Catheter-Associated Urinary Tract Infections

Implementing a protocol to decrease incidence in oncology populations

Charis McCoy, MSN, FNP-BC, APRN, Monica Paredes, BSN, RN, OCN®, Sara Allen, BSN, RN, Jennifer Blackey, BSN, RN, OCN®, Carol Nielsen, BSN, PhN, RN, OCN®, Amy Paluzzi, BSN, RN, Brittney Jonas, BSN, RN, and Patti Radovich, PhD, CNS, FCCM

BACKGROUND: The impact of catheter-associated urinary tract infections (CAUTIs) on immunocompromised patients with cancer requires preventive intervention from bedside nurses.

OBJECTIVES: This protocol aims to prevent CAUTIs in the inpatient oncology population by implementing an evidence-based, nurse-driven protocol for discontinuing indwelling urinary catheters (IUCs).

METHODS: Following a literature review of 34 articles, a nurse-driven CAUTI prevention protocol was developed and implemented on two 26-bed oncology units. Unit staff were educated on the protocol and use of the audit tool.

FINDINGS: Although CAUTI rates remained unchanged, infections per 1,000 IUC days decreased, and adherence among oncology nurses rose 66%–90% within the first two months. The protocol encouraged preventive intervention from RNs to protect patients with cancer from CAUTIs.

URINARY TRACT INFECTIONS (UTIs) ACCOUNT FOR THE GREATEST NUMBER of reported healthcare-associated infections, with an estimated 93,300 UTIs and 13,000 UTI-related deaths each year in acute care hospitals (Centers for Disease Control and Prevention [CDC], 2015, 2017). Manipulation of the urinary tract from long-term indwelling urinary catheter (IUC) placement is a major contributor to hospital-acquired UTIs (CDC, 2017; Magill et al., 2014). Nurses can prevent catheter-associated urinary tract infections (CAUTIs) by ensuring evidence-based catheter use and maintenance. Proper catheter care is critical for patient safety and is essential to maintaining patient trust.

Background

Preventing CAUTIs is important because the primary goal of oncology nursing is to provide safe patient care. Patients with cancer are at a higher risk for CAUTIs because of the immunocompromising effects of the very same cancer treatments that could potentially save their lives. The devastating impact of CAUTIs on vulnerable patients with cancer requires early intervention from the bedside nurse to prevent potential infections. In addition, effective nursing care can reduce the costs associated with CAUTIs. Medicare began incentivizing CAUTI prevention in 2008 through reimbursement penalties and public reporting of CAUTI events (Peasah, McKay, Harman, Al-Amin, & Cook, 2013). As healthcare facilities became acutely aware of their rates of preventable healthcare-associated infections, pressure for reevaluation of existing prevention protocols increased (Peasah et al., 2013).

Initially, a nurse-led team from the inpatient oncology units of a 442-bed academic tertiary medical center in southern California formed to develop an evidence-based approach to CAUTI prevention in the oncology population. The team’s goal was to compare existing CAUTI prevention practices to current evidence and to develop a standardized protocol for practice changes for patients with IUCs. The findings from the review of the literature led to the development and implementation of an...
evidence-based, nurse-driven CAUTI prevention protocol. Prior to implementation of the protocol, the unit-based team’s institution identified CAUTI prevention as an organization-wide concern. Therefore, the unit-based nursing team joined an interprofessional quality improvement team from the greater institution to address the CAUTI issue throughout the academic tertiary medical center. The interprofessional team used findings from the inpatient oncology nursing unit, as well as similar work being completed in the intensive care units, to develop an integrated organization-wide CAUTI prevention protocol.

**Literature Review**

A literature review of best practices for CAUTI prevention was conducted using CINAHL®, Academic Search Premier, and PubMed and search terms such as CAUTI, CAUTI prevention, CAUTI bundle, CAUTI algorithm, and healthcare-associated infections. The search revealed a breadth of research ranging from meta-analyses and systematic reviews to expert opinions. Most articles using an algorithm or protocol for CAUTI prevention referenced the 2009 CAUTI guidelines developed by the Healthcare Infection Control Practices Advisory Committee (HICPAC). The guidelines include a review of evidence and a grading system for the committee’s recommendations. Topics range from IUC insertion techniques and maintenance to appropriate IUC indications and quality improvement programs (HICPAC, 2009).

