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Guidelines to prevent catheter-associated urinary tract infection: 1980 to 2010

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Abstract

Objectives—We set out to review and compare guidelines to prevent catheter-associated urinary tract infection (CAUTI), examine the association between recent federal initiatives and CAUTI guidelines, and recommend practices for preventing CAUTI that are associated with strong evidence and are consistent across guidelines.

Background—Catheter-associated urinary tract infections are the most common healthcare-associated infection, and a cause of significant morbidity and mortality in critically ill patients.

Methods—A search of the English-language literature for guidelines in the prevention of adult CAUTI, published between 1980 and 2010, was conducted in Medline and the National Guideline Clearinghouse.

Results—Many recommendations were consistent across 8 guidelines, including limited use of urinary catheters, the insertion of catheters aseptically, and the maintenance of a closed drainage system. The weight of evidence for some endorsed practices was limited, and different grading systems made comparisons across recommendations difficult. Federal initiatives are closely aligned with the 4 most recent guidelines.

Conclusion—Additional research into the prevention of CAUTI is needed, as is a harmonization of guideline grading systems for recommendations.

Keywords

Catheter-associated urinary tract infection; Evidence-based guidelines; Infection control; Urinary catheter; Hospital-acquired conditions

An estimated1.7 million healthcare-associated infections (HAIs) occur in United States hospitals annually. Urinary tract infections (UTIs) are the most common.[1] Approximately 80% of UTIs are associated with the use of urinary catheters.[2] Costs attributable to catheter-associated urinary tract infections (CAUTIs) are estimated at $1006 (American dollars) per episode.[3] In 2002, an estimated 13,088 deaths were associated with UTIs.[1] In intensive care units in the United States, the incidence ranges from 3.1 to 7.4 CAUTIs per 1000 urinary catheter days.[4]

Organizations promoting the quality of healthcare, such as the Institute for Healthcare Improvement (IHI), accrediting bodies such as the Joint Commission (JC), and payers such

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as the Centers for Medicare and Medicaid Services (CMS) recently targeted and incentivized efforts to reduce CAUTIs. In 2007, the CMS announced that under a revised Acute Care Hospital Inpatient Prospective Payment System (IPPS), beginning in 2008, it would no longer reimburse hospitals for costs attributable to CAUTIs.[5] In 2009, the IHI added CAUTIs as a focus of their Improvement Map Campaign.[6] In 2010, the JC proposed the implementation of evidence-based practices to prevent CAUTIs as one of its 2012 National Patient Safety Goals.[7] Most recently, among proposed changes to the IPPS, the CMS announced it plans in 2014 to begin reporting rates of CAUTI publicly for hospitals participating in the Hospital Inpatient Quality Reporting Program, based on data submitted beginning in 2012.[8]

Several guidelines to prevent CAUTI, compiled by experts in hospital epidemiology and urology, have been published during the past 30 years. This review is intended to assist physicians and healthcare workers in the development of policies at their own hospitals that will include the most important features of the majority of expert guidelines, comply with national quality initiatives, and lead to a reduced rate of CAUTIs. To these ends, we review and compare guidelines to prevent CAUTI, examine the association between recent federal initiatives and CAUTI guidelines, and recommend practices to prevent CAUTI that are associated with strong evidence and consistent across guidelines.

Methods

For the purposes of this study, a guideline was a document developed to guide clinical decision-making, based on scientific and clinical evidence, authored by representatives of key affected groups, and with clear documentation of the analytic methods employed.[9] Electronic searches of Medline (from the National Library of Medicine), using the Ovid platform (Ovid Technologies, Wolters Kluwer, New York, NY), and the National Guideline Clearinghouse (from the Agency for Healthcare Research and Quality) were conducted in March 2011. In Medline, merged subject headings *guideline* or *practice guideline* and *catheter-related infections* or *urinary tract infections*, limited to the English language and years of publication 1980 to 2010, yielded 47 hits. We narrowed our sample to 4 after screening abstracts or full texts for further inclusion criteria, consisting of international or national guidelines for the prevention of CAUTIs in adults at acute care settings. In the National Guideline Clearinghouse, the merged search terms *urinary tract infection* and *urinary catheter* yielded 67 hits, 4 of which met the inclusion criteria but were duplicated in the Medline search. A subsequent hand search of reference lists yielded 4 additional guidelines that met our inclusion criteria, for a total of 8 guidelines.

