

Review of Intermittent Catheterization and Current Best Practices

Diane K. Newman, Margaret M. Willson

Bladder Physiology

During voiding, the bladder contracts, and internal and external sphincters and pelvic floor muscles relax to allow urine to pass through the urethra. Normally, after the bladder empties, a small amount of urine (less than 75 ml), called the post-void residual (PVR), may remain in the bladder. If a person cannot urinate or empty the bladder completely, the PVR increases and can contribute to urinary tract infections (UTIs), overflow urinary incontinence (UI), and permanent damage to the bladder and kidneys. Incomplete bladder emptying or urinary retention may lead to the development of a neurogenic bladder, a general term referring to bladder or voiding dysfunction resulting from interrupted innervation from a lesion or disease in the central or peripheral nervous system (Newman & Wein, 2009). Neurogenic bladder can be caused by 1) upper motor neuron disease (for example, central nervous system lesions, including stroke, Parkinson's disease, and multiple sclerosis [MS]); 2) spinal cord

Diane K. Newman, MSN, ANP-BC, CRNP, FAAN, BCIA-PMDB, is the Co-Director, Penn Center for Continence and Pelvic Health, Division of Urology, Philadelphia, PA.

Margaret M. Willson, MSN, RN CWOCN, is the Manager of Clinical Education, Hollister, Incorporated, Libertyville, IL.

Note: The authors have disclosed that this article contains discussion of cleaning methods for reusing intermittent catheters, which are manufactured and labeled for single sterile use. Re-use is considered "off label."

Intermittent catheterization is the insertion and removal of a catheter several times a day to empty the bladder. This type of catheterization is used to drain urine from a bladder that is not emptying adequately or from a surgically created channel that connects the bladder with the abdominal surface (such as Mitrofanoff continent urinary diversion). Intermittent catheterization is widely advocated as an effective bladder management strategy for patients with incomplete bladder emptying due to idiopathic or neurogenic bladder dysfunction. Urologic nurses are at the forefront of educating and teaching patients how to self-catheterize. Catheterizations performed in institutions, such as acute and rehabilitation hospitals and nursing homes, are done aseptically. Historically, however, intermittent catheterization has been performed by the patient in the home environment using a clean technique involving the re-use of catheters. New guidelines released in the past three years have recommended changes to the practice of re-using catheters. Currently, nurses use their clinical judgment to determine which technique and type of catheter to use, in conjunction with patient preference. Differential costs and insurance coverage of catheters/techniques may also influence decision making. The authors provide an overview of the indications, use, and complications associated with intermittent catheterization, present current guidelines on self-catheterization and treatment of catheter-associated complications, detail types of catheters, and review clinical practice of intermittent catheterization.

© 2011 Society of Urologic Nurses and Associates
Urologic Nursing, pp. 12-29, 48.

Key Words: Intermittent catheterization, neurogenic bladder, clean technique self-catheterization, urinary complications.

Objectives

1. Explain bladder management programs for initiating voiding or ensuring complete emptying of the bladder.
2. Discuss intermittent catheterization as the preferred method of catheterization in patients with bladder dysfunction.
3. Describe the various types and designs of catheters used for intermittent catheterization.

Statement of Disclosure: Diane K. Newman, MSN, ANP-BC, CRNP, FAAN, BCIA-PMDB, disclosed that she receives grant/research support from Allergan and GTX; is a consultant/presenter for Hollister and SCA; and is on the advisory board for Astellas, Pfizer, Watson Pharma, and GSK.

Margaret M. Willson, MSN, RN, CWOCN, disclosed that she receives financial/material support as a manufacturer employee.

Note: Objectives and CNE Evaluation Form appear on page 29.

Table 1.
Common Lower Urinary Tract Diagnoses Seen in Patients with Neurogenic Bladder

Diagnosis	Definition
Underactive bladder (sometimes referred to as atonic, hypoactive or hypocontractile bladder)	A bladder that is not able to contract and empty properly usually because of damage to the nerves that control the bladder. As a result, the bladder fills with urine and remains full. Excess urine the bladder cannot accommodate leads to urine dribbling through the urethra, causing overflow incontinence.
Neurogenic detrusor overactivity (NDO) (formerly detrusor hyperreflexia)	Hyperactivity or overactivity of the bladder muscle causing uncontrolled and involuntary bladder contractions, typically seen in neurological lesions above the sacral spinal cord.
Detrusor areflexia	Inability of the detrusor muscle to contract (referred to as noncontractile) due to abnormality of neural control typically seen in spinal shock or in lesions above the brain stem. Urinary retention may occur.
Detrusor-sphincter dyssynergia (DSD)	Bladder outlet dysfunction that causes a lack of coordination between the bladder and the striated sphincter. The sphincter contracts simultaneously with bladder contraction, clamping in on the urethra, and interfering with the flow of urine. The bladder attempts to empty against the closed sphincter. Urinary retention can occur. Very high bladder pressures may be generated, predisposing these individuals to reflux of urine into the ureters, and ultimately, to kidney damage.
Detrusor hyperactivity with impaired bladder contractility (DHIC)	A condition characterized by frequent but ineffective involuntary detrusor contractions. A person is either unable to empty the bladder completely or can empty the bladder completely only with straining. This abnormality of the bladder was first diagnosed in nursing home residents.

Source: Adapted from Newman & Wein, 2009.

Table 2.
Advantages of Intermittent Catheterization over Indwelling Urinary Catheter

• Improved self-care and independence
• Reduced risk of common indwelling catheter-associated complications
• Reduced need for equipment (such as drainage bags)
• Less barriers to intimacy and sexual activities
• Potential for reduced lower urinary tract symptoms (frequency, urgency, incontinence) between catheterizations

Source: Adapted from Newman & Wein, 2009.

injury, including MS of the cord, and cervical and thoracic disc disease; and 3) lower motor neuron disease (for example, pelvic nerve injury, peripheral neuropathy, diabetes mellitus). Neurogenic bladder represents one of the most common problems in individuals with a variety of neurological impairments. Table 1 lists common lower urinary tract diagnoses seen in patients with neurogenic bladder.

Management of Neurogenic Bladder

Some form of bladder management program is necessary to initi-

ate voiding or ensure complete emptying of the bladder. Bladder management programs may include interventions such as medications, timed voiding, indwelling urinary catheter, manual expression, urinary diversion, and intermittent catheterization.

Intermittent catheterization is one of the most effective and commonly used methods of bladder management in patients with a neurogenic bladder. Regular bladder emptying reduces intravesical bladder pressure and improves blood circulation in the bladder wall, making the bladder mucous membrane more resistant to infec-

tious bacteria (Lapides, Diokno, Silber, & Lowe, 1972). By inserting the catheter several times during the day, episodes of bladder over distention are avoided.

