Reducing Catheter-Associated Urinary Tract Infection in the Critical Care Unit

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Article Outline

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Abstract

Changes in reimbursement policies have focused attention on the use of indwelling catheters in the critical care unit as well as their role in hospital-acquired urinary tract infections. Implementation of an evidence-based prevention program can significantly reduce both the prevalence of indwelling catheterization and the incidence of hospital-acquired catheter-associated urinary tract infection. This article describes the epidemiology and pathophysiology of catheter-associated urinary tract infection, and outlines essential elements of an evidence-based prevention program for the critical care unit.

Changes in the US Centers for Medicare & Medicaid Services (CMS) inpatient prospective payment system continue to impact care delivery in the critical care unit. The Medicare Severity Diagnosis Related Group (MS-DRG) was launched in 2007, and the revised payment system was implemented in October 2008. One component of this program that has particularly impacted care delivery in the critical care unit is the identification of a number of high-cost, high-volume conditions that can be reasonably prevented via application of evidence-based interventions.[1] If the conditions are hospital acquired, the CMS will no longer reimburse the costs associated with them.

Back to Top | Article Outline

Catheter-Associated Urinary Tract Infection

Not surprisingly, catheter-associated urinary tract infection (CAUTI) was identified as one of the original 8 potentially preventable conditions. Urinary tract infections (UTIs) account for approximately 40% of all hospital-acquired infections in the United States[2]; more than 80% are associated with an indwelling catheter.[3] The prevalence of CAUTI in

the acute care setting is directly linked to the widespread use of indwelling catheterization in that setting. Reported hospital wide prevalence rates for indwelling catheterization vary from 25% to 35%.[4,5] Prevalence rates in the critical care unit are substantially higher at 67% to 76%.[6–8]

Multiple factors have been identified as potential risk factors for CAUTI (Table 1).[9–11] Several are especially significant for patients managed in a critical care unit, including fecal incontinence, use of systemic antibiotics, severity of illness, impaired immune system function, and elevated creatinine.

Table 1: Factors Ass...
Image Tools

CAUTI creates significant costs for the individual facility and the health care system at large. The cost of treating a single episode varies from $980 to $2900 depending on the presence of associated bacteremia.[12] Cumulatively, CAUTI adds an additional 90 000 hospital days per year.[13] Although this figure is less than the per case costs attributed to some other hospital-acquired conditions such as a pressure ulcer, its higher incidence results in a collective annual cost of $424 million to $451 million in the United States alone.[14]

Back to Top | Article Outline

Etiology and Pathophysiology

A UTI is an inflammatory response to colonization of the urinary tract, typically owing to a bacterial or fungal pathogen.[15] A UTI should be distinguished from the mere presence of bacteria in the urinary tract. This condition, referred to as asymptomatic bacteriuria, is common and does not require treatment, especially in the patient with an indwelling urinary catheter.[9] A CAUTI occurs when a patient with an indwelling urinary catheter develops 2 or more signs or symptoms of a UTI such as hematuria, fever, suprapubic or flank pain, change in urine character, and altered mental status (especially in frail elderly individuals).

CAUTI is classified as a complicated UTI. The presence of a foreign body in the urinary tract not only predisposes the patient to UTI but also alters the body's ability to eradicate bacteria from the lower urinary tract. Although bacteriuria is present in only a small percentage of community-dwelling women and men, the insertion of a catheter results in colonization of the bladder with bacteria at a rate of 3% to 10% per day, and the incidence approaches 100% when the catheter remains in place for 30 days or longer.[16,17]

Bacterial counts typically vary from 103 to 105 CFU/mL; most reflect common species found in the gastrointestinal tract or on the skin. In the hospital setting, additional pathogenic bacterial species gain access to the urinary tract due to contact with the environment, other patients, visitors, or hospital personnel.[14] Unlike bacterial strains

found in community-dwelling persons, hospital-acquired pathogens tend to be more virulent and resistant to one or more antimicrobials.

