Original Article

Do We Perform Urinary Catheterization With Appropriate Indications in Emergency Departments? What's After All Happening?

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ABSTRACT

Objective: Urinary catheterization (UC) is a frequently utilized intervention in emergency departments (EDs) for bladder drainage, monitoring urinary output in critically ill patients, and facilitating patient care. The literature highlights that a significant proportion of UC applications are performed with inappropriate indications, with complication rates reaching up to 60%. Complications such as hematuria, urethral stricture, pyelonephritis, and catheter-associated urinary tract infections (CAUTI) pose substantial health concerns. This study examines the compliance of UC applications in EDs with Centers for Disease Control and Prevention (CDC) criteria, the complication rates, and the factors contributing to these complications.

Materials and Methods: This prospective observational study was conducted in a tertiary ED between September 1, 2019, and November 30, 2019. A total of 411 patients aged 18 and above who underwent UC were included. Patients' demographic characteristics, comorbidities, indication compliance, and complications were recorded using a three-stage form. Appropriate and inappropriate indications were determined according to CDC criteria, and early and late complications were analyzed in detail.

Results: Of all UC applications, 61.3% were performed with appropriate indications, while 38.7% were conducted with inappropriate indications. Among appropriate indications, the most common reason was the need for critical care, whereas the most frequent inappropriate indication was the application to patients capable of collecting urine independently. Complications occurring within the first 24 hours were categorized as early complications, affecting 20.2% of patients. Late complications were observed in 24.9% of cases, with CAUTI identified as the infectious complication in 7.6% and non-infectious complications in 17.3% of cases.

Conclusion: Approximately 40% of UC applications in the ED were performed with inappropriate indications. Such inappropriate indications do not reduce complication rates; instead, they negatively impact patient safety and healthcare costs. Therefore, implementing educational programs, standardized protocols, and electronic alert systems for UC applications is recommended. These measures could enhance the quality of healthcare services by reducing complications and the rate of inappropriate UC use.

Keywords: CAUTI, complications, emergency department, urinary catheterization

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INTRODUCTION

Urinary catheterization (UC) is a commonly performed interventional procedure in emergency departments (EDs) to ensure bladder drainage, monitor urine output in critically ill patients, and facilitate patient care [1, 2]. Research indicates that Foley catheters are placed in approximately 23% of ED patients, with this rate rising to 30–36% among the geriatric population [1–3]. The easy applicability of the procedure, its low cost and the convenience it provides in terms of healthcare personnel are the main factors that popularize UI applications [4,5].

However, a significant proportion of UC procedures are conducted without appropriate indications, with studies reporting this rate to be as high as 50% among hospitalized patients [6–9]. Improper use of UC can lead to undesirable complications, with reported complication rates nearing 60% in the literature [10]. These complications include traumatic injuries such as hematuria, urethral strictures, urethral and bladder rupture, and rectal perforation, as well as infectious complications including pyelonephritis, prostatitis, epididymitis, orchitis, cystitis, and urinary tract infections (UTIs) [10–12].

According to the Centers for Disease Control and Prevention (CDC) guidelines, UTIs are among the five most common types of healthcare-associated infections. Catheter-associated UTIs account for over 10% of infections reported in healthcare settings [13]. Studies have shown that one-third of hospital-acquired infections are UTIs, with a substantial proportion attributed to catheterization procedures [14]. Such infections can result in severe complications, including bacteremia and sepsis, prolong hospital stays, increase healthcare costs, and elevate mortality rates [2,11,15–17]. Consequently, the incidence of catheter-related infections is regarded as an important indicator of healthcare quality [18].

Emergency departments represent a critical setting where decisions regarding UC are frequently made. Ensuring adherence to appropriate indications and standardized procedures is essential to minimize associated complications. Nevertheless, existing literature predominantly focuses on UC complications in hospitalized patients or those in intensive care units, with limited research addressing this issue in EDs. This study aims to evaluate the compliance of UC procedures with CDC guidelines, identify complications arising during and after the procedure, and investigate underlying factors contributing to these complications in a tertiary-level ED.

MATERIALS AND METHODS

This study was designed as a prospective observational study conducted between September 1, 2019, and November 30, 2019, at a tertiary emergency department. Ethics committee approval was obtained on August 28, 2019, under decision number 1937. The study was conducted in accordance with the Declaration of Helsinki. An AI-based language support tool, "ChatGPT," provided by OpenAI, was used to assist in improving the linguistic quality of this manuscript. The tool was employed solely for language editing purposes, and all intellectual content, analyses, and conclusions remain the responsibility of the authors.