Indications for Intermittent Catheterization

Intermittent catheterization is the preferred method of catheterization in patients who have bladder dysfunction, specifically neurogenic bladder. Lower urinary tract symptoms of neurogenic bladder include either UI or incomplete bladder emptying and urinary retention caused by outlet obstruction, poor detrusor contraction, or compliance.

A common cause of a neurogenic bladder is spinal cord injury, which occurs in more than 200,000 patients (10,000 cases per year) in the United States. (Linsenmeyer et al., 2006). The use of intermittent catheterization in this population has eliminated many complications associated with an indwelling urinary catheter (Weld & Dmochowski, 2000). Advantages of intermittent catheterization over

an indwelling urinary catheter are listed in Table 2. In patients with a spinal cord injury, intermittent catheterization preserves renal function, reduces UI, improves bladder emptying, and reduces the incidence of UTI, leading to a better prognosis and improved quality of life (Cottenden et al., 2009).

Multiple neurological disorders in children are associated with neurogenic bladder. Myelomeningocele, one of the most common causes, is usually seen in children with spina bifida. Children with spina bifida have an opening in the spinal cord through which meninges, cerebrospinal fluid, and neural elements protrude. Although the opening in the spine is closed surgically shortly after birth, some degree of paralysis and bowel and bladder dysfunction remain. According to the Centers for Disease Control and Prevention (CDC) and the National Centers for Health Statistics, spina bifida affected 19.56 out of 100,000 live births in the United States in 2004. This number was between 25 and 30 per 100,000 live births in the early to mid-1990s. These children are now in the school system, which presents even more challenges for bladder management (Katrancha, 2008). According to new CDC guidelines (Gould et al., 2009), clinicians should consider intermittent catheterization in children with myelomeningocele and neurogenic bladder to reduce the risk of urinary tract deterioration.

Management of Bladder Emptying

The preferred long-term management of neurogenic bladder is intermittent self-catheterization performed by the patient or a caregiver. The goal of neurogenic bladder management is to allow the bladder to store a reasonable volume of urine at low pressure and empty the bladder at appropriate time intervals. Long-term use of intermittent catheterization is preferable to an indwelling urinary catheter because intermittent catheterization has a lower risk of

infection and other complications (Newman & Wein, 2009). Long-term intermittent self-catheterization is safe and well accepted. However, an early dropout rate of about 20% has been described in children and adolescents (Pohl et al., 2002), so good support, professional instruction on catheterization technique and periodic follow up is necessary to obtain and maintain patient compliance. According to Clayton, Brock, and Joseph (2010), children can independently perform intermittent self-catheterization between the ages of 8 and 12 years, with girls gaining independence sooner than boys.

Intermittent Self-Catheterization Complications

Although intermittent catheterization is the preferred catheterization method for ensuring bladder emptying, complications and adverse events can arise, especially in patients performing intermittent self-catheterization long-term. Urethral, scrotal, and bladder-related complications may occur. Urethral/scrotal events can include bleeding, urethritis, stricture, creation of a false passage, and epididymitis. Bladder-related events can cause UTIs, bleeding, and stones.

Urethral Adverse Events

Urethral problems, seen primarily in men, include urethritis or inflammation of the urethral meatus from frequent catheter insertion. Urethral bleeding is frequently seen in patients when initiating intermittent catheterization and can occur regularly in one-third of patients performing intermittent catheterization on a long-term basis (Igawa, Wyndaele, & Nishizawa, 2008). Persistent bleeding in a patient who has been performing intermittent self-catheterization long-term may be a sign of a UTI. A more common urethral adverse event is the creation of a false passage, which may occur in men with persisting

urethral strictures or who have an enlarged prostate. The false passage may occur at the site of the external sphincter, just distal to the prostate. Urethral trauma can be secondary to the use of a poorly lubricated catheter or forcible catheterization in a urethra, causing spasms (Vapnek, Maynard, & Kim, 2003). It is believed blind catheterization may lead to both urethral bleeding and formation of a false passage.

Urethral strictures can occur in the anterior portion of the urethra (meatus, penile-pendulous urethra, bulbar urethra) or in the posterior portion (membranous urethra and prostatic urethra). These strictures may be the result of an inflammatory response to repeated trauma and are seen more often in patients who perform intermittent self-catheterization. Difficulty with catheter insertion may be a sign of the presence of a urethral stricture. Increased frequency of catheterization may correlate with fewer urethral changes. This may be because individuals who regularly perform intermittent self-catheterization are more skilled in catheterization, and therefore, have less chance of urethral trauma. Repeat catheterization, however, may induce local traumatic reactions of the urethral wall, especially in male patients performing self-catheterization longer than 1 year.

Some authors purport the surface of the catheter to be an important factor, with less stricture development when hydrophilic catheters are used (De Ridder et al., 2005; Stensballe, Loom, Nielsen, & Tvede, 2005). If a stricture is suspected, a retrograde urethrogram or voiding cystourethrogram should be considered. Prevalence of urethral strictures and false passages may increase with longer use of intermittent catheterization or with traumatic catheterization (Moore, Fader, & Getliffe, 2007; Wyndaele, 2002). Similar findings have been reported in children with spina bifida who had used intermittent

