

Catheter-Associated Urinary Tract Infection

A Successful Prevention Effort Employing a Multipronged Initiative at an Academic Medical Center

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An interdisciplinary clinical improvement workgroup was formed at this academic medical center with the goal of reducing catheter-associated urinary tract infections (CAUTIs). In 2011, the CAUTI rate was noted to be 4.7 CAUTIs per 1000 catheter days. Rounding by 2 lead clinical nurse specialists revealed deficiencies in current practice, which were addressed with multifaceted strategies, including evidence-based indwelling urinary catheter and bladder management protocols, education of staff, reporting of data, and utilization of an icon in the electronic health record (EHR). After the implementation of these strategies, the CAUTI rate decreased and was noted to be 2.4 in February 2013. In addition to this, there was a downward trend line for catheter days. **Key words:** *catheter-related infections, patient outcome assessment, quality improvement, urinary tract infections*

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CATHETER-ASSOCIATED urinary tract infections (CAUTIs) are the most common health care-associated infection worldwide and are associated with considerable morbidity, costs, and attributable mortality.¹⁻³ In recent years, prevention of CAUTI has become even more important as the Centers for Medicare & Medicaid Services no longer reimburses hospitals for costs related to the

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treatment of CAUTIs on the grounds that they are largely preventable.⁴

Prevention of CAUTIs centers around the following considerations: insertion of an indwelling urinary catheter only when medically necessary by a trained individual using sterile technique; regular assessment of ongoing need for an indwelling urinary catheter; and removal of an indwelling urinary catheter as soon as possible.^{5,6} Studies have demonstrated that indwelling urinary catheters are often inserted for inappropriate indications, that health care workers are frequently unaware of the presence of indwelling urinary catheters in their patients, and that removal of these catheters is often delayed.⁷⁻⁹ Requiring health care workers to indicate and document the medical justification for an indwelling urinary catheter at the time of insertion and using a nurse-driven protocol for timely removal may reduce the risk and incidence of CAUTIs.¹⁰⁻¹²

A multifaceted approach was required to reduce CAUTIs and catheter days. This included a 1-month concurrent review on 1 medical and 1 surgical unit, pilot study on the surgical unit, modification to catheter removal and bladder management protocols, creation of icons in the electronic health record (EHR), and education of CAUTI champions.

LOCAL PROBLEM

The hospital-wide CAUTI rate for the first 6 months of calendar year 2011 was 4.7, with 85 CAUTIs reported during those months. The CAUTI rate is determined by the number of CAUTIs per 1000 indwelling catheter days. Nine of 22 inpatient units were underperforming as compared to the National Database of Nursing Quality Indicators (NDNQI) benchmark for similar units for 4 or more quarters as of July 2011.

Intended improvement

The primary goal of this quality improvement project was to reduce the incidence of CAUTIs at this academic medical center through education, clinical practice changes,

and the sustained use of evidence-based hospital-wide protocols for indwelling urinary catheters. The aim was to reduce the number and duration of indwelling urinary catheter use on all inpatient units.

An interdisciplinary clinical improvement workgroup was formed to evaluate current practice related to the use of indwelling urinary catheters. This workgroup consisted of administrative support persons, clinical nurse specialists (CNSs), physicians, an infection control practitioner, nursing informatics, and a quality improvement analyst. Along with the NDNQI reports showing CAUTI rates above the benchmarks, verbal reports from nurses during CNS rounding indicated a wide disparity in beliefs about how best to manage indwelling urinary catheters and when they should be discontinued.

METHODS

Two CNSs conducted a 1-month concurrent review of all patients with indwelling urinary catheters on 1 medical unit and 1 surgical unit to evaluate current practice. The CNSs collaborated with an infection control practitioner, who reviewed the EHR of patients with positive urine culture results. The infection control practitioner then determined whether the patient had an indwelling urinary catheter in place at the time that the urine culture was positive or had an indwelling urinary catheter removed within 48 hours before obtaining the urine culture. The infection control practitioner determined whether the patient had a symptomatic or asymptomatic bacteremic CAUTI according to the 2012 National Healthcare Safety Network criteria for CAUTI.

