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AN OBSERVATIONAL STUDY FROM SOUTHERN INDIA TO EVALUATE CATHETER-ASSOCIATED URINARY TRACT INFECTION IN ONCOLOGY PATIENTS

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ABSTRACT **Background:** Hospital-acquired infections are a major cause of morbidity and mortality, particularly in patients requiring intensive care. Catheter-associated urinary tract infections (CAUTIs) are one of the most frequent infections in these settings. This study explores factors related to CAUTI occurrence among cancer patients with urinary catheters and aims to develop preventative strategies to reduce infection rates. **Materials and Methods:** An observational study was conducted in the Department of Surgical Oncology at Thanjavur Medical College from January 2023 to August 2024. A total of 503 oncology patients with indwelling urinary catheters were enrolled. Urine samples were collected using aseptic techniques and analyzed within two hours of collection. Pathogen identification and antimicrobial susceptibility testing were conducted according to 2019 CLSI guidelines. **Results:** The study identified a CAUTI rate of 2 per 1,000 catheter days, with an overall infection prevalence of 1.5%. Pseudomonas was the most commonly detected pathogen, and infections were most frequently observed on the fourth day after catheter insertion. **Conclusion:** This study provides essential data on CAUTI rates, prevalent pathogens, and risk factors at our institution. Findings underscore the importance of identifying risks and implementing infection prevention practices to reduce CAUTI rates.

KEYWORDS : Catheter-associated urinary tract infection, Healthcare-associated infection, Urinary tract infection

INTRODUCTION

Healthcare-associated infections are an important cause of prolonged hospital stay, around the globe.[1,2] Urinary tract infections (UTIs) are considered as one of the most common healthcare- associated infections (HCAIs) with an estimated prevalence of 1–10%, accounting for 30–40% of all HCAIs reported by hospital settings.[3] Majority of infections of urinary tract are directly linked to the widespread use of indwelling catheters in these settings[4,5]The Center for Disease Control and Prevention (CDC) provides a definition for CAUTI, which pertains to patients who have a catheter inserted and left in place for 48 hours or longer.[6] Catheter-associated urinary tract infection has been a significant factor contributing to illness and death among hospitalized patients.[7,8]The risk factors include female gender, extremes of age, diabetes mellitus, and prolonged catheterization duration.[9]

The duration of catheterization is the most important factor in the development of bacteriuria, as its daily usage increases the risk of infection by 3–7%.[4]

An indwelling catheter interrupts the normal mechanical wash-out effect of the urinary stream, making patients more susceptible to symptomatic infections. This, in turn, can result in the infection ascending from the bladder to the ureter and kidney, ultimately requiring the use of antimicrobial medications.[10]

It can be prevented by maintaining closed urinary drainage system and early removal of catheter. Surveillance, proper training of healthcare personnel, and implementation of bundle care approach aids in reduction of cases.[11]

Urinary tract is a vast reservoir of resistant microorganisms with threat of cross infection.[12] Escherichia coli, Klebsiella species, Proteus species, Pseudomonas aeruginosa, Staphylococcus aureus, Coagulase- negative Staphylococcus, and Enterococcus species are the important culprits. It can cause genitourinary complications, septicemia, skeletal involvement, and over the years, bladder cancer [13] that causes distress to the patient, prolonged hospital stay, economic loss, and mortality.

The study aims to identify the prevalence, contributing risk factors, and causative agents linked to catheter-associated urinary tract infections (CAUTI). These findings are intended to support improvements in hospital infection control measures and reduce the impact of hospital-acquired infections.

MATERIALS AND METHODS

Study Population and Design

This study was a prospective, hospital-based observational analysis conducted within the Department of Surgical Oncology at Thanjavur Medical College in Tamil Nadu, spanning from January 2023 to August 2024.

Sample Size

A total of 503 patients who met the inclusion and exclusion criteria were enrolled in the study. These patients, admitted to the Surgical Oncology unit and requiring urinary catheterization (Foley's catheter), were monitored from admission until discharge or death.

Inclusion Criteria:

Patient having at least one of the following signs or symptoms:

- Fever (>38.0°C).
- Suprapubic tenderness.
- Costovertebral angle pain or tenderness.

Patient having an indwelling urinary catheter that was in place for >2 days on the date of event. Patient having a urine culture with no more than two species of organisms identified, at least one of which is a bacteria of $\geq 10^5$ CFU/mL.

Exclusion Criteria

- Mixed flora (>2 species of microorganisms).
- Candida species or yeast not otherwise specified.
- Mold and dimorphic fungi.

Collection of Data

Cases meeting inclusion criteria were enrolled for surveillance. Data were collected daily using a standardized hospital-acquired infection (HAI) case report form at the same time each day. This data included:

- Numerator data (urinary catheter, and diagnosis of a CAUTI event).
- Denominator data (the daily number of patients with urinary catheter).
- Urinary catheter-related information (site, duration of insertion, disconnection of catheter, and use of any antimicrobials) was collected from the patient's record file and analyzed.

