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Original Article

Frequency of Catheter Infections in Patients of Hemodialysis Despite Using Antibiotic Lock

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ABSTRACT

Non-tunneled catheters are associated with many complications, including infections and thrombosis. **Objective:** To determine the frequency of catheter infections in patients of hemodialysis despite using antibiotic locks, in a Tertiary Care Hospital Karachi. **Methods:** It was a cross-sectional study conducted at the department of nephrology, Liaquat national hospital and medical college, Karachi, Pakistan from 18th October 2020 to 18th April 2021. Patients of age 20 to 70 years of either gender on hemodialysis through double lumen catheter- non-cuffed for ≥ 2 weeks were included in the study. Brief history was taken from all the patients. Gentamicin lock solutions were administered in all patients. Catheter tip was sent to institutional laboratory for culture and sensitivity to reach the outcome i-e catheter related infection. **Results:** The mean age was 58.97 ± 14.82 years. The catheter related blood stream infection was in 21 patients (17.5%). The most common organism was coagulase negative *Staphylococci* (CoNS) (5.9%), followed by Vancomycin-resistant *Enterococcus* (VRE) (4.2%), respectively. There was insignificant association observed between catheter related blood stream infection and age groups, gender, comorbids, duration of catheter insertion and hemodialysis, site of catheter infection and reasons of hemodialysis ($p > 0.05$). **Conclusions:** Catheter-related infections in patients of hemodialysis despite using antibiotic locks is frequent but it has been observed that gram negative infections have responded well to gentamicin lock solution, where as in our study most common organism responsible for infection is coagulase negative *Staph.* followed by VRE.

INTRODUCTION

Chronic kidney disease (CKD) is a major public health concern across the world and the global prevalence of CKD is 9.1% [1]. According to the results of systemic review conducted in 2015, the burden of CKD is higher in developing countries as compared to developed countries (387.5 million cases vs 109.9 million cases) [2]. The reason of high burden of CKD in developing might be the treatment cost, which is very high and unaffordable for majority of the patients [3]. The management of CKD patients who developed end stage renal failure or acute renal failure is renal replacement therapy or dialysis after getting an access placed [4]. Usually for those requiring dialysis for lifetime arteriovenous fistula is the preferred choice and tunneled dialysis catheters, is commonly used for patients who do not have functioning arteriovenous fistulas or grafts. However, access can be a temporary one placed in situations such as for failure of arteriovenous access or for acute renal failure or for bridging the gap to transplantation [5, 6]. In such conditions, when an access is required for a limited time then temporary non-tunneled dialysis catheters/ double lumen catheter are usually placed at bed side [7, 8]. Non-tunneled catheters are associated with many complications, including infections and thrombosis [9]. Hemodialysis patients have compromised immune

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systems as a result of underlying diseases such as diabetes and malnutrition induced by dialysis and uremia therapy, which can lead to catheter-related infection. The reasons and preventive strategies of these infections have been well discussed in literature. Infections are commonly caused by colonization of the catheter tip, the skin around the site of insertion, in the catheter by hematogenous spread from another place, and contamination of the locking solution. Other factors include contamination after catheter placement due to inadequate aseptic procedures and iatrogenic contamination during any subsequent catheter manipulation. There are many types of catheter-related infection including exit site infections, localized infections, tunneled infections, bloodstream infections and pocket infections [10, 11]. In a recent study, the catheter colonization was reported in 4.8% and catheter related bloodstream infection was reported in 4.2% of the hemodialysis patients [12]. In another study, 69% of the hemodialysis patients have experienced bloodstream infections and 31% have experienced localized infections [13]. As we had very few our own local statistics for catheter related bloodstream infections, therefore, the aim of the current study was to determine the frequency of related bloodstream infections and common organism causing catheter related infection in patients of hemodialysis despite using antibiotic locks, in a tertiary care hospital Karachi. This study helped in early suspicion of infection and prevent diagnostic delay in our population.

