% and 2% patients. The mean time of duration where tunneled catheter continued to serve as a vascular access and removed electively without catheter related problems was significantly different with
Conclusion: The success rate of permanent catheter insertion was 99.2 % in our study. The catheter insertion under doppler ultrasound vision by a nephrologist offers a long lasting, safe and reliable alternative to restore a vascular access.
Keywords: End Stage Renal Disease, Tunneled Catheter, Hemodialysis

INTRODUCTION

Arteriovenous fistula (AVF) is the standard vascular access channels for hemodialysis patients (HD)[1]. Because fistulas require longer time to mature, the duration of catheter requirement for vascular access has increased markedly in hemodialysis patients[2]. Tunneled hemodialysis catheters are widely used as a bridge between the creation and maturation of a dialysis arteriovenous fistula or graft, as these catheters can be used for a longer duration of time[3,4]. Though tunneled catheter can be placed in all major veins, the right internal jugular vein is preferred site and the subclavian vein should be considered as a last option to prevent stenosis of subclavian vein which result in failure to construct AVF in future if needed[5].

Data from the dialysis outcome and practice patterns study revealed that 15% to 50% of CKD patients in Europe and 60 % of patients in United States had their HD initiated from Catheter as primary vascular access[6]. KDOGI guidelines recommended, if Catheter is needed for more than three weeks for dialysis, then cuffed (tunneled) catheter should be used for vascular access[7].

The catheter used as primary vascular access for starting HD minimizes the incidence of sepsis and other complications related to non-cuffed tunnelcatheter[8]andfluoroscopy is not always available for insertion of tunnel Catheter as recommended in KDIGO guidelines.

In the present study, we assessed the safety of insertion of tunnel catheter in right internal jugular vein with help of doppler ultrasound but without using fluoroscopy. We also observed outcomes and complications related to tunnel catheter insertion.

MATERIAL AND METHODS

The study was conducted in the department of Nephrology, Shaikh Zayed Hospital, Lahore, and comprised records of 71 consecutive subjects from a list of patients in whom tunneled cuffed catheters were placed from January 2017 to January 2018and were followed up for two years. Data was collected on a proforma from the hospital database and medical records of patients after taking the informed consent from participants. SPSS 20 was used for statistical analysis.

The ESRD patients who needed permanent catheter placement for hemodialysis because of multiple reasons including vascular access failure, cardiomyopathy, waiting time for either maturation of arteriovenous fistula (AVF) or renal transplantation, were selected. The tunneled dialysis catheter was inserted in right internal jugular vein under doppler ultrasound guidance by trained nephrologists.

The ESRD patients who required vascular access were excluded from study if any one of the following is present; right internal jugular vein or right subclavian vein occlusion/thrombosis diagnosed on surveillance doppler ultrasound, history of previous permanent cannulation in right internal jugular vein or placement of tunneled catheter other than right internal jugular vein.

These patients were evaluated for demographic parameters (age, gender), causes of renal failure, number of months on HD, duration (no. of days) of tunneled catheter placement, reason for removal of catheter, complications during procedure following first week, follow up X-ray chest to look for catheter's tip placement and/or complications.

All the patients before undergoing procedure had their complete blood count, prothrombin time, partial thromboplastin time checked and RBC's or fresh frozen plasma (FFP) transfusion was carried out if needed.

Catheter technique: The Doppler ultrasound was used to identify right internal jugular vein and catheter was inserted by seldinger method. All the catheter placements were performed in a room dedicated for interventional procedures. The skin overlying the insertion site was washed with povidine solution, draped and then covered with a surgical cloth with the patient lying in the supine position. After injecting local anesthesia at the insertion site, internal jugular vein was punctured under direct vision of doppler ultrasound. After that, guide wire was passed through the puncture needle followed by removal of the needle.

Finally, the catheter was placed through the guide wire to internal jugular vein after dilation with the dilators. Then catheter was aimed to reach aortocaval junction or right atrium by measuring length by landmark technique, which was marking skin from 4 cm below manubrio- sternal junction which was labelled as 1, second mark was made at midpoint of sternal notch which was labelled as mark 2, third mark was made at venipuncture site which was labelled as mark 3. The length was measured by using measuring tape from mark 1 to 3, depth of right internal jugular vein was measured by using doppler ultrasound which was added to length mark from mark 1 to 3, and appropriate length catheter was selected according to measured length. The tunnel length was

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marked from venipuncture site to the opening of venous/ arterial port and labelled as mark 4.