As part of the pilot study, one of the lead CNSs collaborated with the unit-based CNS, surgeons, and nursing staff on the surgical unit to collect and analyze data on urinary retention in the postoperative patients, with the goal being the removal of indwelling urinary catheters by postoperative day 1. These patients included those with and without epidural analgesia in place. Evidence-based

interventions were then implemented to reduce the number of indwelling urinary catheters and to prevent CAUTIs. Based on outcomes, a hospital-wide CAUTI prevention program was established and initiated.

Setting

The 2 pilot units initially chosen by the CAUTI workgroup were a 28-bed general care medical unit and a 28-bed general care surgical unit. The medical unit population mostly comprised general medicine and forensic patients. The principal diagnoses for the unit are cellulitis, esophagitis, and gastroenteritis with complex comorbidities. The surgical unit's principal diagnoses are bariatric surgery, appendectomy, and ileostomy placement or reversal.

Medical unit findings

The medical unit was selected for the pilot on the basis of the patient population. Clinical nurse specialist rounds were conducted daily on patients with indwelling urinary catheters. The CNS provided real-time education to the clinical nurses on the unit. Emphasis was placed on the need for medical justification for the catheter, appropriate securement of the catheter, proper positioning of the collection bag to prevent urine reflux, and review of possible alternatives to the catheter. In addition, the CNS inquired about adherence to the nurse-driven indwelling urinary catheter removal protocol. The CNS also met with patients to educate them about the importance of having the indwelling urinary catheter removed as soon as medically possible to prevent CAUTI.

The CNS identified multiple issues throughout the 1 month of rounding. The catheter removal protocol was difficult to locate. This inaccessibility was a barrier to its use, as it was difficult to find an electronic copy and paper copies were not readily available. In addition, nurses reported that the complexity of the protocol made it difficult to follow. Poor compliance to the protocols was also related to nurses' apprehension that physicians would respond negatively if the catheter was

removed without a specific order. Off-service patients were often admitted or transferred to this medical unit with different individualized bladder management protocols. Therefore, the nursing staff had difficulty identifying which protocol was appropriate for use for these patients. Discussions with nurses during the CNS rounds also revealed that indwelling urinary catheters remained in place for nurse convenience, patient convenience, unawareness of CAUTI risk, lack of communication related to the justification for the catheter, and reliance on the primary medical team to communicate the need to remove the catheters.

It became evident during CNS rounds that patients were unaware of the risk of CAUTI. This contributed to the patient's request for an indwelling urinary catheter. Nurses not only complied with the patient's request, but it was also determined that indwelling urinary catheters were more likely to be inserted and remain in place for patients with limited mobility and urinary incontinence, even when the patient did not have medical justification for its use or require measurement of intake and output.

Surgical unit findings

The focus of the project on the surgical unit was on removing indwelling urinary catheters early in the postoperative period. It is recommended that catheters be removed within 24 hours postoperatively unless there are appropriate indications to continue the catheter.¹³ The goal of removing urinary catheters by postoperative day 1 was communicated to all surgeons, surgical residents, and nursing staff via e-mail, at interdisciplinary rounds, on the unit, and during CNS rounds. Initially, the surgical nursing staff believed that early removal would result in the need for prolonged intermittent catheterization and the eventual need to reinsert the indwelling catheters. Recognizing the concern, the CNS provided extensive education about the benefits of intermittent catheterization versus indwelling urinary catheters for the prevention of CAUTI. During the month of CNS rounding, 45 of 96 patients (47%) had their indwelling urinary catheter

removed by postoperative day 1. Slightly more than half of the patients (24 of the 45 patients; 53%) required intermittent catheterization, with 12 (50%) of those patients requiring intermittent catheterization only once.

The early removal of indwelling urinary catheters on the surgical unit included postoperative patients receiving thoracic epidural analgesia. Data revealed that 58% of patients with indwelling urinary catheters during the audit month had a thoracic epidural catheter in place. The practice on the general surgery unit was to remove the indwelling urinary catheters 6 hours after the epidural analgesia was discontinued. However, it has been shown that indwelling urinary catheters are not necessary in the postoperative patient with a thoracic epidural.¹⁴⁻¹⁶ This was a focus of the education provided by the CNS to the nurse clinicians and surgical residents. This education occurred predominantly during daily interdisciplinary rounds. Approximately 1 month after the audits were performed, a portion of a nursing educational retreat was dedicated to CAUTI prevention. This provided the CNS an opportunity to share audit results with the nursing staff, as well as time for the staff to ask questions and share their experiences with the practice change.

