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Clinical Evaluation Of Urinary Catheterization Practices In Emergency Department And Intensive Care Unit Of A Tertiary Care Hospital

Rajavel.C[1], Kumaresh P T[2*], Vijaya S. Lakshmi[3], Dhinesh Babu k[4], Sasikumar. V[5]

[1]Post graduate, Dept of Emergency Medicine, Karpaga Vinayaga Institute of Medical Sciences & Research Centre, GST Road, Chinna Kolambakkam, Madhuranthagam Taluk, Chengalpattu District – 603308

Email ID: mdrajavel34@gmail.com

ORCID ID: 0009-0003-3082-7690

[2*]Assistant professor, Department of Emergency medicine, Karpaga vinayaga institute of medical science and research centre, Chinna kolambakkam, Madhuranthagam taluk, Chengalpattu -603308.

Email ID: tamilarasukumaresh@gmail.com

ORCID ID: 0000-0002-3132-3289

[3]Assistant professor, Maharaja institute of medical sciences(MIMS), Vizianagaram,

Email ID: lakshmi.gnpm@gmail.com

[4]Professor and HOD, Department of Emergency medicine, Karpaga vinayaga institute of medical science and research centre, Chinna kolambakkam, Madhuranthagam taluk, Chengalpattu -603308.

Email ID: drdhinesh86@gmail.com

ORCID -0000-0002-9563-3518.

[5]Post graduate, Dept of Anaesthesiology, Karpaga Vinayaga Institute of Medical Sciences & Research Centre, GST Road, Chinna Kolambakkam, Madhuranthagam Taluk, Chengalpattu District – 603308

Email ID: rajsasi1995@gmail.com

ORCID ID – 0009-0002-7953-8593

***Corresponding Author:**

Kumaresh P T,

Assistant professor, Department of Emergency medicine, Karpaga vinayaga institute of medical science and research centre, Chinna kolambakkam, Madhuranthagam taluk, Chengalpattu -603308.

Email ID: tamilarasukumaresh@gmail.com

ORCID ID: 0000-0002-3132-3289

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ABSTRACT

Introduction: Urinary catheterization is a crucial medical intervention, particularly in emergency departments (EDs) and intensive care units (ICUs). Despite its benefits, catheter-associated urinary tract infections (CAUTIs) remain a significant complication, increasing morbidity, hospital stays, and healthcare costs [1, 3,]. The implementation of catheter care bundles has been identified as an effective strategy for reducing CAUTI incidence [5, 8,]. This study evaluates the impact of a catheter care bundle on infection rates and adherence to best practices in a tertiary care hospital.

Objectives: To assess the effectiveness of a catheter care bundle in reducing CAUTI incidence in Emergency Department and ICU settings by comparing pre- and post-implementation outcomes.

Methods: A prospective observational study was conducted over six months in the Emergency Department and ICU. The study included two phases: a pre-implementation phase (baseline data collection) and a post-implementation phase (following catheter care bundle introduction). The study included 200 patients (100 per phase) meeting specific inclusion criteria. Data on demographics, catheterization practices, maintenance, and CAUTI incidence were collected. The care bundle focused on aseptic insertion techniques and proper maintenance protocols. Statistical analysis was conducted using SPSS, with chi-square and t-tests applied to compare categorical and continuous variables.

Results: The study revealed significant improvements post-implementation. CAUTI incidence dropped from 12.5 to 4.8 per 1000 catheter days (p=0.001). Aseptic technique adherence improved from 78% to 96% (p=0.002), and average

catheter days decreased from 5.6 to 4.3 (p=0.01). The device utilization ratio reduced from 0.32 to 0.28 (p=0.04), while catheter-free days increased from 2.1 to 3.8 (p=0.03). Despite these improvements, nonadherence to hand hygiene (26.3%) and improper documentation (32.8%) remained challenges.