Event time frame – It is a 14-day period (considering date of event =

day 1) when UTI is considered to be ongoing. Organisms identified during the event time frame are added to the case report form of the initial UTI. No new UTIs can be reported for the patient during these 14 days.

Specimen Processing

Urine samples, collected without centrifugation, were cultured semi-quantitatively using a standard nichrome loop (1.3 mm diameter, delivering 1 µL) on 5% sheep blood and MacConkey agar, which were then incubated at 37°C for 18–24 hours. Isolates underwent Gram staining, further biochemical identification, and antimicrobial susceptibility testing using the Kirby–Bauer disk diffusion method.

RESULTS

This study comprised of 503 patients admitted under Surgical Oncology in Thanjavur Medical College, Thanjavur. They were followed and monitored from the date of Foley's catheter insertion to the appearance of symptoms. Urine samples were received and processed at the microbiology laboratory(Table 1).

Rate of CAUTI per 1000 urinary catheter days (UCD).
CAUTI rate : Number of CAUTIs / Number of Catheter days * 1000
8 / 4312 * 1000 = 2 CAUTI / 1000 UCD

Table 1: Monthly Catheterization and Infection Data

MONTH – YEAR	Total Catheterisation	Total Infection	Organism
JAN – 23	22	-	-
FEB – 23	23	-	-
MAR– 23	26	1 DAY-5	Pseudomonas
APRIL– 23	19	-	-
MAY– 23	24	-	-
JUNE– 23	26	-	-
JULY– 23	20	-	
AUGUST– 23	23	1 DAY-4	E.coli
SEPTEMBER– 23	30	-	-
OCTOBER– 23	27	-	-
NOVEMBER– 23	22	-	-
DECEMBER– 23	26	-	-
JAN – 24	24	6	E.coli -1 Day 3, Pseudomonas –Day 4 & Day 5, Staphylococcus – Day 4 & Day 6, Klebsiella – Day 4.
FEB– 24	23	-	-
MAR– 24	33	-	-
APRIL– 24	22	-	-
MAY– 24	28	-	-
JUNE– 24	30	-	-
JULY– 24	25	-	-
AUGUST– 24	27	-	-

Table 2: Incidence of Pathogens in CAUTI Cases

Organism	Total incidence
E.coli	2 (25%)
Staphylococcus	2 (25%)
Pseudomonas	3 (37.5%)
Klebsiella	1 (12.5%)

Table 3: Total Catheterizations and Infections

No of catheterization	503
No of infection	8

Prevalance of CAUTI :1.5 %.

DISCUSSION

Over 5 million patients in critical care hospital settings undergo urinary catheter insertion, putting them at an increased risk for CAUTI and its associated consequences.[14] Globally, the urinary catheter is recognized as the primary factor that increases the chances of developing UTIs. In the event that the catheter is not implanted aseptically, it may act as a portal of entry for the pathogen.[15,16] In this study, the CAUTI rate was calculated as 2 per 1000 urinary catheter days in 503 catheterized patients with 4310 catheter days, which is in accordance with other studies.[17,18] The overall magnitude of CAUTI in our study is 1.5%, which is similar to Verma S et al.[12] and Alam J et al.[19] Here, the reduced incidence of CAUTI is a result of strict adherence to infection control practices, proper hand hygiene, and the effective implementation of a catheter care bundle.

This study reported that the magnitude of CAUTI is directly proportional to the duration of catheterization, which is in agreement with other studies.[20–23] This implies that the best approach to decrease the occurrence of CAUTI is to only use indwelling catheters when absolutely necessary or, at the very least, to minimize the duration of catheterization.

E. coli plays a significant role in catheter-associated urinary tract infections (CAUTIs) due to its pili, which enable it to adhere to the urinary epithelium, resisting elimination by urine flow. Pseudomonas was the most frequently isolated pathogen in our study, followed by E. coli, with Enterococcus being the most common among Gram-positive cocci. These findings align with previous studies that also identified E. coli as the most prevalent pathogen.

One limitation of this study was the relatively small sample size, partly due to data collection during the COVID-19 period, which may have restricted patient availability. A larger sample could provide deeper insights into CAUTI trends and risk factors.

At our institution, the CAUTI rate was found to be 2 per 1,000 catheter days, with the duration of catheterization emerging as the primary risk factor. Predominantly Gram-negative pathogens were isolated, showing high susceptibility to aminoglycosides, carbapenem, and nitrofurantoin. For all patients with catheters, the focus should be on CAUTI prevention as a priority over post-infection treatment.

CONCLUSION

Surveillance allows the health system to estimate the burden of cases, associated risk factors, detecting outbreaks, as well as evaluating the role of preventive strategies and monitoring the quality of infection control practices.

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