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ORIGINAL ARTICLE

Role of antibiotic lock in the prevention of catheter induced infection in patients undergoing hemodialysis.

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ABSTRACT… Objective: To determine the role of antibiotic lock in the prevention of catheter related infection in patients undergoing hemodialysis at a tertiary care hospital. **Study Design:** Descriptive Case Series. **Setting:** Department of Nephrology, Nishtar Hospital in Multan. **Period:** 1st March 2021 to 31st May 2021. **Methods:** Following approval from the ethics review committee, 136 patients who presented to the Department of Nephrology at Nishtar Hospital in Multan and met the inclusion criteria were selected after informed consent. After each session of dialysis, catheter lock solution (CLS) containing 1.35% taurolidine and 4% sodium citrate was fed into both catheter lumens. This solution was then withdrawn prior to the beginning of the second session, and these patients were observed for a period of ninety days. **Results:** Of 136 patients, 66.9 % (n=91) were male, their mean age was 53.04 ± 9.60 years. Of these 136 patients, 38.2 % (n = 52) were from poor social background. Diabetes was noted in 25.7 % (n = 35) and hypertension in 47.8 % (n = 65). Obesity was noted in 14.0 % (n = 19). Infection free survival of the catheter was noted in 89.7 % (n = 122) of our participants. Infection prevention was significantly higher in ≤ 50-years old (p-value 0.023), from urban population (p-value 0.001), poor socioeconomic status (0.002) and non-diabetic patients (0.048). **Conclusion:** Non-Diabetics, age ≤50-years, urban residence, and poor socioeconomic standing were significantly related with prevention of catheter infection using antibiotic lock. It is recommended to use taurolidine based lock solutions in dialysis facilities.

Key words: Antibiotic Lock, Catheter Induced Infection, Hemodialysis.

INTRODUCTION

Patients undergoing hemodialysis, in particular, have a greater need for dependable vascular access in order to get the most out of their routine dialysis treatments.[1,2] According to statistics collected in the United States, around twenty percent of patients undergoing hemodialysis make use of tunneled central venous catheters during procedures such as catheterization or grafting.[3] Infections caused by bacteria and thrombosis are two of the most prevalent complications that are associated with dialysis catheters. After just one day, it was shown that the majority of central venous catheters develop bacterial biofilms on the inner surfaces of the catheters themselves.

Because of this biofilm, infections that manifest themselves as a result of catheterization are often resistant to the conventional treatment techniques that include the administration of systemic antibiotics.[4] In order to give successful therapy for a catheter-induced infection, it is possible that the patient may need to have their catheter replaced in addition to their regular course of antibiotic medication. The administration of concentrated antibiotics after dialysis as a means of preventing the formation of bacterial biofilm and avoiding the removal of the catheter is one alternate approach; nevertheless, this method has been associated with the development of Candida infections in certain patients.[5] A recurring episode of bacteremia is often anticipated in these patients regardless of the treatment method that is used to address catheter-induced bacteremia, while catheter-induced thrombosis may be treated by infusing a variety of thrombolytic medicines into the catheter lumen. It is preferable to avoid complications with catheters altogether than

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address them after they have occurred since this may save patients and their families a large burden of morbidity as well as extra costs associated with medical treatment.[6] It is common practice to use anticoagulation medications like heparin and citrate to prevent catheter-related thrombosis; however, no pharmacological therapies have been identified as a preventive alternative against catheter-induced bacteremia.[7,8] It has been demonstrated that injecting a pure solution of the medication gentamicin into the catheter lumen after each dialysis session significantly reduces the risk of catheter-related bacteremia (more than 90 percent of instances) in comparison to injecting citrate alone.[9,10]

Taurolidine, which is a derivative of taurine, has been found to be an effective antibacterial agent that inhibits the growth of a wide variety of microorganisms. Taurolidine has been shown to be effective against a number of other types of gram-positive and gram-negative bacteria, in addition to Candida albicans, in the context of laboratory research. Taurolidine, when injected into the lumen of a catheter, has shown in preliminary research to have the potential to lower the risk of infections caused by catheters.[11,12,13] Those who did not have antibiotic lock had a 94 percent infection-free survival rate, whereas patients who did have antibiotic lock had only a 47 percent infection-free survival rate. These findings were reported by patients who received the (Allon et al.)[12] study.

These data will enable us to establish evidence of the effectiveness of antibiotic lock in lowering the burden of these illnesses and combatting antibiotic resistance in these patients. Antibiotic lock is useful in decreasing the burden of these infections and battling antibiotic resistance in these patients.

