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ORIGINAL ARTICLE

Survival Rate of Tunneled Hemodialysis Catheters in Patients on Hemodialysis due to Chronic Kidney Disease (CKD)

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ABSTRACT

Objectives: To determine the survival rate and reasons of failure of tunneled hemodialysis catheters in patients on hemodialysis due to chronic kidney disease (CKD).
Study Design: Prospective case series.
Place and Duration of Study: Department of Nephrology, Sheikh Zayed hospital Rahim Yar Khan from 1-June-2020 to 30-June-2021.
Methodology: A total number of 195 patients of CKD in whom tunneled hemodialysis catheters (HDCs) were inserted for hemodialysis were included. Data regarding baseline study variables e.g. age, and gender, site of insertion and reason for removal was also collected. All patients were followed for 06 months to determine the survival rate of tunneled hemodialysis catheters.
Results: Mean age in this study was 46.79±13.54 years. There was 130 (66.7%) male population. HDC was inserted in Jugular vein in 184 (94.4%) patients and in subclavian vein in only 11 (5.6%) patients. HDCs were survived in 156 (80%) patients at 3 months and in 134 (68.7%) patients at 6 months follow-up. The reasons for removal of HDCs were sepsis in 16 (8.2%) patients, catheter clotting in 14 (7.7%) patients and mechanical damage in 8 (4.1%) patients. On univariate analysis, we did not find any statistical association of advanced age, female gender, diabetes and hypertension with failure of HDCs.
Conclusion: The 06 month's survival rate of HDCs was 68.7%. Sepsis was the predominant cause of failure of these catheters.
Keywords: Chronic kidney disease, Tunneled hemodialysis catheters, Survival rate.

INTRODUCTION

There is a consistent growth in number of patients of chronic kidney disease (CKD) requiring hemodialysis.[1] This rise is due to growing prevalence of chronic diseases such as hypertension and diabetes which ultimately result in renal failure. Moreover, availability of renal replacement therapy in developing world has also increased the number of CKD patients.[1, 2]

Vascular access is the main and first step for maintaining hemodialysis in CKD patients.[3] A patent and reliable vascular access is the main lifeline of hemodialysis, therefore establishing and maintaining this access is of prime importance.[4] Arteriovenous fistula (AVF) and synthetic arteriovenous graft (AVG) are the recommended vascular accesses for long term management of CKD patients on hemodialysis.[5] The other module of vascular access is tunneled hemodialysis catheters (HDCs) that are frequently used in children and in adults are used in acute settings. Sometimes these catheters are the only source of hemodialysis access.[6] The use of these catheters is increasing worldwide because of increase in aging population requiring hemodialysis or need of hemodialysis for longer periods which intern is associated with complications of vascular access using AVF or AVG and difficulties in creation of new AVFs. So in these patients these catheters serve as a bridge to permanent vascular access. And in some centers due to financial burdens patients are maintained only on these tunneled catheters.[7] When compared to AVG and AVF, these catheters have a higher complications profile starting from insertion till the removal of the catheter.[8, 9]

Survival of hemodynamic catheters is always a major concern in these patients. The aim of the proposed study is to determine the survival rate of tunneled hemodynamic catheters in hemodialysis patients. because there is a variability in reported literature regarding the survival rate of these catheters.[10, 11] So the results of this study can help us to determine the survival rate of tunneled hemodialysis catheters in our population. The results of this study can also lead us for further studies how can we improve the survival rate of hemodialysis catheters in these patients. Because failure and reinsertion of hemodialysis catheters is associated with considerable morbidity.

METHODOLOGY

In this prospective analysis, we included a total of 195 patients of CKD who were on maintenance hemodialysis. The inclusion criteria were; patients of age 20 to 70 years in whom first time tunneled hemodialysis catheter were inserted for hemodialysis. While patients with repeated insertions of hemodialysis catchers were excluded from analysis. The study period was 1-June-2020 to 30-June-2021. Approval from IRB of Hospital was obtained.

All insertion of catheter all patients were followed till 6 months to determine the survival rate and reasons for failure of primary catheter. The main reasons for removal of catheter were labelled as tunnel infection/sepsis, clotting of catheter, mechanical damage. Sepsis was defined as presence of swelling/redness at insertion site along with sepsis (presence of fever (body temperature >99 °F) and hypotension defined as systolic blood pressure (SBP) < 90 mm Hg or mean arterial pressure (MAP) < 65 mm Hg after 20 mL/kg intravenous fluid bolus). Finally, blood cultures were taken and sent to the laboratory to confirm the diagnosis of sepsis; (i) presence of two or more positive blood cultures, (ii) serum CRP levels >50 mg/L, and (iii) serum Procalcitonin (PCT) value >2 ng/ml was used as diagnostic criteria for sepsis. Clotting of catheters was defined as formation of blood clots resulting in blockage of catheter. This was determined by aspirating blood from the catheter. In case of failure to aspirate or presence of big clots in aspirate was labelled as clotting of catheter. Mechanical damage was defined as severe kinking of catheter resulting in failure to aspirate blood or presence of other damage such as hole in the catheter was labelled as mechanical damage.

Data was entered in SPSS v23 software. Mean and standard deviations was calculated for quantitative variables for age. Gender, hypertension, diabetes mellitus, site of catheter insertion, survival (yes/no) and reasons for removal of hemodialysis catheters were presented as frequency and percentage.