METHODS

It was a cross-sectional study carried out at the department of nephrology, Liaquat national hospital and medical college, Karachi from Oct 2020 to April 2021. Sample size of 118≈120 patients on hemodialysis, calculated on the basis of frequency of catheter related infection despite using antibiotic lock was 22% [13], confidence level as 95% and bond on error as 7.5%. Patients of age 20 to 80 years of either gender on hemodialysis through double lumen catheter– Non-Cuffed for > 2 weeks were included in the study. Patients with sepsis, malignancy and ESRD patients having AV fistula were excluded from the study. Non-probability consecutive sampling was applied. The approval from the institutional ethical committee was taken prior to commencement of study. Patients meeting the inclusion criteria were enrolled and prior to inclusion written informed consent was taken. Brief history regarding the co-morbid conditions i.e. diabetes mellitus (patients having HbA1C > 6.5 on treatment for > 1 year), hypertension (patients on antihypertensive medications for > 3 months, uncontrolled due to lack of exercise and dietary modifications), duration of hemodialysis, duration sine catheter insertion, site of catheter insertion, reason of hemodialysis and clinical examination was done. Gentamicin locks were administered in all patients. In all patient's catheter tip sent to institutional laboratory for culture, catheter related infection were labeled as positive if culture report showed > 102 cfu bacteria/ml on catheter tip. This information along with demographics were entered in the proforma by researcher herself. Data were entered on SPSS version 22.0. Mean, standard deviation was calculated for age, duration of hemodialyis and duration sine catheter insertion. Frequency and percentages was calculated for gender, co-morbids i.e., diabetes mellitus, hypertension, site of catheter insertion (femoral / transjuglar), reason of hemodialysis, catheter related blood stream infection (yes / no), if yes then organism of catether tip culture. Effect modifiers were controlled through stratification of age, gender, diabetes mellitus, hypertension, duration of hemodialysis, duration since catheter insertion, site of catheter insertion and reason of hemodialysis. Chi square test was applied and $p \leq 0.05$ was taken as significant.

RESULTS

Of 120 patients, the mean age was 58.97+ 14.82 years. The median duration of hemodialysis was 14.5 days ranging from 7 to 425 days. Furthermore, the mean duration since catheter insertion was 8.975 + 2.612 days. Most of the patients were males (56.7%) and 43.3% were females. Out of 119 patients, 65% were diabetic and 70.8% were hypertensive. Common reason of hemodialysis was AKI (75%), followed by ESRD (25%), respectively. In 97 patients site of catheter insertion was femoral and in 22 patients, it was transjuglar (Table 1).

Variables	Statistics
Age (years)	58.97 + 14.82
Duration of hemodialysis (days)	14.5 (7-425)
Duration since catheter insertion (days)	8.98 + 2.62
Gender	
Male	68 (56.7%)
Female	52 (43.3%)
Comorbids	
Hypertension	85 (70.8%)
Diabetes mellitus	78 (65%)
Reasons of hemodialysis	
ESR	30 (25%)
DAKI	90 (75%)
Site of catheter	
Femoral	97 (81.7%)
Transjuglar	22 (18.7%)

Table 1: Baseline characteristics of study variables

The catheter related blood stream infection was present in 21 patients (17.5%). We found no gram-negative bacteria. The most common organism responsible of catheter related infection was coagulase negative *Staph*. (5.9%),

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followed by VRE (4.2%), respectively (Table 2).

Organism of catheter culture	N (%)
Diptheroid species	1 (0.8)
Enterococcus	4 (3.3)
Klebsella MDR	1 (0.8)
Morgenella morganil	1 (0.8)
Ochrobactrum anthropic	1 (0.8)
Coagulase negative Staph.	7 (5.8)
VRE	5 (4.2)
Yeast	1 (0.8)

Table 2: Frequency distribution of organism of catheter culture

We found that catheter related infection was more in higher age (46-80 years) than lower age, but this difference was statistically insignificant. The proportion of infection in males and females were almost similar. In hypertensive individuals, proportion of infection was higher, while in diabetic and non-diabetic individuals proportion of infection was similar. No significant in proportion of comorbid and infection was observed. Furthermore, duration of hemodialysis, duration since catheter insertion, site of catheter infection, and reasons of hemodialysis showed statistically insignificant differences in proportion of catheter related infections (Table 3).

Age groups	Catheter related blood stream infection		p-value
	Yes	No	
	N(%)	N(%)	
20-45 years	3 (14.3)	18 (85.7)	0.457
46-80 years	18 (18.2)	81 (81.8)	
Gender			
Male	11 (16.2)	57 (83.8)	0.421
Female	10 (19.2)	42 (80.8)	
Diabetes mellitus			
Yes	12 (15.4)	66 (84.6)	0.451
No	9 (21.4)	33 (78.6)	
Hypertension			
Yes	16 (18.8)	69 (81.2)	0.379
No	5 (14.3)	30 (85.7)	
Duration of hemodialysis			
<1 month	12 (14.8)	69 (85.2)	0.567
1 to 6 months	7 (23.3)	23 (76.7)	
>6 months	2 (22.2)	7 (77.8)	
Duration since catheter insertion			
6 to 11 days	17 (17)	83 (83)	0.481
12 to 16 days	4 (20)	16 (80)	
Site of catheter infection			
Femoral	18 (18.4)	80 (81.6)	0.431
Transjuglar	3 (13.6)	19 (86.4)	
Reasons of hemodialysis			
ESRD	5 (16.7)	25 (83.3)	0.567
AKI	16 (17.8)	74 (82.2)	

