E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/16.01.599

Research Article

A Study to Evaluate The Effectiveness of Catheter Associated Urinary Tract Infection (CAUTI) Care Bundle on Prevention of Infection Among Male Patients with Indwelling Catheter in Intensive Care Units at Hi-Tech Medical College & Hospital, Sundergarh, Odisha

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Received: 14.04.26, Revised: 16.05.26, Accepted: 19.06.26

ABSTRACT
Introduction: Catheter-Associated Urinary Tract Infection (CAUTI) is among the most frequent infections acquired in hospitals, particularly by patients in critical care units (ICUs). With prolonged catheterization. These infections often lead to increased patient morbidity, lengthier hospital stays, and added financial burden. Implementing evidence-based CAUTI care bundles has emerged as a preventive strategy to minimize these complications.
Methodology: The research group was created using a quasi-experimental post-test-only approach. The study included 200 male ICU patients with indwelling catheters 100 in the both the groups (Experimental & Control). The experimental group received a structured CAUTI care bundle intervention that included aseptic catheter insertion, daily perineal hygiene, monitoring catheter duration, and maintaining a closed drainage system. The control group was given conventional care on a regular basis. CAUTI incidence was evaluated using CDC/NHSN assessment criteria after seven days of catheterization.
Results: The post-test CAUTI rate was noticeably lower in the group that was experimental. With 16 patients (16%) testing positive and 84 (84%) testing negative. In contrast, the control group showed a higher infection rate, with 78 patients (78%) testing positive and only 22 (22%) negatives. Statistical comparison revealed a highly significant difference (Chi-square = 77.158, $p < 0.001$), 0.054 is the odds ratio (95% CI: 0.026– 0.110), indicating that the likelihood of CAUTI was approximately 18.5 times lower in the experimental group. Regarding microbial findings, 84% of participants in the experimental group had no organisms detected, while 6% had E. coli, 4% had Pseudomonas, and 3% each had Klebsiella and Proteus. In contrast, the control group showed high prevalence of organisms, with E. coli (38%), Klebsiella (26%), Pseudomonas (8%), and Proteus (6%), while only 22% had no organism identified. Among clinical and demographic variables, only the type of organism identified showed a significant association with CAUTI incidence ($p < 0.001$); other factors include age, marital status, and kind of catheter, perineal care frequency, and antibiotic administration were not significantly associated with infection outcomes.
Conclusion: The CAUTI care bundle intervention proved to be highly efficient in lowering the frequency of urinary tract infections linked to catheter use among male ICU patients. These findings underscore the importance of standardized, evidence-based nursing interventions and regular monitoring protocols in improving patient safety and clinical outcomes in critical care environments. By integrating such care bundles into routine daily practice, infection risk substantially decreases, enhancing overall care quality.

Keywords: Evaluate, Catheter Associated Urinary Tract Infection, CAUTI Care Bundle, Indwelling Catheter, Intensive Care Units.

INTRODUCTION

Catheter-associated urinary tract infection (CAUTI) is a major device-associated healthcare-associated infection (HAI) that develops when microorganisms enter the urinary tract through an indwelling urinary catheter. It is clinically important in intensive care units (ICUs), where urinary catheterization is frequently required for accurate urine-output monitoring, management of critically ill patients, perioperative care and bladder drainage. Internationally, approximately 15–25% of hospitalized patients receive short-term indwelling urinary catheters, and about 75% of

hospital-acquired urinary tract infections are catheter related.[1,2] The risk is closely linked with catheter duration; bacteriuria increases by about 3–10% for each catheter day and may approach 100% after 30 days of catheterization.[3] Prolonged catheterization, breaks in aseptic technique, disconnection of the closed drainage system, inadequate perineal hygiene and delayed catheter removal contribute to biofilm formation and infection.[4]

CAUTI is not merely a laboratory event; it can result in fever, cystitis, pyelonephritis, bacteremia, sepsis, antimicrobial exposure, longer ICU stay, additional cost and avoidable mortality. CDC/HICPAC estimates suggest that 17–69% of CAUTIs may be preventable through recommended infection-control measures.[3] The National Healthcare Safety Network (NHSN) recommends standardized CAUTI surveillance using the number of CAUTI events per 1,000 indwelling urinary-catheter days.[2] In India, standardized HAI surveillance has shown a substantial burden of urinary tract infections in ICUs, with 737 healthcare-associated UTIs reported from 89 ICUs across 26 tertiary hospitals, along with high antimicrobial resistance among uropathogens.[5] Therefore, CAUTI prevention is a key patient-safety priority in Indian critical-care settings. A CAUTI care bundle—covering appropriate indication, aseptic insertion, securement, unobstructed closed drainage, hand hygiene, perineal care, daily review and early catheter removal—offers a structured, evidence-based approach for reducing infection risk among catheterized male ICU patients. Such bundled practice also promotes nursing accountability, uniform documentation and early identification of infection-warning signs.

