



Risk Factors of Catheter-Associated Urinary Tract Infections in Hospitalized Patients in Internal Medicine Ward of Tertiary Referral Hospital in Indonesia

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ARTICLE INFO	ABSTRACT
Keywords: Urinary Tract Infection (UTI), Infectious disease, CAUTI, Health risks, Internal Medicine Submitted: Jan 27th 2025 Reviewed: March 6th 2025 Accepted: April 14th 2025	Introduction: Urinary Tract Infection (UTI) is the most common type of nosocomial infection. An increase of 80% of nosocomial urinary tract infections is caused by the usage of urinary catheters. Previous studies have found that inpatients are more susceptible to UTI than outpatients. Objective: The Objective of this study is to assess the prevalence and risk factors for internal medicine patients at tertiary referral hospitals in Surabaya with Catheter Associated Urinary Tract Infections (CAUTI). These findings may aid in strategies to minimize CAUTI occurrences. Methods: This study was a single-center cross-sectional study that obtained data from medical records. Data samples were tested using Chi-Square to find a correlation between UTI and age, gender, length of stay, and underlying disease or comorbidities with a p-value of $p < 0,05$. Results: The proportion of patients who experienced CAUTI during May 2020-May 2021 was 32.8%. The characteristics of the sample in this study were in the age range of 28 to 78 years with an average of 54 years. There were four male patients and 17 female patients in the CAUTI group. The p-values for age, gender, duration of hospitalization, and underlying disease or comorbidities were 0.465 ($p > 0.05$); 0.064 ($p > 0.05$); 0.146 ($p > 0.05$); and 0.064 ($p > 0.05$). Conclusions: There was a reduction in the prevalence of CAUTI from 2018 compared to 2020-2021. There were no variables that were significantly associated as risk factors for CAUTI.

Introduction

Urinary tract infections (UTIs) are the most common type among all healthcare or community-related infections. While Catheter-Associated Urinary tract infections account for approximately 26.7% of all device-associated infections. A

Catheter-Associated Urinary tract infection occurs when a bacteria invades the body through a catheter into the urinary tract and the bladder (Mangal et al., 2021). Although it rarely causes symptoms, CAUTIs are known to be associated with increased mortality and length of stay in acute care

facilities. Besides that, UTI can also lead to urosepsis which accounts for a quarter of sepsis cases (Utami et al., 2022). With the presence of CAUTI complications, the cost of multiple blood cultures, additional days of parenteral antibiotics, and longer hospital stays may be affected (Hollenbeak & Schilling, 2018). Previous studies reported that risk factors for CAUTI are female patients, prolonged duration of catheter insertion, diabetes, history of previous catheter insertion, and long duration of hospitalization (Li et al., 2018).

A study in Uganda reveals a higher percentage of bacteriuria in inpatients (57%) than that of outpatients (43%). Additionally, 59.2% of inpatients have an increased risk of UTIs due to catheter usage (Odoki et al., 2019). This suggests that catheter insertion has a role in increasing the risk of nosocomial UTI. In addition, data that supports the urgency of this study is data taken from the National Healthcare Safety Network (NHSN) regarding the incidence of CAUTI increasing by 5.6% per year in 2012-2014 (Soe et al., 2020).

In the present, there have been no research updates regarding CAUTI in Indonesia, especially in Surabaya. In addition, from the review above, there are differences in research results regarding risk factors for CAUTIs from several reading sources. Therefore, it is necessary to update research on risk factors for

CAUTIs in order to determine what risk factors have an effect and future preventive measures.

Methods

This study was a cross-sectional study conducted in the department of internal medicine at a tertiary referral hospital in Surabaya. The study aims to determine the prevalence and risk factors for CAUTIs among inpatients in the period from May 2020 to May 2021. Data for this study were taken from electronic medical records.

The data taken is categorized into two groups of samples. The first group is the control group where patients who have not developed CAUTI after having an indwelling the catheter for at least 48 hours. The second group is the case group where patients developed CAUTI after having an indwelling catheter for at least 48 hours.