Table 3.
Causes of Intermittent Catheterization-Related Urinary Tract Infections

Cause	Reason	Solution
Inadequate frequency of emptying	Can lead to excessive bladder volumes with long periods of urine stagnation, increasing the risk of UTI.	<ul style="list-style-type: none"> Draining the urine regularly will prevent migration of bacteria into the bladder long enough to produce symptomatic infection.
Inadequate emptying at the time of catheterization	Residual volume left in the bladder after catheterization promotes an environment for bacteria proliferation.	<ul style="list-style-type: none"> To ensure adequate emptying, patients should perform a gentle Credé maneuver as the catheter is removed.
Inadequate fluid intake	Companion problem to inadequate frequency of emptying. When low urine volumes are produced (less than 1200 ml of urine per day), patients are less inclined to empty at desired intervals, producing urine stagnation and bladder distention.	<ul style="list-style-type: none"> Total daily fluid intake (from foods and all types of beverages) is approximately 2.7 L/day for women and 3.7 L/day for men. Most adults adequately meet their daily hydration needs by letting thirst be their guide.
Poor catheterization technique and catheter care	Inadvertent introduction of bacteria into the bladder.	<ul style="list-style-type: none"> Consider re-evaluation of catheterization technique of the person performing catheterization. Consider a sterile closed system or single-use catheters based on medical necessity.
Excessive fluid intake	If the person cannot or will not adjust fluid intake appropriately for the intermittent self-catheterization schedule, he or she risks periodic or regular bladder over distention and possible overflow UI. Excessive intake could produce bladder volumes greater than 500 mL at one time or would be evidenced by the need to catheterize more than six times a day.	<ul style="list-style-type: none"> Encourage regular fluid intake, small volumes spaced hourly between breakfast and the evening meal, and reducing to sips thereafter.
Nocturnal polyuria	Some patients (such as those with spinal cord injury and/or multiple sclerosis, and older patients) may have nocturnal diuresis related to inadequate antidiuretic hormone secretion at night or impaired cardiac condition.	<ul style="list-style-type: none"> Large fluid intake in the evening should be discouraged. Catheterize several times during the night. Consider a trial of desmopressin administration at bedtime with careful monitoring of serum sodium levels.
Traumatic catheterization	Breaks in the bladder urothelium and urethral lining increase the risk of infection. Difficulty passing the catheter may lead the person to avoid performing catheterization.	<ul style="list-style-type: none"> Assessment of catheterization technique to help correct faulty insertion technique. Consider an alternative catheter design (Coudé tip, hydrophilic coated) to ease passage. Consultation with urologist.

Source: Adapted from Newman & Wein, 2009.

catheterization with an uncoated PVC catheter for at least 5 years (Campbell, Moore, Voaklander, & Mix, 2004).

Scrotal Complications

Epididymitis, or epididymo-orchitis (inflammation of the epididymis and testes), is one of the most common genital infections in men with spinal cord injury who perform intermittent self-catheterization. This infection

appears to be more common in men who have a urethral stricture. Prevalence of this complication of intermittent catheterization has been reported to be between 2% to 8% (Igawa et al., 2008). Men may also experience prostatitis, which can cause UTIs.

Bladder-Related Complications

Hematuria is frequently seen in the initiation of intermittent

catheterization but should not be a persisting problem. New-onset hematuria may indicate a UTI or a stricture. Bladder stones, caused by the introduction of pubic hair or loss of the catheter in the bladder, are common in patients performing long-term intermittent self-catheterization. There have been anecdotal reports of short catheters with a smooth, soft funnel end being inserted and lost in the bladder. Only a few cases of squamous

cell cancer of the bladder in patients performing intermittent self-catheterization have been reported in the literature (Casey, Cullen, Crotty, & Quinlan, 2009).

Pain

Pain or discomfort is often experienced during catheterization in individuals with intact periurethral sensation, especially during initiation of intermittent self-catheterization. Pain may be worsened by tension and anxiety. Adequate catheter lubrication and correct positioning of the urethra can decrease pain in men. In women, pain may be caused by hypoestrogenized urethral and perineal tissue. Over time, pain and discomfort during catheterization is typically reduced.

Urinary Tract Infections

UTI is the most frequent complication in patients performing intermittent catheterization. UTI is of concern because when urethral damage occurs, the mucosal barrier to infection is compromised (De Ridder et al., 2005). In addition, the bladder wall is susceptible to bacteria that circulate in retained urine. When the bladder becomes stretched from retained urine, the capillaries become occluded, preventing the delivery of metabolic and immune substrates to the bladder wall (Heard & Buhner, 2005).

These patients are at higher risk than the general population for developing a UTI and renal deterioration. UTIs can be the result of poor catheterization technique or the passing of the catheter through a normally very contaminated area of the urethra before the catheter reaches the bladder (Moore, Day, & Albers, 2002). A UTI may also be caused by the formation of biofilms (micro-organisms that colonize the internal surface of catheters). Under unfavorable conditions (re-use of a catheter), organisms can detach from the biofilm and become free-floating in the urine, which can lead to symptomatic infection (Saint & Chenoweth, 2003).

Table 4.
Suggestions for Prevention of UTIs Associated with Intermittent Catheterization

1. Maintenance of hygiene, particularly of the hands and perineum
 - a. Hands should be thoroughly washed before attempting catheterization.
 - b. The genitalia should be washed daily with soap and water and always cleansed from front to back.
 - c. Preferable to perform catheterization before bowel program to minimize *E. coli* bacteria contamination of the urethra.
 - d. Immediate perineal hygiene is recommended after vaginal intercourse because the act of intercourse may push anal bacteria into the urethra. Avoidance of spermicidal lubricants in sexually active females because these products may alter normal vaginal and lower urethral flora.
2. Teach male patients the correct positioning of the male urethra during insertion of the catheter to minimize trauma as the catheter passes through curved portions of the urethra (see Figure 18).
3. Be careful to avoid touching the tip of the catheter and/or letting it touch other surfaces.
4. If a postmenopausal female patient has hypoestrogenized perineal tissue, consider transvaginal estrogen medication.
5. Use a generous amount of lubricant along the length of the catheter (especially male patients) since dry catheters may cause excoriations in the urethra, leading to an entry point for bacteria contamination.
6. Keep bladder as empty as possible by having patients catheterize at least four to six times a day or to maintain bladder urine volume less than or equal to 400 mls. Keeping the bladder as empty as possible will prevent over-distension of the bladder and increases in intravesical pressure that can lead to inadequate blood supply to the bladder wall.
7. Encourage use of a new catheter each time performing intermittent catheterization. Most catheters are manufactured and packaged for single-sterile use.
8. Acidification of the bladder may prevent bacteria growth. In non-catheterizing populations, cranberry capsules and juice have been shown and recommended to help prevent the growth of bowel bacteria in the urethra and the bladder. Cranberry ingestion may be contra-indicated in some patients (for example, patients prone to oxalate or uric acid calculi). Cranberry is contraindicated in patients on anticoagulation therapy and should not be recommended to this group. Lactobacillus in the diet (yogurt) has been shown to prevent *E. coli* from growing in the urethra. Hiprex® 1000 mg combined with vitamin C 1000 mg capsules twice daily is thought to acidify urine enough to prevent bacterial growth in the bladder and is recommended in patients with recurrent UTIs.

Source: Adapted from Newman & Wein, 2009.

Woodbury, Hayes, and Askes (2008) reported on a large ($N = 912$) community-based population of individuals with spinal cord injury, half of which were women. Women reported a significantly greater number of UTIs than men ($p = 0.003$). Predictor factors of UTI included high mean catheterization volumes and non-self-catheterization (someone other than the patient performs the catheterization). Busy patient lifestyles, especially for those who are mobility-impaired, and lack of

access to more public places with restrooms may further increase the risk of UTI. Moy and Wein (2007) noted the longer the time frame an individual catheterizes, the incidence of UTI increases. One reason may be that catheterization habits become less of a priority as their lives become busier outside the home (Wyndaele, 2002). Wheelchair-dependent paraplegic individuals are often seen entering highly contaminated public bathrooms in which to perform intermittent self-catheterization.