Pathogens enter the urinary tract during catheter insertion, through the catheter lumen, or from the urethral meatus via the catheter-urethral interface.[18,19] Most CAUTIs (66%) are attributed to bacteria gaining access via the catheter-urethral lumen interface, and the remaining 34% are attributed to intraluminal migration associated with manipulation of the catheter and urinary drainage system.[19]

The presence of an indwelling catheter further predisposes the patient to a symptomatic infection because it acts as a surface for the attachment of microbial adhesion.[14] Once they gain access to the urinary tract, bacteria produce various adhesions, including hair-like fimbriae that allow them to firmly attach to the catheter wall. Following attachment, the bacteria up regulate their expression of certain genes, resulting in production of exopolysaccharides that ultimately lead to a biofilm. The genesis and evolution of a biofilm follows a predictable sequence beginning with attachment, followed by maturation, and ultimately dispersion into the local (or systemic) environment. The complex structures of the biofilm promote bacterial proliferation and protect bacteria from destruction from cleaners, antiseptics, antibiotics, and the host's immune system. Bacteria within a biofilm exhibit a greater ability to communicate and exchange genetic information than do free-floating (planktonic) bacteria. This communication is hypothesized to promote antibiotic resistance and spread of the biofilm to other surfaces of the catheter and urinary epithelium.

The presence of a catheter further predisposes the patient to CAUTI by provoking inflammation and traumatizing the mucosa of the urethra and bladder neck. In vitro experiments reveal that exposure to bacteria in the presence of a catheter provokes uroepithelial cells to produce inflammatory cytokines.[20] This production increases over time, and it is affected by the material used in the catheter. Both silicone and latex catheters promote inflammatory cytokine production, but the magnitude of production is greater for latex catheters. Inflammation and mechanical damage to the urinary epithelium not only increases the risk of UTI but also compromises the patient's ability to mount an effective immune response to bacteria in the bladder.

Back to Top | Article Outline

Preventing CAUTI

It has been estimated that between 17% and 69% of hospital-acquired CAUTI may be prevented by implementation of an evidence-based prevention program.[11] Establishing this type of program is particularly important in the critical care setting given the comparatively high prevalence of indwelling catheterization as well as the percentage of patients with comorbid conditions that increase their risk for CAUTI (Table 1).

Designing a strategy for preventing CAUTI begins with identification of the infrastructure and facility resources needed to implement an effective program. The

advanced practice nurse (APN) is ideally suited to initiate, coordinate development of, and evaluate outcomes of this type of program. The process typically begins with identification of a multidisciplinary committee to review pertinent literature and interpret this evidence for the specific needs of the local facility and its critical care units. Key players will vary on the basis of local resources and clinical leaders, but they should include representatives from medicine, nursing, and infection control specialists. Other players usually include the wound, ostomy, and continence (WOC) nurse; urologic specialists; and clinical educators.

The APN should work with this group to (1) review current facility policies about indwelling catheterization and CAUTI prevention; (2) review clinical evidence and clinical practice guidelines pertaining to CAUTI prevention and apply these to the local facility and its critical care units; (3) revise or draft new policies, including indications for catheter insertion, monitoring of indwelling catheters, and evaluation of the need for continuing an indwelling catheter, selecting optimal catheters and drainage systems, and identifying alternatives to indwelling catheterization in selected patients, such as external collection devices; and (4) documentation and analysis of program outcomes.

Back to Top | Article Outline

Reducing Indwelling Catheter Days

It is widely accepted that the risk for CAUTI is proportional to the number of days a catheter remains indwelling.[2,9,15,19] Therefore, reduction of indwelling catheter days is a cornerstone of any CAUTI prevention program. Nevertheless, achieving this goal in the critical care unit presents unique challenges. A review of existing evidence reveals several reasonable strategies for reducing indwelling catheter days.[21] Indications for inserting an indwelling catheter should be established. An updated guideline from the US Centers for Disease Control and Prevention (CDC), although still in draft form,[11] lists reasonable indications for indwelling catheterization in the acute or critical care setting (Table 2). In addition to the indications listed in Table 2, conditions such as urinary incontinence, staff convenience, or epidural analgesia or anesthesia are not appropriate indications for inserting an indwelling catheter.

