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Prevalence and Risk Factors of Suspected Case Primary Bloodstream Infection in Chronic Renal Failure Patients with Catheter Double Lumen at Dr. Mohammad Hoesin General Hospital Palembang

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A B S T R A C T

Background: Primary bloodstream infection (BSI) is an infection that occurs without any other organ or tissue suspected as a source of infection. BSI is often found in patients who have a catheter double lumen (CDL) attached device. The use of CDL causes a lot of risk of infection in patients with renal failure. Factors that influence the occurrence of BSI can be endogenous and exogenous factors. This study aimed to determine the prevalence rate and the factors that influence BSI in chronic renal failure patients with double-lumen catheters undergoing hemodialysis at the Dr. Mohammad Hoesin General Hospital, Palembang. **Methods:** This study was an analytical observational study with a cross-sectional design undertaken in the hemodialysis unit, medical record installation, and clinical laboratory of Dr. Mohammad Hoesin General Hospital Palembang from February to December 2021. There were 93 patients who met the inclusion criteria. The relationship between risk factors and the incidence of BSI was analyzed using the Chi-Square and Fisher Exact tests. All data were analyzed by SPPS version 22.0. **Results:** In this study, 44 people (47.3%) had primary bloodstream infection (BSI). In addition, there was a significant relationship between gender (PR = 2.508 (CI5% 1.087 – 5.784); p = 0.049); BMI (PR = 6.150 (CI5% 2.349 – 16.099); p = 0.000); and catheter type (p = 0.000) with the incidence of BSI. However, there was a non-significant relationship between age, catheter location, and duration of catheter insertion with the incidence of BSI (p > 0.05). **Conclusion:** Body mass index and gender are risk factors for primary bloodstream infection.

1. Introduction

Primary bloodstream infection (BSI) is an infection that occurs without any other suspected organ or tissue as a source of infection other than the blood. BSI is often found in patients with chronic renal failure who have a cathether double lumen (CDL) device that is required for drug administration and nutritional support that cannot be safely administered through a peripheral venous catheter. However, the use of CDL increases the risk of infection in patients.[1,2]

The prevalence of BSI in Denmark was found to be 13.7% per 100 hemodialysis patients per year.[3] The results of the study at Dr. Mohammad Hoesin General Hospital Palembang, in 17 respondents showed that 41.2% of patients using CDL in hemodialysis installations had BSI with the bacteria causing *Staphylococcus epidermis* and *Staphylococcus saphrophyticus* from the results of blood culture and mostly in double lumen CDL rather than triple or quadruple line.[4]

Factors that influence the occurrence of BSI can be endogenous and exogenous factors. Endogenous factors include age (55% occur at age > 60 years, gender (58% in men), comorbidities (38%), body resistance, and client's condition. Exogenous factors can be in the form of a length of stay, cleanliness of equipment, medical conditions, hospital environment, health worker or nurse factors, and other patient factors being treated together.[5] This study aims to determine the prevalence rate and the factors that influence primary bloodstream infection in patients with chronic renal failure with catheter double lumen undergoing hemodialysis at the Dr. Mohammad Hoesin General Hospital, Palembang.

2. Methods

This study was an analytic observational study with a cross-sectional design in chronic renal failure patients undergoing hemodialysis at Dr. Mohammad Hoesin General Hospital Palembang. The independent variables in this study were age, gender, BMI, location of catheter insertion, type of catheter, and duration of catheter insertion, while the dependent variable was primary bloodstream infection (BSI). BSI is established by the presence of hyperemia at the insertion site of the hemodialysis double lumen catheter accompanied by fluid exudate or signs of SIRS in the absence of other sources of infection.

This research was undertaken in the hemodialysis unit, medical record installation, as well as the clinical laboratory of Dr. Mohammad Hoesin General Hospital Palembang from February to December 2021. There were 93 research subjects who met the inclusion criteria. All participants have agreed to the informed consent, which is explained before data collection or research begins. This study has been accepted from the ethical review: No.04/kepkrsmh/2021.

Characteristics and data distribution of each variable which is then presented in tabular or graphic form. Numerical data is tested for normality, if the distribution is normal, then the data used is the mean, and if the data distribution is not normal, then the data used is the median. Categorical data are presented in percentage form, and Chi-Square/Fisher Exact statistical tests are performed to determine the relationship between risk factors and the incidence of BSI. Logistics Regression Test is used to determine the most important risk factors. All data were analyzed with SPPS version 22.0.