After adjusting to the available data in the medical record, the variables examined included age, gender, the patient's disease, and duration of hospitalization.

Each variable was categorized individually, as follows:

- Age categories are adulthood (26-45 years), elderly (46-65 years), and seniors (65 years and over). (Al Amin, 2017)
- Patient's disease variables are $\geq$ median and $<$ median where the median will be

discovered when the study is conducted.

- Duration of hospitalization are $\geq$ median and $<$ median with days as units where the median will be discovered when the study is conducted.

Data collection was carried out and subsequently split into two groups. Statistical comparison between the two groups was then done using the chi-square method.

Results

Data collection began with a search for UTI cases at the Internal Medicine installation for the period May 2020-May 2021 and a total of 64 patients were found to have UTIs. The search results were filtered again by looking for UTI patients who met the criteria that the UTI was caused by catheter insertion and found 21 patients. So, the proportion of catheter UTIs in internal medicine inpatients at a tertiary referral hospital in Surabaya for the period from May 2020 to May 2021 is 32.8%. The search for a control group started with cases of hypertension, diabetes, and malignancy at the Internal Medicine Installation for the period May 2020-May 2021 which are common diseases that people often suffer from. The search results were filtered again by looking for patients who had data on catheter insertion for at least 48 hours and

27 patients were taken who did not have a UTI.

a. Univariate Analysis

The distribution of variables is presented in Table 1.

Table 1. Variables Distribution

Variables	N	%
Age		
Young Adults	12	25%
Middle Age	27	56,3%
Elderly	9	18,8%
Gender		
Male	16	33,3%
Female	32	66,7%
Disease		
≥ 3	32	66,7%
< 3	16	33,3%
Length of Stay		
≥ 12	24	50%
< 12	24	50%

Age variables are categorized into adults (26-45 years), middle age (46-65 years), and elderly (> 65 years). The characteristics of the sample in this study ranged in age from 28 to 78 years with an average age of 54 years. The sample is dominated by the middle age category (56.3%). There were 16 men and 32 women who were sampled in this study. That indicated that the female sample dominated twice as much as the male.

Table 2. Disease Categorization

Disease	n
Plasma disorders and metabolism diseases	32
Respiratory diseases	30
Cardiovascular and hematology diseases	34
Renal diseases	13
Digestive disorders	4
Neurological diseases	10
Immunological disorders	2
Infection diseases	9
Liver diseases	7

The underlying disease or comorbidities in this study were categorized into nine categories listed in Table 2. The category with the highest number of cases was cardiovascular and hematology diseases. Based on the nine categories above, the sample is divided into two categories namely ≥ 3 dan < 3 . The number 3 is obtained from the median number of diseases suffered by the sample. In the variable duration of hospitalization, the CAUTI sample underwent treatment with a range of two days to 56 days. Meanwhile, non-CAUTI patients were treated with a range of four days to 41 days. The number 12 is obtained from the median of all the number of days of hospitalization of the patients who were the sample of this study.

b. Bivariate Analysis

The chi-square analysis result is presented in Table 3.

Table 3. Bivariate Analysis

Variables	CAUTI (%)	Non-CAUTI (%)	p
Age			
Young Adults	7 (33,3%)	5 (18,5%)	0,465
Middle Age	11 (52,4%)	16 (59,2%)	
Elderly	3 (14,3%)	6 (22,2%)	
Gender			
Male	4 (19%)	12 (44,4%)	0,064
Female	17 (81%)	15 (55,5%)	
Disease			
≥ 3	11 (52,4%)	21 (77,8%)	0,064
< 3	10 (47,6%)	6 (22,2%)	
Length of Stay			
≥ 12	8 (38,1%)	16 (59,3%)	0,146
< 12	13 (62%)	11 (40,7%)	

The age range for the CAUTI group in this study was 38 to 77 years, while the age range for the non-CAUTI group was 28 to 78 years. The largest sample is the non-CAUTI group in the middle age category. In the gender variable, the largest group was the female CAUTI sample, totaling 17 people (81%). More samples suffer from at least three diseases. More specifically, there are more samples in the non-CAUTI group that suffer from at least three diseases.

