



Bacteriological Profile of Catheter Associated Urinary Tract Infection at West Nusa Tenggara's Hospital

Baiq Isti Hijriani^(✉) and Pauzan Pauzan

Medical Laboratory Technology, Polytechnic of Medica Farma Husada Mataram, Mataram, Indonesia

baiqistih@gmail.com

Abstract. Hospitals have the potential for developing the transmission of nosocomial infections. Nosocomial infection is an infection that develops in the hospital environment. Urinary tract infection (UTI) is one of the most common infections in hospitals and more than 80% of UTI cases are associated with the use of a urethral catheter. This infection is caused by the development of microorganisms in the urinary tract and is characterized by the discovery of bacteria more than 10^5 CFU/mL. This research is an observational descriptive study with a cross-sectional approach. A total of 60 patients who used in this research from the hospital at West Nusa Tenggara. Urine samples were collected and then cultured. Bacterial profiles that cause UTI that found in urine of catheter were *Staphylococcus aureus* (43.33%), *Escherichia coli* (21.67%), *Staphylococcus epidermidis* (10%), *Proteus mirabilis* (6.67%), *Enterobacter aerogenes* (6.67%), *Serratia marcescens* (5%), *Klebsiella sp* (3.33%), and *Pseudomonas sp* (3.33%).

Keywords: Bacterial pattern · Catheter · Catheter-associated urinary tract infection

1 Introduction

Infectious disease is still a health problem in the world, including in Indonesia. One of them is a nosocomial infection which is one of the causes of increased morbidity and mortality in hospitals in both developing and developed countries [1]. Nosocomial infection is defined as an infection acquired by a patient during hospitalization if the patient suffers from symptoms of infection after 3×24 h of hospitalization and does not experience symptoms of infection before hospitalization [2]. One of the most common nosocomial infections is urinary tract infection (UTI). This infection is often found in both outpatients and inpatients in hospitals [3].

UTI is one of the most common infections and infects 150 million people worldwide every year [4]. Data of clinical epidemiological report that 25–35% of adult women have experienced UTI [5]. UTI can be found in infants and children ranging from 1–2%, in young women 1–3%, while in pregnant women 4–7%. Women are more at risk for UTI than men, approximately 50% of all women will have UTI in their lifetime [6].

More than 80% cases of UTI are associated with the use of urethral catheters and an estimated 13,088 deaths in 2002 were attributed to UTI in the United States [7]. Based on data survey, 36,3%–42,7% of nosocomial infections are caused by UTI [6]. UTI can be found in 10–15% of hospitalized patients using a catheter. Using a catheter increases the risk of developing a UTI by 3–5% per day. These urinary tract infections can then progress to bacteremia, sepsis, and even death [8].

UTI shows the presence of microorganisms that are characterized by the formation of bacterial colonization in the urinary tract [3]. UTI is caused by bacteria, but fungi and viruses can also be the cause. The bacteria that often cause UTI is *Escherichia coli*, an organism that can be found in the anus. In addition to *Escherichia coli* bacteria that can cause UTI are *Proteus sp*, *Klebsiella sp*, *Pseudomonas sp*, *Enterococcus sp*, *Serratia sp* and *Staphylococcus sp* and *Streptococcus sp* [5, 9].

2 Materials and Methods

2.1 Study Design and Ethical Clearance

The descriptive observational with a cross-sectional approach was conducted at Biomedical Research Unit, West Nusa Tenggara General Hospital, Indonesia. This research has been approved by the Ethics Committee of the Regional General Hospital of West Nusa Tenggara Province.

2.2 Sample Collection

A total of 60 samples were collected using the purposive sampling method. Inclusion criteria were patients with ≥ 72 h catheterization with a diagnosis of urinary tract infection, age > 14 years, willing to provide urine (sample), and filling in informed consent.

2.3 Microbiological Analysis

Urine samples from the catheter were cultured on solid media, namely Mannitol Salt Agar (MSA) and Eosin Methylene Blue (EMB), then incubated at 37 °C for 18–24 h. Bacterial colonies from both media then inoculated on the surface of the Nutrient Agar Plate (NAP). Then gram staining was performed on the colonies. If gram-positive bacteria are found, it is continued with catalase and coagulase tests. Meanwhile, if gram-negative bacteria are found, then proceed with biochemical tests.

3 Results

A total of 60 patients were divided into three categories, such as gender, age, and duration of catheterization. For the age category, there were 30 (50%) male patients and 30 (50%) female patients. The age category is divided into several age categories, starting from the age range of 15 years to 75 years. For the 15–40 year age group, there were 7 patients (11,67%) suffering from UTI, the 31–45 year age group as many as 15 patients (25%), the 46–60 year age group as many as 28 patients (46,67%). And the age group 61–75 years

Table 1. Distribution of UTI by Gender.