3. Results

General characteristics of patients

In this study, there were differences in gender (p = 0.049), body mass index (p = 0.000), and comorbidities (p = 0.000) among chronic renal failure patients with and without BSI. However, there was no difference in age (p = 0.960) and age category (p = 1,000) between chronic renal failure patients with and without BSI (Table 1).

Surgical characteristics of patients

In this study, there was a difference in catheter type (p = 0.000) between chronic renal failure patients with and without BSI. However, there was no difference in catheter location (p = 0.102) and length of insertion (p = 0.122) between chronic renal failure patients with and without BSI (Table 2).

Relationship of general characteristics with primary bloodstream infection

In this study, there was a significant relationship between gender and the incidence of primary bloodstream infection (BSI). Female patients were 2.508 times more likely to have primary bloodstream infection (BSI) than male patients (PR = 2.508 (CI5% 1.087 – 5.784; p = 0.049).

In this study, the results showed that there was a non-significant relationship between age and the incidence of primary bloodstream infection (BSI), patients aged 18 years had the same risk of primary bloodstream infection (BSI) as patients aged <18 years. (PR = 1.056 (CI5% 0.326 – 3,419); p = 1,000).

In this study, the results showed that there was a significant relationship between BMI and the incidence of primary bloodstream infection (BSI), patients with a lower BMI were significantly 6,150 times more at risk

of experiencing primary bloodstream infection (BSI) than patients with moderate BMI (PR = 6,150). (IK5% 2.349 – 16.099); p = 0.000).

Table 1. General characteristics of patients.

Characteristic	Bloodstream infection		
	Yes (n = 44)	No (n = 49)	p-value
Gender			
Female	27 (61.4)	19 (38.8)	0.049*
Male	17 (38.6)	30 (61.2)	
Age			
Mean ± SD	45.32 ± 19.76	44.98 ± 19.21	0.960†
Median	50.5	51	
Min-Max	5-86	9-76	
Age Category			
≥ 18 years old	38 (86.4)	42 (85.7)	1.000†
< 18 years old	6 (13.6)	7 (14.3)	
Body Mass Index			
Underweight	24 (54.5)	8 (16.3)	0.000*
Normoweight	20 (45.5)	41 (83.7)	
Comorbid			
Hypertension (HT)	13 (29.5)	36 (73.5)	0.000‡
Diabetes mellitus (DM)	16 (36.4)	2 (4.1)	
Non HT/DM	15 (34.1)	11 (22.4)	

*Chi Square test, p =0.05; †Mann Whitney test, p = 0.05; ‡Pearson Chi Square, p = 0.05.

Association of surgical characteristics with primary bloodstream infection

In this study, there was a non-significant relationship between the location of the catheter and the incidence of primary bloodstream infection (BSI). (p = 0.102). In this study, the results showed that there was a significant relationship between the type of catheter and the incidence of primary bloodstream infection (BSI) (p = 0.000). In this study, the results showed that there was a non-significant relationship between the length of catheter insertion and the incidence of primary bloodstream infection (BSI) > 6 months but not significant (PR = 2.173 (CI5% 0.910 – 5.187); p = 0.122).

Table 2. Surgical characteristics of patients.

Characteristic of catheter	**BSI**		
	Yes (n = 44)	**No (n = 49)**	**P-value**
Location			
Femoralis	3 (6.8)	0 (0)	0.102*
Jugularis	41 (93.2)	49 (100)	
Type			
Shortterm	12 (27.3)	0 (0)	0.000*
Longterm	32 (72.7)	49 (100)	
Duration			
< 6 months	32 (72.7)	27 (55.1)	0.122†
≥ 6 months	12 (27.3)	22 (44.9)	

*Fisher Exact test, p = 0.05; †Chi-square test, p=0.05.

Risk factors of primary blood flow infection (BSI)

From the Logistics Regression test in table 3, it can be concluded that the factors that influence primary bloodstream infection (BSI) are body mass index and gender. Low body mass index was significantly 6,076 times more at risk for primary bloodstream infection (BSI) in patients with moderate BMI (PR = 6.076 (95% CI 1.992-18.5297); p-value = 0.002) and patients with female gender were significantly less significantly 3,450 times more risk of experiencing primary bloodstream infection (BSI) men (PR = 3,450 (95% CI 1.184-10.048); p-value = 0.023.