The sample in this study had an average and median of three underlying diseases or comorbidities. In CAUTI patients, 52.4% of patients had at least three underlying diseases or comorbidities and 47.6% of patients had less than three underlying diseases or comorbidities. In patients who

were not infected with CAUTI, it was found that 77.8% of patients had at least three basic diseases or co-morbidities, and 22.2% of patients had less than three underlying diseases or comorbidities. Almost all disease categories in this study found that these diseases were more common in patients who were not infected with CAUTI. Only the category of kidney disease and digestive disorders suffered more from the CAUTI group.

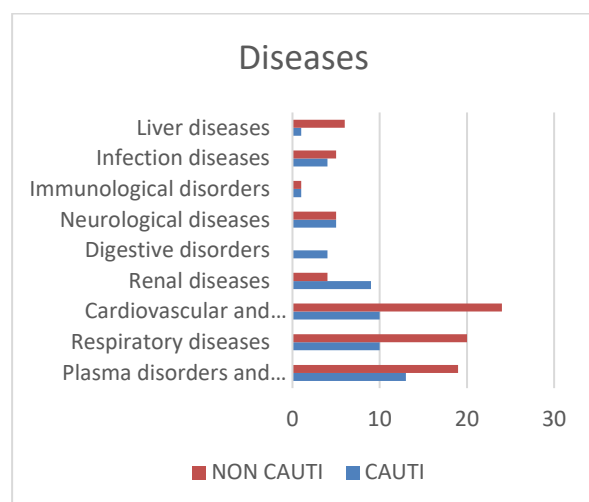


Figure 1. Distribution of diseases

Based on table 3, it is known that the p-value of the relationship between age and CAUTI status is 0.465 ($p > 0.05$), p-value of the relationship between gender and CAUTI status is 0.064 ($p > 0.05$), p-value of the relationship between disease and CAUTI status is 0.064 ($p > 0.05$), and the p-value of the relationship between duration of hospitalization and CAUTI status is 0.146 ($p > 0.05$). So there is no significant

relationship between all variables and the incidence of CAUTI.

Discussion

A 2018 study conducted in Medan reports a prevalence of 44,4% for CAUTI (Anggi et al., 2019). Compared to this study which reported a prevalence of 38.2% a difference can be observed to be 6.2%. Meanwhile, a study in Saudi Arabia between 2020 and 2021 also exhibits a decrease of 6.2% in CAUTI prevalence (Alsaffar et al., 2023). This can happen because during the COVID-19 pandemic, there was a reduction in the number of operations in the hospital. Hospitals during the pandemic also focused on the overflowing patients. COVID-19 patients who have susceptible immune systems are also given broad-spectrum antibiotics to enable COVID-19 patients to avoid urinary bacterial infections. Reducing urine culture measures is also carried out to reduce contact with COVID-19 patients (Alsaffar et al., 2023; Fakhri et al., 2022).

This study found no significant effect between certain age categories on the incidence of CAUTI in this study. The insignificant results obtained from this study could have occurred because of the small sample size or because patients who were recorded as not having a UTI did not have their urine culture examined, as well as the role of age range on immunity,

comorbidities, and others. There was a study conducted in South Korea at six hospitals which showed a relationship between age and the incidence of CAUTI of $p=0.194$ (Kim et al., 2017). A systematic review also supports the statement that age does not have a significant effect on the incidence of CAUTI (Li et al., 2018). However, a study conducted in the United States showed that there was an older mean age of patients with CAUTI, 58 years, compared to catheterized patients who did not have CAUTI, 53 years (Hagerty et al., 2015). There is even a study that states that for every one-year increase in age, there is an increase in the risk of suffering from CAUTI by 3% (Gillen et al., 2015).