Overlooking basic hygiene prevention techniques could lead to serious health problems. Table 3 details other common causes of intermittent catheterization-associated UTIs and solutions.

According to a *Cochrane Review* (Moore et al., 2007), there are no definitive studies showing the incidence of UTIs is improved with any catheter technique, type, or strategy. Recurrent symptomatic UTIs can be a problem for many patients performing intermittent self-catheterization long-term (Heard & Buhner, 2005). If a clinical infection occurs in these individuals, treatment should be considered. In patients with an internal prosthesis (pacemaker, heart valve), however, the use of prophylactic antibiotic therapy is often recommended (American Urological Association, 2008; Clarke, Samuel, & Boddy, 2005).

Prevention of UTIs

Adherence to basic daily prevention habits may help avoid UTIs in the higher-risk intermittent catheterization population (see Table 4). The most important prevention measures are adequate education, patient compliance, the use of appropriate catheter type and material, and consistent catheterization technique (Wyndaele, 2002). Less frequent catheterization results in higher catheterized urine volumes and places a patient at increased risk for developing a UTI. Thus, more frequent catheterization and the avoidance of bladder overfilling is an extremely important prevention measure. Catheterization between four and six times a day is recommended for most individuals. More frequent catheterization, however, increases the opportunity for introduction of harmful bacteria. Cardenas and Hoffman (2009) noted individuals with a solid education and understanding about intermittent catheterization technique and who follow a strict catheterization protocol have fewer UTIs.

Table 5.
Defining Catheterization Techniques

Type	Technique
Clean re-used	<ul style="list-style-type: none"> • Use of a sterile, disposable catheter and with good hand hygiene. • After use, catheter is washed and rinsed. • Catheter is then air dried and stored in a ventilated container or ziplock plastic bag. • Catheter is re-used by the same patient for a limited period of time (usually 1 week) as directed by clinician.
Clean, single-use	<ul style="list-style-type: none"> • Use of a sterile, disposable catheter and good hand hygiene. • Catheter is disposed after single use.
Sterile or aseptic	<ul style="list-style-type: none"> • Use of sterile gloves, disinfectant wipes or swabs, sterile single-use catheter, sterile drainage tray, or closed collection bag.

Source: Adapted from Newman & Wein, 2009.

Another measure that may reduce infection is the acidification of urine with cranberry juice or capsules, foods containing *lactobacillus*, and vitamin C capsules (Newman, 2008; Newman & Wein, 2009). Cranberries inhibit bacterial adherence to the uroepithelial wall and have been primarily studied with *Escherichia coli* (*E. coli*) (Jepson & Craig, 2008). In a community-based survey of patients with a spinal cord injury on intermittent catheterization, Woodbury et al. (2008) found those who ingested cranberry or vitamin C agents decreased their incidence of UTI. Hess and colleagues conducted a small, randomized, double-blind, placebo-controlled study in patients who had a spinal cord injury ($N = 57$) and neurogenic bladder who received cranberry tablets over six months. Bladder management differed with only eight subjects performing intermittent self-catheterization. The authors found a reduction in the likelihood of UTIs and symptoms for any month in the group taking cranberry tablets versus the control group. All patients on intermittent self-catheterization were in the treatment group and had fewer UTIs than the control group (Hess, Hess, Sullivan, Nee, & Yalla, 2008).

Intermittent Catheterization Methods

There are different catheterization techniques (sterile or clean), as well as different types of catheters (coated [pre-lubricated] or uncoated [separate lubricant] HCPCS code A4332), sterile (single-use) catheters, or clean (multiple use) catheters used for intermittent catheterization. Catheterization methods include self-catheterization or catheterization by others (such as parents, spouses, or caregivers). The literature reports various ways to clean catheters when used multiple times (Cottenden et al., 2009; Moore et al., 2007). Different catheterization techniques have been defined in Table 5. Research in the area of intermittent catheterization does not always distinguish between clean intermittent catheterization (CIC) and clean intermittent self-catheterization (CISC), and the general term CIC is most often used. According to a *Cochrane Review* (Moore et al., 2007), available data on intermittent catheterization do not provide convincing evidence that any specific technique (sterile or clean), catheter type (coated or uncoated), method (single-use or multiple-use), person (self or other), or strategy is

better than any other for all clinical settings.

Sterile (aseptic) technique implies genital disinfection and the use of sterile catheters, catheter insertion kits, and gloves. In hospitals, sterile intermittent catheterization is preferred over a nonsterile procedure because fewer cases of bacteriuria and UTI occur (Prieto-Fingerhut, Banovae, & Lynne, 1997). According to Lapidès et al. (1972), clean technique with cleansed, re-used catheters implies hand washing with soap and water, and cleansing the perineum only if fecal or other wastes are present. Intermittent catheterization with a single-use sterile catheter also infers good hand hygiene, and in many publications, the term *clean* is used when describing sterile, single-use catheterization.

CIC was introduced by a urologist, Dr. Jack Lapidès, and has been used in the bladder management of patients for over 30 years. CIC has proved to be the most effective and practical means of attaining a catheter-free state in patients with a spinal cord injury and chronic, intractable urinary retention (Moy & Wein, 2007). Lapidès method of intermittent self-catheterization was believed to be associated with low intravesical pressures and urinary bacterial wall translocation, and thus, less chance for infection in a variety of neurogenic and non-neurogenic bladder disorders. CIC has been successful in a large number of adults and children on follow up of more than 20 years (Lindenhall, Abrahamsson, Jodal, Olsson, & Sillén, 2007). CISC may be more suitable than the use of an indwelling urinary catheter in patients who require long-term bladder drainage as a means of minimizing the histological changes that can occur in the bladder mucosa, which predispose and lead to malignant transformation (Gould et al., 2009; Vaidyanathan, Mansour, Soni, Singh, & Sett, 2002). However, this may occur because the catheter is not left in

Table 6.
Recommendations for Intermittent Catheterization

In 2007, the Veterans Administration (VA) issued the following recommendations:

- Clinicians should follow the manufacturer's instructions for catheter use, which recommend single-use devices should not be re-used in any setting.
- Patients should be provided with an adequate number of catheters to allow the use of a sterile catheter for each catheterization.
- Clinicians should inform patients, family members, and caregivers that catheters are for single-use only (Department of Veterans Affairs, 2007; Newman, 2008).