INTERVENTIONS

The information gathered during audits and rounds clearly indicated that neither CAUTI rates nor indwelling urinary catheter days would be reduced unless education and evidence-based strategies were put in place. A multifaceted approach was needed for success of the program.

Modification of the catheter removal and bladder management protocols

The first step to this process was to modify the existing Indwelling Urinary Catheter Removal Protocol as well as the Bladder Management-Surgical and Bladder Management-Medical Protocols. Algorithms for these

protocols were developed to guide nurses in decision making regarding when to remove an indwelling urinary catheter (Supplemental Digital Content Figure 1, available at <http://links.lww.com/JNCQ/A50>), when to perform straight catheterization on a surgical patient (Supplemental Digital Content Figure 2, available at <http://links.lww.com/JNCQ/A51>), and when to perform straight catheterization on a medical patient (Supplemental Digital Content Figure 3, available at <http://links.lww.com/JNCQ/A52>).

The 2 CNSs from the workgroup collaborated with the unit-based CNSs and nursing staff on the modifications to ensure that the protocols were simplified and easy to use. Once the modifications were completed, the CNSs discussed the recommended changes with the CAUTI workgroup. Additional meetings were held with the lead surgeon and hospitalist to secure physician approval of the recommended changes. The lead surgeon and hospitalist physician on the team met with other medical providers to ensure agreement with the protocols and to educate on how providers' orders would be written and followed.

Standardization of the protocols

The next step was to standardize the protocols throughout the inpatient units and services. The group decided that certain patient populations should be excluded from the protocols. These included all urology patients, patients with an indwelling urinary catheter placed by the urology service, gynecology patients, patients with spinal cord injuries, patients with complex pelvic surgery, patients with chronic indwelling urinary catheters, patients with lumbar epidurals, and those receiving end-of-life care. In addition, a decision was made by the CAUTI workgroup that intermittent catheterization would be performed for a bladder scan volume of 500 mL or greater or if a patient complained of discomfort. Standardization of the protocols helped eliminate the confusion nurses experienced when there were a variety of protocols.

Linking the protocols to physician's order in the electronic health record

Once the protocols were approved, the 2 lead CNSs worked with Nursing Informatics and a Clinical Content Facilitator to link the protocols to the physician's orders in the EHR. This strategy provided nurses with easy access to the electronic version of the protocols and resolved the current barrier of difficulty locating the protocols. In addition, the order was formatted to automatically default to the nurse-driven indwelling urinary catheter removal protocol, unless it was de-selected by the ordering provider. De-selection required a medical justification.

Creation of icons on the patient list in the electronic health record

In an effort to make patients with indwelling urinary catheters or those on the bladder management protocol more highly visible, the 2 lead CNSs worked with Nursing Informatics and a clinical content facilitator to create a new icon that would display on the patient list in the EHR. The innovative use of icons provided a visual cue to indicate patients with indwelling urinary catheters and those who were on the bladder management protocol.

Identification of unit-based CAUTI champions

The lead CNSs wanted to achieve sustained improvement in clinical practice and believed that this would not occur unless every inpatient unit had a CAUTI champion(s). This proposal was endorsed by the Nursing Executive Council despite the cost that would be incurred by having nurse champions from each inpatient unit attend a 3-hour educational program. In addition to the clinical nurses, the unit-based CNS and nurse manager were asked to be CAUTI champions. A total of 63 clinical nurses, 13 nurse managers, and 12 CNSs attended the educational program and were identified as CAUTI champions.

CAUTI education workshop

The lead CNSs collaborated with a nursing education specialist, 2 unit-based CNSs, and 2 nurse managers from the trial units to create content and format for a comprehensive 3-hour CAUTI education workshop. Six 3-hour workshops were scheduled to accommodate all shifts.

Creation of a CAUTI toolbox on the hospital intranet

The lead CNSs also created a CAUTI toolbox on the hospital's intranet site, which provided a "one-stop shop" for all CAUTI-related materials. This centralization of CAUTI prevention resources made it easier for nurses to access educational information. The toolbox also included patient education material.