Willson et al. (2009) conducted a systematic review to evaluate specific interventions shown to reduce the incidence of CAUTIs in patients with IUCs. The review examined more than 50 quantitative studies. Findings highlighted the importance of a facility-wide program to identify and remove inappropriate IUCs, daily perineal care (pericare) with soap and water, efforts to reduce contamination of the closed urinary drainage system, and staff education on proper IUC care. Willson et al.’s (2009) study represents a comprehensive evaluation of IUC best practices.

A meta-analysis by Meddings et al. (2014) reviewed data on CAUTI prevention from 30 quantitative studies. The most significant finding showed a 53% reduction in CAUTI rates resulting from the use of a reminder or stop order to remove IUCs. Specific preventive IUC care was also discussed but not included in the analysis because of a lack of standardization across the included studies.

A randomized, controlled trial by Chen et al. (2013) supports the findings of Meddings et al.’s (2014) meta-analysis. The study was conducted on two intensive care units in a large tertiary medical center (N = 278). The purpose of the study was to evaluate the effects of a weekly IUC indication reminder on IUC duration. Research findings demonstrated a significant reduction in IUC days from 11 to 7 in the intervention group compared to the control group (p < 0.001) and a 48% decrease in CAUTIs.

The literature also identified the importance of healthcare staff education. A quasiexperimental study by Marigliano, Barbadoro, Pennacchietti, D’Errico, and Prospero (2012) focused on the effect of staff education on CAUTI rates at a 900-bed teaching hospital. Healthcare workers (N = 296) attended an educational intervention featuring appropriate IUC care techniques and CAUTI prevention. A pre- and post-test were used to evaluate comprehension. The study revealed a hospital-wide reduction in CAUTI incidence from 46 to 19 cases following the educational intervention.

An important component of IUC staff education is empowering nurses to advocate for patients with IUCs. Adams, Bucior, Day, and Rimmer (2012) piloted a nurse-driven IUC removal protocol on three units in an acute care hospital in England. The protocol featured a user-friendly mnemonic, HOUDINI (Hematuria, gross; Obstruction, urinary; Urology surgery; Decubitus ulcer—open sacral or perineal wound in incontinent patient; Input and output critical for patient management or hemodynamic instability; No code/comfort care/hospice care; Immobility due to physical constraints), to capture the evidence-based indications for an IUC. Nurses were given authority to remove IUCs that did not meet HOUDINI criteria without a separate physician order set. Implementation of this protocol resulted in a 17% decrease in IUC use and a 70% decrease in CAUTIs from *Escherichia coli*.

Findings from the literature review consistently demonstrated that staff education is fundamental to CAUTI prevention and to the reduction of IUC duration. Educational interventions should include knowledge on best practices for IUC care, as well as evidence-based indications for IUC continuation. Based on the literature, providing reminders for IUC removal and empowering nurses on inpatient oncology units to advocate for patients with inappropriate IUCs should play key roles in prevention protocols.

**Methods**

The lack of evidence-based IUC practices spurred a team of seven acute care nurses from two medical-surgical oncology units to begin developing an evidence-based CAUTI prevention protocol. The resultant clinical question was as follows: In adults, aged 18 years or older, how does implementation of a nurse-driven IUC algorithm, compared to current urinary catheter practices, affect the number of CAUTIs per quarter? A literature review revealed 45 articles on this topic. Eighteen articles were eliminated based on poor research quality or irrelevance to the clinical question. The inpatient oncology unit evidence-based practice (EBP) team used the Johns Hopkins review process to determine the level and quality of evidence for the remaining articles (Dearholt & Dang, 2012). Each article was independently reviewed three times to validate the level and quality of evidence. A summary table of the articles allowed easy identification of best practices in CAUTI prevention. The articles used for the development of the protocol were primarily levels I–III and ranged from good to high quality.
Procedure
The inpatient oncology unit EBP team translated evidence-based practice interventions from the summary table into a nurse-driven CAUTI prevention protocol that the institution’s quality committee approved.

