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Major article

# Inappropriate use of urinary catheters: A prospective observational study

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*Key Words:*
Urinary tract infection
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***Background:*** Despite the well-recognized role of urinary catheters in nosocomial urinary tract infections, data on risk factors associated with inappropriate urinary catheter use are scarce.
***Methods:*** A prospective review of electronic medical records of 436 patients admitted to an adult medical-surgical unit between October and December 2007 was performed to examine the appropriateness of urinary catheter use.
***Results:*** The use of 157 urinary catheters in 144 patients was observed. A total of 557 urinary catheter-days were recorded in these patients, of which 175 (31.4%) were found to be inappropriate based on the study criteria. The total number of catheters used and the total duration of catheterization were risk factors for inappropriate urinary catheter use ($P < .05$). Inappropriate catheter use was not associated with such adverse events as mortality, readmission, intensive care unit admission, catheter complications, or urine culture rates, but was associated with a trend toward longer duration of hospitalization.
***Conclusions:*** Significant rates of inappropriate urinary catheter use and a trend toward longer duration of hospitalization with inappropriate catheter use were observed. These findings underscore the importance of establishing guidelines and effective policy implementation for the appropriate use of urinary catheters in hospitalized patients.


Urinary catheters are indispensable tools and among the most common medical devices used in patient management. It is estimated that approximately 25% of hospitalized patients have an indwelling urinary catheter in place at some time during the course of their hospitalization.[1] The use of indwelling urinary catheters in hospitalized patients is now well recognized as a significant risk factor in the development of nosocomial urinary tract infections.[2] Catheter-associated urinary tract infections (CAUTIs) account for nearly 40% of all nosocomial infections.[3] Among catheterized patients, the incidence of CAUTIs is ~5% per day, resulting in an estimated 800,000 infections per year.[4,5] Several studies have associated CAUTIs with longer duration of hospitalization and excess costs.[6-9] Previous observational studies have identified various risk factors for CAUTI, including age, sex, duration of catheterization, and presence of comorbid conditions.[10,11] Recently, it has become increasingly clear that the inappropriate use of urinary catheters during hospitalization accounts for a substantial number of CAUTIs and a significant percentage of preventable CAUTI-associated morbidity.[10,12]

Despite growing evidence of the role of inappropriate urinary catheter use in development of CAUTI, data on risk factors associated with inappropriate urinary catheter use, particularly in non–intensive care unit (ICU) settings, are relatively scarce. The objectives of this prospective study were to examine the appropriateness of urinary catheter use in a non-ICU setting using specific predetermined clinical criteria, to examine risk factors associated with inappropriate urinary catheter use, and to assess clinical outcomes associated with inappropriate catheter use.

## METHODS

### *Study setting and design*

This Institutional Review Board–approved prospective study was conducted between October and December of 2007 in an adult general medical-surgical unit at the Nebraska Medical Center. All patients admitted to the unit during the study period were included in the study. Before study initiation, the accuracy of electronic data was validated by comparing electronic and paper

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medical records. This process was repeated periodically throughout the study to ensure accuracy of records. In addition, several point prevalence surveys had been performed previously by Department of Healthcare Epidemiology personnel to ensure the accuracy of electronic data regarding the presence of a urinary catheter (unpublished data).

*Data collection*

Data were extracted on a daily basis from patients with and without urinary catheters by an independent observer not associated with day-to-day patient care. Data extracted included demographic information, such as age and sex, length of hospital stay, medical history and diagnosis, and outcome measures such as mortality, readmission within 30 days, and ICU admission. In addition, data on urinary catheter use were recorded, including type of catheter used, duration of catheter use, device-related complications, and urine culture results. Ward personnel were not aware of details of the study during the course of the study.

*Criteria for appropriate urinary catheter use*

Criteria used to classify urinary catheter devices as appropriate were developed before the start of the study from previously accepted indications.[10,13,14] In brief, the use of a urinary catheter was considered appropriate for any of the following indications: urinary retention, urine output monitoring, medication instillation, urinary tract obstruction, neurogenic bladder dysfunction, immediate postoperative management in surgical patients, decubitus ulcer or other wounds with a need for urinary diversion, or comfort care in the terminally ill. The presence of urinary incontinence with one of these appropriate indications was classified as an appropriate catheter use. However, the use of a urinary catheter for urinary incontinence alone was classified as inappropriate catheter use. Scores from the activity and mobility sections of the Braden pressure ulcer risk assessment scale were used to partially determine the appropriateness of urinary catheter use in postoperative patients; specifically, an activity and mobility score of $<4$ on the Braden risk assessment scale was considered to support urinary catheter use. Braden scores were calculated daily by nursing staff as part of routine pressure ulcer prevention practice.