Table 2: Indications...
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Several studies have examined CAUTI rates following implementation of a facility-wide policy for catheter insertion. Apisarnthanarak et al[22] reported a before–after study conducted in a 450-bed acute care facility. Baseline data were collected over a 12-month period, followed by implementation of policies for inserting and removing indwelling catheters. These policies were created by a multidisciplinary team that included infection control specialists, medical doctors, nursing, and hospital administration. Patients managed with an indwelling catheter for more than 3 days were reviewed by the team, and all catheters determined to have been inserted for inappropriate reasons were

discontinued in consultation with the patient's physician. In addition, patients deemed to have an indwelling catheter inserted for appropriate indications were reviewed for indications for discontinuation on a daily basis. This program significantly reduced the incidence of CAUTI, the frequency of patients deemed to have a catheter inserted for inappropriate indications, and the mean length of catheterization. The researchers further noted that the greatest impact of this intervention was in the facility's critical care areas, resulting in reduced antimicrobial use and a reduction in associated costs.

Huang et al[7] studied the efficacy of a daily nurse-driven catheter removal program on patients admitted to 5 critical care units (cardiovascular surgery, coronary care, surgical, neurosurgical, and medical) located in a 1310-bed hospital. The baseline frequency of urinary catheterization, indwelling catheter days, and incidence of CAUTI over a 12-month period were estimated by retrospective chart review, followed by a nurse-led intervention implemented over a 12-month period. Nurses reminded physicians to review the necessity of catheterization on a daily basis if the catheter remained indwelling for a period of 5 days. This program significantly reduced the incidence of CAUTI, the mean duration of indwelling catheterization, and the mean monthly costs for antimicrobial medications.

Dumigan et al[23] also identified indications for inserting an indwelling catheter and implemented a program that empowered critical care nurses to remove the catheter without a physician's order when it was deemed no longer medically indicated. This study was set in 3 intensive care units (ICUs) in a 500-bed hospital, and CAUTI rates were monitored over a 5-year period. CAUTI incidence in the surgical ICU did not significantly change following the intervention, but the incidence rates in the medical and coronary care ICUs declined significantly after implementation of the removal program.

Elpern et al[24] evaluated the effect of a program designed by a team of medical ICU clinicians that included 2 APNs with critical care expertise to regularly review indications for indwelling urinary catheters and to remove catheters when not indicated. During the researchers' 6-month evaluation, 337 patients experienced 1437 days of urinary catheterization. Following implementation of the program, the mean duration of indwelling catheterization was significantly reduced, as was the mean number of CAUTI per 1000 patient-days.

Findings from these studies provide evidence to support establishing a facility-wide policy detailing indications for indwelling catheterization, combined with a prompted catheter removal program. The key elements of an effective program appear to be (1) reformulation or clarification of policies related to indwelling catheterization; (2) active involvement of a multidisciplinary team, including staff nurses and key specialty practice nurses (WOC nurses and urologic nurses), medical doctors, and the facility's infection control team; (3) a standardized mechanism to review the appropriateness of catheter insertion; (4) a mechanism for reviewing the patient for potential catheter removal beginning as soon as 1 day and no later than 3 days after insertion; and (5) a mechanism for regular and constructive staff feedback about results of the program.

Back to Top | Article Outline

Selecting an Optimal Catheter and Drainage System

Multiple aspects of both indwelling catheters and drainage systems have been manipulated in an attempt to reduce CAUTI risk. One strategy is to alter the material used to construct the indwelling catheter. Latex was incorporated into the original indwelling catheter designed by Frederick Foley in the 1930s, and it continues to be used today.[25] More recently, catheters have been constructed from silicone. Evidence from laboratory-based studies demonstrates that silicone catheters become encrusted more slowly than do latex catheters, although neither material has proved immune from this process.[26]

These findings suggest that selection of a silicone catheter may provide some advantage over a latex catheter for the patient who is managed by long-term indwelling catheterization and experiences catheter blockage caused by biofilm formation and encrustation. However, these findings must be interpreted with caution in the critical care setting, where the majority of patients are managed by short-term catheterization (less than 30 days). In addition, a randomized clinical trial[27] comparing irrigation and catheter changes in homebound patients managed by long-term indwelling catheterization demonstrated that encrustation was not the most common cause of recurring blockage, contrary to results obtained in highly controlled laboratory experiments. Instead, the researchers found that the majority of catheters were blocked by overgrowth of biofilm, mixed with debris in the urine. Because both silicone and latex catheters ultimately form biofilm over time, there is insufficient evidence to conclude that either material is superior for use in the acute or critical care setting.