Need of the Study

The need for the present study arises from the continuing occurrence of preventable CAUTI despite the availability of international and national infection-prevention recommendations. Critically ill patients are particularly vulnerable because they often have severe underlying disease, impaired immunity, immobility, altered sensorium, multiple invasive devices and frequent exposure to broad-spectrum antibiotics. In low- and middle-income countries (LMICs), CAUTI rates are consistently higher than those reported by high-income surveillance systems; an International Society for Infectious Diseases review noted that INICC data showed CAUTI rates in LMICs decreasing from 8.9 to 2.91 per 1,000 urinary-catheter days but remaining above CDC/NHSN benchmarks.[6] The INICC 2015–2020 report, covering 630 ICUs in 45 countries, also highlighted longer hospitalization among CAUTI patients than patients without HAI, demonstrating the clinical and economic relevance of prevention.[7]

Indian data further justify local evaluation of preventive bundles. The Indian HAI surveillance network reported high HAI and antimicrobial-resistance rates in tertiary hospitals, including carbapenem resistance among Gram-negative urinary isolates, emphasizing the need for multimodal HAI prevention and antimicrobial-resistance containment strategies.[5] National IPC guidelines also emphasize HAI surveillance, education, care bundles, monitoring, audit and feedback as core components for safer healthcare facilities.[8] Evidence from a South Indian tertiary-care ICU showed that implementation of a catheter-care bundle reduced CAUTI incidence by nearly 60%, from 10.7 to 4.5 per 1,000 catheter days.[9] Similarly, an INICC multidimensional infection-control strategy in adult ICUs of developing countries reduced CAUTI rates from 7.86 to 4.95 per 1,000 urinary-catheter days, a 37% reduction.[10] However, published evidence specific to male catheterized ICU patients in Odisha is limited. Hence, evaluating a CAUTI care bundle at Hi-Tech Medical College & Hospital, Sundergarh district, Odisha, is necessary to generate setting-specific evidence on infection prevention, compare experimental and control posttest rates and identify demographic or clinical variables associated with CAUTI.

Objectives of the Study

1. To assess the posttest rates of CAUTI among Catheterized male patients admitted in ICU both in experimental and control group
2. To compare the posttest rate of CAUTI between experimental and control group
3. To associate the posttest rate of CAUTI with the selected demographic and clinical variables in both experimental and control group

Hypotheses

- RH_1: There will be significant difference in the Posttest rate of CAUTI among experimental and control group

- RH2: There will be significant association between post-test rates of CAUTI in experimental group with their selected demographical variables
- RH3: There will be significant association between post-test rates of CAUTI in Control group with their selected demographical variables
- RH4: There will be significant association between post-test rates of CAUTI in experimental group with their selected clinical variables
- RH5: There will be significant association between post-test rates of CAUTI in Control group with their selected clinical variables

METHODOLOGY

Given the goals of the study and the nature of the research topic, a quantitative research approach was used. The Posttest-Only Control Group Design is a type of true experimental research where participants are randomly assigned to either the experimental or control group without conducting a pretest. The Independent variable in the present study is CAUTI Bundle Care. Dependent variable in the present study is Catheter Associated Urinary tract infection. Age, Marital Status, Educational Qualification, Religion, Occupation, Monthly Income, Type of Family, Place of Residence are the demographic variables and Primary Diagnosis/Reason for ICU Admission, Type of catheter Used, Frequency of Perineal Care Practice, Antibiotic Administered, Organism Identified are the clinical variables. 200 (experimental Group-100, and control Group-100) Patient admitted in critical care units who fulfil the inclusion criteria, where selected from Hi-Tech medical college & Hospital, Rourkela, Odisha through simple random sampling method. The data collection by NHSN Urinary Tract Infection Assessment Criteria, and HICPAC /CDC CAUTI Prevention Care Bundle Checklist. Data collection was carried out over a period from 1st Jan 2025 to 31st May 2025. A total of 200 Catheterized male patient in ICU were assessed using National Health care Safety Network (NHSN) Urinary tract Infection Assessment Criteria.