After controlling the patency of the arterial and venous ports of the catheters by drawing blood, both were flushed with 20 ml isotonic saline followed by injection of heparin to both lumens.The procedure was completed by stabilization of the catheter with sutures and surgical opsite was applied overlying skin.

The patients were continuously monitored by cardiac monitoring throughout the procedure and record of any undesirable event was noted. Post procedure blood pressure, pulse and oxygen saturation was checked and documented; all patients were continued to follow up for further 2 weeks to observe any immediate complication associated with procedure.

All these patients underwent chest X-ray (PA view) after completion of procedure to see the correct position of catheter and possible complications. The x-ray was also used to locate proper position of tunneled catheter 's tip by measuring length from mid atrium to below carina, this measurement was divided into 2 groups- group A "ideal" position (2 -4cm below carina) and group B "non-ideal" position but not needing adjustment (0-2cm below carina or 4-6cm below carina)

On follow up, the line related sepsis was treated according to culture sensitive intravenous antibiotics and mechanical obstruction (thrombosis or poor flow) was managed by using anticoagulant agent (e.g. heparin, streptokinase, urokinase) to maintain the patency of permanent catheter.

Follow up: Quantitative analysis included the success rate of procedure, the number of catheter days, the number of procedure related complications and the number of catheter removals. Patients who died with a working catheter in situ were included in our study. At the end of follow up, all catheters with functional venous access were labelled as *patent*.

RESULTS

The study included 71 patients; average age of them was 41±13 years ranging between 19 and 77 years. Of them, 43(60.6%) were males. Diabetes was the leading cause of ESRD in 24(33.8%) whereas 20(28.2%) had glomerulonephritis as a reason for ESRD, the remaining causes of ESRD are showed in (Table 1). The history of temporary catheterization as a vascular access was present in 55(77.5%) patients in our study population. The common indications for permanent catheter insertion was failure of existing vascular access, absence of any permanent vascular access for hemodialysis, cardiomyopathy (Ejection Fraction<30%), waiting time for renal transplantation and patient's own choice for permanent catheter as shown in (Table 1). In our study, the success rate to insert the permanent catheter to an ideal location was observed in 52(73.2%) patients and in 19(26.8%) patients, catheter could not be placed in an ideal location although researchers do not opt to adjust or remove the permanent catheter as shown in Table 2.

The immediate complications observed in 2 weeks follow up period were hypotension and line related infection, 2.8% and 5.6% respectively shown in Table 2. The permanent catheter was removed in 48(67.6%) patients for various reasons, and it remained in situ till end of study as a patent vascular access in 23(32.4%) patients (Table 2).

The formation or maturation of AV fistula, renal trans-plantation and resolving AKI were elective reasons to remove catheters in 19(40%), 14(29) and 1(2%) patients respectively (Fig. 1). The non-elective reasons to remove tunneled catheter were death in 4(8%) patients (not related to either procedure or catheter related complication), line related sepsis in 5(11%), thrombosis or poor flow in 5(10%) patients.

The mean time of duration in patients where tunneled catheter continued to serve as a vascular access and removed electively without catheter related problems was significantly different with p-value <0.001.

On the other hand, the mean time of duration in patients where permanent catheter was removed due to death(not related to catheter complication) was almost similar to the patients where it was removed due to complications.

The average life of permanent catheter serving as a vascular access was 125 days in patients whose catheter was removed due to line related sepsis. Whereas the patients getting it electively removed either of AVF creation or transplantation, had an average life of 91 and 101 days respectively which were not different statistically. In other conditions, the time duration of patency of catheter are mentioned in figure 1.