Study Design

All patients presenting to the ED for any reason and undergoing UC as decided by the treating emergency physician were included in the study, provided they met the inclusion criteria and did not meet any exclusion criteria. The study protocol did not involve additional interventions, examinations, or treatments outside routine patient care.

Data related to UIC procedures were recorded using a structured study form comprising three sections:

1. Demographic and Clinical Data:

o   Patient demographics

o   Comorbidities

o   Medications

o   History of urogenital surgeries

o   Information about the healthcare personnel performing the UC

2. Procedure-Related Data:

o   Indications for UC, categorized as appropriate or inappropriate according to CDC criteria[13]

o   Early complications occurring during or within 24 hours post-procedure

o   Challenges encountered before or during the procedure

o   Characteristics of the catheter used

o   Patient discharge status from the emergency department

If patients had multiple indications for UC, they were categorized under "appropriate indications" if at least one appropriate indication was present.

3. Follow-Up Data:

o   Late-term complications (1–30 days post-procedure)

o   Data collected via the hospital information management system or by contacting patients or their relatives.

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Inclusion Criteria:

- Patients undergoing UC in the ED

- Patients aged 18 years and older

- Patients providing consent to participate in the study

Exclusion Criteria:

- Patients under 18 years of age

- Pregnant women

- Patients refusing to participate

- Patients whose data were inaccessible

- Patients undergoing prolonged intermittent catheterization

- Patients who underwent UC at another center on the same day

- Patients voluntarily withdrawing from the study

Additionally, patients requiring repeated UC during hospitalization inwards or intensive care units after their ED visit were excluded from the evaluation of late-term complications.

CDC Criteria for UC Indications[13]

Appropriate Indications:

- Acute urinary retention (glob vesicale)

- Prolonged immobilization due to trauma

- Atraumatic hematuria

- Palliative care

- Catheter exchange in patients with existing UC

- Critically ill patients requiring urine output monitoring (e.g., acute kidney injury, decompensated heart failure) when self-collection of urine is not feasible
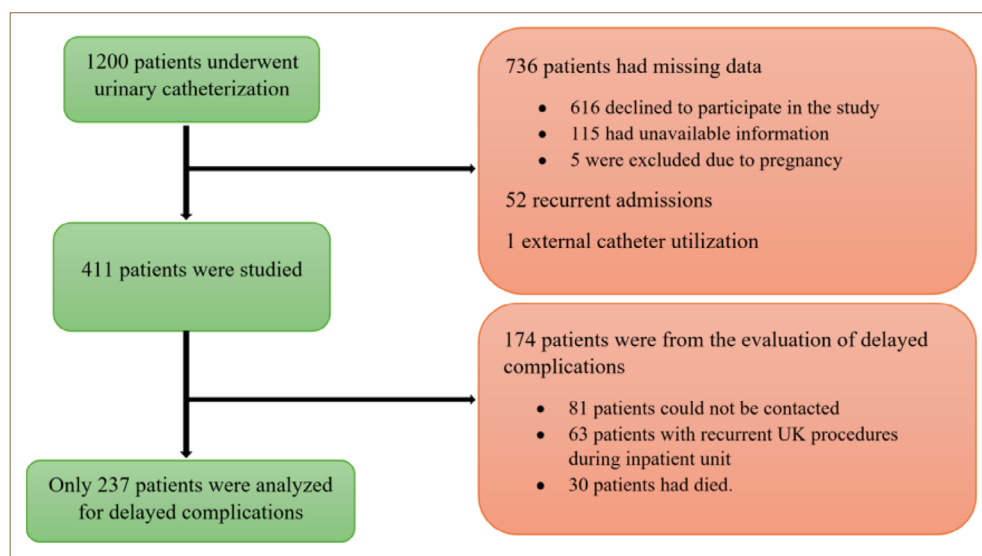
Inappropriate Indications:

- Urinary incontinence (e.g., neurogenic bladder)

- Urine sample collection (e.g., for urinalysis or culture)

- Monitoring urine output in patients capable of self-collection

Statistical Analysis

Statistical analyses were conducted using SPSS 15.0 (Statistical Package for the Social Sciences) software (Armonk, New York: IBM Corp.). Descriptive data were reported as mean±standard deviation or median (IQR) values. Normality of continuous data distribution was assessed before comparison. The Mann-Whitney test was employed for comparing continuous variables between groups, while chi-square and Fisher's exact tests were used for categorical and quantitative data analysis. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 411 patients who underwent UC in the ED were included in the study (Fig. 1). The mean age of the patients was 68.8±15.5 years, and 51.3% were male. Of these patients, 238 (57.9%) were discharged from the ED, 74 (18%) were admitted to intensive care units, and 6 patients (1.5%) died in the ED.