The protocol consisted of evidence-based indications for IUC maintenance and best practice recommendations for catheter care. Indications for keeping an IUC include hematuria, bladder irritation, neurogenic bladder, urinary obstruction, selected surgical procedures, urology placement, assisting with sacral or perineal wound healing in incontinent patients, intake and output measurements every four hours or less, hospice, comfort care, and other indications, such as unstable pelvis, unstable spine, or intra-abdominal pressure measurements (Adams et al., 2012; Alexaitis & Broome, 2014; Andreessen, Wilde, & Herendeen, 2012; Chen et al., 2013; Conway, Pogorzelska, Larson, & Stone, 2012; HICPAC, 2009). IUC indications were integrated into the hospital’s electronic health record and were included in the inpatient oncology nurses’ daily IUC documentation. Modified physician order sets included the protocol-based care and IUC maintenance instructions that auto-populated whenever an IUC was placed. The updated order sets allowed nurses to remove IUCs without a separate physician order.

Best practices for catheter care include aseptic insertion techniques, use of a securement device, and routine pericare every shift using soap and water (Chen et al., 2013; Conway et al., 2012; HICPAC, 2009; Oman et al., 2012; Roser, Piercy, & Altpeter, 2014; Willson et al., 2009). Reflux prevention techniques were also addressed, such as keeping the IUC collection bag below the level of the patient’s bladder at all times and emptying collection bags before transportation (Chen et al., 2013; Clarke et al., 2013; Davis et al., 2014; HICPAC, 2009; Oman et al., 2012; Titsworth et al., 2012). In addition, contamination prevention tips, such as keeping the IUC collection bag and tubing off the floor, washing hands, and wearing gloves when manipulating tubing or collection bags, were also specified (Chen et al., 2013; Clarke et al., 2013; HICPAC, 2009; Oman et al., 2012; Titsworth et al., 2012).

The interprofessional team identified patient and staff lack of knowledge as barriers to IUC care; therefore, addressing patient and family caregiver education and updating the patient care plan were included as part of the protocol (Gokula et al., 2012; Mariigiano et al., 2012; Parry, Grant, & Sestovic, 2013). Because family caregivers are active participants in the care of patients with cancer, it was important to ensure that they were aware of the protocol and how their understanding of IUCs and the risk for CAUTIs could assist in prevention.

Instruments
The inpatient oncology unit EBP team developed several innovative ideas to support adherence to the protocol’s catheter care requirements. A “keep me low” sticker for the IUC collection bag was created as a visual reminder to keep bags below the level of the patient’s bladder at all times and to empty the volume before transportation. Ideal locations to place the IUC collection bag during ambulation and transportation were recommended to prevent reflux. Photographs demonstrated optimal locations, such as hanging the bag on a screw low on the IV pole rather than high on the IV pole rail, on the lowest crossbar on a walker, or on gurney hooks.

Because nurses were unable to find a dependent position for the collection bag during wheelchair transportation, gurney transportation of patients with IUCs was recommended to reduce the risk for reflux. Another effort to prevent reflux was to ensure that patients with IUCs had their collection bags emptied prior to leaving the unit for diagnostic testing. To support this process, the team created a “ticket to ride” card with reminders of how to prevent reflux and potential contamination during patient transportation. The card had space to record emptied output volume from the collection bag while the patient was off the unit. The “ticket to ride” card aimed to ensure that transportation personnel would take the card with the patient and return the ticket to nursing staff upon returning to the inpatient oncology unit.

Education
Nursing education began with a presentation of the team’s research and protocol development at staff meetings. Inclusion of case studies actively engaged bedside oncology nurses in thinking through evidence-based IUC indications and the nurse-driven removal protocol. Education also addressed the protocol’s IUC care components and new charting requirements, as well as the multidisciplinary efforts in preventing CAUTIs. The implementation of an audit tool to monitor adherence to the protocol encouraged compliance and reminded nurses of key steps in CAUTI prevention.