The full texts of these 8 guidelines were retrieved and analyzed by a single reviewer (L.J.C.). First, recommendations for preventing CAUTIs in acute-care patients with short-term, indwelling catheters were examined and compared, and trends were noted. Next, to facilitate comparisons of the strength of each recommendation across guidelines, the guidelines' original diverse categories for strength of recommendation were transformed into a common scale with 3 categories, from strong to weak (+++, ++, and +). A 3-category system was chosen because 4 of the 8 guideline grading systems used 3 categories. Practices that were discussed in guidelines but not graded by strength were compared as "recommended" or "not resolved." Lastly, guideline introduction, methods, and discussion sections were combed for evidence of a relationship between the development of each guideline and concurrent national quality initiatives or regulations.

Results

The Centers for Disease Control and Prevention (CDC) released the *Guideline for Prevention of Catheter-Associated Urinary Tract Infections* in 1981.[10] In 2001, the Department of Health in England published guidelines for the prevention of HAIs, ie, *epic Project Phase 1*, which included guidelines regarding CAUTIs.[11] These were updated in 2007 as *epic2*.[12] Early in 2008, the European Association of Urology (EAU), the Urological Association of Asia (UAA), and others published *European and Asian Guidelines on Management and Prevention of Catheter-Associated Urinary Tract Infections*.[13] The same year, the Society for Healthcare Epidemiology of America (SHEA), the Infectious Diseases Society of America (IDSA), and others jointly published the *Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals*, including strategies to prevent CAUTI.[14] In 2009 the Wound, Ostomy, and Continence Nurses Society (WOCN) published *Nursing Interventions to Reduce the Risk of Catheter-Associated Urinary Tract Infection*.[15–17] In 2010, the IDSA published *Diagnosis, Prevention, and Treatment of Catheter-Associated Urinary Tract Infection in Adults: 2009 International Clinical Practice Guidelines From the Infectious Diseases Society of America*.[18] Later the same year, the Healthcare Infection Control Practices Advisory Committee (HICPAC) at the CDC published an updated *Guideline for Prevention of Catheter-Associated Urinary Tract Infections 2009*.[19] An overview of the evolution of specific recommendations shows broad agreement among these international panels of experts, and little change over the years (Table 1).

Recommendations

Three recommendations were present in all CAUTI guidelines reviewed: catheterize only when necessary and only for as long as necessary, insert catheters using aseptic techniques and sterile equipment, and maintain a closed, sterile drainage system. Across guidelines we found other commonalities, some new developments, and a few contradictions.

Appropriate Use and Indications for Urinary Catheterization

Most guidelines (6 of 8) agreed on a list of 3 appropriate indications for the use of catheters: acute urinary retention or obstruction, perioperative applications in select procedures, and the frequent, accurate measurement of urine output in critically ill patients. Other appropriate uses were cited by fewer guidelines, eg, patient comfort at the end of life (4 of 8), sacral or perineal wound healing in incontinent patients (3 of 8), and prolonged immobilization under conditions such as unstable spine or pelvic fracture (1 of 8). Six of the 8 guidelines endorsed the use of condom catheters or intermittent urethral catheterization as alternatives to indwelling catheters for selected patients, but only 3 suggested suprapubic catheters as a viable alternative. Since 2001, guidelines have advised regularly reviewing the need for a catheter. More recently, authors have suggested specific implementation strategies, such as daily reviews of patients with indwelling catheters, standardized reminders, automatic stop orders, or nurse-directed protocols to discontinue catheters. Using portable bladder scanners to rule out urinary retention, thus avoiding unnecessary catheterization, constituted another recent recommendation.

Catheter Selection

All but 1 of the guidelines advised using the smallest bore catheter possible. Early guidelines could offer no recommendations regarding the use of silver alloy or antimicrobial catheters, because sufficient evidence had not accumulated. More recent guidelines support their use in select patients. The use of hydrophilic catheters for intermittent catheterization was opposed by 1 guideline and endorsed by another.

Insertion

All authors advised using aseptic technique and sterile equipment for inserting catheters in acute-care settings. However, the advice was contradictory regarding meatal cleaning with antiseptic versus sterile saline before insertion.