The Centers for Medicare and Medicaid Services (CMS) has not made a recommendation on re-use of catheters, but in the spring of 2008, increased coverage of monthly catheter utilization up to 200 catheters (Muller, 2009).

- CMS catheter reimbursement policy change supports the VA recommendation that clinicians should follow manufacturer's instructions, which are for single-use of these catheters.

Most other insurers will cover only four catheters per month.

place rather than the technique of intermittent catheterization.

With scheduled catheterizations, CIC has become the standard of care in this population. When compared to the use of an intermittent urinary catheter, this technique has resulted in improved kidney and upper urinary tract status, and improved continence in patients with neurogenic bladder dysfunction. It also is considered to be less expensive and more practical for individuals because the original sterile technique is believed to be more time-consuming and costly.

Sterile versus Clean versus Single-Use Intermittent Catheterization

There is little debate among urologic experts that patients with certain medical conditions (for example, immunosuppressed patients) should catheterize with sterile or aseptic technique and a single-use catheter on each catheterization. Catheterization in hospitals and nursing homes is performed aseptically because of the high risk of nosocomial infections. In cases in which a parent or caregiver is performing intermittent catheterization, use of sterile equipment is recommended to minimize the transfer of non-indigenous skin flora into the blad-

der and avoid the possibility of cross-infection. There is little evidence-based research upon which to base recommendations for catheterization in long-term care facilities, but because of the prevalence and incidence of nosocomial infections, aseptic intermittent catheterization should be used.

Debate continues on the use of sterile or clean intermittent catheterization technique in the clinical rehabilitation setting (Kovindha, Mai, & Madersbacher, 2004). Moore, Burt, and Voaklander (2006) compared the incidence of symptomatic UTI and asymptomatic bacteriuria in a small sample of quadriplegic individuals ($N = 36$) admitted from the acute care neurology unit to the spinal cord rehabilitation unit. Shortly after admission to rehabilitation, subjects were randomized to either clean ($n = 16$) or sterile ($n = 20$) intermittent catheterization technique, using time to symptomatic UTI (pyuria plus symptoms) as the study end point. In this study, clean technique with a sterile, single-use polyvinyl catheter (PVC) appeared safe and effective for this population. Of importance is the authors defined clean technique as the use of a new catheter with each catheterization, not the Lapidès definition of clean technique (Moore et al., 2006).

Figure 1.

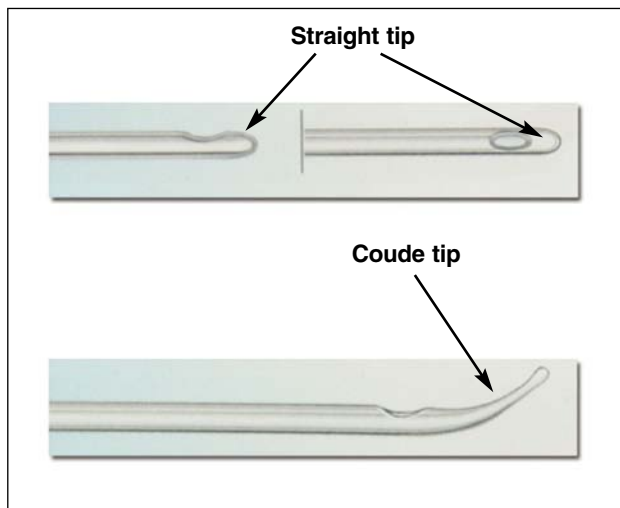
Example of a Female Compact Catheter (Coloplast)



Source: Reprinted with permission from Coloplast.

Figure 2a.

Catheter Tip Configurations – Straight and Coude (Hollister)



Source: Reprinted with permission from Hollister.

Recommendations for Single Use of Catheters

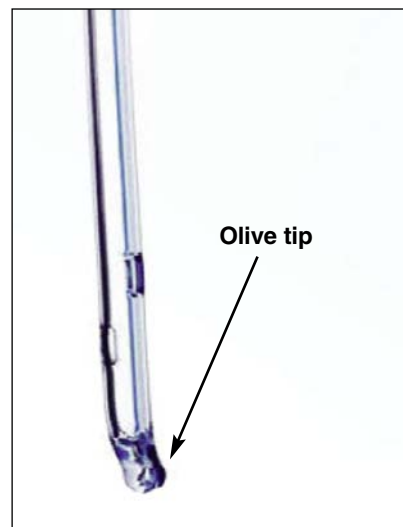
Recent research comparing single, one-time use of a sterile catheter to repeated or re-use of the same catheter for multiple catheterizations is sparse, so one method cannot be recommended over the other (Getliffe, Fader, Allen, Pinar, & Moore, 2007). These authors believe there are few reliable sources that advocate for any type of re-use protocol (Getliffe et al., 2007). As per current manufacturer instructions and labeling, all disposable catheters are for single-use only. No recommendations have been made by Medicare or any other insurer for cleaning catheters between uses and for re-using the same catheter for multiple catheterizations. Table 6 reviews the new guidelines for intermittent catheterization. In time, sterile single-use intermittent catheterization may decrease health care costs because of a decrease in catheter-associated risks (such as UTIs, urethral bleeding) and may prevent the misuse of catheters by patients concerned about costs of these devices.

Catheter Design and Types

The number of catheter types and designs has increased with the advancement of new technology. This has added complexity to the catheterization process for both the nurse and the patient. Catheter types are now gender-specific, acknowledging the anatomical differences in urethral length between men and women. Design changes include the integration of all needed equipment (such as catheter, water-based lubricant, and drainage receptacle/bag) into a compact and user-friendly system (closed system). The clinician who instructs the patient usually recommends the catheter choice, so knowledge of the different types of catheters is important (Newman, Fader, & Bliss, 2004). The type of catheter packaging can be decisive in the choice of catheter. However, catheter choice more often depends on the general clinical situation of the patient, such as injury, manual dexterity, visual impairment, urethral sensibility, gender, and age, than on cause of the bladder dysfunction (Newman & Wein, 2009). The patient may need to try several catheters

Figure 2b.