Category of gender	Total (n)	Percentage (%)
Men	30	50%
Women	30	50%

Table 2. Distribution of UTI by Age.

Category of age	Total (n)	Percentage (%)
15–30 years	7	11,67%
31–45 years	15	25%
46–60 years	28	46,67%
61–75 years	10	16,66%

Table 3. Distribution of UTI by Duration of Catheterization.

Category of catheterization	Total (n)	Percentage (%)
≤7 days	42	70%
≥7 days	18	30%

Table 4. Bacteriological Profile That Cause Catheter Associated Urinary Tract Infection (CAUTI).

Microorganism	Total (n)	Percentage (%)
Gram Positive		
<i>Staphylococcus aureus</i>	26	43,33
<i>Staphylococcus epidermidis</i>	6	10
Gram Negative		
<i>Escherichia coli</i>	13	21,67
<i>Proteus mirabilis</i>	4	6,67
<i>Enterobacter aerogenes</i>	4	6,67
<i>Serratia marcescens</i>	3	5
<i>Klebsiella sp</i>	2	3,33
<i>Pseudomonas sp</i>	2	3,33
Total	60	100

as many as 10 patients (16,66%). For the category of the duration of catheterization, there were 42 patients (70%) who used a catheter for 7 days, and as many as 18 patients (30%) with a catheter duration of 7 days (can be seen in Table 1).

After being cultured in the microbiology laboratory, the results of bacterial growth on the media contained eight types of bacteria, including two gram-positive bacteria and six gram-negative bacteria, it can be seen in Table 4. The most common bacteria found were *Staphylococcus aureus* for the gram-positive bacteria group and *Escherichia coli* for the gram-negative bacteria group. Bacteria that cause UTI is *Staphylococcus aureus* as much as 26 (43,33%), then followed *Escherichia coli* as much as 13 (21,67%), *Staphylococcus epidermidis* as much as 6 (10%), *Proteus mirabilis* as much as 4 (6,67%), *Enterobacter aerogenes* as much as 4 (6,67%), *Serratia marcescens* as much as 3 (5%), *Klebsiella sp* as much as 2 (3,33%), and *Pseudomonas sp* as much as 2 (3,33%).

4 Discussion

From this research, it was found that from 60 patients who used urethral catheters and suffered from urinary tract infections (UTI), of which 30 patients (50%) were male and 30 patients (50%) were female (in Table 1). Based on previous research, female is associated with the risk of UTI, women more at risk than men, this is due to the shorter anatomical structure of the female urethra (about 4 cm) and also its proximity to the anus [10].

In Table 2, we can see that urinary tract infections were found in category age 46–60 years as much as 28 patients (46,67%). Age is one of the risk factors for UTI, decreased immune system and the presence of comorbidities such as diabetes are one of the causes of the elderly group being susceptible to UTI infection [11].

There are two methods of catheterization that are commonly used, such as indwelling catheters that are used for a long time and intermittent catheters that are used from time to time [12]. As much as 42 (70%) patient with duration of catheterization ≥ 7 days (in Table 3). Approximately 15–25% of hospitalized patients use a catheter [7] and catheterization is the most common cause of urinary tract nosocomial infections because of its longtime to use and not in accordance with the indications [12].

Based on results of urine culture, there are eight types of bacteria found, including two gram-positive bacteria; *Staphylococcus aureus* (42,33%) and *Staphylococcus epidermidis* (10%) and six gram-negative bacteria; *Escherichia coli* (21,67%), *Klebsiella sp* (3,33%), *Proteus mirabilis* (6,67%), *Pseudomonas aeruginosa* (3,33%), *Serratia marcescens* (5%) and *Enterobacter aerogenes* (6,67%).

The results of this study indicate that *Staphylococcus aureus* is the dominant bacteria causing CAUTI. These results are in agreement with a study conducted in France, where only 1,3% of *S. aureus* was recovered from urine culture in community-acquired infections. The presence of *Staphylococcus aureus* bacteria in urinary catheters can be caused by direct contact with family and through catheter tubes or other medical equipment used by nurses and objects around the catheter tube and urine box [13].

The most common gram-negative bacteria causing CAUTI is *Escherichia coli*. The results of this study are in accordance with research that has been carried out in 2011–2012 in Europe, *E.coli* bacteria became the most frequent microorganism isolated from

urinary tract infection patients [14]. These results are consistent with research conducted in Iran, where the most common gram-negative bacteria causing CAUTI is *E. coli* [15].

The variety of research results related to the bacteria that cause CAUTI may be caused by several factors, such as a disturbance in the immune system, widespread and inappropriate use of steroids and antibiotics, research tools and media used [16] and also social habits of the community such as personal hygiene and knowledge about health [13].

5 Conclusion

Based on the results of this research, it can be concluded that *Staphylococcus aureus* and *Escherichia coli* was the most common bacteria that causing catheter associated urinary tract infection (CAUTI).

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