Maintenance

All guidelines advocated maintaining a closed, sterile drainage system for indwelling catheters. To that end, the 3 most recent guidelines recommended the use of a preconnected catheter and drainage system with sealed junctions. All but 1of the guidelines also sanctioned several strategies for catheter maintenance: obtain small-volume urine samples aseptically from a sampling port, keep the drainage bag below the level of the bladder, avoid routine irrigation, and do not perform special meatal care. The guidelines agreed that catheters should not be changed routinely. However, they disagreed over what to do if a closed sterile catheter and collection system are disconnected, if leakage occurs, or if breaks in the aseptic technique occur. Earlier guidelines recommended that if a sterile closed system is violated, the collection system should be replaced using an aseptic technique. The most recent guideline recommends replacing both the catheter and collection system.

Antimicrobials

A majority of guidelines include proscriptions against the routine use of any antimicrobial or antiseptic for treating asymptomatic bacteruria, for systemic prophylaxis against CAUTIs, or for applications inside the drainage bag. In addition, a majority counseled against the routine bacteriologic monitoring of urine in catheterized patients.

Administrative Controls and Quality Measures

Three recommendations for assuring the implementation of best practices were consistent across guidelines for the prevention of CAUTIs: train all persons responsible for catheter insertion and maintenance (7 of 8), document the indications for use of each catheter (6 of 8), and provide feedback and outcome measures to clinical staff and administrators (6 of 8).

Differentiating CAUTIs and Asymptomatic Bacteriuria

The definition of CAUTI was not consistent across guidelines. All guidelines acknowledged that a CAUTI is often asymptomatic.[20] Six guidelines[11–13,15–19] distinguished catheter-associated asymptomatic bacteriuria from CAUTI by the presence of symptoms including urgency, pelvic pain, fever, or bacteremia. All 5 guidelines that provided a written definition of CAUTI[11,12,15–19] used these distinguishing criteria. However, only the EAU/UAA and IDSA guidelines included separate recommendations for the prevention of symptomatic CAUTIs vs. asymptomatic bacteriuria.

Evidence Grading and Recommendation Categories

All authors of guidelines based their recommendations on literature reviews of original scientific studies, and each group of authors included citations unique to their guideline. In addition to these primary sources, all but 1 group (ie, EAU/UAA in 2008) cited other CAUTI guidelines among their source documents. The authors of the 2008 SHEA/IDSA guidelines stated that their recommendations were based largely on previously published guidelines and on literature published after those guidelines. The authors of the 2009 WOCN and 2010 HICPAC studies explained that they used earlier guidelines to formulate key questions for their literature reviews. The remaining 4 groups of authors cited previous guidelines as sources of expert opinion in making specific recommendations.

The guidelines used 6 different grading systems for quality of evidence, and 5 different grading systems for strength of recommendation. All but 1 of the 8 guidelines used a grading system for quality of evidence, and 6 of 8 used a separate but related grading system for strength of recommendation. Quality of evidence influenced but did not fully determine the strength of recommendations. In most of the guidelines, the strength of a recommendation was based on a combination of 1 or more of several factors: the nature of the evidence (including expert opinion), applicability to practice, characteristics of healthcare systems, and cost. In 3 guidelines, the cost of interventions was a factor influencing recommendations (see individual guidelines for further information on categories for quality of evidence). The categories for strength of recommendation of each guideline are compared in Table 2.

The working group for the 1981 CDC guideline used a 3-level scale for strength of recommendation that included strong, moderate, and weak recommendations. The authors of EPIC Phase 1 used a grading scale for quality of evidence, but not for strength of recommendation. Instead, they endorsed all recommendations equally, and none was regarded as optional. The authors of EPIC 2 used a dual scale for level of evidence and grade of recommendation, and that scale was a modification of the United Kingdom National Institute for Health and Clinical Excellence tool for developing guidelines.[21] The authors of the EAU/UAA guideline used a dual scale for level of evidence and grade of recommendation, and that scale was a modification of a tool developed in 1992 by the United States Department of Health and Human Services Agency for Health Care Policy and Research (a forerunner of the Agency for Healthcare Research and Quality). The SHEA/IDSA and IDSA guideline groups both used a dual scale for grading quality of evidence and strength of recommendation, and that scale was adapted from the Canadian Task Force on the Periodic Health Examination.[22] The WOCN graded quality of evidence as 1 through 4, but did not explain the grading scheme; no grades were assigned to indicate strength of recommendation. The HICPAC authors used methods adapted from the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group[23] to rate quality of evidence, and a modified HICPAC categorization scheme for strength of recommendation.