Figure 1. Flow chart.

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Among the 411 UC procedures, 252 (61.3%) were performed with appropriate indications, while 159 (38.7%) were determined to have been performed for inappropriate indications. The most common appropriate indication was the inability of critically ill patients to collect urine independently. Conversely, the most frequent inappropriate indication was catheterization despite the patient's ability to self-collect urine (Table 1).

There were no statistically significant differences in age, gender, or complication rates between patients who underwent UC with or without appropriate indications (p>0.05) (Table 2).

Early complications occurring within the first 24 hours of UC application were categorized into those occurring during or after the procedure. The most frequent complication during the procedure was hematuria, observed in 4.1% of cases, while the most common early complication after the procedure was pain, reported in 12.7% of patients. Late complications, defined as those occurring within 1 to 30 days after UC, most commonly included persistent pain and a burning sensation during urination, each affecting 15.6% of patients (Table 3).

Factors influencing early complications were assessed using univariate and multivariate analyses. Male gender (OR: 1.93; 95% CI: 1.02–3.67; p=0.02), catheter size (p=0.01), and the

Table 1. Causes of urinary catheter application

Indications*	n	%
Appropriate Indications		
Critically ill patients unable to self-collect urine	140	34.1
Acute urinary retention (glob vesicale)	48	11.7
Palliative care needs	37	9.0
Prolonged immobilization due to trauma	17	4.1
Atraumatic hematuria	14	3.4
Catheter replacement	14	3.4
Total	252	61.3
Inappropriate Indications		
Critically ill patients able to self-collect urine	114	27.7
Urine collection for diagnostic purposes	89	21.7
Urinary incontinence	5	1.2
Total	159	38.7

*It includes more than one indication in one patient.

Table 2. Association between indication relevance and age, gender and complications

		Appropriate Indications n=252	Inappropriate Indications n=159	p
Age, median (IQR)	411	71 (60–81)	72 (63-79)	0.61
Male, n (%)	211	132 (52.4)	79 (49.7)	0.59
Female n (%)	200	120 (47.6)	80 (50.4)	
Early complications, n (%)	83	46 (18.3)	37 (23.3)	0.21
Late complications, n (%)*	59	35 (14.7)	24 (10.1)	0.79

*237 Patients. Mann-Whitney U test and χ^2 test were used.

Table 3. Early and late complications associated with urinary catheterisation

Early Complications	n=411	%
During the process		
None	364	89.8
Haematuria	17	4.1
Catheter could not be inserted	15	3.7
Vaginal procedure	10	2.4
After the procedure		
None	350	85.2
Pain	52	12.7
Haematuria	27	6.6
Leakage	2	0.5
Removal of the catheter by the patient	1	0.2
Late Complications	**n=237**	**%**
Developing within 1-30 days		
None	178	75.1
Pain	37	15.6
Dysuria	37	15.6
Difficult urinating	26	11.0
Catheter-related urinary infection	18	7.6
Haematuria	14	5.9
Pollacuria	9	3.8
Incontinence	3	1.3
Urethral stricture	1	0.4
Dermatitis in the genital area	1	0.4
Sexual dysfunction	0	0

* One patient had more than one complication.

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number of failed attempts (OR: 3.89; 95% CI: 2.53–5.99; p<0.01) were identified as independent determinants of early complications. For late complications, catheter size was found to be an independent determinant factor (OR: 0.38; 95% CI: 0.21–0.67; p=0.01) (Table 4).

No statistically significant associations were identified between UC indications, comorbidities, or the use of antiaggregant/anticoagulant and antibiotic medications at the time of UC and the development of early or late complications (p>0.05). However, hematuria within the first 24 hours post-UC was significantly more common among patients using anticoagulant or antiaggregants therapy (p=0.02). Additionally, patient non-compliance during the procedure was found to have a statistically significant effect on early complications (p<0.01), whereas time constraints, physical challenges, and material limitations during the procedure did not significantly influence the occurrence of early or late complications (p>0.05).