Another strategy is the incorporation of an antimicrobial substance in the catheter.[21,26,28–30] Silver oxide or silver alloys may be impregnated into the walls of latex catheters. Alternatively, an antimicrobial, usually nitrofurazone or minocycline and rifampin in combination, may be used to coat the walls of all silicone catheters. Silver oxide–impregnated catheters were not found to be effective.[31] However, multiple meta-analyses and systematic reviews provide robust evidence that either silver alloy latex catheters or antimicrobial–coated silicone catheters reduce the incidence of bacteriuria over a period of 5 to 7 days, and weaker evidence that these catheters also reduce the incidence of CAUTI.[26,28,31–34] Nevertheless, those reviews that also considered direct cost versus benefit also observed that additional evaluation is needed before silver alloy–impregnated or antibiotic-coated catheters can be recommended for routine clinical use.[31,32] This conclusion is also reflected in the draft clinical practice guideline available from the CDC.[11] Although existing evidence is insufficient to support the use of antimicrobial catheters for routine use, evidence of efficacy should be carefully considered when designing a prevention program in the critical care unit, where patients tend to have multiple risk factors for CAUTI and where the cost of treating a symptomatic infection, especially one that is complicated by sepsis, tends to be considerable.

Additional considerations related to catheter design include catheter size. In its original clinical guideline, the CDC recommended selection of small catheter sizes as a strategy to reduce CAUTI risk.[30] The rationale for inserting a small catheter, less than 18 French, is to reduce the irritation and inflammation associated with higher-diameter catheters. In addition, larger catheters are thought to impede secretion of glycosaminoglycans from the urethral mucosa, which play a role in preventing urethral ascension of bacteria from the distal urethra to the bladder vesicle. Although clinical experience and expert opinion tend to support the use of smaller catheters to promote comfort and reduce urethral irritation, there is insufficient evidence to determine whether this strategy exerts any clinically relevant influence on prevention of CAUTI.[26]

The design of the urinary drainage system also influences CAUTI risk. The most important design element enables maintenance of a closed system.[21] Although closed systems have been used in North America and the United Kingdom for a long time, few studies have examined this aspect of urinary drainage systems within the past several decades. However, Allepuz-Palau et al[35] analyzed data obtained from a national database of more than 70 000 patients managed in acute care facilities in Spain, where open urinary catheter drainage systems remained in use between 1990 and 2000. They found that as the use of closed drainage systems rose from slightly above 50% to 70% of facilities, the likelihood of experiencing a CAUTI while in the hospital declined significantly. Although only suggestive, these data support older studies supporting the maintenance of a closed urinary drainage system whenever possible.

Some catheter manufacturers provide prepackaged seals designed to help ensure maintenance of a closed urinary drainage system. These systems consist of a plastic covering that joins the catheter and drainage system. The covering was designed to act as a physical barrier to the entry of microbes into the lumen of the drainage tubes as well as to discourage intentional or inadvertent disruption of the closed urinary drainage system.

The evidence concerning the use of these preconnected systems is mixed; one study found a reduced incidence of bacteriuria in patients using a preconnected, sealed system,[36] but no differences were found in another study using a broadly similar approach.[37] A detailed review of these studies suggests that use of a preconnected sealed system may have been more effective in one of the studies[36] because it deterred clinicians from purposely or inadvertently opening the closed system. Neither study provides sufficient evidence to conclude that preconnected systems provide an effective barrier to the migration of bacteria into the lumen of the catheter or proximal drainage tubing. Similar to considerations for use of an antimicrobial catheter, the use of a preconnected system may be financially justified if frequent opening of the system occurs in order to obtain specimens or for similar procedures, but it may not be justified if education or existing policies render this practice rare.