RESULTS

Mean age in this study was 46.79±13.54 with male predominance having 130 (66.7%) male population. Regarding co-morbidities 78

(40%) patients were diabetic and 134 (68.7%) were hypertensive. HDC was inserted in Jugular vein in 184 (94.4%) patients and in subclavian vein in only 11 (5.6%) patients (Table 1).

HDCs were survived in 156 (80%) patients at 3 months and in 134 (68.7%) patients at 6 months follow-up. The reasons for removal of HDCs were sepsis in 16 (8.2%) patients, catheter clotting in 14 (7.7%) patients and mechanical damage in 8 (4.1%) patients (Table 2).

On univariate analysis, we did not find any statistical association of advanced age, female gender, diabetes and hypertension with failure of HDCs (Table 3).

Table 1. Baseline Study Variables.

Variable	Value
Age	46.79±13.54
Gender	
Male	130 (66.7%)
Female	65 (33.3%)
Co-morbidities	
Diabetes	78 (40.0%)
Hypertension	134 (68.7%)
Catheter Insertion Site	
Subclavian	11 (5.6%)
Jugular	184 (94.4%)

Table 2. Data of Catheter Survival.

Survival at 3 months	156 (80%)
Survival at 6 months	134 (68.7%)
Reason of Removal	
Sepsis	16 (8.2%)
Clotting	14 (7.7%)
Mechanical Damage	08 (4.1%)

Table 3. Analysis of Factors Leading to HDCs Failure.

	HDCs Survival		Odds Ratio (95% CI)	P-value
	Yes	No		
Age >60 Years	33 (21.2%)	8 (20.5%)	0.96 (0.40-2.28)	0.93
Female Gender	51 (32.7%)	14 (35.9%)	0.86 (0.41-1.80)	0.70
Diabetes	64 (41.0%)	14 (35.9%)	0.80 (0.39-1.66)	0.55
Hypertension	108 (69.2%)	26 (66.7%)	0.88 (0.42-1.87)	0.75

DISCUSSION

Maintaining vascular access is the lifeline for patients on hemodialysis. The primary purpose of using HDCs is that these provide cost-effective and easy access.[12] However the risk of complications should be weighted against these potential benefits. As the complications associated with HDCs insertion can significantly increase the health care cost.[13] Different studies have been conducted to prevent complications related to HDCs and to increase survival of catheters such as use of different pre-and post-placement measures use of different types of catheters. Still no standardized data have been developed that can help clinicians to judge the possibility of HDCs failure in specific populations and the protocol usually depends on institutional preferences e.g. some centers have contraindication to place HDCs in ICU admitted patients, some suggest to avoids these in patients with recent fever or leukocytosis. These institutional or physician specific preferences can either lead to ill-decisions in catheter placement and can lead to un-necessary delays in catheter placement for initiating hemodialysis.[14]

In present study, we determined the 06 months survival of HDCs and determined the reasons of failure of HDCs. In our study, the survival rate of HDCs at 03 months follow-up was 80% and at 06 months follow-up was 68.7% and we did not followed the patients for more than 06 months. The main reason for removal of HDCs was sepsis in 41.0% patients, 7.7% catheters were removed due to clotting, and 4.1% due to catheter dysfunction.

A study conducted by Weber et al. including data of 171 patients of HD managed using tunneled HDCs reported a survival rate of 94.2% at 3 months' follow-up, and 90.2% at 06 months' follow-up. Among the reasons of failure the authors reported catheter related sepsis in 5.0% patients, mechanical damage in 1.7%, clotting/malfunctioning in 2.2% and tunnel infections in 1.7% patients.[10]

Wang et al.in a study of 16 pediatric patients of ESRD managed on HDCs, reported a survival rate of 85.7% at 06 months follow-up.[11]

Sampathkumar et al. in a study of 100 patients of tunneled HDCs reported a survival rate of only 80% and 55% at 03 months and 06 months follow-up respectively. The reasons for removal of HDCs were death in 23% patients, sepsis in 3.0%, catheter blockage in 2.0%, renal transplantation in 11% and switch of AVF in 4% patients.[15]

Another study by Shingarev et al. on 472 patients ESRD with tunneled HDCs insertion reported a 3 months survival rate of 69% at 3 months, 53% at 6 months and 34% at q2 months follow-up. While the common reasons for failure were catheter dysfunction in 55% and bacteremia in 45% patients. Moreover, the authors reported that left sided insertion is a risk of early failure of HDCs and they did not find any association of age, sex, race, diabetes, hypertension, and coronary artery disease (CAD) with patency of HDCs.[16]

A recent study conducted in Canada on complications of HDC leading to removal of catheter, reported infection rate of 9.6% and 38.4% catheters dysfunction that leads to removal of HDC. In their study overall survival rate was 51.97%.[14]

In present study we did not found any significant association of advanced age with HDC failure. The probable reason for this is that we only took patients with age range upto 60 years, and the above mentioned studies also included patients >60 years, moreover they defined older age >60 years that was the upper limit of age for our study.

The present study also has some limitations. First, we reported data only from a single center, secondly, we did not performed imaging evaluation to more specifically determine the reasons for catheter dysfunction such as tip migration or intra-luminal thrombosis, which may help to define the more specific reasons for catheter dysfunction.

CONCLUSION

The 06 month's survival rate of tunneled hemodialysis catheters was 68.7%. Sepsis was the predominant cause of failure of these catheters. So adequate aseptic care of the catheter insertion site can reduce the risk of sepsis in these patients and will prolong the survival of tunneled hemodialysis catheters.

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