RESULTS

Table No. 1: Frequency and Percentage Distribution of Demographic Variable in Experimental and Control Group

Demographic Variables		Experimental (n=100)		Control (n=100)	
		Freq (f)	Percent (%)	Freq (f)	Percent (%)
Age in years	18-30	23	23	33	33
	31-45	25	25	30	30
	46-60	32	32	15	15
	Above 60	20	20	22	22
Marital Status	Unmarried	30	30	29	29
	Married	24	24	22	22
	Widowed	22	22	20	20
	Divorced	24	24	29	29
Educational Qualification	Illiterate	18	18	15	15
	Primary School	19	19	27	27
	Secondary School	18	18	27	27
	Higher Secondary	17	17	19	19
	Graduate & above	28	28	12	12
Religion	Hindu	36	36	36	36
	Christian	31	31	36	36
	Muslim	33	33	28	28
Occupation	Unemployed	22	22	10	10
	Daily Wage Worker	14	14	18	18
	Farmer	14	14	13	13
	Government Employee	15	15	19	19
	Private Sector	21	21	19	19
	Retired	14	14	21	21

Monthly Income (in Rs)	Less than 10,000	29	29	22	22
	10,001-20,000	25	25	25	25
	20,001-30,000	24	24	25	25
	Above 30,000	22	22	28	28
Family Type	Nuclear	33	33	42	42
	Joint	31	31	33	33
	Extended	36	36	25	25
Place of Residence	Rural	30	30	37	37
	Semi-Urban	39	39	25	25
	Urban	31	31	38	38

The table no. 1 show the demographic characteristics of samples. Majority 32 (32%) of the participants in the experimental group belonged to the age group of 46–60 years, Majority 30 (30%) of the participants were unmarried, Majority 28 (28%) of the participants were graduates and above, Majority 33 (33%) of the participants were Muslims, Majority 22 (22%) of the participants were unemployed, Majority 29 (29%) of the participants had monthly income less than ₹10,000, Majority 36 (36%) of the participants belonged to extended families, Majority 39 (39%) of the participants resided in semi-urban areas in experimental gropu.

In control group majority 33 (33%) of the participants were in the age group of 18– 30 years, Majority 29 (29%) were both unmarried and divorced, 27 (27%) participants had studied up to primary and secondary school levels, Majority 36 (36%) participants were both Hindus and Christians, Majority 21 (21%) participants were retired, Majority 28 (28%) participants had income above ₹30,000, Majority 42 (42%) participants were from nuclear families, Majority 38 (38%) participants resided in urban areas.

Table No. 2: Frequency and Percentage Distribution of Post Rate of CAUTI in Experimental Group

Group	Posttest Rates of CAUTI			
	Positive		Negative	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Experimental	16	16	84	84

Table: 2 presents the frequency and percentage distribution of Posttest Rate of CAUTI within the experimental group, which comprised 100 participants. The results indicate that a minority of the experimental group developed a CAUTI, 16 participants (16%) tested positive for CAUTI in urine culture, while the majority, 84 participants (84%), had a negative for CAUTI in urine culture. This suggests that in the experimental group, the incidence of CAUTI was relatively low.

Table no. 3: Frequency and Percentage Distribution of Post Rate of Cauti in Control Group

Group	Posttest Rates of CAUTI			
	Positive		Negative	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Control	78	78	22	22

Table 3 presents the frequency and percentage distribution of Posttest Rate of CAUTI within the control group, which also consisted of 100 participants out of which 78 participants (78%) tested positive for CAUTI in urine culture, while only 22 participants (22%) had a negative for CAUTI in urine culture. This indicates a high incidence of CAUTI in the control group.

Table No. 4: Comparison of Posttest Rates of Urinary Tract Infection among Experimental and Control Group

Group	Posttest Rate of CAUTI		Chi Square	P-Value	Odds Ratio	Lower Limit	Upper Limit
	Negative	Positive					
Experimental	84	16					

(n=100)			77.158	<0.001	0.054	0.026	0.110
Control (n=100)	22	78					

Table 4 shows the comparison of Posttest Rates of CAUTI results between the control and experimental groups after intervention revealed a highly statistically significant difference. The Chi-Square tests (Pearson $\chi 2$ = 77.158, df = 1, $p < 0.001$; Fisher's Exact Test $p < 0.001$) confirm a strong association between the group. (Experimental vs. Control) and the post-UTI outcome. The observed counts clearly show that the control group had a much higher incidence of positive result of CAUTI (78 out of 100, or 78%) compared to the experimental group (16 out of 100, or 16%). Furthermore, the Odds Ratio of 0.054 indicates that the odds of developing a CAUTI in the experimental group are significantly lower (approximately 18.5 times lower, or 1/0.054) than in the control group. This strongly suggests that the intervention implemented in the experimental group was highly effective in reducing the rates of CAUTI.