A number of additional strategies have been explored as possible strategies to reduce CAUTI incidence, including incorporation of antimicrobial filters in the drainage system, multi chamber drainage bags, and placement of antiseptic substances in the drainage bags. None has proven effective for prevention of CAUTI.[21]

Catheter securement devices have also been evaluated to determine whether they reduce the likelihood of CAUTI.[38] Although these devices have been shown to reduce urethral trauma and discomfort caused by inadvertent traction against the bladder neck and proximal urethra, a single randomized clinical trial found no significant differences when compared to patients managed without a catheter strap.

Back to Top | Article Outline

Insertion Technique and Ongoing Care

Sterile technique is considered a standard of care when inserting an indwelling catheter in the acute care setting, but variability in how clinicians define and maintain sterile technique during catheterization makes it difficult to evaluate the limited evidence pertaining to this important question. Strict sterile technique often involves donning a sterile gown and mask, prolonged hand washing, opening a sterile insertion kit, donning sterile gloves, cleansing the urethral meatus and perineal area with an antiseptic solution, and inserting the catheter using a no-touch technique. However, clinical experience reveals that this level of rigor is rarely used outside the operating room setting.

Instead, most clinicians employ a modified sterile technique that typically includes hand washing, donning sterile gloves, opening a sterile catheter insertion kit, cleansing the perineal area with an antiseptic solution, and employing a no-touch technique during catheter insertion. The technical challenges associated with maintaining strict sterile technique are especially evident when faced with the difficulty of catheterizing a morbidly obese female patient. In this case, strict sterile technique is not feasible, and maintenance of the modified sterile technique requires 2 or more staff members, with 1 staff member performing the catheterization and 1 or 2 additional clinicians ensuring that the urethral meatus remains adequately exposed to enable catheter insertion using modified sterile technique.

The argument for strict sterile technique is supported by evidence demonstrating that insertion in the operating room is associated with a lower CAUTI incidence when compared to catheters inserted on the inpatient hospital unit.[39–41] However, the results of these studies do not definitively demonstrate whether use of stricter aseptic technique, as compared to the preparation and experience of the clinician inserting the catheter or the presence of assistive personnel during catheterization, is primarily responsible for the lower rate of CAUTI.

The argument for sterile technique is weakened by the results of several other studies that directly compared the effects of various insertion techniques on CAUTI incidence. For example, Carpeti et al[42] reported a randomized clinical trial comparing sterile versus clean insertion catheterization in 1567 patients undergoing elective surgery.

Sterile technique was described as hand washing for 4 minutes, donning sterile gloves and gowns, opening a sterile catheter insertion kit, and cleansing the perineum using a povidone-iodine solution. A technique they described as “clean” comprised hand washing

using soap and water, donning nonsterile gloves, and cleansing the patient's perineum only if visible soiling or debris were observed. No catheter insertion pack was used. No differences in CAUTI incidence occurred within 3 days of catheterization using these vastly different techniques.

Two additional studies focused on specific components of insertion technique. Pickard and Grundy[43] compared 2 modified sterile techniques for catheter insertion. Both used sterile gloves and a catheter insertion pack, but the more rigorous technique included a longer period of hand washing and donning a sterile gown. No differences in bacteriuria rate were found. Webster et al[44] reported a randomized clinical trial comparing 2 catheter insertion techniques in 436 women receiving obstetric care. Nurses washed their hands using a detergent-based cleanser, opened a sterile pack for catheterization, donned sterile gloves, and inserted the catheter using a no-touch technique. However, subjects were randomly assigned to perineal cleansing using a chlorhexidine solution or tap water. Again, no statistically significant differences were found when the frequency of bacteriuria was compared between the 2 groups.

The draft proposal from the CDC recommends use of a modified sterile technique for indwelling catheterization in the acute care setting.[11] Key components of sterile technique include hand washing immediately prior to catheterization; catheterization only by personnel trained in the proper technique; use of sterile gloves, a drape, sponges, an appropriate antiseptic or sterile solution for periurethral cleaning, and a single-use packet of lubricant jelly for insertion. They further note that additional research is needed to determine whether an antiseptic solution for cleansing the perineal area provides any advantage when compared to sterile water or saline. Given the mixed evidence regarding this deceptively complex question, these guidelines provide a reasonable framework for defining proper technique for insertion of an indwelling catheter until stronger evidence is available.