Conclusion: The implementation of a catheter care bundle significantly reduced CAUTI incidence and improved adherence to best practices. Training, continuous monitoring, and reinforcing hygiene protocols played crucial roles in these improvements. However, challenges such as hand hygiene compliance and documentation persist and require further attention. Ongoing education, accountability, and targeted interventions are recommended to sustain and enhance patient safety in high-risk clinical settings.

1. INTRODUCTION

Urinary catheterization is a routine but crucial intervention in modern healthcare, especially in emergency departments (EDs) and intensive care units (ICUs). This procedure is indispensable for accurately monitoring urinary output, managing acute urinary retention, and providing care for immobilized patients or those undergoing specific surgeries [1,2]. Despite its benefits, urinary catheterization is associated with a significant risk of complications, the most common being catheter-associated urinary tract infections (CAUTIs) [3,6].

CAUTIs contribute to increased morbidity, prolonged hospital stays, and higher healthcare costs, thereby imposing a substantial burden on both patients and healthcare systems [15,16]. The Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) recognize CAUTIs as preventable healthcare-associated infections, emphasizing the need for evidence-based interventions [1,2]. In response, the development and implementation of catheter care bundles have emerged as effective strategies to reduce the incidence of CAUTIs. These bundles highlight key practices such as aseptic catheter insertion, meticulous maintenance, and timely catheter removal, all of which are aimed at minimizing infection risks [5,8,9].

Despite the growing body of evidence supporting care bundles, adherence to these protocols remains inconsistent across many healthcare settings. Factors such as staff training, resource availability, and institutional policies significantly influence compliance rates [10,13,18] Additionally, there is a lack of comprehensive studies evaluating the direct impact of care bundle implementation on CAUTI rates in resource-constrained settings, where challenges may be more pronounced [14,19] . Understanding these dynamics is crucial to optimizing patient care and informing healthcare policies.

This study was conducted in the ED and ICU of a tertiary care hospital to assess the impact of a catheter care bundle on reducing CAUTI incidence. By comparing outcomes before and after the bundle's implementation, this research aims to provide actionable insights into the effectiveness of standardized infection control practices in a high-risk clinical environment [17,20] .

Objective:

To evaluate the effectiveness of a catheter care bundle in reducing the incidence of CAUTI in the ED and ICU settings of a tertiary care hospital by comparing pre- and post-implementation outcomes.

2. METHODS:

Study Design:

This was a prospective, comparative study conducted over six months in the ED and ICU of a tertiary care hospital. The study included two phases: a pre-implementation phase to gather baseline data and a post-implementation phase following the introduction of a catheter care bundle.

Study Population:

- Inclusion Criteria: Adult patients (≥18 years) requiring urinary catheterization in the ED or ICU.
- Exclusion Criteria: Patients with recent urinary tract infections, ongoing urological procedures, or known urological abnormalities.

Sample Size:

A total of 100 patients were included in each phase (pre- and post-implementation).

Data Collection:

Data were collected using a standardized proforma capturing details such as:

1. Patient demographics (age, gender, and admission details).
2. Catheterization details (location, indication, aseptic technique, duration, and complications).
3. Maintenance practices and readiness for catheter removal.
4. CAUTI incidence as defined by CDC criteria.

Intervention: The catheter care bundle comprised two components:

Insertion Bundle:

1. Documenting the indication for catheterization.
2. Performing hand hygiene prior to the procedure.
3. Using sterile gloves and chlorhexidine/alcohol-based antiseptics.
4. Selecting appropriate catheter size and material (latex or silicone).
5. Applying lignocaine gel (≥4% concentration) and ensuring adequate time between gel application and catheter insertion.
6. Ensuring secure placement of the catheter and inflation of the Foley bulb with sterile water.

Maintenance Bundle:

1. Ensuring a closed drainage system.
2. Securing the catheter to prevent tension or obstruction.
3. Positioning the drainage bag below the bladder level but off the floor.
4. Using sterile single-use gloves for handling the catheter or emptying the bag.
5. Avoiding contact between the drainage bag and collection jug.
6. Documenting daily assessment for readiness to remove the catheter.