DISCUSSION

The present study revealed a marked difference in the posttest rate of CAUTI between the experimental and control groups. In the experimental group, only 16% of catheterized male ICU patients developed CAUTI, whereas 78% of patients in the control group developed CAUTI. The chi-square value of 77.158 with $p<0.001$ indicated a highly significant difference between the groups. The odds ratio of 0.054 further showed that patients who received the CAUTI care bundle had substantially lower odds of developing infection than those who received routine catheter care. Thus, the findings strongly support the effectiveness of structured CAUTI bundle care in preventing infection among male patients with indwelling urinary catheters in ICUs.

The present findings are consistent with Soundaram et al., who reported that implementation of a catheter care bundle in intensive care units of a tertiary care teaching hospital in South India reduced CAUTI incidence by nearly 60%, from 10.7 to 4.5 per 1,000 catheter days [11]. Similarly, Prakash et al. observed that the care bundle approach significantly reduced device-associated infections, including CAUTI, from 4.86 to 2.36 per 1,000 urinary catheter days during the post-implementation phase [12]. These findings support the present study, where systematic catheter maintenance, aseptic handling, closed drainage, perineal care and daily review may have contributed to a lower CAUTI rate in the experimental group.

The results are also comparable with Rosenthal et al., who demonstrated that a multidimensional infection-control strategy in adult ICUs of developing countries reduced CAUTI rates from 7.86 to 4.95 per 1,000 catheter days [13]. Van Decker et al. also reported that bundled CAUTI-prevention tools in critical care units were effective in reducing catheter-associated infections through standardization of practice, nursing participation and continuous monitoring [14]. Overall, the present study confirms that CAUTI bundle care is an effective evidence-based nursing intervention for reducing infection among catheterized ICU patients.

CONCLUSION

The present study concluded that the CAUTI care bundle was highly effective in preventing catheter-associated urinary tract infection among male patients with indwelling urinary catheters admitted in intensive care units. The findings showed that only 16% of patients in the experimental group developed CAUTI, whereas 78% of patients in the control group developed CAUTI. This clearly indicates that patients who received structured CAUTI bundle care had a much lower infection rate compared with those who received routine catheter care. The statistically significant chi-square value of 77.158 with $p<0.001$ confirmed that the difference between the experimental and control groups was highly significant. The odds ratio of 0.054 further indicated that the CAUTI care bundle greatly reduced the risk of infection among catheterized ICU patients. The bundle practices such as hand hygiene, aseptic catheter handling, maintenance of closed drainage system, regular perineal care, unobstructed urine flow, proper catheter securement, daily catheter assessment and timely removal were important contributors to infection prevention.

Hence, the study supports the implementation of CAUTI care bundle as an evidence-based nursing intervention in intensive care units. Regular training, monitoring, documentation

and compliance audits are recommended to sustain the reduction of CAUTI and improve patient safety.

Recommendations

- Expand the Scope of Future Research with Larger Sample Sizes: A similar study should be meticulously designed and carried out with a significantly larger sample size.
- Deepen the Exploration of Key Associations: Additional research should be specifically designed to explore these key associations, potentially employing mixed-methods approaches to uncover underlying mechanisms and contributing factors.
- Evaluate the Long-Term Impact of the CAUTI Care Bundle: Future studies should be specifically designed to longitudinally evaluate the sustained impact and long-term effectiveness of the CAUTI Care Bundle.
- Conduct Comparable Research Across Diverse Healthcare Settings: To ascertain the broader applicability of the CAUTI care bundle, comparable research should be conducted using the same type of patient population
- Investigate Contextual Differences across Regions and Socio-Cultural Backgrounds: A comparative investigation on the same topic can be performed by selecting participants from various regions and diverse socio- cultural backgrounds.

Conflict of Interest: The authors certify that they have no involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this paper.

Funding Source: There is no funding Source for this study"

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