Urinary catheterization is a common healthcare intervention used to manage urinary dysfunction that poses serious associated risks and complications. This article discusses methods of urinary catheterization and their indications, catheter-associated complications, and assessment and management strategies that home healthcare practitioners can employ to ensure best patient outcomes and minimize complications.

**BEST PRACTICES IN URINARY CATHETER**

**Case Study**

Edward Jones is an 82-year-old man with an indwelling urethral catheter for postoperative urinary retention following colon resection surgery 3 weeks ago. He currently resides with his daughter and is visited by a home healthcare nurse for catheter management and monitoring. When his nurse arrived 3 days ago, she discovered a blockage in the urinary drainage system. She immediately removed and replaced the catheter and collecting system. In the past 2 days, Mr. Jones has become increasingly more confused and agitated, and his urine has a cloudy appearance and foul odor but he remains afebrile. A dipstick urinalysis reveals the presence of leukocytes. The nurse suspects that Mr. Jones has developed a catheter-associated urinary tract infection. She promptly contacts the healthcare practitioner managing Mr. Jones’ postsurgical care for further guidance and treatment.

How did this infection occur? What catheter management and care practices could have been used to prevent this infection? What role can the home healthcare practitioner play in reducing the risk of such infections in their patients?

Urinary catheters are used by home healthcare patients, like Edward Jones, for a variety of reasons. Urinary catheterization allows access to the bladder for the purpose of draining urine. This access is gained by inserting either a catheter through the urethra into the bladder or a suprapubic catheter through the anterior abdominal wall into the bladder. The practice of urinary catheterization may date back to 300 AD or possibly earlier. The precursor to the modern catheter, made of gum elastic, was introduced in 1779, followed by the first latex catheter in the 1800s. In 1853, Jean François Reybard developed the first indwelling catheter, which utilized an inflated balloon to secure its place in the bladder. Frederick Foley later redesigned this catheter in 1932, and the Foley catheter remains one of the most commonly used devices for management of urinary dysfunction today (Bloom et al., 1994; Lawrence & Turner, 2005). As the materials and design of catheters have evolved over time, too have the care and management involved with catheterization. To ensure the best patient outcomes and minimal complications, the home healthcare practitioner must stay informed about catheter care. This article reviews current options for urinary catheterization and their associated complications and provides approaches to the assessment and management of catheters in patients with urinary dysfunction.
Approximately 4 million Americans undergo urinary catheterization annually, and more than 500,000 of these catheterizations involve indwelling catheters left in place for some period (Warren, 2001). Between 15% and 25% of patients may receive indwelling catheters during hospitalization, and the prevalence of catheter use in residents of long-term care facilities is estimated between 7.5% and 10% (Saint et al., 2000). One study found that of 4,010 individuals receiving home care services, 4.5% used an indwelling catheter (Sorbye et al., 2005). Although the indications for catheterization have been extensively outlined, reports of the inappropriate use of catheters range from 21% to more than 50% (Hazelett et al., 2006).

**Urinary Catheters**

Urinary catheters are primarily used to manage urinary problems, namely urinary incontinence and urinary retention. The cause of urinary dysfunction determines the need for either short- or long-term catheterization and consequently the appropriate selection of catheterization method (Newman, 2008). These methods of catheterization include intermittent and indwelling catheterization. Indwelling catheterization can be either urethral or suprapubic.

**Intermittent Catheterization**

Intermittent catheterization involves the brief insertion of a catheter into the bladder through the urethra to drain urine at regular intervals. Uses for intermittent catheterization include

- Obtaining urine samples
- Emptying the bladder
- Measuring residual volume
- Instilling medication
- Instilling contrast material into the bladder to study the bladder and urethra (Hart, 2008).

Intermittent catheterization is becoming the gold standard for the management of bladder-emptying dysfunctions and following surgical interventions. Certain advantages to intermittent catheterization,
including the lower risks of catheter-associated urinary tract infection (CAUTI) and complications, may make it a more desirable and safer option than indwelling catheterization. Practicing intermittent catheterization, however, may be difficult for patients with limited vision, dexterity, and mobility, although, in these cases, family members and caregivers can be taught the procedure (Robinson, 2009).

Indwelling Urethral Catheterization
Indwelling urethral catheterization involves the insertion of a catheter through the urethra into the bladder. The catheter is held in place with a retention balloon and then connected to a drainage bag, creating a closed urinary system. The indications for indwelling urethral catheters include:

- Accurate monitoring of urine output in critically ill patients
- Increasing comfort in terminally or severely ill incontinent patients and managing any skin damage caused by incontinence, when all other methods of managing urinary incontinence have failed
- Maintaining a continuous outflow of urine in preoperative patients and patients with voiding difficulties resulting from neurological disorders
- Providing immediate treatment of acute urinary retention (Hart, 2008).