Figure 1: Distribution of 48 cases with different reasons of removal of Perm catheter and duration till it was removed

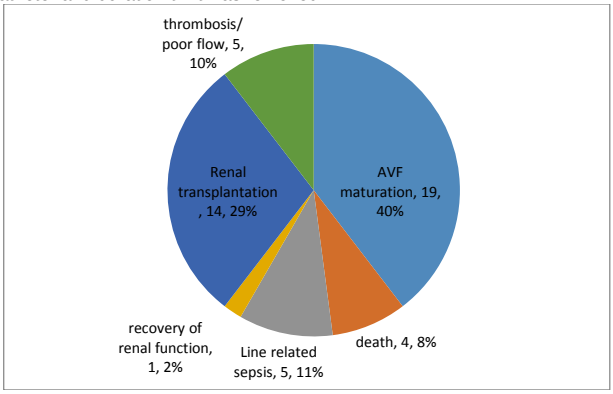

Table 1: Basic characteristics of cases went through tunneled dialysis catheterization

		n	%
Gender	Male	43	60.6
	Female	28	39.4
Diagnosis	Diabetes	24	33.8
	Glomerulonephritis	20	28.2
	Bil. Shrunken Kidneys	14	19.7
	Nephrolithiasis	9	12.7
	Unresolved Postpartum AKI	3	4.2
	Others	1	1.4
Previous temporary catheter	Yes	55	77.5
	No	16	22.5
Indications for Permcath	Vascular access Failure	25	35.2
	Absence of vascular access	20	28.2
	Cardiomyopathy EF < 30%	15	21.1
	Patients waiting for renal transplant	9	12.7
	Patients choice	2	2.8

Table 2: Post Tunnel Catheter procedure statistics

Catheter removal	Yes	48	67.6
	No	23	32.4
Position of catheter	Ideal	52	73.2
	Non-ideal	19	26.8
Complication (within two weeks)	Hypotension	2	2.8
	Infection	4	5.6
	None	65	91.5

Table 3: Duration of Tunnel Catheter severing as vascular access

	Mean	SD	Min	Max	Median	Q1	Q3
Age	41	13	19	77	42	30	50
Duration of Tunnel catheter serving as a vascular access (days)	138	64	70	307	120	90	180
Total no. days on HD	434	427	0	1800	310	80	700

Table 4:

	n	Mean	SD	Median	Minimum	Maximum
AVF maturation	19	91	26	85	70	190
death	4	184	48	185	124	240
Line related sepsis	5	125	30	130	94	170
Renal transplantation	14	101	26	95	77	170
thrombosis/ flow poor	5	178	19	180	150	200

DISCUSSION

The tunneled catheters are widely used for both short- and long-term vascular access in ESRD patients needing hemodialysis[9]. Despite continuous effort by the National Kidney Foundation (NKF) and Fistula First National Vascular Access Improvement Initiative, the tunneled catheters are still required for vascular access in different regions[10].

In our study the success rate of right internal jugular permanent catheter tip insertion to an ideal location as described was 73.2%. According to a study conducted by Ibrik'O et al[31] the success rate was 87.8%for cannulation of right internal jugular vein, whereas Densy et al [30]in his study observed success rate of 78% for insertion, these findings were comparable to our results, which gave a good emphasis that in centers where fluoroscopy is not readily available, doppler ultrasound guided technique is still safe with appreciable success.

In our follow up, catheter was removed due to sepsis in 5 patients which is in accordance with previous study conducted by Trerotola *et al* who reported a removal rate of 11% to 14% owing same issue on 3 months follow up[25]. The slightly better results may be due to a fact that proper sterile technique along with robust monitoring for infection was carried out in our practice and none of our patient had previous cannulation for permanent catheter at the same site. In the present study, 5(10%) tunneled catheters were removed due to mechanical reasons and similar findings were also implied by two scientists earlier namely Sayani who reported removal of 7 catheters[28] and O'Dwyer mentioning removal of6 catheters because of thrombosis in their respective studies.

The present literature found a mean duration of the catheter patency of 125 days which was slightly low as compared to 141 days observed in a previous report[29], the difference may be due to early removal of catheter as a consequence of good reasons like AVF maturation or renal transplantation in significant number of participants in our study.

It is a single center study recruiting a smaller number of patients but a larger data may be required in future to gain the confidence of nephrologists to do successful cannulations with the help of doppler ultrasound. At the same time, it does not undermine the fact that fluoroscopy is still the gold standard technique for insertion of tunneled catheter in ESRD patients although studies are scarce to reflect its wide usage in the developing countries.

CONCLUSION

The permanent catheter insertion is a well-recognized modality of vascular access in ESRD patients. Though fluoroscopy guided insertions are still widely accepted as a first choice but doppler ultrasound guided technique, if performed by an expert nephrologist offers a long lasting, safe and reliable alternative to restore a vascular access in 3rd world countries where resources and expertise to use fluoroscope are compromised.

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