

Original Article

Comparison of Underlying Factors of Indwelling Venous Catheter Infection in Hemodialysis Patients Hospitalized in Medical Education Centers of Isfahan

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HIGHLIGHTS

- Those who are dialyzed with Permocate, have the risk of infection especially in people over 60 years old.
- The risk of infection in dialyzed patients is higher, especially in people with diabetes and also in the femoral site.
- It is suggested that in these people other places such as the left internal jugular should be used for embedding Permanent catheters.

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ABSTRACT

Introduction

Catheter infection is the second cause of death in hemodialysis patients. The purpose of this study is to promote health and take appropriate measures to prevent the occurrence of permcath infection.

Methods

The current study is a Retrospective analysis of cross-sectional data. The inclusion criteria for the study included the following: age over 18 years, ESRD diagnosis by a nephrologist, having a Permanent catheter, and patients who had permanent venous catheters and had been referred to Alzahra Hospital in Isfahan for hemodialysis were included. The patients were examined for 6 months and the information related to the patients included the occurrence of infection, factors related to infection, the relationship between the infection and the location of the Permanent catheter, the history of changing the Permanent catheter, and underlying diseases were collected.

Results

Among the 195 End-Stage renal disease (ESRD) patients participating in the present study, 4.6% (9 people) had Permocate infection. The rate of infection was significantly higher in people over 60 years of age (P-value=0.05), people with underlying diabetes (P-value<0.05), people with a history of previous Permocate infection, and a history of changing Permocate (P-value<0.05). In terms of the location of the femoral catheters, the infection is significantly higher (P-value<0.05). However, there was no relationship between the type of permcath and the incidence of permcath infection (P-value>0.05).

Conclusions

During 6 months, about 4.6% of patients undergoing Permocate implantation have an infection, and this risk is higher in people over 60 years old and with diabetes, as well as in the femoral area.

Keywords: Infection; Permanent Catheter; End-Stage Renal Disease; Hemodialysis

Introduction

Hemodialysis is the most important and also the most common treatment method for patients with End-Stage renal disease (ESRD), which is performed by different methods (1, 2). Vascular access is one of the necessities

of hemodialysis (3, 4). Currently, there are three types of vascular access for these patients: arteriovenous fistula (AVF); Arteriovenous graft (AVG), and central venous catheters (5-7). Although various studies state that the mortality rate and complications of vascular access such

as arteriovenous fistula are lower than those of central venous catheters, in cases such as not taking timely action to install suitable vascular access, the need for emergency dialysis, people who can They do not have other vascular access methods, and children are often forced to use central venous catheters (8-10). Central venous catheters are associated with many complications, including infection, improper placement, catheter breakage, thrombosis, and embolism. It has been stated that the long-term use of cuffed central vein catheters for hemodialysis increases the probability of the patient's death by 2 to 3 times, and this category of patients is 5 to 10 times more exposed to infection than those who use fistulas(11, 12). In a study, the risk of bacteremia related to hemodialysis catheters was estimated at 48% in 6 months (13). Also, during a retrospective study conducted in the United States investigating the complications of dialysis catheters in 5984 people from 2000 to 2007, they concluded that catheter infection with a rate of 5.1% in the three months after catheter insertion is the most common. It is a complication of dialysis catheters (10, 13, 14), and catheter infection can be systemic infection, catheter tunnel infection, or catheter exit site infection (15).

It seems that the first cause of catheter exertion is infection and bacteremia (sepsis) caused by it, and catheter infection is the second cause of death in hemodialysis patients. Catheter infection is one of the main causes of sepsis and prolonged hospitalization in these patients (16). Bloodstream infection related to the catheter has increased the length of hospitalization from 2.4 days to 7.5 days, and the mortality rate is increasing. Based on previous studies, several factors are mentioned as risk factors for catheter infection, which can be mentioned as diabetes mellitus, hypertension, location of the catheter, duration of catheter use, and cardiovascular diseases (17, 18).

Considering the increase of hemodialysis patients in developing societies, as well as the high prevalence of Permanent catheters infection in these patients and the high costs of curability of these patients, which are imposed on the health system of the country, and also considering the lack of effective information about the factors predicting Permanent catheters infection and the need to identify and prevent these factors, in this study, we will identify the predictors of Permanent catheters infection so that appropriate measures can be taken to prevent the occurrence of Permanent catheters infection.

Methods

The current study is a Retrospective analysis of cross-sectional data that was conducted in 2015-2018 on hemodialysis patients with Permanent catheters. This study design was approved by Ethical Committee of Isfahan University of Medical Sciences (IR.MUI.MED.REC.1399.444). The inclusion criteria for the study

included the following: 1. Age over 18 years, 2. ESRD diagnosis by a nephrologist, 3. Having a Permanent catheter, 4. Patients who had permanent venous catheters and had been referred to Alzahra Hospital in Isfahan for hemodialysis were included. The exclusion criterion was age under 18 years.