Suprapubic Catheterization
Suprapubic catheterization involves the insertion of a catheter midline above the symphysis pubis through the anterior wall of the abdomen into the bladder. Like the indwelling catheter, the suprapubic catheter uses a balloon to hold its position and is connected to a drainage bag. Suprapubic catheterization is performed under local or general anesthesia usually in a hospital or office setting (Robinson, 2009). Indications for using suprapubic catheters include:

- Anatomical problems in the lower urinary tract, including the urethra
- Total urethral or prostatic obstruction or urethral strictures that cause difficulty when inserting a urethral catheter
- Weak pelvic floor muscles causing urethral catheters to fall out
- Urethral or pelvic floor trauma
- Complex urethral or abdominal surgery
- Patients in wheelchairs or patients who want to maintain sexual relationships
- Patients with fecal incontinence who might soil urethral catheters (Robinson, 2009).

Complications of Urinary Catheterization
Although catheterization is a common healthcare practice, it presents many risks that must be taken seriously. The complications associated with catheterization include:

- Trauma or introduction of bacteria into the urinary system, resulting in infection and, consequently, possible septicemia or death
- Trauma to the urethra or bladder from incorrect insertion or attempts to remove the catheter without deflating the balloon
- Accidental catheter dislodgement
- Urine bypassing the bladder
- Urethral perforation
- Blockage of the catheter
- Encrustment
- Urinary stones
- Chronic renal inflammation
- Profound effects on a patient’s social, work, and psychological well-being (Hart, 2008).

Particular attention must be paid to the most likely complication associated with catheter use: CAUTI. CAUTI is currently one of the most common infections and comprises 40% of all institutionally acquired infections (National Center for Health Statistics, 2004). In the home setting, CAUTIs occur in 8% of patients (Getliffe & Newton, 2006). The daily risk of developing CAUTI ranges from 3% to 7% and cumulatively increases the longer the catheter remains in place (Lo et al., 2008). After 30 days of indwelling catheterization, bacteriuria, bacteria in the urine, will be present in virtually 100% of patients. In addition, bacteremia, a serious and potentially life-threatening complication, will develop in approximately 3% of all catheterized patients (Parker et al., 2009a, 2009b). Using infection control measures, an estimated 17% to 69% of CAUTIs may be prevented (Association for Professionals in Infection Control and Epidemiology [APIC], 2008).

The bacteria that cause CAUTI can gain entry into the bladder via two pathways: the periurethral
pathway and the intraluminal pathway. Bacteria following the periurethral route move into the bladder between the outside of the catheter and the inner side of the urethral wall. Bacteria following the intraluminal route, likely the most common route, move upward inside the catheter drainage system after contamination of the drainage bag through the outflow tap or disconnection of the catheter (Madeo & Roodhouse, 2009). The bacteria associated with CAUTI are particularly problematic because they attach to the surface of the catheter and produce a biofilm. Biofilm is a densely adherent polysaccharide structure that protects bacteria from the body's natural defense mechanisms, allowing for bacterial growth and reproduction (Trautner & Darouiche, 2004). After a biofilm has formed on the inside or outside surface of a catheter, the risk of CAUTI can only be eliminated by removing the catheter (APIC, 2008).

As catheterization poses serious risks, this method of bladder drainage should not be considered until all other interventions have been assessed as inappropriate or deemed unsuccessful. When patients require catheterization, intermittent catheters should be considered first, and indwelling catheters should be left in place for as short a time as possible (Healthcare Infection Control Practices Advisory Committee [HICPAC], 2009). To minimize the complications associated with catheterization, healthcare interventions supported by best practice evidence should be implemented by all practitioners involved in catheter care. With proper assessment and management of catheters, the benefits of catheterization outweigh the risks.

Urinary Catheterization Assessment
A practitioner’s assessment of the catheterized patient is an essential part of catheter care. Because the incidence of complications rises the longer the catheter remains in place, the need for the continued usage of an indwelling catheter must be assessed during every visit (Healthcare Infection Control Practices Advisory Committee [HICPAC], 2009). In cases of indwelling catheterization, the practitioner should determine whether the catheter is functioning properly. This means looking to see whether the catheter system is draining effectively by comparing the urine output with the patient’s fluid intake. A discrepancy in intake and output volumes may indicate a mechanical problem with the catheter. The practitioner should also inspect the catheter to ensure that it is properly anchored and positioned, as catheter stabilization may be a factor in decreasing the risk of complications especially infection (Gray, 2008). A thorough physical assessment of the patient upon each visit should focus on the presence of any drainage and excoriation of the urethral orifice, which may indicate leakage or irritation from the catheter (Nazarko, 2009).