This study also has not found other studies that found similar results found by this study, where patients of female or male gender did not have a significant association with the incidence of CAUTI. Several previous studies conducted in the United States found that women are a risk factor for CAUTI (Flores-Mireles et al., 2019; Gillen et al., 2015; Perrin et al., 2020). This can happen because females have a shorter urethra, also the distance from the anus to the opening of the urethra is shorter than males, allowing the transfer of uropathogenic bacteria from the digestive tract to the urinary tract (Flores-Mireles et al., 2019). Such female anatomy makes females have a higher risk of contracting a

UTI. Meanwhile, several other studies such as those conducted in South Korea, China, and Saudi Arabia, found that males are the sex that experiences CAUTI more often (Deltourbe et al., 2022; Kim et al., 2017; Saleem et al., 2022). A study explains that this can occur due to urodynamic changes. Urodynamic changes, for example, prostatic hypertrophy and bladder outlet obstruction. A meta-analysis study stated that the lifetime risk of uncircumcised men getting a UTI was 32%, while that of uncircumcised men was 8.8% (Morris & Wiswell, 2013).

A study states that prolonged hospitalization after catheterization usually has serious co-morbidities that make patients more susceptible to infection as well as increased antibiotic resistance and death (Liu et al., 2020). The results of previous studies found that almost all of them showed significant results between the duration of hospitalization and CAUTI, where the longer the duration of the patient's hospitalization, the higher the risk of CAUTI (Flores-Mireles et al., 2019; Gillen et al., 2015; Hagerty et al., 2015).

Unlike previous studies, there was no significant effect of the duration of hospitalization and the number of CAUTI cases in this study. It is known that several samples did not complete treatment at the hospital as recommended or were called forced discharge and some other samples

were also known to have died. 11 samples who forced to be discharged and/or died in this study. The duration of hospitalization that researchers found in this sample has a very wide range from one another. A study in Saudi Arabia stated that the recommendation for placing a urinary catheter should be no more than 3-8 days (AL-Hazmi, 2015). Based on this statement, it is possible for patients in the category of less than 12 days that exceeded eight days of catheter insertion to experience a UTI. It is also possible that a patient who has been hospitalized for at least 12 days has a UTI but is asymptomatic and therefore does not have a urine culture done.

A previous study conducted in America showed that there were other diseases that were not found in this study sample, namely hyperglycemia in patients with subarachnoid hemorrhage and the Intensive Care Unit (ICU) which were found to have a strong association with CAUTI (Hagerty et al., 2015). The same study also stated that anemia requiring transfusion was also had a relationship with the incidence of CAUTI. Research by Liu et al. (2020) found several other diseases suffered by CAUTI patients, including chronic respiratory disease, chronic liver disease, congestive heart failure, solid tumors, septic shock, hypoproteinemia, and immunosuppression. Among the diseases that have been mentioned in this study, a disease that has a

significant effect on CAUTI is congestive heart failure (Liu et al., 2020). The research was conducted in the Internal Medicine ward of the tertiary referral hospital in Surabaya and found that there was no relationship between the number of underlying diseases or comorbidities affecting the incidence of CAUTI. Researchers have not found other studies that examine the relationship between the number of underlying diseases or comorbidities with the incidence of CAUTI. Further analysis is needed regarding the relationship between each underlying disease or comorbidity to CAUTI.

While we found no significant risk factors for CAUTI, research by Gray et al (2023) presented a few methods that can minimize the occurrence of CAUTI. These methods vary from interventions in protocol, changes in protocol, or the use of reminders.

These methods include a daily interdisciplinary huddle on catheter safety, a daily catheterization review on patients, and the use of a checklist in catheterization. Additionally, a team consisting of two nurses can reduce errors by having one insert a catheter and the other person do the checklist.

Conclusion

Results from the study reveal that a notable number of patients at internal

medicine at a tertiary referral hospital in Surabaya experienced Catheter-Associated Urinary tract Infections (CAUTI). However, after analyzing patient characteristics, disease, and hospital treatment, no variable was found to be a risk factor for CAUTI itself.

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