Table 3. Relationship of general characteristics with BSI.

General characteristics	**BSI**			
	Yes (n = 44)	**No (n = 49)**	**PR (CI95%)**	**P-value**
Gender				
Female	27	19	2.508	0.049
Male	17	30	(1.087 – 5.784)	
Age				
≥ 18 years old	38	42	1.056	1.000
< 18 years old	6	7	(0.326 – 3.419)	
Body Mass Index				
Underweight	24	8	6,150	0.000
Normoweight	20	41	(2.349 – 16.099)	

Chi-square test, p = 0,05.

Table 4. Relationship of surgical characteristics with BSI.

Characteristic of Catheter	**BSI**			
	Yes (n = 44)	**No (n = 49)**	**PR (CI95%)**	**P-value**
Location				
Femoralis	3	0	-	0.102
Jugularis	41	49		
Type				
Shortterm	12	0	**-**	0.000
Longterm	32	49		
Duration				
< 6 months	32	27	2.173	0.122
≥ 6 months	12	22	(0.910 – 5.187)	

*Fisher Exact test, p = 0,05; †Chi Square Test, p =0,05.

Table 5. Risk factors of BSI.

Variable	**Unadjusted***		**Adjusted†**	
	OR	p-value	AOR	p-value
Body mass index	6.150	0.000	**6.499**	**0.001**
Gender	2.508	0.049	**3.201**	**0.032**
Duration	2.173	0.122	1.311	0.625
Location	-	0.102	1034985114.170	0.999
Type	-	0.000	3202443964.480	0.998

* Chi square test; †Logistic regresion.

4. Discussion

In this study, 44 people (47.3%) had primary bloodstream infections (BSI). This number is greater than the results of the study of Uslan et al.[6] (38.2%) but smaller than the study of Bai et al.[7] (50%). The difference in the percentage incidence of BSI in some of these studies was due to differences in the population and the number of samples included in the study.

The mean age of patients with primary bloodstream infection (BSI) in this study was 45.32 ± 19.76 years (range 5 to 86 years), and the majority were female (61.4%). The results of this study are not much different from those of Mesiano et al. (2007)[8], Schwab et al. (2017)[9], and Rogne et al. (2019)[10], which reported that the majority of BSI patients were women with a mean age of 48 years (range 36.5–62.3 years).

The differences in anatomical, physiological, and hormonal systems will cause differences in the frequency of disease according to gender. This difference in frequency can also be caused by differences in the life roles and behavior of men and women in society, such as differences in work, habits, and others.[11] In this study, there was a significant difference in BMI between patients with and without BSI. In line with the results of this study, a study by Rogne et al. in 2019 reported that an increase in BMI can increase the risk of BSI events and death in BSI.[10]

The most common type of germ found in this study was Staphylococcus hominis. These results are in line with the theory that the thirteen most common organisms causing BSI include *Staphylococci* (CNS), *Enterococcus spp., S.aureus, C.albicans, non-albicans-Candida spp., E. coli, Klebsiella spp. , Enterobacter spp., P.aeruginosa, Serratia spp., Acinetobacter spp., Proteus spp.*, and *S.maltophilia*,[9] Another study conducted by Olaechea et al.[12] in 2013 reported that microorganisms with a high risk of causing BSI include *Pseudomonas aeruginosa, Staphylococcus aureus* methicillin-resistant, *Acinetobacter baumannii, enterobacteriaceae* that produce broad-spectrum beta-lactamase and fungi.

Based on the type of catheter, the majority of patients with primary bloodstream infection (BSI) had a long-term catheter type (72.7%), and the results showed that there were differences in the type of catheter between patients with and without primary bloodstream infection (BSI). The short-term catheter type is more at risk for BSI because all patients with the short-term catheter type have BSI. Multivariate the type of catheter is not a contributing factor to the incidence of BSI. However, the multivariate test showed that catheter type was not a risk factor for BSI. Likewise, with the location and duration of catheter insertion, the results obtained that these two factors are not risk factors for BSI.

5. Conclusion

It can be concluded that the factors that influence the incidence of BSI are body mass index and gender, while the location, type, and duration of catheter insertion are not related to the incidence of BSI.

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