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Antibiotic Sensitivity Profile of Catheter-Associated Urinary Tract Infection at Hasan Sadikin Hospital, Bandung, Indonesia

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Background: Urinary tract infections are the most common type of healthcare-associated infection, accounting for more than 30% reported by acute care hospitals. Virtually all healthcare-associated UTIs are caused by instrumentation of the urinary tract. Catheter-associated urinary tract infection (CAUTI) has been associated with increased morbidity, mortality, hospital costs, and length of stay. In addition, bacteriuria commonly leads to unnecessary antimicrobial use. Understanding the patient profile is initial data that is important in case of CAUTI for future research.

Aim: To find the antibiotic resistance pattern of bacterial infection of urinary Tract Infection associated with catheterization in Hasan Sadikin Hospital, Bandung.

Methods: The Subject is a patient indicated for catheterization in Hasan Sadikin Hospital, Bandung, with the number of samples is 21 participants. The initial data are patient identity, blood, urine bacterial culture, and resistance examination results. Catheterization insertion is performed for 1

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week, and the catheter tip is then prepared again for bacterial culture and resistance examination. CAUTI diagnosis is based on the recommendation of the CDC (Centers for Disease Control and Prevention). The data is processed and analyzed by a chi-square test, then presented in the table.

Results: Twenty-one sample of 40 (52.5%) catheterized patients shows positive culture results. All Subjects are male, with an age range is between 18-73 years old. The 5th decade is the most often group of 9 patients (22.5%), 13 patients (61.9%) had urine culture findings showing *E. coli* bacteria in their results, 5 patients (23.8%) had urine culture findings showing *Staphylococcus haemolyticus*, one patient (4.8%) had findings showing *Micrococcus*, one patient (4.8%) had finding *Acinetobacter baumannii* and one patient (4.8%) had findings *Pseudomonas aeruginosa*. Netilmicin antibiotic is most sensitive, 6 of 12 patients (50%), and cefoperazone is found resistant in 10 of 10 patients (100%).

Conclusion: Urinary tract infection associated catheterization is more common in the fifth decade of age and also in patients whose glucose level is above the normal value. The most common bacteria found is *E. coli*, and the most sensitive antibiotic for the urinary tract is netilmicin, while the most resistant is cefoperazone

Keywords: Urinary tract infection; antibiotic resistance; catheterization.

1. INTRODUCTION

Urinary tract infection (UTI) is the most common infection associated with medical personnel, where 30% of hospital-acquired infections are UTIs (Kleven et al. 2007). In 2019, more than 404.6 million people worldwide experienced a UTI, an increase of approximately 60% compared to 1990 (Zeng Z., et al. 2022). In Indonesia, data estimates that there are 180,000 new cases of UTI each year, or around 90–100 cases per 100,000 population (Kusuma I.Y., 2023). Almost all catheter placements in the urinary tract will cause infection, where data varies between 60-90%. Catheter-associated urinary tract infection (CAUTI) causes increased morbidity, mortality, treatment costs, and length of stay in hospital (Iacovelli et al. 2014; Ivanova, Sychev, and Lazareva 2025). In addition, bacteriuria is often the reason for giving unnecessary antibiotics (Amiri et al. 2024, Rahul, Jayasenani, and Duraisamy 2025). Urinary tract infections (UTIs) due to catheter use not only prolong hospitalization but also increase treatment costs and mortality risk. One of the main problems in the management of CAUTI is the increasing pattern of antibiotic resistance in pathogens that cause infection. Over time, inappropriate or excessive use of antibiotics has caused microorganisms to develop resistance to available treatments. Understanding the profile of patients with CAUTI and the antibiotic resistance patterns of the causative microorganisms is essential to determine an effective therapeutic approach (Hollenbeak and Schilling 2018; Kranz et al. 2020). This study aims to evaluate the characteristics of patients with CAUTI, including age, gender, duration of catheter use, and

comorbidities. In addition, this study will also identify the types of microorganisms most frequently found in CAUTI cases and evaluate their sensitivity and resistance patterns to various antibiotics. Several risk factors associated with CAUTI have been studied in Europe and America (ICE, 2019). It is estimated that mortality due to CAUTI increases if these risk factors are found. CAUTI can cause complications such as cystitis, pyelonephritis, bacteremia, prostatitis, epididymitis, orchitis, endocarditis, osteomyelitis of the vertebrae, arthritis, endophthalmitis, and meningitis (Perrin et al. 2021). Empirical antibiotic administration must be adjusted to the pattern of germs in the area, and the pattern of resistance of these germs can change over time because the nature of germs that can adapt themselves so that they become resistant to type certain class of antibiotics. Therefore, researchers want to know the pattern of germ resistance in Hasan Sadikin Hospital along with the profile of CAUTI patients (Li et al. 2019). By understanding the risk factors and characteristics of the pathogens involved, healthcare institutions can develop better prevention and treatment strategies. These strategies include the use of appropriate antibiotics based on culture and sensitivity results, as well as preventive measures such as catheter restriction, increased hygiene, and training of medical personnel in catheter insertion and care procedures. The problem of antibiotic resistance is a global challenge, and CAUTI cases are an important part of this problem (Werneburg 2022). Therefore, local data on resistance patterns are needed to adjust empirical therapy guidelines. In this context, this study is expected to provide an important contribution to the development of