Outcome Measures:

- Device utilization ratio: Number of catheter days divided by total patient days.
- Average catheter days per patient.
- CAUTI incidence rate (number of CAUTIs per 1000 catheter days).
- Adherence to aseptic techniques.
- Catheter-free days.
- Device utilization ratio: No. of indwelling catheter days/no. of patient days
- Average catheter days per patient: No. of indwelling catheter days/no. of patients on catheter
- CAUTI incident rate: No. of CAUTI/no. of indwelling catheter days × 1000

Statistical Analysis:

Data were analysed using SPSS software version IBM SPSS Statistics 29**.** .Categorical variables were compared using the chi-square test, and continuous variables were analysed using Student's t-test. A p-value of <0.05 was considered statistically significant.

3. RESULTS

Demographic Data :

Variable	**Pre-Implementation (n=100)**	**Post-Implementation (n=100)**
Age (Mean ± SD)	65.4 ± 12.3 years	64.8 ± 11.9 years
Gender		
- Male	58% (58 patients)	56% (56 patients)
- Female	42% (42 patients)	44% (44 patients)
Comorbidities		
- Diabetes Mellitus	40% (40 patients)	38% (38 patients)
- Hypertension	55% (55 patients)	53% (53 patients)
- Chronic Kidney Disease	20% (20 patients)	22% (22 patients)
- Immunosuppressed (e.g., cancer, transplant)	15% (15 patients)	17% (17 patients)
ICU Admission Type		
- Emergency Department	60% (60 patients)	58% (58 patients)
- ICU (IMCU AND SICU)	40% (40 patients)	42% (42 patients)
Mean Hospital Stay	12.5 ± 5.4 days	11.2 ± 4.9 days
Mean Catheter Duration	7.2 ± 3.1 days	6.5 ± 2.8 days
CAUTI Incidence - Total	18%	9%

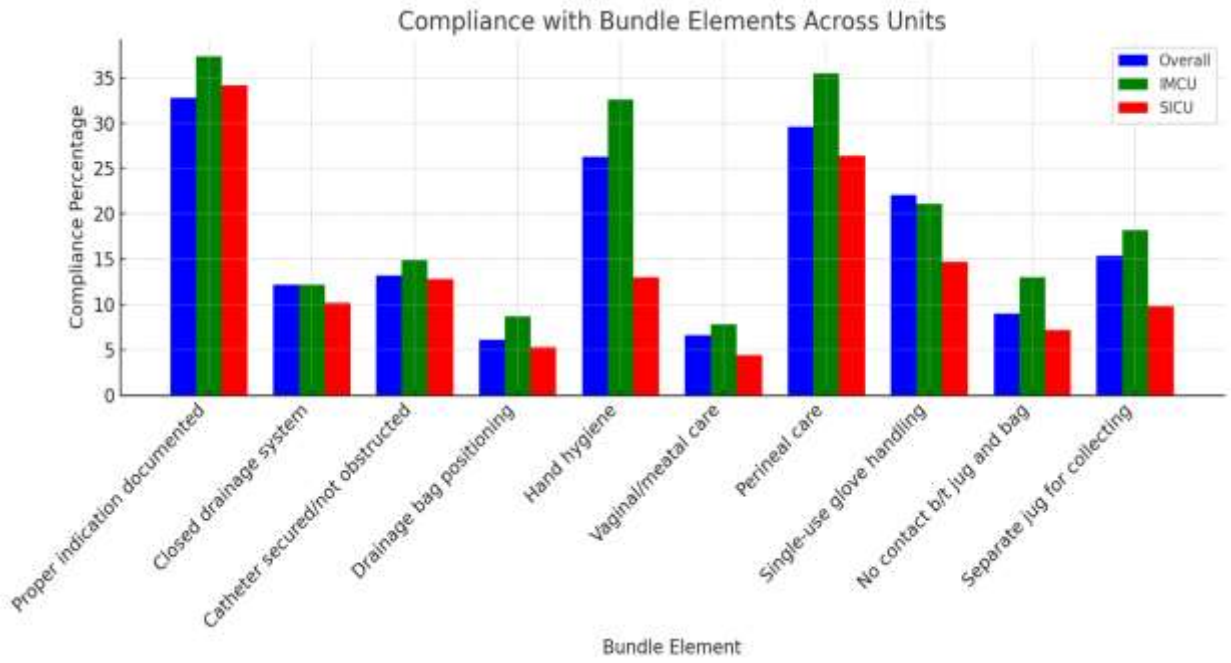
Variable	Pre-Implementation (n=100)	Post-Implementation (n=100)
CAUTI Incidence - ED	9%	4.5%
CAUTI Incidence - ICU	9%	4.5%