*Determination of appropriateness of urinary catheter use*

Prospective follow-up of patients with a urinary catheter in place was done daily to determine appropriateness of use. Each day with a urinary catheter in place was considered 1 catheter-day. For each patient, the total number of urinary catheters used, total catheter-days, appropriate catheter-days, and inappropriate catheter-days were calculated at the end of hospitalization.

*Statistical analysis*

Statistical analyses were performed using SAS software (SAS Institute, Cary, NC). Analyzed data for categorical variables are presented here as frequency distribution percentage and continuous variables as mean $\pm$ SD. A $P$ value $<.05$ was considered significant. Univariate logistic regression analysis was performed to compare patients with and without a urinary catheter to identify risk factors associated with urinary catheter use and appropriateness of use. The presence of a urinary catheter and appropriateness of urinary catheter use were modeled as functions of predictors or risk factors. To examine the outcome measures associated with urinary catheter use and inappropriate use, an additional logistic regression analysis was performed. Unadjusted odds ratios (ORs) and 95% confidence intervals (CIs) are presented for associations between the variables. For comparison of duration of catheterization (continuous variable) as an outcome measure of inappropriate catheter use, a 2-tailed $t$ test was performed. Adjusted ORs with 95% CIs were calculated using stepwise logistic regression analysis to model the effects of multiple variables on outcomes of interest.

**Table 1**
Urinary catheter use: Patient characteristics

| Variable | Total n | Mean $\pm$ SD |
|---|---|---|
| Number of patients | 436 | - |
| Age, years | - | 51.7 $\pm$ 19.2 |
| Female sex | 252 (57.8%) | |
| Length of stay, days | 2,909 | 6.7 $\pm$ 9.5 |
| Patients with urinary catheter | 144 | - |
| Total catheters | 157 | 1.1 $\pm$ 0.4 |
| Total catheter-days | 557 | 3.7 $\pm$ 3.9 |
| Appropriate catheter-days | 382 | 2.6 $\pm$ 2.8 |
| Inappropriate catheter-days | 175 | 1.2 $\pm$ 2.7 |

**Table 2**
Indications of urinary catheter use

| Catheter indication* | Patients with urinary catheter, n (%) |
|---|---|
| No indication | 8 (5.6%) |
| Urinary retention | 2 (1.4%) |
| Monitoring urine output | 10 (7.0%) |
| Urinary tract obstruction | 2 (1.4%) |
| Neurogenic bladder dysfunction | 4 (2.8%) |
| Surgery or postoperative management | 111 (77.6%) |
| Decubitus ulcer or need for diversion | 5 (3.5%) |
| Comfort care in terminally ill | 3 (2.1%) |

* Multiple indications present in some patients.

## RESULTS

*Patient characteristics and urinary catheter use*

Tables 1 and 2 summarize patient and catheter characteristics, respectively. A total of 436 patients were observed, 252 females (57.8%), with a mean age of 51.7. A total of 2,909 days of hospitalization were recorded during the study period, with a mean duration of hospitalization of 6.7 days. A total of 144 patients (33.0%) had a urinary catheter in place at some point during hospitalization; 157 urinary catheters were used in these patients, for a mean of 1.1 $\pm$ 0.4 urinary catheters per patient. A total of 557 catheter-days were recorded, with a mean duration of catheterization of 3.7 $\pm$ 3.9 catheter-days per catheterized patient. The most common indication for urinary catheter use was surgery or postoperative management. A total of 111 patients (77.6% of patients with a urinary catheter) had a urinary catheter in place for surgery or postoperative management. No indication for urinary catheterization was found in 8 patients (5.6%) with a urinary catheter. Based on our criteria, 175 (31.4%) of urinary catheter-days were deemed to be inappropriate. Approximately 40% (n = 58) of patients with a urinary catheter experienced at least 1 day of inappropriate catheterization.

*Predictors and outcomes of urinary catheter use*

Univariate logistic regression analysis performed to identify the factors associated with urinary catheter use found that only patient age was significantly associated with catheter use. Patients with