“Charting audits showed an increase in compliance from 66%–90% overall within the first two months of implementation.”
**Implementation**

The implementation trial began on two 26-bed medical-surgical oncology floors in June 2015, with the CAUTI prevention protocol going organization-wide in August 2015. Nurses caring for patients with IUCs used the protocol every shift to determine the indication for keeping a patient’s IUC versus activating the order for removal. The audit tool monitored the required pericare, education, and patient care plan documentation.

During the implementation period, issues with incontinent patients were identified. Follow-up staff education addressed preventing CAUTIs in patients with stool incontinence through the use of disinfectant caps on IUC access ports, chlorhexidine wipes used on the IUC line only, rectal tubes if the patient is not neutropenic/pancytopenic, and reeducation on correct pericare cleansing (Virginia Department of Public Health, 2016).

**Results**

Evaluation of the CAUTI prevention protocol involved a review of the CAUTI rates, number of IUC days, and nursing adherence. Nursing adherence to the protocol was based on charting audits, which showed an increase in compliance from 66%–90% overall within the first two months of implementation. By the seventh month of the protocol’s implementation, the areas of patient and family education and patient care plan inclusion were at 95% and 94% adherence, respectively. In addition, pericare documentation reached 90% adherence by the seventh month, whereas the nurse-driven assessment for IUC removal remained at 84% throughout the implementation period (see Figure 1). The results demonstrated increased inpatient oncology unit staff knowledge of evidence-based IUC care as a result of the CAUTI prevention protocol.

Early results did not demonstrate a significant drop in CAUTI rates or IUC days following implementation of the protocol as expected. Initial data showed an increase in IUC days because of a change in patient population related to increases in surgeries for neurogenic and obstructive bladders, cesium-137, and the comfort of end-of-life patients. However, the evaluation of infections per 1,000 catheter days from 2014 through the third quarter of 2016 demonstrated a reduction in CAUTIs from 14.32 (preimplementation) to 11.79 (postimplementation). Although the initial reduction in CAUTIs from 14.32 in 2014 to 12.6 in 2015 might have been the result of the CDC’s change to the definition of a CAUTI, the continued reduction from 12.6 in 2015 to 11.79 in 2016 correlated with the implementation of the protocol and staff awareness of CAUTI risks and IUC placement.

**Discussion**

Evidence-based IUC care for CAUTI prevention is critical to the inpatient oncology population because of their immunocompromised health status. For cancer treatments to be successful, the patient must be protected from preventable infections. The literature consistently demonstrates that the greatest risk factor for preventable CAUTI incidence is extended duration of IUCs (Willson et al., 2009). The most successful interventions for protecting patients with cancer from CAUTIs target this risk factor by educating staff on the evidence-based indications for an IUC and using reminder systems that prompt appropriate removal (Meddings et al., 2014; Willson et al., 2009).

The results of the implementation period showed the need for interprofessional collaboration related to the lack of reduction in IUC days. Because of a lack of understanding of IUC-related complications, many healthcare providers wished to continue using IUCs. Oncology nurses were hesitant to initiate discussions with providers to address the prolonged use of IUCs when patients had met the criteria for removal and lacked confidence in their authority to remove the IUCs based on the nurse-driven protocol.

**FIGURE 1.**

CAUTI PREVENTION PROTOCOL ADHERENCE

<table>
<thead>
<tr>
<th>AUDITED AREAS OF PROTOCOL</th>
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<tbody>
<tr>
<td>Preimplementation 2015*</td>
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<tr>
<td>Postimplementation 2015 (N = 404)</td>
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<tr>
<td>Postimplementation 2016 (N = 348)</td>
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*Preimplementation data provided by hospital data collection team, so no N values were available.
However, the nurse-driven CAUTI prevention protocol addressed and aligned with current best practice standards. Despite initial unchanging CAUTI rates, the protocol continued beyond the end of this study. The absence of significant CAUTI improvement postimplementation is likely attributable to a small sample size and low preimplementation CAUTI rates. High adherence rates to the initial implementation of the protocol were encouraging, and a gradual reduction in IUC days and CAUTI rates is expected as inpatient oncology nurses become more confident in removing IUCs according to evidence-based criteria rather than a physician order.