hospital policies related to antibiotic use and infection control. This study was conducted in one of the main referral hospitals with a fairly high number of patients and relatively frequent use of urinary catheters. Thus, the data obtained from this study are expected to have good external validity and can be a reference for other healthcare facilities.

2. MATERIALS AND METHODS

2.1 Research Design

This study used a quantitative descriptive design with a retrospective approach. Data were collected from patient medical records and urine culture results obtained during the study period.

2.2 Place and Time of Research

The study was conducted at Hasan Sadikin Hospital, Bandung during the period May to October 2013.

2.3 Population and Subjects

The target population of the study was patients indicated for urinary catheterization at Hasan Sadikin Hospital between May and October 2013. The subjects of the study were patients indicated for catheterization at Hasan Sadikin Hospital who met the inclusion criteria, which were 21 people.

2.4 Inclusion Criteria

1. Patients who have used a urinary catheter for at least 48 hours.
2. Patients with positive urine culture results.
3. Complete data on patient identity, duration of catheter insertion, and antibiotic sensitivity test results are available.

2.5 Exclusion Criteria

1. Patients with urinary tract infections before catheter insertion.
2. Patients with incomplete medical record data

2.6 Data Collection

Data were collected from the hospital's medical record department and microbiology laboratory. Data on urine culture results and antibiotic sensitivity tests were obtained from laboratory reports. Data were coded and entered into a worksheet using Microsoft Excel

2.7 Data Analysis

Data tabulation was done descriptively, and data analysis was conducted using the chi-square test using SPSS.

3. RESULTS AND DISCUSSION

3.1 Research Results

Forty catheterized patients participated between May and October 2013. All subjects were male, with an age range from 18 to 73 years. A total of 21 patients who used catheters showed positive culture results. The age of the 5th decade is the largest group suffering with 9 patients (22.5%).

In Tables 2, 3, and 4, it can be seen that as many as 15 patients (71.4%, $p=0.0043$) with positive culture had random glucose levels above normal limits, and as many as 18 patients had blood creatinine levels (45%, $p=0.7195$) within normal limits. As many as 16 patients (40%, $p=0.0318$) had serum albumin levels within the normal range.

Table 1. Distribution of culture results based on patient age

Year (Decade)	Culture				Total	
	(+)		(-)			
2	4	10%	1	2.5%	5	12.5%
3	2	5%	1	2.5%	3	7.5%
4	3	7.5%	6	15%	9	22.5%
5	9	22.5%	7	17.5%	16	40%
6	2	5%	1	2.5%	3	7.5%
7	0	-	2	5%	2	5%
8	1	2.5%	1	2.5%	2	5%
Total	21	52.5%	19	47.5%	40	100%

Table 2. Distribution of culture results based on random blood sugar levels (GDS) of patients

GDS	Culture				Total	
	(+)		(-)			
Normal	6	15%	14	35%	20	50%
High	15	37.5%	5	12.5%	20	50%
Total	21	52.5%	19	47.5%	40	100%

Table 3. Distribution of culture results based on patient creatinine levels

Creatinine	Culture				Total	
	(+)		(-)			
Normal	18	45%	17	42.5%	35	87.5%
High	3	7.5%	2	5%	5	12.5%
Total	21	52.5%	19	47.5%	40	100%

Table 4. Distribution of culture results based on patient albumin levels

Albumin	Kultur				Total	
	(+)		(-)			
Normal	11	27.5%	16	40%	27	67.5%
Low	10	25%	3	7.5%	13	32.5%
Total	21	52.5%	19	47.5%	40	100%

Table 5. Types of pathogen found in culture

Types of Germs	Amount isolated
Escherichia coli	13
Staphylococcus haemolyticus	5
Micrococcus	1
Acinetobacter baumannii	1
Pseudomonas aeruginosa	1
Total	21