Relationship Between Guidelines and Regulations

Two guidelines for the prevention of CAUTIs were published between 1980 and 2007, and 6 were published between 2007 and 2010. The flurry of new guidelines began the same year that the CMS announced its nonreimbursement regulation. The primary purpose of all guidelines reviewed, as stated, was to assist clinician decision-making. However, a secondary purpose in 4 guidelines involved assisting hospitals in meeting new external quality standards and regulations.[11,14,15,19] In 2 cases, the authors cited the CMS regulations as an impetus for developing guidelines.[14,15] In 1 case, the authors discussed the implications of their grading scheme for policymakers; and noted that the strongest recommendations may be adopted as policy.[19]

Recommendations in the guidelines form the basis of national quality initiatives by IHI and JC. The IHI Improvement Map[6] promotes implementation at the institutional level of measures to prevent CAUTI that are closely aligned with the most recent SHEA/IDSA guideline. The IHI How-to Guide focuses on 4 components of care, including the avoidance of unnecessary urinary catheters, the insertion of urinary catheters using aseptic technique, the maintenance of urinary catheters based on recommended guidelines, and daily review of the necessity for using a urinary catheter. Specific strategies are those listed in the SHEA/IDSA guideline.

The 2012 National Patient Safety Goal for hospitals, proposed by the JC, is also congruent with guideline recommendations reviewed here. The elements of performance are general and defer to established, evidence-based guidelines for particulars (eg, rather than dictating appropriate indications for the use of urinary catheters, the element states only, "limit use and duration to situations necessary for patient care"[7]). Other elements of the goal include the use of aseptic technique for insertion, the management of indwelling urinary catheters to prevent infection, and the monitoring of processes to prevent CAUTI and their outcomes. The IDSA/SHEA and HICPAC documents are cited as appropriate sources for specific guidance.

The CMS IPPS and Hospital Inpatient Quality Reporting Program regulations, which are focused on CAUTI outcomes rather than on processes of prevention, are supported by the guidelines in principle, but not in practice. A majority of guidelines proposed outcome measures for *internal* reporting to hospital staff and administrators. In particular, some guidelines recommended measuring incidence rates of CAUTI using catheter days as a denominator, according to valid case-finding methodology and standard surveillance criteria, but none offered specific performance measures suitable for *external* reporting or regulatory oversight. The CMS relies on Medicare and Medicaid claims and administrative data to identify and deny payment for treatment of CAUTIs not present on admission, and for public reporting of CAUTI rates by hospitals.[24] This methodology may be inaccurate.[25,26] Thus, although the measurement of CAUTI outcomes is endorsed in a majority of guidelines, the public reporting of CAUTI rates, as determined by claims and administrative data, is not.

Discussion

Although guidelines differ in the amount of detail provided and their focus of efforts to prevent CAUTI (eg, the EAU/UAA guidelines discuss antimicrobial prophylaxis in detail, whereas the WOCN guidelines address catheter type and size in detail), the consistency of recommendations across 30 years is remarkable. Several of the most frequent and strongest recommendations were present in the 1981 guidelines. This consistency would most obviously be attributable to a strong body of evidence for the recommendations. Although this is true for some recommendations to prevent CAUTI (eg, the research into closed vs. open drainage systems is conclusive), for others, wide agreement exists only in theory (eg, the use of the smallest bore catheter possible). In fact, the authors of several guidelines state that the weight of evidence for many recommendations is scant.[13,14,19] Lo et al noted that Cochrane reviews of CAUTI interventions consistently observed a "limited number of studies addressing any specific question, small study numbers, low quality of most studies, and heterogeneity in results, particularly when morbidity is addressed."[14] In fact, of the many strategies listed in the SHEA/IDSA guideline, only 3 positive recommendations and 4 proscriptions are based on good evidence from ≥1 properly randomized, controlled trial.

An alternate explanation for the consistency may involve the use by most guidelines of other guidelines as part of their evidence base. Although authors of guidelines need to appraise all evidence and review previous guidelines for gaps in recommendations, this cross-pollination may lend undue weight to some recommendations (especially those based on expert opinion). When good quality evidence was available, this threat was minimized. For example, after appraising new evidence, and in contrast to earlier guidelines, the IDSA recommended that the presence of a sacral ulcer did not provide an appropriate indication for catheter placement, and the WOCN recommended the routine use of silver alloy or antimicrobial catheters in select patients.