As a strong antibacterial agent with broad-spectrum antimicrobial effects, taurolidine, a taurine derivative, has been reported. Several gram-positive and gram-negative bacterial species, as well as Candida albicans, have been demonstrated to be eliminated by Taurolidine in laboratory studies. Initial studies have demonstrated that Taurolidine may reduce catheter-related infections when it is injected into the catheter lumen.[11,12,13] Compared to patients without antibiotic lock, those with (Allon et al.)[12] reported 94% infection-free survival compared to just 47% in those with antibiotic lock.

Antibiotic lock is beneficial in reducing the burden of these infections and battling antibiotic resistance in these patients, and these data will allow us to build proof of this efficacy.

METHODS

Non-probability purposive sampling was used for this descriptive case series from 1st March 2021 to 31st May 2021 at the Department of Nephrology, Nishtar Hospital Multan. Our research comprised a total of 136 hemodialysis patients. The WHO calculator found that the sample size was 136, with a 95 percent confidence level, a margin of error of 4%, and a percentage of catheter-induced infection avoidance with antibiotic lock.[12] In our research, we included all hemodialysis patients ages 15 to 70, male and female. Uncontrolled diabetes, uncontrolled hypertension (BP > 160 mmHg systolic and >90 mm Hg diastolic, Patients with solitary kidney (assessed on USG) were excluded for participation in the study.

After receiving clearance from the ethics review committee (23483/NMU&H) of Nishtar Medical University, Multan, 136 patients who met the inclusion criteria were chosen. After discussing the biopsy procedure's risks and advantages with each patient, they signed an informed permission form. After each dialysis session, a CLS containing 1.35 percent taurolidine and 4 percent sodium citrate was infused into both catheter lumens and then withdrawn just before to the commencement of the following session. The patients were subsequently monitored for 90 days while on CLS. A 2 mg dose of tPA was injected into the lumen of catheters with flow issues that potentially affect dialysis effectiveness. Catheter-related bacteremia was the study's main endpoint. This study was conducted using SPSS version 23.0 for statistical analysis. The mean and standard deviation were computed for factors such as age, BMI, and length of illness. Diabetes,

hypertension, obesity, and the prevention of infection (yes/no) were all reported in frequency and percentage form for each gender and age group, as well as for each of the aforementioned conditions. Patients were stratified according to a variety of factors, including age, gender, illness duration, diabetes, hypertension, and obesity, in order to determine the impact each factor had on the likelihood of hematoma development in the final result. Results were analysed using post-stratification Chi squares, and p values 0.05 were deemed statistically significant.

RESULTS

We included 136 patients on hemodialysis, of which 66.9 % (n=91) were male and 33.1 % (n=45) were female patients with their mean age was 53.04 ± 9.60 years (range; 35 – 67 years) and 56.6 % (n=77) were aged more than 50 years. Of these 136 study cases, 36 % (n=49) were rural while 64 % (n = 87) were from urban localities, 38.2 % (n = 52) were from poor social background and 61.8 % (n=84) from middle income families. Diabetes was noted in 25.7 % (n = 35) and hypertension in 47.8 % (n = 65). Mean body mass index was 25.43 ± 2.11 kg/m^2 and obesity was noted in 14.0 % (n = 19). Infection free survival or prevention of infection was noted in 89.7 % (n = 122) of our study cases [Table-I].

Age (years), mean ± SD	53.04 ± 9.60
Gender n (%) Male Female	 91 (66.9) 45 (33.1)
Area of residence n (%) Rural Urban	 49 (36%) 87 (64%)
Socioeconomic status n (%) Poor income Middle Income	 52 (38.2) 84 (61.8)
Body Mass Index (kg/m^2) mean ± SD	25.43 ± 2.11
Obesity (yes) n (%)	19 (14)
Hypertension (yes) n (%)	65 (47.8)
Diabetes Mellitus (yes) n (%)	35 (25.7)
Infection free survival (yes) n (%)	122 (89.7)

Table-I. Characteristics of end stage renal disease patients on hemodialysis through central venous catheter (N=136)

Infection free survival of the catheter was significantly higher in patients ≤ 50-years compared to > 50-years (96.6% vs. 84.4%, p-value 0.023). Similarly, infection free survival of the catheter was significantly higher in patients from urban areas compared to rural areas (97.7% vs. 75.5%, p-value 0.001), in patients from poor socioeconomic standing compared to middle (100% vs. 83.3%) and in non-diabetics compared to diabetics (93.1% vs. 80%, p-value 0.048) [Table-II].