DISCUSSION

In emergency departments, the indication for UC is often determined based on factors such as personal experiences, common misconceptions, and the convenience of either patients or healthcare personnel [19-21]. Unlike other interventional procedures, the lack of stringent and well-defined indication criteria for UC contributes to its application at a relatively lower threshold. Studies in the literature report that inappropriate UC indications range from 30% to 50% [5-8,19,22]. For instance, Schuur et al. [19] observed that two-thirds of UC applications in emergency departments could be avoided, with nearly half being performed for inappropriate indications. Similarly, Munasinghe et al. [6] reported a 38%

rate of inappropriate indications in their prospective study evaluating UC appropriateness within the first 24 hours of hospital admission. Aligning with these findings, our study revealed that over one-third of UC procedures in the emergency department were performed with inappropriate indications. Despite the high-pressure environment and rapid patient turnover in emergency departments, these rates comparable to other units suggest a concerted effort to maintain careful application practices. However, the prevalence of inappropriate UCs, consistent with the literature, warrants critical evaluation in terms of their implications on healthcare costs, workload, complications, morbidity, and mortality.

When we examined the CDC indication criteria, which we accepted as a reference in our study, we observed that the criteria favor patient follow-up without the application of a UC. The guideline frequently emphasizes the necessity of avoiding UC placement unless it is absolutely required [13]. The literature identifies perioperative procedures and inpatient follow-up as the most frequent indications for UC [10,23]. In contrast, our study found that critical care patient management and urine test collection were the most common reasons for UC application. This deviation may be attributed to the unique patient population and operational dynamics of tertiary emergency services. Specifically, the inclusion of critical care patients under emergency department management may have influenced the indication profile observed in our study. This finding aligns with the inherent nature of emergency department practices. UICs are commonly utilized to monitor urine output in critically ill patients requiring rapid intervention and close monitoring, or to facilitate urinalysis in immobile patients who cannot provide samples otherwise.

Table 4. Factors affecting early and late complications

	Early Complications			Late Complications		
	Yes **n=83**	**No** **n=328**	**p**	**Yes** **n=59**	**No** **n=178**	**p**
Male, n (%)	52 (24.6)	159 (76.4)	0.02	34 (28.3)	86 (71.7)	0.21
Female, n (%)	31 (15.5)	169 (84.5)		25 (21.4)	92 (78.6)	
Non-compliant patient, n (%)	21 (31.3)	46 (68.7)	0.01	9 (25.0)	27 (75.0)	0.98
Antiaggregants/anticoagulants, n (%)	41 (49.4)	160 (48.8)	0.92	30 (25)	90 (75)	0.97
Antibiotic use on admission, n (%)	4 (4.8)	26 (7.9)	0.33	4 (4.8)	26 (7.9)	0.33
BPH, n (%)	19 (22.9)	47 (14.3)	0.05	10 (29.4)	24 (70.6)	0.51
Number of failed attempts Median (IQR)	2 (1-2)	1 (1-1)	<0.01	1 (1-2)	1 (1-1)	0.08

Mann-Whitney U test, χ^2 and Fisher's exact test were used.

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Notably, UC applications for urine test collection constituted a significant proportion of inappropriate indications. Childers et al. [24] found that only 15% of urine cultures obtained in emergency settings yielded clinically relevant results, which led to unnecessary antibiotic use and extended hospital stays. This highlights the close relationship between UC application and urine test collection. Addressing inappropriate UC practices will necessitate robust frameworks for evaluating both UC indications and the criteria for ordering urine tests. Furthermore, the literature provides limited data on the detailed indications for UC, particularly in emergency departments, and the drivers of inappropriate use. Our study, therefore, contributes valuable insights toward addressing these gaps and expanding the existing body of research.