Regular cleansing of the catheter and urethral meatus, sometimes referred to as catheter care, is another routine that deserves scrutiny when designing a program to prevent CAUTI. Multiple studies have evaluated the effectiveness of a variety of antiseptic cleansers, ointments, or creams. Koskeroglu et al[45] evaluated the effectiveness of 4 protocols for urethral meatus care in a group of 130 patients in an ICU. The techniques were (1) cleansing plus once-daily application of a 9% povidone-iodine solution, (2) cleansing plus twice-daily application of a 9% povidone-iodine solution, (3) once-daily cleansing using a 4% chlorhexidine gluconate, (4) twice-daily cleansing with a 4% chlorhexidine gluconate, and (5) a control group. None of the protocols that employed antiseptic solutions proved more effective for preventing CAUTI, bacteriuria, or bacterial colonization at the urethral meatus than routine cleansing alone. Other studies have evaluated the use of an iodine-povidone solution or cream[46]–[48] or a 1% silver sulfadiazine cream.[49] None of these techniques was found to be more effective for the prevention of CAUTI than routine meatal care using soap and water or water alone to remove visible soiling.

Although the results of these studies show that routine perineal cleansing is just as effective for prevention of CAUTI as more complex protocols involving application of antiseptic cleansers, ointments, or creams, it is essential to remember that a structured care regimen is strongly recommended, especially for patients with coexisting fecal incontinence resulting in increased exposure of the indwelling catheter to coliform bacteria.[50]

Back to Top | Article Outline

Exploring Alternatives to the Indwelling Catheter

A successful program to reduce the frequency and duration of indwelling urinary catheters also must identify reasonable alternatives for bladder management in the critical care unit. Given the acuity of illness associated with management in a critical care unit, combined with the significant proportion of patients requiring sedation, self-voiding is rarely a viable alternative. More realistic alternatives include application of external urinary collecting devices or intermittent catheterization. Selection of an alternative bladder management program is made in consultation with the physician and the patient or family.

Back to Top | Article Outline

Intermittent Catheterization

Intermittent catheterization has long been used in the management of persons with neurogenic bladder dysfunction due to spinal cord injury, myelomeningocele, multiple sclerosis, or other paralyzing neurologic disorders. It is preferred over use of long-term indwelling catheters because it is associated with a reduced risk for febrile UTIs, malignancies of the bladder, and deterioration of renal function.[51–54] Clean intermittent catheterization is preferred when routine catheterization is performed in the community setting, but sterile technique using a protocol similar to that for insertion of an indwelling catheter (hand washing, donning sterile gloves, cleansing the perineal area, etc) is utilized in an acute care setting because of the more virulent bacteria present in this environment.[11]

Intermittent catheterization is a viable option for bladder management in patients with neurogenic bladder dysfunction, especially those with a history of intermittent catheterization. It may also be considered for patients experiencing urinary retention who no longer require an indwelling catheter. Further research and more extensive clinical experience is needed to identify the optimal role for intermittent catheterization in the critical care setting.

Back to Top | Article Outline

External Urinary Collection Devices

External urinary collection devices are specifically recommended as an alternative to the indwelling urinary catheter in the 2009 draft clinical guideline from the CDC.[11] These devices adhere to the genital organs and collect urine in a drainage bag. Two types of devices are currently available—condom catheters and a device that incorporates a hydrocolloid adhesive wafer to adhere to the glans penis (Liberty BioDerm Inc, Large, Florida) (Figure 1). They are applicable to men only; the search for an external collection device suitable for women remains an unresolved engineering challenge.

Figure 1:. a Condom ...
Image Tools

Existing evidence comparing external collection devices to indwelling urinary catheters is sparse. Saint et al[34] reported a randomized clinical trial comparing indwelling to condom catheters in 3 acute care wards and a single long-term care unit in a Veterans Administration facility. Seventy subjects were randomly assigned to receive an indwelling or a condom catheter. Subjects assigned to the condom catheter had fewer adverse events than did those managed with indwelling catheters, including a lower incidence of UTI. In a follow-up study based in the same facility, 99 patients were interviewed about the use of condom versus indwelling urinary catheters.