Study Variables	Prevention of infection		P-Value*
	Yes	No	
Gender			
Male (n= 91)	84 (92.3)	07 (7.7)	0.229
Female (n=45)	38 (84.4)	07 (15.6)	
Age groups			
Up to 50 Years (n= 59)	57 (96.6)	02 (3.4)	0.023
More than 50 Years (n=77)	65 (84.4)	12 (15.6)	
Residential status			
Rural (n= 49) 37 (75.5)		12 (24.5)	0.001
Urban (n=87)	85 (97.7)	02 (2.3)	
Socioeconomic status			
Poor (n=52)	52 (100)	00 (00)	0.002
Middle Income (n=84)	70 (83.3)	14 (16.7)	
Diabetes			
Yes (n=35)	28 (80)	07 (20)	0.048
No (n=101)	94 (93.1)	07 (6.9)	
Hypertension			
Yes (n=65)	58 (89.2)	07 (10.8)	0.999
No (n=71)	64 (90.1)	07 (9.9)	
Obesity			
Yes (n=19)	19 (100)	00 (00)	0.217
No (n=117)	103 (88)	14 (12)	

Table-II. Stratification of prevention of catheter infection with regards to study variables (N=136). *chi-square test

DISCUSSION

Catheter induced infection is frequently observed in dialysis units all over the world[13] and it is associated with significant loss of productivity, morbidities, poor quality of life and increased

healthcare budget.[14,15] Different novel techniques have been documented to encounter this infection with different results while recently catheter lock solution comprising of Taurolidine (non – antibiotic agent having antimicrobial properties such as reduction of biofilm formation and limited risk for bacterial resistance) and citrate (such as sodium citrate to act like anticoagulant).[12]

We included 136 patients on hemodialysis, of which 66.9 % (n=91) were male and 33.1 % (n=45) were female patients. Similar results have been reported by Anees et al[16] such as 58 % male patients with end stage renal disease. Azeem et al[17] has reported 53 % female patients undergoing hemodialysis, different from our findings. Malik et al[18] has also reported 68 % male gender preponderance, similar to our results.

Mean age was 53.04 ± 9.60 years (range; 35 – 67 years) and 56.6 % (n=77) were aged more than 50 years. Anees et al[16] from Lahore also reported 49.76 ±12.61 years mean age, close to our findings. Azeem et al[17] has reported 50.15 ± 12.92 years mean age of hemodialysis patients, close to our results. Malik et al[18] has also reported 42.16 ± 14.92 years mean age of hemodialysis patients.

Out of these 136 study cases, 36 % (n=49) were rural while 64 % (n = 87) were from urban localities, 38.2 % (n = 52) were from poor social background and 61.8 % (n=84) from middle income families. Anees et al[16] from Lahore also reported similar results.

Diabetes was noted in 25.7 % (n = 35) and hypertension in 47.8 % (n = 65). Anees et al[16] from Lahore also reported 45.8 % diabetes and 38.1 % hypertension, similar to that of our study results. Azeem et al[17] has also reported 51 % diabetes and 98 % hypertension, similar to our results. Malik et al[18] has also reported 21.4 % diabetes and 76 % hypertension, similar to our study results.

Mean body mass index was 25.43 ± 2.11 kg/m^2 and obesity was noted in 14.0 % (n = 19). Azeem et al[17] has reported similar results. Rehman et al[19] has reported 23.47 ± 3.26 kg/m^2 mean BMI of hemodialysis patients.

Infection free survival or prevention of infection was noted in 89.7 % (n = 122) of our study cases. Prevention of infection was significantly associated with younger age groups (less than 50 years), urban living status, poor socioeconomic status and non – diabetic patients. Allon et al[12] has reported 94 % infection free survival compared with 47 % in patients with antibiotic lock versus without antibiotic lock. These findings are similar to our results. Winnickie et al[20] from Austria has also found Turolidine based catheter lock solution was effective in controlling infection and other complications.

CONCLUSION

According to the findings of our study, using a catheter lock solution containing taurolidine was useful in avoiding infection in hemodialysis patients, which provides support for its utilization. Diabetes, age, place of residence, and socioeconomic standing were all factors that had a significant bearing on infection prevention. To appropriately manage these patients and address the rising problem of antibiotic resistance in our society as a result of the extensive use of antibiotic drugs, dialysis facilities may use lock solutions based on taurolidine.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Nargis Abid:** Conception and design of study, data collection, analysis, manuscript draft, final approval.
2	**Ghulam Abbas:** Literature review, manuscript draft, final approval.