After entering the patients according to the entry and exit criteria, the patient information form was completed by the researcher with the information from his file (with the help of the patient himself). The patient information form includes checking the presence of diabetes and hypertension diseases, cardiovascular disease, immunodeficiency disease (use of immunosuppressive drugs and the presence of viral infections that cause immunodeficiency), the type of permanent catheter used by the patient (with or without cuff), location of Permanent catheters (internal jugular, subclavian and femoral), history of Permanent catheters replacement and history of permanent catheter infection. The catheters were placed under the same conditions and by the same surgeon.

The patients were examined for 6 months and the information related to the patients included the occurrence of infection (patients who were treated with various symptoms of hospitalization and diagnosis of dialysis catheter infection - systemic or local infection or exit site infection), factors related to infection, the relationship between the infection and the location of the Permanent catheter, the history of changing the Permanent catheter, and underlying diseases were collected and subjected to statistical analysis.

Data analysis was done with SPSS software version 25. Frequency and percentage were used to describe qualitative data, and mean and standard deviation was used to describe quantitative data. Chi-square statistical tests were used to analyze the data, and logistic regression tests were used to check the relationship between the phenomena.

Results

In general, the number of 220 patients with chronic renal failure (ESRD) using Permocate were evaluated, and in

Table 1. Demographic characteristics of the studied patients

Variable	Patients
Age, Mean(SD)	52.67 (12.82)
Gender, (Number, percent)	
Female	102 (53%)
Male	93 (47%)
Permanent catheters infection, (Number, percent)	
Yes	9 (4.6%)
No	186 (95.34%)

Table 2. Determining the frequency distribution of demographic variables in ESRD patients

The underlying disease		Permanent catheters infection		P-value
		No	Yes	
Age Group	< 60	3 (33%)	107 (58%)	0.005
	> 60	6 (67 %)	79 (42 %)	
Gender	Female	5 (56 %)	97 (52 %)	0.65
	Male	4 (44 %)	89 (48 %)	

total, with the availability of complete information, 195 patients were evaluated in the present study. According to Table 1, the average age of ESRD patients was 52.67 ± 12.82 years. 53% of the participants are women and 47% of the participants are men.

Based on the results obtained in Table 2, the rate of infection in people over 60 years old was significantly higher than in other age groups (P -value <0.05). However, no significant difference was observed between the prevalence of infection and the gender of ESRD patients (P -value >0.05). Permanent catheters

The results are reported as numbers and percentages. The chi-square test was used to compare the data. P -values <0.05 indicate the significance of the test.

Table 3 examines the distribution of frequencies and the relationship between underlying diseases, including hypertension, diabetes, cardiovascular, and immunodeficiency in ESRD patients based on the incidence of Permanent catheter infection. As the results of Table 3 show, people with a history of previous infection and people with the underlying disease of diabetes are significantly more likely to have Permanent catheters infection (P -value <0.05). However, there was no significant difference between the incidence of Permanent catheter infection with underlying diseases such as hypertension, immunodeficiency, and cardiovascular diseases (P -value >0.05).

The results are reported as numbers and percentages. The chi-square test was used to compare the data. P -values <0.05 indicate the significance of the test.

Table 4 examines determining the relationship between the use of the type, location, and history of Permanent catheter replacement and the incidence of Permanent catheter infection. Based on the findings in Table 4, the incidence of Permanent catheter infection in femoral sites is significantly higher (P -value <0.05). Also, patients with a history of Permanent catheter replacement have significantly more Permanent catheters infection. (P -value <0.05). However, there was no significant relationship between the type of Permanent catheters

Table 3. Investigation of the determination and comparison of the frequency of underlying diseases in terms of Permanent catheters infection

The underlying disease		Permanent catheters infection		P-value
		No	Yes	
Hypertension	Yes	4 (44 %)	56 (30 %)	0.32
	No	5 (56 %)	130 (70 %)	
Diabetes	Yes	6 (67 %)	76 (40 %)	0.01
	No	3 (33 %)	110 (60 %)	
Cardiovascular Diseases	Yes	2 (23%)	65 (34%)	0.18
	No	7 (77%)	121 (66%)	
Immunodeficiency	Yes	1 (11%)	6 (3.2%)	0.50
	No	8 (89 %)	180 (96.8 %)	
Previous Permanent catheters infection	Yes	6 (66 %)	35 (18 %)	0.001
	No	3 (34 %)	151 (82 %)	

and the type of surgeon with the incidence of Permanent catheter infection (P -value >0.05).