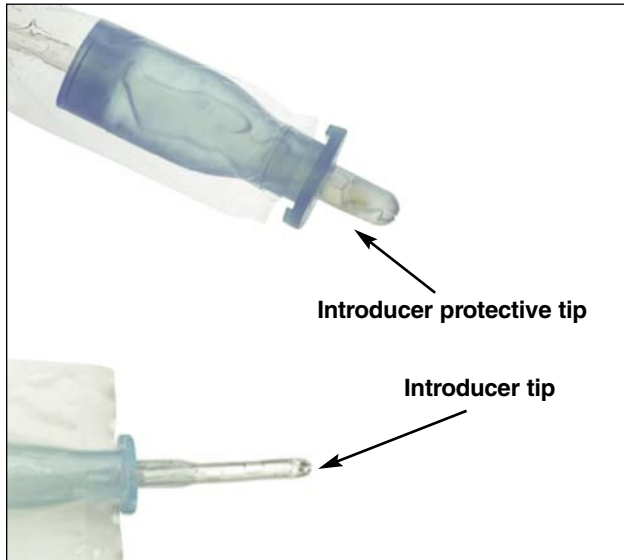
Catheter Olive Tip (Coloplast)



Source: Reprinted with permission from Coloplast.

before finding the preferred type. Not all catheters are suitable for one individual's needs and circumstances. For example, some patients may require one type of catheter for home use and another for catheterizing outside the home (while at work).

Figure 3.
Introducer Tip (Hollister)



Source: Reprinted with permission from Hollister.

Catheter Size and Length

Catheter sizes available for intermittent catheterization are similar to those available for an indwelling urinary catheter. Catheter diameter is measured in French (Fr or Ch) units, and sizes range from 6 to 12 Fr for children and 14 to 22 Fr for adults. The funnel end of the catheter is usually color-coded to easily identify Fr size. Intermittent catheters have different lengths and are gender-specific. Catheters with lengths of approximately 12 inches (about 40 cm) allow for adequate passage through a male urethra. Women and children, whose urethras are shorter in length, may find a shorter-length catheter of 6 to 12 inches (20 to 40 cm), which is easier to grasp and manipulate because it will not loop or kink, thus allowing easy flow and urine drainage through the catheter. Catheters have now been designed to be more compact so they can fit easily in a small purse or bag and are easy for the person to use (see Figure 1).

Table 7.
Types of Catheters Available for Intermittent Catheterization

Type	Characteristics	Concerns
Uncoated catheters <ul style="list-style-type: none"> • Latex-free • Red rubber 	Used for clean technique Latex free <ul style="list-style-type: none"> • Most commonly used catheter – made of medical-grade plastic, such as polyvinyl (PVC) or silicone • Available in a range of stiffness Red rubber <ul style="list-style-type: none"> • Natural rubber latex is very soft and flexible 	Latex free <ul style="list-style-type: none"> • Packaged and labeled for single use • PVC is produced in firm and soft versions and has a larger diameter Red rubber <ul style="list-style-type: none"> • Not appropriate for individuals with latex sensitivities • Flexibility can make them difficult to insert
Coated catheters <ul style="list-style-type: none"> • Hydrophilic • Antibiotic 	Depending on design, used for clean, sterile, or aseptic technique Hydrophilic <ul style="list-style-type: none"> • Have an outer layer of polymer coating bound to the catheter surface, which becomes smoother when hydrated • Coating on catheter surface becomes slippery when wet Antibiotic <ul style="list-style-type: none"> • Antibacterial coating (nitrofurazone) on surface of a silicone catheter to produce local antibacterial activity • Some antibacterial catheters also have a hydrophilic coating • Some hydrophilic catheters require water to be added. 	Hydrophilic <ul style="list-style-type: none"> • Can be slippery if catheter does not have a sleeve, making it difficult for the patient to grasp and manipulate for insertion • Cannot be re-used Antibiotic <ul style="list-style-type: none"> • Risk of superinfection • Patient may become sensitized to antibiotic coating • Minimal data to support effectiveness • Cannot be re-used
Closed systems <ul style="list-style-type: none"> • Gel • Hydrophilic • Antibacterial 	<ul style="list-style-type: none"> • Pre-lubricated intermittent catheter with an attached collection bag and often includes a protective introducer tip • All inclusive – includes gloves, drape, underpad, antiseptic wipe, or swaps • Allows user to catheterize without touching the catheter • Used for sterile or aseptic technique 	<ul style="list-style-type: none"> • Can be difficult for some with limited dexterity to advance catheter through collection bag • Cannot be re-used

Figure 4.
Uncoated Catheter (Coloplast)



Source: Reprinted with permission from Coloplast.

Figure 5.
Hydrophilic Uncoated Catheter (Astra Tech)



Source: Reprinted with permission from Astra Tech.

Catheter Tips

The tip of a catheter used for intermittent catheterization can be either straight (HCPCS code A4351) or curved (referred to as Coudé-tipped [HCPCS code A4352] Tiemann). Most straight-tipped catheters are tapered so they can pass smoothly through the urethra. Using a curved catheter tip in the male patient with an enlarged prostate or a narrowed urethra (for example, from a stricture) may allow for ease of insertion (see Figure 2a). Mentor (now Coloplast) designed an additional tip called the olive-tipped catheter, which has been used in several different situations (such as it may help women locate the meatus) (see Figure 2b).

In the United States, some clinicians advocate the use of an introducer tip when performing intermittent self-catheterization (see Figure 3). The introducer tip was first studied in the 1990s (Bennett et al., 1997; Charbonneau-Smith, 1993). These tips, found in closed-catheter systems, were originally used in obstetric patients, but have been tested in acute care and rehabilitation hospitals. By inserting this tip in the urethra before advancing the catheter, the first portion (1.5 cm) of the distal urethra is bypassed. This portion of the distal urethra can be colonized with perineal bacteria, particularly *E. coli*. Colonization of *pseudomonas* and *klebsiella* frequently occurs in the perineum and urethra in men with a spinal cord injury. To bypass the distal urethra area, the catheter is advanced into the introducer tip, the tip is inserted into the distal urethra, and then the catheter is passed through the tip into the urethra. This prevents contamination of the catheter and introduction of bacteria into the bladder (Hudson & Murahata, 2005). Bennett and colleagues (1997) found the use of an introducer-tipped catheter reduced UTI in hospitalized patients with spinal cord injury on intermittent catheterization.

Figure 6.
Hydrophilic Catheter (Coloplast)



Source: Reprinted with permission from Coloplast.

Catheter Materials

Catheters fall into several different categories and these are described in detail in Table 7.

Catheters are packed individually in sterile packaging (see Figures 4 & 5). As per industry standards, all disposable catheters are intended for one-time use. However, uncoated catheters have frequently been re-used in the past because of cost or concern about the environment (Gray, 2009). Most catheters are used with a separate lubricant, although this is a matter of personal choice as some patients may just use water or nothing (Newman & Wein, 2009). Woodbury and colleagues (2008) found in their national survey of intermittent catheterization practice in a Canadian spinal cord injury group ($N = 912$) that 74% of the sample used uncoated catheters for intermittent self-catheterization, with 53% using it only once.