Daily rounding by Quality and Safety CNS

On completion of the workshops, the Quality and Safety CNS, who was also a lead CNS on the workgroup, made daily rounds on all patients who had an indwelling urinary catheter. During rounds, the CNS worked with the CAUTI champions, unit-based CNSs, and nursing staff to evaluate the necessity for the catheter. After approximately 2 weeks of daily rounding, the CAUTI champions, unit-based CNSs, and nurse clinicians began to take a more active role in ensuring that the catheters were removed by following the protocols and/or by discussing the need for the catheter at interdisciplinary rounds. By week 4, rounding was able to be reduced because nurse clinicians were discontinuing the indwelling urinary catheters evidenced by monitoring of catheter days from an EHR-generated report.

Monthly unit-based scorecard

To assist the CAUTI workgroup in tracking the success of this initiative, the infection control practitioner provided regular updates on the monthly data including catheter utilization and CAUTI rates. Catheter-associated urinary tract infection rates were added to each unit's quality scorecard every month. This

allowed nurses to easily review the unit's performance.

OUTCOMES

Surgical patients

A total of 96 patients were followed during the surgical unit early catheter removal trial period. Of these, 7 patients were excluded from further evaluation, as they did not receive any type of surgical intervention. The remaining 89 patients included 11 patients who had their catheter replaced after initial removal. Overall, the rate of urinary tract infection was 2.1% and the rate of urinary retention was 28%, including all patients who required intermittent catheterization after removal of indwelling catheter. The majority of patients (94%) had their urinary catheters placed in the operating room after induction of anesthesia. Of these, 15% had the catheter removed before leaving the operating room. Of the patients who had their catheters left in after surgery, 84% were removed within 48 hours. Only 2 of 14 patients (14%) who had their catheters removed in the operating room suffered from subsequent urinary retention. One of these patients had to have an indwelling catheter reinserted and developed a urinary tract infection related to catheterization. Ten patients of the remaining 75 (13%) had their catheter reinserted and none developed a urinary tract infection.

Epidural analgesia

Epidural analgesia was used for 31 of the 89 patients (35%). Urinary retention occurred in 48% of patients receiving epidural analgesia after catheter removal compared with 19% of patients without epidural analgesia ($P = 0.002$). The urinary catheter had to be reinserted in 19% of patients with epidural analgesia compared with 9% of patients without epidural analgesia. This was deemed acceptable and was not considered a barrier to removing the indwelling urinary catheters.

Hospital outcomes

The overall goal of this project was to establish a sustained use of an evidence-based hospital-wide protocol for indwelling urinary catheters by identifying, implementing, and measuring the impact of strategies to create a robust prevention process. To determine the success of this initiative, it was important to measure the expected outcomes from the interventions. The chosen metrics were indwelling catheter days (or device utilization) and CAUTI rate (incidence). To determine device utilization, the total indwelling urinary catheter days per patient was divided by patient days (Fig 1). While device utilization was trending in a positive direction, the ultimate goal of decreasing the CAUTI rate was also closely monitored, and overall CAUTI rates decreased from 4.2 in 2011 to 3.5 in 2012. The CAUTI rate in February 2013 was 2.4 (Fig 2). Hospital and unit CAUTI outcomes were presented at monthly Infection Control Committee meetings, reviewed on the hospital and unit level scorecards, and documented in the monthly nursing quality newsletter.

IMPACT ON CLINICAL PERFORMANCE

To ensure that the changes made were sustained in clinical practice areas, discussions about indwelling urinary catheter management were added to the daily Interdisciplinary Model of Care rounds, where the patient's plan of care was discussed. At Interdisciplinary Model of Care rounds, unit CNSs initially guided discussions about early removal of catheters and developing an individualized plan for managing any urinary retention after removal of the catheter. These discussions are now being initiated by clinical nursing staff and medical providers and have become a regular part of the Interdisciplinary Model of Care rounds.

Additional changes at the bedside include increased communication between nurses and providers regarding the use of indwelling urinary catheters with patients who are receiving thoracic epidural analgesia. This has

resulted in earlier removal of the catheter. Nurses also have demonstrated increased willingness to employ bladder scanners and intermittent catheterization rather than advocating for replacement of the urinary catheter.