The results are reported as numbers and percentages. Chi-square test was used to compare the data. P -values <0.05 indicate the significance of the test.

Discussion

Studies have been done on the use of Permanent catheters and related infections. These studies have emphasized the importance of this issue and have published reports in this area. In a study conducted by Ng and colleagues in China in 2014, 868 patients undergoing hemodialysis with Permanent catheters were followed for 3 years. In this study, it was reported that during 3 years, about 16.2% of the patients had percutaneous infections, which is a relatively high statistic compared to the recent study and other studies. It was also reported that the risk of infection was significantly higher in people who were older than 65 years old (19), which is consistent with the results of a recent study. In 2011, a study by Gabaldon and others was conducted in the United States, in which it was reported that the risk of Permanent catheters infection in the first year is about 5-6%, although factors such as old age, underlying diseases, and history of infection can increase the risk of infection (20). These results are also in line with the results of the recent study.

Also, in another study conducted by Lok in 2011 in Canada, it was stated that Permanent catheter infection is one of the most important causes of death in people with ESRD. They also showed that the incidence of infection in pregnant women may vary from 0.6 to 6.5% of people in the first two years, and this risk is higher in people with

Table 4. Determining the relationship between the use of the type, location, and history of Permanent catheter replacement and the incidence of Permanent catheter infection.

Variable	Permanent catheters		P-value	
	infection			
	No	Yes		
Permanent catheter type	cuffed	9	186	
	without cuffs	-	-	
Permanent catheter site	Internal	2 (22.2 %)	86 (46 %)	0.001
	jugular			
	Subclavian	3 (33.3 %)	76 (41 %)	
	Femoral	4 (44.5%)	24 (13%)	
History of replacing carpeting	Yes	5 (53 %)	56 (30 %)	0.002
	No	4 (47 %)	130 (70 %)	
Type of surgeon	A	4 (45 %)	78 (42 %)	0.15
	B	5 (55 %)	108 (58 %)	

a previous history of infection (21). The results of our study are also in line with the results of previous reports. In a recent study, 4.6% of the examined people had a Permanent catheter infection in the first year, and these infections mostly occurred in people over 65 years of age with a previous history of infection.

According to our results, people with diabetes had more infections than others. In 2017, a study by Sahli et al., examined risk factors for catheter infection in dialysis patients. In this study, it was reported that there is a 16.6% risk of infection in pregnant women in the first 3 years, and diabetes is considered one of the most important factors that increase the risk (22). Also, in 2014, Murea and others mentioned diabetes and age over 60 years as the main underlying factor of Permanent catheter infection (23). Our results are also in line with previous studies. Patients with diabetes and aged over 60 years can be considered the main groups susceptible to Permanent catheter infection, and for this reason, special attention is needed for these patients.

Among our other findings was a previous history of Permanent catheter infection and patients with a history of Permanent catheter replacement as well as femoral Permanent catheters have a higher risk of infection. The study by Chua and his colleagues in 2014 also showed that femoral catheters may get infected more than other places due to hygiene reasons, and it was suggested that other places like the left internal jugular should be used (24). Also, in 2012, a comprehensive study was conducted, which stated that femoral catheters should not be used in people who have risk factors such as a previous history of Permanent catheter infection, and other places were used

for Permanent catheter insertion (15).

The results of our study are also in line with these results. Also, the remarkable thing that was shown in the recent study was that 4.6% of the patients had an infection in the 6-month follow-up, which was in line with the previous results. One of the limitations of this project was the lack of investigation of other effective factors in Permanent catheter infection, such as a history of bacteremia or urinary infections, which were mentioned in previous studies. Also, the duration of this study was limited and it is suggested to conduct a long-term study in this field.

Conclusions

In general, we showed that during 6 months, about 4.6% of patients who are dialyzed with Permocate, have an infection, and this risk is higher in people over 60 years old and with diabetes and also in the femoral site. Therefore, it is suggested that in these people, other options should be considered or other places such as the left internal jugular should be used for embedding Permanent catheters. Our results were in line with previous studies that emphasize the importance of the issue of infection in Permanent catheters.

Authors' contributions

All authors contributed equally.

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Conflict of interest

All authors declare that there is no potential competing or conflict of interest.

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Ethics statement

This study design was approved by the Ethical Committee of Isfahan University of Medical Sciences (IR.MUI.MED.REC.1399.444).

Data availability

Data will be provided on request.

Abbreviations

AVF Arteriovenous fistula
AVG Arteriovenous graft
ESRD End-Stage Renal Disease

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