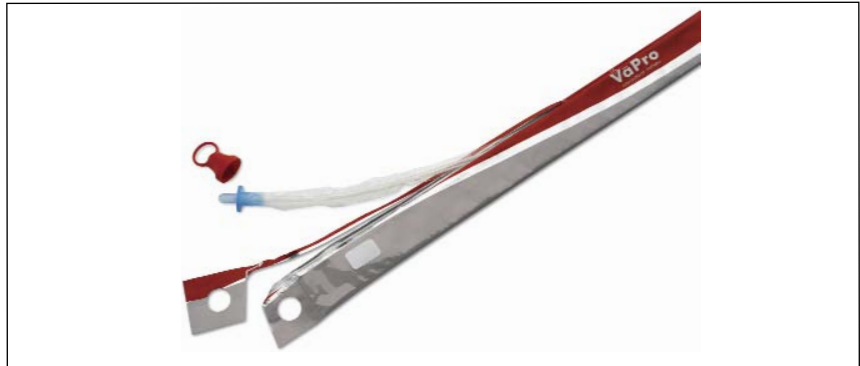
Coated catheters with hydrophilic or other coatings (such as antimicrobial or antibacterial) are sterile and not intended for reuse. Hydrophilic-coated catheters were introduced in an attempt to reduce long-term urethral complica-

Figure 7a.
Hydrophilic Catheter with Water
(Astra Tech)



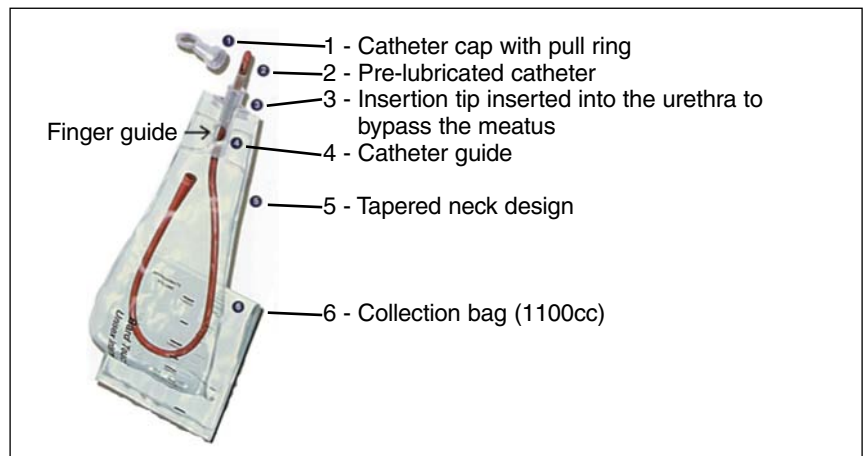
Source: Reprinted with permission from Astra Tech.

Figure 7b.
Hydrophilic Catheter (water vapor) (Hollister)



Source: Reprinted with permission from Hollister.

Figure 8.
Self-Contained Catheter and Bag (Bard)



Source: Reprinted with permission from C.R. Bard.

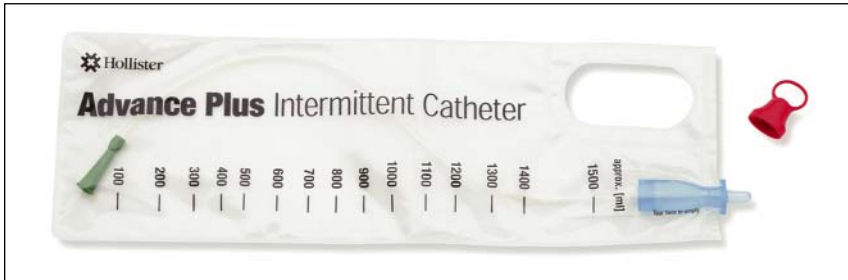
tions. Recent CDC guidelines (Gould et al., 2009) have noted these coated catheters may be preferable to a standard catheter. Hydrophilic catheters are PVC catheters coated along the entire length with a hydrophilic polymer, primarily polyvinyl-pyrrolidone (PVP) and some with sodium chloride. When these catheters are exposed to water, the PVP coating attracts the water to the surface of the catheters, creating the biocompatible salt coating that binds the water to the surface of the catheter and forming an outer layer mainly consisting of water. This thick, slippery, smooth layer of water stays on the catheter, ensuring lubrication of the entire urethra during catheter

insertion and withdrawal, thereby reducing the friction coefficient by at least 95% (Waller, Jonsson, Norlen, & Sullivan, 1995). PVP is a non-allergenic substance that has been used in medical products and cosmetics industries since the 1930s. However, there is an increasing demand for PVC-free materials, with efforts to avoid the use of medical devices that use PVC and its plasticizer (di [2-ethylhexyl] phthalate). There is ongoing research to test PVC-free catheters (Witjes et al., 2009).

PVP-coated hydrophilic catheters may be indicated for patients who experience particular discomfort during catheterization when using gel-lubricated uncoated catheters or patients who have

difficulty with other types of catheters (Diokno, Mitchell, Nash, & Kimbrough, 1995). This outer layer has been designed to allow for easier insertion, minimize discomfort, and reduce friction between the urethra and the catheter during intermittent catheterization. In addition, it may minimize the risk of urethral trauma and other complications (Fader et al., 2001; Vapnek et al., 2003). Because of their low friction, PVP-coated catheters seem to be associated with a lesser degree of urethral inflammatory response when compared to PVC catheters (Biering-Sorensen, Bagi, & Hoiby, 2001; Stensballe et al., 2005; Waller et al., 1995). The use of hydrophilic catheters may also

Figure 9.
Closed System (Hollister)



Source: Reprinted with permission from Hollister.

Figure 10.
Closed Advance Plus System with Hands (Hollister)



Source: Reprinted with permission from Hollister.

Figure 11.
Self-Catheter, Closed System (Coloplast)



Source: Reprinted with permission from Coloplast.

Figure 12.
Self-Contained Sterile Systems with Accessories (Cure Medical)



Source: Reprinted with permission from Cure Medical.

decrease the incidence of strictures (De Ridder et al., 2005; Giannantoni et al., 2002; Stensballe et al., 2005).

Nurses and patients have many hydrophilic-coated catheters from which to choose (see Figure 6). Some available products include sterile water in the package, making it easier to activate the catheter hydrophilic coating (see Figure 7a). A new hydrophilic catheter (see Figure 7b) utilizes water vapor inside the unique package to hydrate the catheter without adding water.

Hedlund, Hjelmås, Jonsson, Klarskov, and Talja (2001) found clinical evidence showing hydrophilic-coated catheters decrease urethral irritation and have a higher user satisfaction. In clinical practice, the reduction in the number of clinically significant UTIs is the most important issue with intermittent self-catheterization. Thus, there may be a beneficial effect regarding UTI when using hydrophilic-coated catheters.