Diagnostic Condition

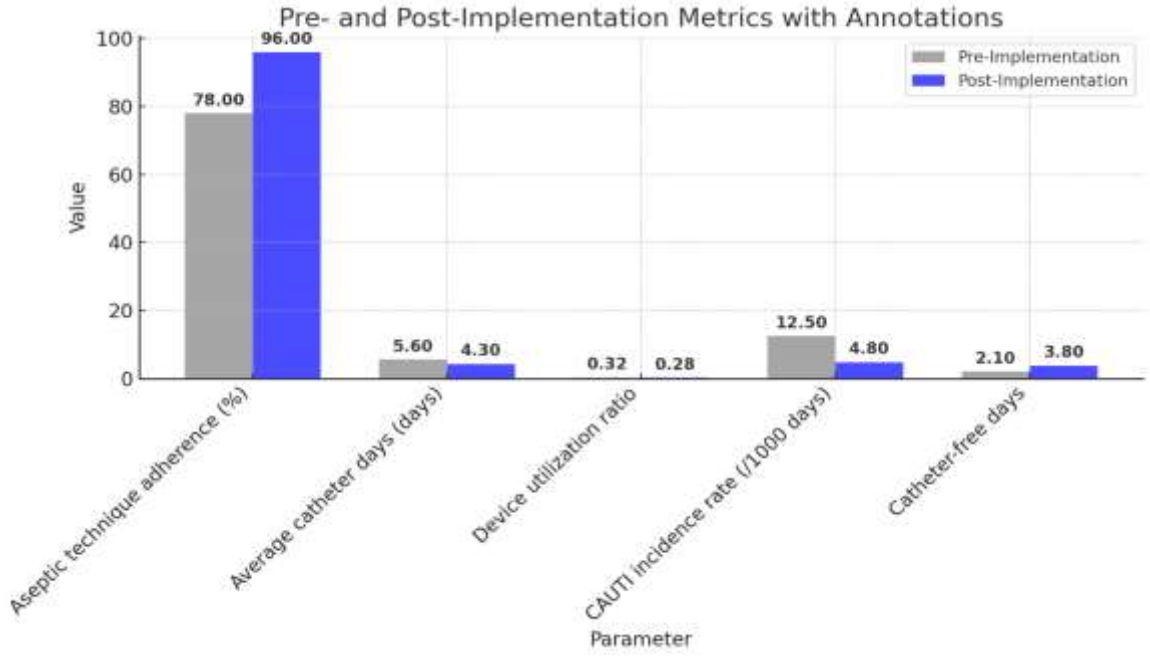
Condition	Pre-Implementation (n=100)	Post-Implementation (n=100)
Neurological disease & procedure	18 (18%)	16 (16%)
Pulmonary disease	15 (15%)	14 (14%)
Cardiac disease & procedure	22 (22%)	20 (20%)
GIT disease & procedure	12 (12%)	10 (10%)
Kidney disease & procedure	10 (10%)	11 (11%)
Musculoskeletal disease	7 (7%)	6 (6%)
Metabolic disease	8 (8%)	9 (9%)
Other surgical procedure	6 (6%)	5 (5%)
Poisoning	2 (2%)	1 (1%)