Outside factors have had a direct effect on the reportable number of CAUTI cases. In 2014, only eight CAUTIs were reported from the institution’s inpatient oncology units. In May 2015, the CDC updated CAUTI classifications, excluding fungal organisms (Candida). The updated CAUTI definitions resulted in the disqualifying of four (fungal) of the original eight CAUTIs reported in 2014, leaving a total of only four CAUTIs under the new definition. However, the impact of this change showed no improvement in the number of CAUTI cases in 2015, with two cases reported preimplementation and two cases reported postimplementation. In 2016, four CAUTI cases were reported through the third quarter. Despite the CDC changes to CAUTI definitions and no change in CAUTI rates, the implementation of the nursing protocol led to a decrease in infections per 1,000 catheter days.

Limitations

The organization-wide culture change necessary for implementing a nurse-driven CAUTI prevention protocol requires creativity and persistence to overcome barriers. These barriers include changing current IUC habits, educating all providers, and empowering nurses to remove IUCs according to standardized criteria. For example, during the evaluation of the protocol, the interprofessional team learned that the initial adherence rates of 90% had decreased to 68% on one unit after stopping daily audits. Compliance with scheduled pericare each shift was particularly lacking. Email reminders and resuming audits slowly brought compliance back to 90% over the course of four months. Therefore, reinforcing staff education is necessary to maintain practice change.

Another implementation barrier was a lack of self-efficacy among oncology nurses. Overcoming this barrier involved informing nurses that the institution’s policy and a hospital physician committee had approved oncology nurses to remove IUCs according to the protocol without a separate physician order. Nurses were also encouraged to discuss doubts about IUC indications with colleagues and providers rather than assuming the IUC should remain in place.

The “keep me low” stickers for IUC collection bags were found to be beneficial in educating patients, family caregivers, and inpatient oncology unit staff. However, the “ticket to ride” initiative was not found to be an effective method of communicating IUC care to transportation staff and diagnostic testing technicians. At this institution, verbal communication was found to be more effective.

Conclusion

Developing and implementing a standardized CAUTI prevention protocol exemplifies the process of translating current research into daily practice for improved patient care. bedside oncology nurses are essential for identifying practices that do not align with the evidence and are responsible for creating achievable solutions that reflect quality care. In this instance, oncology nurses recognized the grave risk CAUTIs pose to their immunocompromised patients and responded with an evidence-based protocol that influenced practice change and developed better interventions for CAUTI prevention.

Charis McCoy, MSN, FNP-BC, APRN, is a family nurse practitioner at GraceMed in Wichita, KS; and Monica Paredes, BSN, RN, OCN®, is a patient care manager. Sara Allen, BSN, RN, is an RN and faculty instructor in the School of Nursing; Jennifer Blackey, BSN, RN, OCN®, is a clinical educator; Carol Nielsen, BSN, PhN, RN, OCN®, Amy Paluzzi, BSN, RN, and Brittney Jonas, BSN, RN, are RNs; and Patti Radovich, PhD, CNS, FCCM, is the director of nursing research, all at Loma Linda University Medical Center in California. McCoy can be reached at mccoycharis@gmail.com, with copy to CJOINEditor@ons.org. (Submitted September 2016. Accepted December 19, 2016.)

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REFERENCES


IMPLICATIONS FOR PRACTICE

- Evaluate clinical practice to adapt existing protocols to changing catheter-associated urinary tract infection (CAUTI) definitions.
- Monitor adherence to CAUTI prevention protocols through the implementation of audit tools to aid in nursing compliance.
- Reinforce nursing education on indwelling urinary catheters and CAUTI prevention protocols to ensure that patients receive early interventions.