Although the guidelines are relatively consistent, different grading systems for quality of evidence and strength of recommendation make comparisons difficult. Moreover, what the recommendations purport to prevent remains unclear. With the exception of EAU/UAA and IDSA, these recommendations do not distinguish between the prevention of symptomatic CAUTI and the prevention of catheter-associated asymptomatic bacteriuria. This lack of clarity occurs because the majority of studies regarding CAUTI use outcome measures that do not make this distinction. Instead, investigators use varying levels of bacteriuria as the outcome of interest. For clinicians seeking to prevent CAUTI, the distinction is a moot point, because all symptomatic CAUTI begins as asymptomatic bacteriuria. However, for clinicians making treatment decisions, the distinction between CAUTI and bacteriuria is important and much debated.[27] Separate guidelines address the management of asymptomatic bacteriuria.[28]

One notable change in recommendations has occurred in the area of catheter selection. Emerging evidence[29,30] has led to tentative recommendations for the use of silver alloy and antimicrobial-impregnated catheters, an issue that was previously unresolved. A second change has involved the addition of quality measures. Since 2001, all but 1 of the CAUTI guidelines included recommendations for internal processes or outcome measures to guide efforts at prevention (eg, audit catheter care practices and feedback CAUTI incidence rates to clinical staff). In addition, the 2008 SHEA/IDSA and 2010 HICPAC guidelines provided detailed recommendations for the surveillance of CAUTIs, and advised the internal reporting of 3 outcome measures, ie, the incidence rates of CAUTIs using catheter days as the denominator, bacteremia attributable to CAUTI, and the proportion of appropriate urinary catheter use. Gaps exist, however, in guideline recommendations for strategies that promote the early removal of catheters. Specific advice is needed regarding the context in which automatic stop orders or nurse-directed protocols reduce catheter days or decrease rates of CAUTI.

The temporal relationship between the spike in guideline development and national quality/regulatory initiatives is in keeping with one of the purposes of developing guidelines: “they are to serve as a foundation for instruments to evaluate practitioner and health system performance,”[9] and a goal of quality organizations such as the IHI involves “ensuring the broadest possible adoption of best practices.”[31] The broad agreement of quality initiatives with guideline recommendations is reassuring, in that clinicians are not forced to choose between practices that benefit patients vs. those that benefit the institution.

Studies suggest that the strategies recommended in these guidelines to prevent CAUTI have not been widely adopted. In 2005, Saint et al surveyed the practices for preventing CAUTI in 719 acute-care American hospitals.[32] Although >70% of participating hospitals monitored rates of CAUTI, only 44% monitored which patients had urinary catheters in place, and 26% monitored duration of catheterization. No single, widely used strategy to prevent CAUTI was evident. A small proportion of hospitals reported the regular use of antimicrobial catheters or portable bladder ultrasound (30%), condom catheters in men (14%), or catheter reminders or stop-orders (9%). A more recent national study resulted in similar findings.[33] Further research is needed to elucidate why these recommendations are not adopted.

This study is subject to some limitations. Other than applying the 4 inclusion criteria, this review does not offer a critical appraisal of the methodological quality of the clinical practice guidelines included. Therefore, it cannot be used as a primary resource to guide policy or practice. Also, the review is subject to English-language bias, although one European guideline was included. Lastly, a single reviewer compared the guidelines, although the reviewer’s education and experience in the field of preventing infection served to reduce possible information bias. This summary provides a broad overview of

recommendations over time; the reader is referred to individual guidelines for important caveats and nuances that accompany the recommendations.

Implications for Practice

The results of this review suggest that clinicians seeking to reduce rates of CAUTI at their hospitals should focus on 2 strategies that are strongly recommended according to good quality evidence: limit the use and duration of urinary catheterization, and maintain a closed, sterile drainage system. Good evidence supports daily reviews or automatic stop orders for identifying and removing catheters that are no longer necessary. Catheter maintenance practices that are well-justified with good evidence include hand hygiene immediately before or after any manipulation of the catheter or apparatus, obtaining small-volume urine samples aseptically from a sampling port, keeping the drainage bag below the level of the bladder, avoiding routine irrigation, and performing routine daily bathing rather than special urethral meatal care. Strong evidence exists that routinely treating asymptomatic bacteriuria, giving systemic antimicrobial prophylaxis, and placing antiseptics in the urine collection bag do not reduce rates of CAUTI.