Table 6. Antibiotic sensitivity to germs

Types of Germs	Sensitivity (%)									
	AM	AC	AS	CD	CZ	CP	CX	CR	CT	CI
Escherichia coli	15.38	15.38	30.76	15.38	15.38	30.76	15.38	15.38	0	15.38
Staphylococcus haemolyticus	40	20	40	20	20	40	0	0	0	20
	CF	CE	CU	CH	CA	CO	ER	GE	IM	LE
	38.46	0	0	30.76	7.69	30.76	0	7.69	30.76	46.15
Staphylococcus haemolyticus	40	0	0	0	20	60	0	0	0	20
	LI	ME	NE	PT	TI	VA				
	15.38	61.53	61.53	15.38	7.69	7.69				
Staphylococcus haemolyticus	40	60	80	20	20	20				

AM, Amikacin; AC, Amoxicillin clavulanamat; AS, Ampicilin sulbactam; CD, Cefadroxil; CZ, Cefazolin; CP, Cefepime; CX, Cefixime; CR, Cefoperazone; CT, Cefotaxime; CI, Cefoxitin; CF, Cefazidime; CE, Ceftriaxone; CU, Cefuroxime; CH, Chloramphenico; CA, Cipfloxacin; CO, Cotrimoxazole; ER, Erythromycine; GE, Gentamycin; IM, Imipenem; LE, Levofloxacin; LI, Linezolid; ME, Meropenem; NE, Netilmicine; PT, Piperacillin Tazobactam; TI, Tigecyclin; VA, Vancormycin

In Tables 5 and 6, as many as 13 patients (61.9%) were found to have *E. coli* in urine culture results. The most sensitive antibiotic netilmicin was found in 6 of 12 patients (50%) and cefoperazone was found to be resistant in 10 of 10 patients (100%).

3.2 Discussion

This study identified the prevalence and resistance patterns of bacteria that cause CAUTI in catheterized patients at Hasan Sadikin Hospital, Bandung. The high incidence in male patients and in the fifth decade age group indicates that age and gender factors may play a role in susceptibility to this nosocomial infection (Saint et al., 2000). *Escherichia coli* as the most dominant bacteria, is consistent with global literature reports, where *E. coli* is the main pathogen in urinary tract infections, including those associated with catheterization (Flores-Mireles et al., 2015, Li et al., 2019).

The results of antibiotic resistance indicate challenges in the management of this infection. Netilmicin still showed relatively good effectiveness against bacterial isolates, but its sensitivity rate (50%) indicated that the selection of empirical therapy needs to be done carefully. In contrast, the high resistance to Cefoperazone (100%) made it clear that this antibiotic is not recommended for the treatment of CAUTI in this study setting, in line with the global trend of resistance to third-generation cephalosporins (Magill et al., 2018). In addition, it was found that patients with blood glucose levels above normal values experienced more infections, supporting the evidence that hyperglycemia is a risk factor for medical device-associated infections, including CAUTI (Turina et al., 2006). These findings emphasize the importance of optimal glycemic control in hospitalized patients to reduce the risk of nosocomial infections. The patients who participated in this study were all men, perhaps because the sample was more often found in the emergency unit, where patients who were indicated for catheterization were generally elderly men with symptoms of difficulty or inability to urinate. From table 2, it was found that in the high blood sugar group, more urinary tract infections were found due to catheters. In theory, it is known that hyperglycemia is associated with decreased immune system activity, making someone more susceptible to infection, this may also occur in urinary tract infections due to catheters (Kuy et al. 2020; Saint 2000; Saint et al. 2016). Increased

serum creatinine levels, which are one indicator of kidney damage, can occur due to the use of urinary catheters to urinary tract infections. Table 3 shows that the difference between serum creatinine levels and the presence of germs in urine cultures was not significant. This may be because this study was conducted using only a catheter for one week, so that the germs that developed were still located in the bladder and had not reached the kidneys (Assadi 2018; Hosseininasab et al., 2024; Kranz et al. 2020). Hypoalbuminemia is often associated with an increased risk of infection. Table 4 found that patients with normal albumin levels showed more negative culture results. The culture of bacteria from this study showed a similar pattern to similar studies, where *Escherichia coli* was the most common bacterium found. The antibiotic netilmicin was the most sensitive, perhaps because this antibiotic is still rarely used in urinary tract infections at Hasan Sadikin Hospital.

4. CONCLUSION

CAUTI was more common in male patients in their fifth decade and in patients with high blood glucose levels. The most common bacteria found was *Escherichia coli*. The most effective antibiotic against the bacterial isolates in this study was Netilmicin, while Cefoperazone showed the highest resistance and is not recommended for use in the treatment of CAUTI in this population. These findings support the need for close monitoring of nosocomial infections, management of risk factors such as hyperglycemia, and a wise antibiotic use policy based on local resistance data.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

CONSENT

As per international standards or university standards, patient(s) written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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