The practitioner can guard against the threat of CAUTI using risk assessment and detection strategies. Patients identified as being at high risk for these infections should be carefully monitored. Risk factors for developing CAUTI include female sex, older age, prolonged catheterization, impaired immunity, and lack of antimicrobial exposure (HICPAC, 2009). Practitioners should monitor all catheterized patients for signs and symptoms of CAUTIs. The APIC criteria for symptomatic catheter infection (2008) include

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1. Urgency, frequency, dysuria, or other supra-pubic tenderness
2. Fever (>$104^\circ F or 38^\circ C$)
3. Color or character changes in the urine indicative of infection, hematuria, or positive culture.

Older patients with indwelling catheters may not present with the typical signs and symptoms of infection. Change in mental status, particularly in older adults, may be symptomatic of CAUTI (Parker et al., 2009b). Consequently, any subtle change in physical condition or behavior should lead practitioners to consider the possibility of infection and quickly investigate, as sepsis may develop before diagnosis of the infection (Siegel, 2008).

After noting signs and symptoms of infection in catheterized patients, practitioners should obtain a urine sample from a freshly inserted catheter or collection port of an indwelling catheter for urine culture and sensitivity testing and perform a dipstick urinalysis. Diagnosis of CAUTI is only made when signs and symptoms of CAUTI coexist with microbiologic evidence of bacteriuria and elevated white blood cell count upon urinalysis (Parker et al., 2009b).

Urinary Catheterization Management
Over the past several years, catheter management interventions have been evaluated to produce evidence-based best practice guidelines for providing effective catheter care at home and minimizing the risks of catheter-associated infections and complications (Emr & Ryan, 2004). These guidelines, presented in the following sections, cover proper techniques for insertion and management of catheters as well as information that should be included in patient/caregiver training and education.

Insertion
To minimize the potential for introduction of microorganisms into the bladder, urinary catheters should only be inserted by properly trained individuals. Hand hygiene is the most important means of preventing infection and should be performed immediately before and after insertion or any manipulation of the catheter device or site (Emr & Ryan, 2004). Indwelling catheters should be inserted using aseptic technique and sterile equipment. The equipment needed for insertion includes sterile gloves, drape, sponges, an appropriate antiseptic or sterile solution for periurethral cleansing, and a single-use packet of lubricant jelly (HICPAC, 2009). Chronic intermittent catheterization in the nonacute setting can be practiced using clean technique. Clean technique involves the use of cleansed reusable catheters, washing hands with soap and water, and daily cleansing of the perineum or more often only when fecal or other wastes are present (Newman, 2008). Cleansing the perineal area to decrease bacteria in the surrounding area is highly recommended.

During the catheterization procedure, efforts should also be made to minimize pain and trauma. These efforts include using an appropriate-size catheter, lubricating the catheter thoroughly, and inserting the catheter far enough into the bladder to prevent trauma to the urethral tissues with the inflation of the retention balloon (Hart, 2008). Select the smallest bore catheter possible that will allow for adequate drainage. Large-size catheters (18 Fr or larger) can increase erosion of the bladder neck and urethral mucosa, cause the formation of strictures, and impede adequate drainage of periurethral gland secretions. The use of 30 mL balloons is not recommended. The buildup of these secretions may result in infection or irritation (Newman, 2008). The indwelling catheter should be secured to the thigh or abdomen after insertion to prevent movement and the exertion of excessive force on the bladder neck or urethra (Gray, 2008). Unsecured and displaced catheters can also cause pressure ulcers on the perineum and buttock (Siegel, 2008).

Management
Once an indwelling catheter has been inserted using aseptic technique, all possible measures should be employed to maintain a closed drainage system. If breaks in aseptic technique, disconnection, or leakage occur, use aseptic technique and sterile equipment to replace the catheter and collecting system. The use of urinary catheter systems with preconnected, sealed catheter-tubing junctions may reduce the occurrence of disconnections (HICPAC, 2009). Extensive measures should also be taken to maintain unobstructed urine flow. To prevent obstruction, the catheter and collecting tube should be kept free from kinking, the collecting bag should be positioned below the level
of the bladder at all times and never placed on the floor. The collecting bag should be emptied regularly using a clean collecting container (HICPAC, 2009). In ambulatory patients, collecting bags may be disguised in bags and pouches.