A hospital committee tasked with setting institutional policies for preventing CAUTI will find either the 2010 IDSA or 2010 HICPAC guidelines most helpful. Both provide discussions of the evidence for each recommendation, along with extensive reference to the medical literature. Both are comprehensive. However, the HICPAC guideline addresses catheter insertion, maintenance, and quality measures in more detail, and includes a prioritization of recommendations.

Conclusions

Practice recommendations contained in guidelines for preventing CAUTI from 1980 to 2010 are remarkably consistent, and national quality and regulatory initiatives are aligned closely with the guidelines. Clinicians who prioritize the appropriate use and early removal of catheters, aseptic insertion, and the maintenance of a closed urinary drainage system will reduce the risk of CAUTI in their patients and meet quality and regulatory requirements for their institution. Clinicians should expect to receive prompt, reliable feedback of CAUTI incidence rates in their patient population from their hospital's department of quality improvement or infection control. Research into preventing CAUTIs is needed to provide an increasingly solid foundation of evidence to guide practice. A harmonization of evidence-grading criteria and guideline recommendation systems is needed.

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Table 1

Comparison of guideline recommendations for prevention of catheter-associated urinary tract infection, 1980 to 2010

Recommendation	CDC[10] (1981)	NHS EPIC 1[11] (2001)	NHS EPIC 2[12] (2007)	EAU/UAA[13] (2008)	SHEA/IDSA[14] (2008)	WOCN[15–17] (2009)	IDSA[18] (2010)	HICPAC[19] (2010)
Limiting use of catheters								
Catheterize only when necessary and only for as long as necessary	+++	Y	+	+++	+++	Y	+++	++*
Appropriate catheter uses								++
Acute urinary retention or obstruction	Y			Y	Y	Y	Y	Y
Perioperative use in select procedures	Y			Y	Y	Y	Y	Y
Accurate, frequent measurement of urine output in critically ill patients	Y			Y	Y	Y	Y	Y
Sacral or perineal wound-healing in incontinent patients					Y	Y		Y
Patient comfort at end of life					Y	Y	Y	Y
Prolonged immobilization								Y
Do not use catheters for management of incontinence or convenience of personnel	+++						+++	++*
Remove catheters within 24 hours postoperatively or as soon as possible				++				++*
Regularly review the need for a catheter		Y	+		Y	Y	Y	Y
Identify catheters no longer necessary via daily review, standardized reminders, automatic stop orders, or nurse-directed protocols					+++†	Y	+++	++
Use portable bladder scanners to assess volume of urine					++†		++	+
Consider alternative methods of urinary drainage for selected patients		Y	+					
Condom catheter	+			++	+++	Y	+++	+
Intermittent urethral catheterization	+			++	+++	Y	+	+
Suprapubic catheter	+			++			+	NR
Urethral stent for bladder outlet obstruction								NR
Insertion								
Insert catheter using aseptic technique and sterile equipment	+++	Y	+	++	+++	Y	++	++*

Recommendation	CDC[10] (1981)	NHS EPIC 1[11] (2001)	NHS EPIC 2[12] (2007)	EAU/UAA[13] (2008)	SHEA/IDSA[14] (2008)	WOCN[15–17] (2009)	IDSA[18] (2010)	HICPAC[19] (2010)
Have sterile supplies readily available					+++			++
Use gloves, drape, and sponges	++				+++			++
Use sterile lubricant from a single-use packet	++	Y	+	++	+++			++
Use antiseptic for periurethral cleaning on insertion	++				+++			NR
Use sterile saline for meatal cleaning on insertion		Y	+		NR			NR
Secure the catheter properly	+++				+++	Y		++
Catheter selection								
Use the smallest bore catheter possible	++	Y	+	++	+++	Y		+
Use a catheter with a 10-mL balloon		Y	+					
Use silver alloy catheters in select patients		NR	NR	++	NR	Y	++	++†
Use antimicrobial-impregnated catheters in select patients		NR	NR	NR	NR	Y	++	++†
Use hydrophilic catheters for intermittent catheterization							++, against	+
Maintenance								
Hand hygiene immediately before or after any manipulation of the catheter or apparatus	+++	Y	+	+++	+++			++
Maintain a closed, sterile drainage system	+++	Y	+++	+++	+++	Y	+++	++*
Use a preconnected catheter and drainage system with sealed junctions						Y	+	+
Replace the collecting system using aseptic technique if breaks in aseptic technique, disconnection, or leakage occur	+				++			
Replace the catheter and collecting system if sterile, closed drainage system is violated								++
Obtain small-volume urine samples aseptically from a sampling port	+++	Y	+		+++	Y	+++	++
Obtain large-volume urine samples (other than for culture) aseptically from the drainage bag	+++				+++			++
Maintain unobstructed urine flow (keep the collecting tube from kinking)	+++				+++			++*