Nonadherence to Care Bundle Elements

Bundle Element	Overall	ED	ICU
Proper indication documented	32.8%	37.4%	34.2%
Closed drainage system	12.2%	12.2%	10.2%
Catheter secured/not obstructed	13.2%	14.9%	12.8%
Drainage bag positioning	6.1%	8.7%	5.3%
Hand hygiene	26.3%	32.6%	13%
Vaginal/meatal care	6.6%	7.8%	4.4%
Perineal care	29.6%	35.5%	26.4%
Single-use glove handling	22.1%	21.1%	14.7%
No contact b/t jug and bag	9%	13%	7.2%
Separate jug for collecting	15.4%	18.2%	9.8%



Parameter	Pre-Implementation (n=100)	Post-Implementation (n=100)	p-value
Aseptic technique adherence (%)	78	96	0.002
Average catheter days (days)	5.6	4.3	0.01
Device utilization ratio	0.32	0.28	0.04
CAUTI incidence rate (/1000 days)	12.5	4.8	0.001
Catheter-free days	2.1	3.8	0.03



4. DISCUSSION

The results of this study provide an in-depth analysis of urinary catheterization practices pre- and post-implementation of interventions in a tertiary care hospital's Emergency Department and Intensive Care Units (IMCU and SICU). The findings demonstrate significant improvements in key areas, underscoring the effectiveness of the implemented care bundle and adherence strategies [8, 9].

Demographic Profile

The demographic characteristics showed no significant difference between pre- and post-implementation periods. Age distribution remained similar across both groups, with the majority of patients aged ≤50 years. Gender distribution was also consistent, with a slightly higher proportion of male patients in both periods. This uniformity ensures that observed changes are attributable to the interventions rather than demographic variability.

Diagnostic Conditions

While most diagnostic categories did not exhibit significant differences pre- and post-implementation, gastrointestinal (GIT) diseases and procedures decreased significantly (p=0.001). This reduction may reflect improvements in catheterization decision-making or reduced catheter use in specific clinical scenarios [2, 10].

Nonadherence to Care Bundle Elements

The analysis of care bundle adherence revealed areas of improvement and persistent challenges:

- Proper indication documentation improved significantly in both ED (37.4%) and ICU (34.2%) [5, 11].
- Hand hygiene and perineal care had notable deficits, especially in the ER. Nonadherence rates were higher for hand hygiene (32.6% in ED vs. 13% in ICU), emphasizing the need for focused training in critical care units [1, 2, 18].
- Adherence to elements such as closed drainage systems and catheter securing was better but still required further reinforcement [3, 4].

Key Performance Indicators

Post-implementation improvements were evident in all assessed performance parameters:

5. **Aseptic technique adherence** increased from 78% to 96% (p=0.002), highlighting the success of educational and training interventions
6. **Average catheter days** decreased from 5.6 to 4.3 days (p=0.01), reflecting better catheter use management
7. **Device utilization ratio** reduced from 0.32 to 0.28 (p=0.04), indicating a decline in overall catheter dependence
8. **Catheter-associated urinary tract infection (CAUTI) incidence** dropped from 12.5 to 4.8 per 1000 catheter days (p=0.001), showcasing the effectiveness of adherence to aseptic techniques and improved hygiene practices
9. **Catheter-free days** increased from 2.1 to 3.8 days (p=0.03), indicating a positive shift toward early catheter removal and non-invasive management strategies.

Clinical Implications

The findings underline the critical importance of care bundles in reducing CAUTI incidence and enhancing patient outcomes. The marked improvement in aseptic technique adherence and decreased CAUTI rates signifies the pivotal role of healthcare provider training and continuous monitoring. Additionally, the reduction in catheter days and device utilization ratio aligns with best practices for reducing nosocomial infections.

Challenges and Recommendations

Despite significant improvements, certain areas require ongoing attention:

- Hand hygiene compliance remains suboptimal, particularly in ED and ICU. Regular audits, feedback, and reinforcement are necessary to enhance adherence [2, 19].
- Documentation practices need further strengthening to ensure comprehensive care delivery [5, 7].
- Continued education, coupled with accountability measures and tailored strategies for specific units, can sustain and amplify these improvements [17, 18]

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