DISCUSSION

The interdisciplinary nature of the CAUTI workgroup allowed for collaborative partnership among the various departments

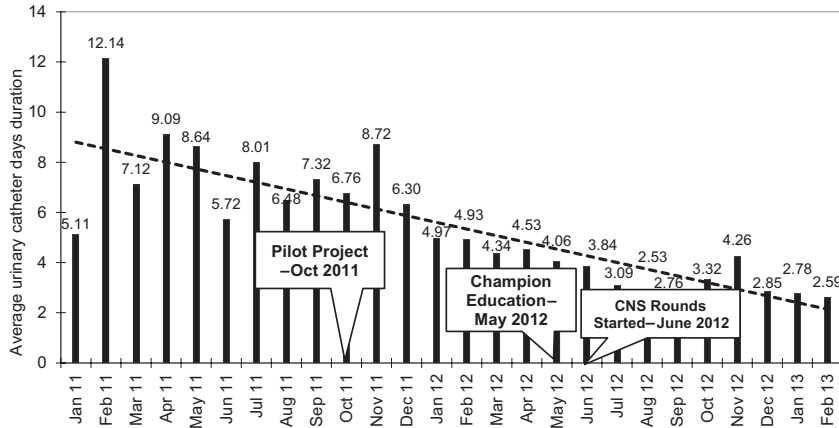


Figure 1. Device utilization. Overall average urinary catheter duration (days). CNS indicates clinical nurse specialist.

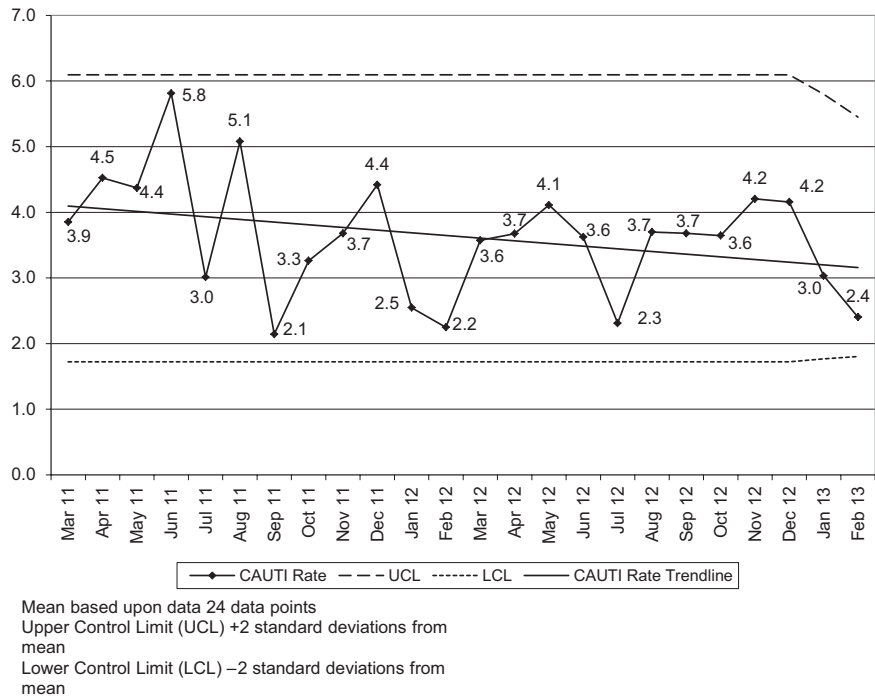


Figure 2. CAUTI rate. Overall CAUTI per 1000 catheter days rate. CAUTI indicates catheter-associated urinary tract infection.

and specialties to design and implement strategies to prevent CAUTI, including the use of education, information technology, infectious disease, medicine, nursing, and equipment resources such as bladder scanners. The workgroup also found that 2 teams consisting of a CNS and a physician to assess indwelling urinary catheter utilization on 2 pilot units was an effective way to evaluate current practice and to provide information to the workgroup about what the clinical issues were that needed to be addressed. The CNS and the physician were able to address misinformation about indwelling urinary catheter use at meetings and on the clinical units. This helped empower the nurses to be

more assertive in teaching patients about the need for early removal of indwelling urinary catheters. Catheter-associated urinary tract infection champions were also very effective resources on the units to help sustain practice changes initially begun by this project workgroup.

SUMMARY

Interdisciplinary teamwork was critical in the success of this CAUTI prevention initiative. This collaborative effort resulted in a multifaceted approach to the reduction of CAUTI and catheter days at this academic medical center.

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