Our analysis of complications revealed that 20.2% of patients experienced at least one early complication, defined as occurring within the first 24 hours of UC application. Hematuria was the most frequent complication during the procedure, occurring in 4.1% of cases, and also during emergency department stays, where it was observed in 6.6% of patients. Notably, patient non-compliance was identified as a significant factor contributing to early complications. In a multicenter study on UC-related complications, Saint et al. [10] reported complication rates of 7.9% during catheter placement and 30.9% during catheter removal, including pain, discomfort, bleeding, and trauma. Our study also found that early complications were significantly more frequent among male patients, consistent with existing literature [25]. Despite similar numbers of UC applications across genders, the higher complication rates in males may be attributed to anatomical differences, such as a longer urethra and the presence of the prostate, which can complicate catheter placement and increase the likelihood of trauma or discomfort.

The study by Saint et al. [10] revealed that 57% of patients experienced at least one complication within 30 days of UC application, with non-infectious complications observed in 55.4% and infectious complications in 10.5%, indicating that non-infectious issues were five times more frequent. Our findings showed a lower rate of late complications at 24.9%, comprising catheter-associated urinary tract infections (CAUTI) in 7.6% and other non-infectious complications in 17.3%. Among these, 11% of patients experienced difficulty initiating or ceasing urine flow, and 5.9% developed hematuria. Compared to studies like that of Darbyshire et al. [26], which reported higher rates of pain and leakage, our findings may reflect differences in sample size and patient demographics, such as gender distribution. Notably, the male gender, a known

risk factor for complications due to anatomical considerations, was less prevalent in our cohort, potentially influencing these results. Additionally, our study found no significant association between complications and the presence of benign prostatic hyperplasia or the use of antiaggregants/anticoagulants, contrary to some assumptions. While these results require validation through larger multicenter studies, they suggest that these factors may not necessitate categorization as risk factors for UC complications.

CAUTI remains one of the most prevalent healthcare-associated infections, with the risk of infection closely tied to catheterization duration [18,27]. The literature documents a 1-10% daily increase in bacteriuria risk, escalating to CAUTI in 30% of cases after two weeks and 100% after six weeks [11,28,29]. Our study identified a CAUTI rate of 7.6%, consistent with findings from inpatient studies like Apisarnthanarak et al. [30], where CAUTI developed in 14% of patients undergoing inappropriate UC. However, the relatively lower rate in our cohort likely reflects the shorter catheterization duration typical of ED settings. Antibiotic use at admission did not significantly influence CAUTI rates, underscoring the importance of appropriate UC application and duration management to minimize infection risks.

Our examination of complications based on UC indications found higher percentages of complications among procedures performed without appropriate indications, albeit without statistical significance. This finding challenges the principle of "primum non nocere" as unnecessary procedures not only increase complication rates but also prolong hospital stays and elevate morbidity, mortality, and healthcare costs [31]. Addressing inappropriate UC application through strict adherence to indication protocols could mitigate these risks. Studies such as Lou Hilken's [32] demonstrated that implementing training programs and protocols reduced inappropriate UC use, while Schweiger et al. [33] reported a rise in appropriately indicated procedures to 90% and a corresponding decline in complications following targeted training interventions.

Limitations

Our single-center study was conducted in a university hospital ED serving approximately 70,000 adult patients annually, limiting the generalizability of findings to other settings. The exclusion of patients admitted to other departments or undergoing UC changes/reapplications may have influenced late complication outcomes. Additionally, data reliability may have been affected by challenges in contacting patients post-discharge due to mortality or changes in contact information, as well as reliance on phone interviews for some late complication reports.

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CONCLUSION

This study provides critical insights into UC use and associated complications in the ED, a setting often underrepresented in the literature. We identified that 38.7% of UCs in the ED were performed without appropriate indications and that complication rates were significant, occurring in 20.2% of cases early and 24.9% late. The similarity in complication rates between appropriately and inappropriately indicated procedures highlights the urgent need for improved protocols, training, and electronic warning systems to ensure judicious UC use. Such measures could enhance patient safety, reduce healthcare costs, and alleviate ED workloads, aligning clinical practice with the ultimate goal of preserving human life.

DECLARATIONS

Ethics Committee Approval: The Ankara Kecioren Training and Research Hospital Clinical Research Ethics Committee granted approval for this study (Date: 28.08.2019, Number: 1937).

Author Contributions: Concept – FB, OFT; Design – FB, OFT; Supervision – OFT; Resource – IK, SHA; Materials – MAA, AK; Data collection and/or processing – MAA, OFT; Analysis and/or interpretation MAA, OFT; Literature review – FB, OFT; Writing – FB, OFT; Critical Review – FB, OFT.

Conflict of Interest: The author declared that they do not have any conflict of interest.

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