Table 3: Effect modification of catheter related blood stream infection

DISCUSSION

The requirement of high flow intravascular devices to do dialysis in ESRD patients implies an increased risk of developing bloodstream infections, which negatively affects the clinical profile of the patients. Catheter related bloodstream infections in hemodialysis increased the risk of complications like endocarditis, septic thrombosis, and need of ICU admission and mortality. Therefore, its prevention and monitoring is very essential [14, 15]. According to CDC, the rate of catheter related bloodstream infections are steady in chronic hemodialysis patients, accounting for 37 per 1000 cases in 2008. As of 2011, rate of infection stays increased and 300 hospital admission were due to sepsis or bacteremia per 1,000 patient-years [16]. Hence, in the current study, we have assessed the frequency of catheter related bloodstream infections in hemodialysis patients. We found catheter related blood stream infection in 17.5% hemodialysis patients. In a similar study conducted by Menegueti *et al.*, the catheter related bloodstream was reported in 69% of the patients and 31% had localized infections [13]. In another recent study conducted in Malaysia by Shahar *et al.*, observed catheter related blood stream infections in 4.2% of hemodialysis patients and 4.8% of the patients had catheter colonization [12]. Thompson *et al.*, conducted a cohort study in Canada among adult hemodialysis patients and found that the overall incidence rate of catheter related blood stream infections was 0.19/1000 catheter days [17]. In another retrospective cohort study conducted in India, the overall incidence rate of catheter related blood stream infections was 0.36 per 1000 catheter days [18]. Zhang *et al.*, in their retrospective cohort study observed rate of catheter related blood stream infections as 0.84 / 1000 catheter days. They also observed that catheter related blood stream infections were highly associated with complications, prolonged hospital stay, and mortality [19]. In a recent Pakistani study by Shehzadi *et al.*, the frequency of bloodstream infection was 52.9%, exit site infection was 16.3% and tunnel infection was 7.7% among hemodialysis patients [20]. In the present study, we have also assessed the organisms responsible for catheter related bloodstream infections found on tip of catheter. We found most frequent was coagulase negative *Staph*. (5.9%), followed by VRE (4.2%), and *Enterococcus* (3.4%). We found no gram-negative infections; hence, gentamicin locks were effective against it. While, there is difference observed in distribution of pathogens in catheter related infections by different studies [21, 22]. In a recent Pakistani study by Shoaib *et al.*, the catheter contamination was observed in 51% of hemodialysis patients and most of gram-negative rods, among them 14.3% of the bloodstream infection was related to tunneled double lumen catheter. Additionally, they found *Pseudomonas aeruginosa* in 10.4% of the cases [23]. In another Pakistani

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study by Mehmood *et al.*, gram positive organism was present in 69% and gram negative was present in 31% of the cases [24]. Shehzadi *et al.*, reported that *Staphylococcus aureus*, *E. coli* and *Klebsiella pneumoniae* were the frequent pathogens observed in blood culture whereas, *Staphylococcus aureus*, *Pseuodmonas aeuroginosa* and *E. coli* were the common pathogens found in culture of catheter tip [20]. The high proportion of catheter-associated infection in dialysis patients necessarily needs frequent antibiotics administration. Moreover, vancomycin usage is common because of the *Staphylococcus* infections showed resistance to methicillin. Unfortunately, this resulted into the emergence of vancomycin-resistant *S. aureus* in the dialysis patients [25, 26]. There is an urgent need for an efficient non-antibiotic chemoprophylaxis of catheter-related bacteremia given that there will always be a subset of hemodialysis patients with catheters.

CONCLUSIONS

Catheter-related infections in patients of hemodialysis despite using antibiotic locks is frequent but it has been observed that gram negative infections have responded well to gentamicin lock solution, where as in our study most common organism responsible for infection is coagulase negative Staph. followed by VRE.

Conflicts of Interest

The authors declare no conflict of interest

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