Those using an external collection device were more likely to report that their device was comfortable and less likely to report that their device caused intermittent episodes of pain than did men managed with indwelling urinary catheters. Men using indwelling catheters were also more likely to report that the tube restricted their activity than did those using an external collection device. Interviews with nursing staff also revealed experience-based impressions that a condom catheter was more comfortable and less restrictive for men than an indwelling catheter.

Because of the paucity of available evidence, selection of an optimal external collection device is based on clinical experience. Most catheters are made of materials other than latex, thus diminishing the risk for hypersensitivity responses. The optimal catheter should securely adhere to the penile shaft without occluding the urethra. It should also avoid twisting at the condom-drainage tubing junction because this action blocks urine drainage. Some condom catheters incorporate an adhesive into the wall of the device (Freedom Cath, Coloplast, Minneapolis, Minnesota; Extended Wear Self-Adhesive Catheter, Hollister, Libertyville, Illinois), whereas others use an adhesive strap to ensure adherence (Texas Catheter, Kendall Healthcare, Mansfield, Massachusetts). Multiple catheter sizes should be stocked to accommodate differences in the length and width of the penile shaft. Anticipated wear time for a condom catheter is 24 to 48 hours.

Some view the hydrocolloid external collection device as an attractive alternative to the condom catheter. The device consists of a hydrocolloid wafer shaped like the bloom of a flower that adheres to the glans penis (Figure 1B). It acts as a skin protectant, avoiding occlusion of the skin of the penile shaft, while protecting the glans penis from excessive exposure to urine. The seal is reinforced by a second hydrocolloid strip that is applied

over the initial wafer, providing a more secure connection to the drainage pouch. The device is appropriate for both circumcised and uncircumcised men and does not require sizing. Wear time is comparable to what is anticipated for condom catheters, although the wear time may initially be shorter until the glans penis adapts to the device.

Switching a patient from an indwelling catheter to an external collection device requires assessment of bladder evacuation. Traditionally, this task is completed via a voiding trial, where the indwelling catheter is removed and the patient either fills the bladder via natriuresis and voids spontaneously, or the bladder is filled with sterile water or saline and the patient voids.

However, many patients in the critical care setting are sedated or have altered consciousness and may not be able to participate in a voiding trial. In this case, the indwelling catheter is removed and the external collection device is applied. The bladder is then allowed to fill via natriuresis and the drainage system is monitored for spontaneous voiding. This is followed by ultrasonic assessment of the urinary residual volume.

A growing number of bladder ultrasound devices are available, and their function is rapidly and easily mastered by the novice or experienced critical care nurse. One device provides a circular pattern of green arrows that assists the nurse to center the ultrasonic probe over the bladder vesicle (BladderScan, Verathon, Bothell, Washington), and multiple devices allow estimation of intravesical (bladder) volume after scanning in a single plane.

Figure 2 illustrates an algorithm for indwelling catheter removal and application of an external collection device in a critical care setting. Additional clinical experience and research is needed to identify and adapt external collection devices and ultrasonic assessment to the critical care setting. Nevertheless, these devices provide a particularly attractive alternative to the indwelling catheter for patients who require prolonged management in a critical care setting but no longer require indwelling catheterization.

Figure 2:. Evaluatio...
Image Tools
Back to Top | Article Outline

Conclusion

Changes in US CMS reimbursement policies have created a fundamental shift in many aspects of hospital-based care from management of complications to their prevention. CAUTI and indwelling catheter management is central to this revised policy, and this emphasis has profound implications for bladder management in the critical care setting. Implementation of a prevention program can greatly reduce the incidence of hospital-acquired CAUTI. A prevention program should define policies and systems for indwelling catheter insertion and the prompt removal of catheters, and it should identify

optimal characteristics of the urinary catheter and drainage system. In addition, critical care nurses should work with physicians and specialty practice nurses to define viable alternatives to indwelling catheterization, including expanded use of external collection devices in males, combined with selected use of intermittent catheterization in women and men.

Back to Top | Article Outline

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