Recommendation	CDC[10] (1981)	NHS EPIC 1[11] (2001)	NHS EPIC 2[12] (2007)	EAU/UAA[13] (2008)	SHEA/IDSA[14] (2008)	WOCN[15–17] (2009)	IDSA[18] (2010)	HICPAC[19] (2010)
Keep drainage bag below the level of the bladder	+++	Y	+		+++	Y	+++	++
Empty drainage bag regularly, using a separate container for each patient, and not allowing the spigot to touch the collecting container	+++	Y	+		+++			++
Avoid routine irrigation	++	Y	+++		+++	Y	+++	+
If irrigation is needed to relieve obstruction, use aseptic technique and sterile supplies	+++							
Do not perform special meatal care	++	Y	+++		+++	Y	+++	++
Do not use meatal creams or ointments				+++		Y	+++	
Spatially separate infected from uninfected patients	+						NR	NR
Do not change catheters routinely	++	Y	+	++	+++			+
Change catheter if it is contributing to obstruction	++			++				++
Change catheter before sampling urine for culture						Y	+++	
Change catheter before initiating treatment of CAUTI				++			+++	
Antimicrobials and antiseptics								
Avoid routine bacteriologic monitoring	+			++	+++		+++	+
Do not treat asymptomatic bacteruria				+++	+++	Y	+++	
Avoid systemic antimicrobial prophylaxis				+++	+++		+++	++
Avoid urinary antiseptics (eg, methenamine)				+++			+≠	NR
Do not use antimicrobials or antiseptics in the drainage bag		Y	+++			Y	+++	+
Administrative controls								
Train all persons responsible for catheter insertion and maintenance	++	Y	+		+++	Y	+++	++*
Require a physician's order for catheterization							+++	
Develop written policies for use, insertion, and maintenance of catheters				++	+++	Y	+++	

Recommendation	CDC[10] (1981)	NHS EPIC 1[11] (2001)	NHS EPIC 2[12] (2007)	EAU/UAA[13] (2008)	SHEA/IDSA[14] (2008)	WOCN[15–17] (2009)	IDSA[18] (2010)	HICPAC[19] (2010)
Document indication for use of each catheter		Y	+		+++	Y	+++	+
Document insertion, care, and removal		Y	+		+++			+
Quality measures								
Provide personnel and technology to support surveillance of CAUTIs					+++			++
Target surveillance to high-risk groups					++			+
Use valid surveillance methodology					+++			++
Use standard surveillance criteria					+++			Y
Monitor and audit catheter care practices and documentation		Y	Y					
Measure incidence rates of CAUTIs, using catheter days as denominator		Y			+++	Y		Y
Measure bacteremia attributable to CAUTIs					Y			Y
Measure device use, duration, and appropriate indications					++		+++	+
Measure risk-stratified adverse events from catheter use					++†			
Feedback process and outcome measures to staff and administrators		Y	Y		Y	Y	+	+
Engender shared accountability for CAUTIs			Y		Y			

+++, ++, +, strength of recommendation, from strongest to weakest; *CAUTIs*, catheter-associated urinary tract infections; *CDC*, Centers for Disease Control and Prevention; *EAU*, European Association of Urology; *HICPAC*, Healthcare Infection Control Practices Advisory Committee; *IDSA*, Infectious Diseases Society of America; *NHS*, National Health Service; *NR*, not resolved; *SHEA*, Society for Healthcare Epidemiology of America; *UAA*, Urological Association of Asia; *WOCN*, Wound, Ostomy, and Continence Nurses Society; *Y*, recommended but no strength given.