Patients practicing intermittent catheterization should pay close attention to the catheterization schedule and avoid bladder overdistension and unnecessary catheterizations. As CAUTIs are more prevalent for intermittent catheterization in patients with high residual urine volumes at the time of catheterization, urine volume should determine the catheterization schedule. In general, bladder volume should not exceed 400 mL (Newman, 2008). Intermittent catheterization should be performed at regular intervals to prevent bladder distension. Portable ultrasound devices have also been recommended as a means of assessing urine volume and consequently minimizing unnecessary catheter insertions (HICPAC, 2009). It should be noted that in May 2008, Medicare coverage was extended from 4 to 200 single-use, disposable catheters per month for many patients undertaking intermittent catheterization (Muller, 2009). In patients with long-term indwelling catheters, self- or family management of the system requires infection control methods that are both economical and effective. Nash (2003) conducted a recent review of the literature on self-cleaning of catheter training bags. She recommends adhering to the findings of a clinical trial by Dille and Kirchhoff (1993) in which the daily cleansing of both nighttime and leg drainage bags with 1:10 household bleach solution extended the use of the urinary drainage bags from 1 week to 1 month without any significant increase in urine or drainage bag colonization or increase in rate of urinary tract infection. One study was found that compared distilled white vinegar and 3% hydrogen peroxide irrigation of catheter bags in a sample of 20 patients. The study showed that patients whose bags were irrigated with vinegar showed a significant reduction of bacteriuria compared with patients whose bags were irrigated with the hydrogen peroxide solutions (Washington, 2001). Authors concluded that more research is needed on the self-cleaning of Foley bags.

Additional strategies can also be employed to reduce the risk of CAUTI and other complications.

- Choose catheter materials appropriate for each patient.
  - For patients requiring intermittent catheterization, consider hydrophilic catheters over standard catheters (HICPAC, 2009).
  - The short-term use of silver alloy catheters may reduce the incidence of CAUTI and bacteriuria.
  - Silicone or hydrogel catheters are recommended for patients using catheters longer than 14 days (Parker et al., 2009a).
- Change indwelling catheters and drainage bags according to clinical indications such as infection, obstruction, or when the closed system is compromised rather than at routine, fixed intervals.
- Obtain urine samples aseptically and only from newly placed catheters (≤ 7 days). After cleansing the needleless sampling port with a disinfectant, aspirate the urine with a sterile syringe.
- Avoid irrigation unless needed to prevent or relieve obstructions.
- Practice routine meatal care while a catheter is in place, including cleansing with soap and water during daily showers. Avoid vigorous
cleansing, which may increase the risk of infection (HICPAC, 2009).

- Although there is insufficient clinical evidence to support it, increasing fluid intake in patients with urinary catheters is a common practice and may result in decreased encrustation and other benefits (Siegel, 2008).

Recent information has also been released regarding catheter management practices that have no support from clinical research. These practices include instilling antibiotics or other additives to the drainage bag, applying antiseptic compounds to the meatus, and using specific agents for meatal cleansing. In addition, systemic antibiotics should not be used routinely to prevent CAUTI in patients requiring short- or long-term catheterization. And, although cranberry juice may be beneficial for preventing urinary tract infections in noncatheterized patients, there is no evidence to suggest that cranberry juice reduces the risk of CAUTI (Parker et al., 2009a).

**Education and Training**

Education and training of catheterized patients and their caregivers should play an integral role in the practitioner’s efforts to ensure best patient outcomes and reduce the likelihood of complications. Practitioners should train patients and caregivers in the correct techniques for catheter insertion and care. Education should focus on the importance of catheter hygiene and the avoidance of catheter-related problems. Troubleshooting advice on common problems occurring with urinary catheters, including obstruction, leakage, bladder spasms, encrustment, and balloon malfunction, should be included (Nazarko, 2009). Patients and caregivers should be educated about symptoms of CAUTI and other catheter-related complications and when to contact a healthcare practitioner.

**Conclusion**

Urinary catheterization is a common intervention used by home healthcare patients to manage urinary problems such as urinary retention and urinary incontinence. The common use of this intervention does not, however, imply that catheterization is without serious complication or is always used appropriately. Catheterization should only be undertaken when all other methods of urinary system management have been deemed inappropriate or have failed. If indwelling catheterization is required, the catheter should be removed as soon as possible to reduce the risk of complications. By adhering to the recommendations and guidelines outlined above, home healthcare practitioners can participate in the nationwide effort to provide effective care and prevent catheter-associated complications in all settings where catheterization is undertaken.

Rebecca Herter, BS, is an Adult/Geriatric Nurse Practitioner Student at Yale University School of Nursing, New Haven, Connecticut.

Meredith Wallace Kazer, PhD, APRN, A/GNP-BC, is an Associate Professor at Fairfield University School of Nursing, Fairfield, Connecticut.

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Address for correspondence: Meredith Wallace Kazer, PhD, APRN, A/GNP-BC, Associate Professor, Fairfield University School of Nursing, Fairfield, Connecticut (e-mail: MKazer@Fairfield.edu).

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