* HICPAC priority recommendations.

† Recommended for use if a comprehensive program of basic strategies fails to reduce CAUTIs.

‡ May be useful after gynecological surgery for patients with an indwelling catheter for up to 1 week. This table was adapted from that of Lo et al.[14]

Table 2

Categories of strength of recommendation in catheter-associated urinary tract infection prevention guidelines, 1980 to 2010

Strength of recommendation	+++	++	+	**Y**
CDC[10] (1983)	1 Strongly recommended for adoption	2 Moderately recommended for adoption	3 Weakly recommended for adoption	
NHS EPIC 1[11] (2001)				All recommendations are endorsed equally
NHS EPIC 2[12] (2007)	A At least 1 high-quality meta-analysis, systematic review of RCTs, or RCTs with a *very low* risk of bias; directly applicable to the target population, *or* A systematic review of RCTs or a body of evidence that consists principally of well-conducted meta-analyses, systematic reviews of RCTs, or RCTs with a *low* risk of bias; and directly applicable to the target population and demonstrating over-all consistency of results, *or* Evidence drawn from a NICE technology appraisal	B A body of evidence that includes high-quality systematic reviews of case-control or cohort studies; or high-quality case-control or cohort studies with a *very low* risk of confounding, bias, or chance and a *high* probability that the relationship is causal; and directly applicable to the target population and demonstrating overall consistency of results, *or* Extrapolated evidence from high-quality or well-conducted meta-analyses, systematic reviews of RCTs, or RCTs with a *very low* or *low* risk of bias C A body of evidence that includes well-conducted case-control or cohort studies with a *low* risk of confounding, bias, or chance and a *moderate* probability that the relationship is causal; and directly applicable to the target population and demonstrating overall consistency of results, *or* Extrapolated evidence from high-quality systematic reviews of case-control or cohort studies; or high-quality case-control or cohort studies with a *very low* risk of confounding, bias, or chance and a *high* probability that the relationship is causal	D Evidence from nonanalytic studies (eg, case reports or case series) or expert opinion and formal consensus, *or* Extrapolated evidence from well-conducted case-control or cohort studies with a *low* risk of confounding, bias, or chance and a *moderate* probability that the relationship is causal, *or* Formal consensus D (GPP) A GPP is a recommendation for best practice based on the experience of the guideline development group IP Recommendation from NICE IP guidance	
EAU/UAA[13] (2008)	A Based on clinical studies of good quality and consistency addressing the special recommendations and including at least 1 randomized trial	B Based on well-conducted clinical studies, but without randomized clinical trials	C Made despite the absence of directly applicable clinical studies of good quality	
SHEA/IDSA[14] (2008)	A Good evidence to support a recommendation for or against use	B Moderate evidence to support a recommendation for or against use	C Poor evidence to support a recommendation for or against use	
WOCN[15–17] (2009)				No categories of strength of recommendation are provided
IDSA[18] (2010)	A Good evidence to support a recommendation for or against use	B Moderate evidence to support a recommendation for or against use	C Poor evidence to support a recommendation for or against use	
HICPAC[19] (2010)	1A	1B	2	

Strength of recommendation	**+++**	**++**	**+**	**Y**
	A strong recommendation supported by high-quality to moderate-quality evidence suggesting net clinical benefits or harms	A strong recommendation supported by low-quality evidence suggesting net clinical benefits or harms, or an accepted practice (eg, aseptic technique) supported by low to very low quality evidence 1C A strong recommendation required by state or federal regulations	A weak recommendation supported by any quality evidence suggesting a trade-off between clinical benefits and harms	

+++, ++, +, strength of recommendation, from strongest to weakest; *CDC*, Centers for Disease Control and Prevention; *EAU*, European Association of Urology; *GPP*, good practice point; *HICPAC*, Healthcare Infection Control Practices Advisory Committee; *IDSA*, Infectious Diseases Society of America; *IP*, interventional procedures; *NHS*, National Health Service; *NICE*, National Institute for Clinical Excellence; *RCTs*, randomized controlled trials; *SHEA*, Society for Healthcare Epidemiology of America; *UAA*, Urological Association of Asia; *WOCN*, Wound, Ostomy, and Continence Nurses Society; *Y*, recommended but no strength given.