De Ridder and colleagues (2005) studied the prevalence of UTIs in male patients with spinal cord injury who were randomized to a PVC group ($n = 62$) and a hydrophilic (Coloplast SpeediCath) group ($n = 61$). Results over a 1-year period showed the number of patients with spinal cord injury free of clinical UTI ($n = 57$) was double in the hydrophilic catheter group as compared to the PVC group.

Cardenas and Hoffman (2009) conducted a study to determine if patients who used a hydrophilic-coated catheter would have less UTIs when compared to patients (control group) using a non-coated catheter with clean technique. Of the 56 subjects enrolled, 45 completed the study (22 in the treatment group, 23 in the control group). There were no significant differences in demographics (including sex) between the treatment group and the controls except for more tetraplegic subjects in the control group ($p = 0.05$). Seventy-one percent (71%)

Figure 13.
Closed Sterile System Kit
(Astra Tech)



Source: Reprinted with permission from Astra Tech.

of the treatment group and 52% of the control group were men. The total number of symptomatic UTIs was the same in both groups, but the number of symptomatic UTIs that required antibiotics was significantly smaller in the treatment group than in the control group ($p = 0.05$). Seventy percent (70%) of the control group had at least one antibiotic treatment episode compared with only 50% with the hydrophilic catheter ($p = 0.18$). There was no significant difference in the incidence of bacteriuria or symptomatic UTIs among the two groups. Level of injury and years with injury were unrelated to symptomatic UTIs, but being female increased the risk of UTIs ($p = 0.01$).

There are disadvantages to using a hydrophilic-coated catheter for intermittent catheterization. The hydrophilic catheter is

Figure 14.
Self-Contained Sterile Systems (Bard)



Source: Reprinted with permission from C.R. Bard.

intended for one-time use, and may not be cleaned and re-used; surface drying times vary by product, and some become sticky when dry. Furthermore, the design of these catheters varies in terms of material, length, and flexibility because there is no research comparing the different products.

Closed-Catheter Systems

A closed intermittent catheterization system is available and has been designed to reduce contamination of the bladder because the catheter never comes in direct contact with the inserter's hands. These systems should not be re-used. These pre-lubricated products with an integrated (all-in-one) collection bag give flexibility for the user and are efficient for hospital use. Some closed systems are packaged as a sterile kit containing all the equipment required to do aseptic catheterization (for example, when traveling or while at work). Most systems have an introducer tip that is passed through a pre-lubricated plastic sleeve or guide, keeping the catheter straight and lubricated as it is advanced. When the plastic sleeve is squeezed, it prevents the catheter from slipping during insertion (Day, Moore, & Albers, 2003; Newman et al., 2004; Newman & Wein, 2009). The 15 mm introducer tip on the closed system has been shown to bypass the distal urethra where harmful bacteria

reside (Hudson & Murahata, 2005), which is key in the prevention of UTI. The Centers for Medicare and Medicaid allows coverage for closed-catheter systems with introducer tips for those who self-catheterize, are immune-compromised, reside in a nursing facility, experience vesico-ureteral reflux while on an intermittent self-catheterization program, are pregnant females with spinal cord injury and a neurogenic bladder, and/or have developed two or more UTIs in a 12-month period in which they practiced self-catheterization. Reimbursement is under HCPCS code A4353. Figures 8 through 11 illustrate available closed-system choices. Figures 12 through 14 show closed-system sterile kits.

Implementing Intermittent Catheterization

Intermittent catheterization can have a significant physical and/or emotional impact on patients' lives. However, very little research addresses the patient's problems and challenges in everyday life (Woodbury et al., 2008). Although medical personnel may be concerned about complications of intermittent catheterization, patients may be concerned about the discomfort associated with it, the need to maintain privacy, the fear of performing the catheterization, and the

Figure 15.
Catheter Mirror (Astra Tech)



Source: Reprinted with permission from Astra Tech.

Figure 16.
Catheter Holder (Astra Tech)



Source: Reprinted with permission from Astra Tech.

inability to find a clean and appropriate toilet when traveling outside their home. Clinicians need to consider these patient concerns in their teaching and recommend possible strategies.

Teaching Catheterization

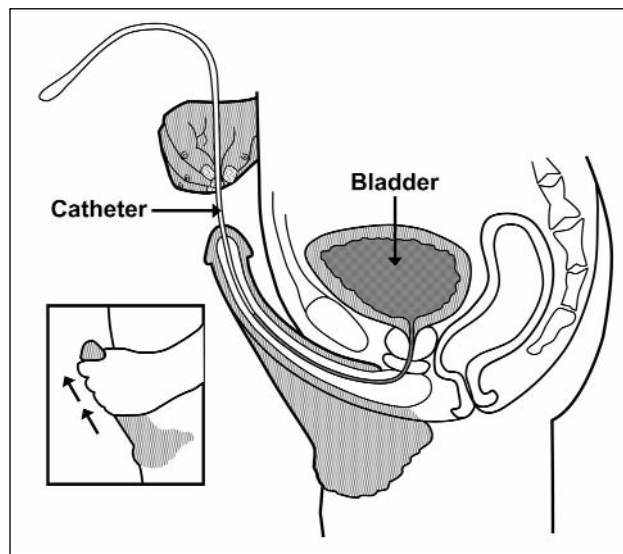
Any type of bladder catheterization is not a procedure to be

Figure 17.
Knee Spreader with Mirror



Source: Reprinted with permission from Diane Newman.

Figure 18.
Correct Penis Placement for Male Intermittent Self-Catheterization



Source: Reprinted with permission from Diane Newman.

undertaken lightly. Intermittent self-catheterization requires education and support, particularly during initial teaching and follow up. A knowledgeable and experienced clinician, in most cases a nurse, is an important component for successful self-catheterization teaching. The nurse should assess patient and/or caregiver knowledge about the urinary tract (Martins, Soler, Batigalia, & Moore 2009). Providing an overview of anatomy with pictures or the use of an anatomic model of the perineum can be very helpful. Many catheter manufacturers have visual guides or videos that can be

used when teaching patients and/or caregivers (Newman & Wein, 2009). Most adults learn best under low to moderate stress, so it is important to teach self-catheterization in a low stress setting. The nurse should also assess the patient's ability to learn intermittent self-catheterization, motivation to continue long-term catheterization, awareness of problems associated with catheterization, and the understanding of how to avoid possible complications. Disabilities, such as blindness, lack of perineal sensation, tremor, mental disability, and paraplegia, do not necessarily

preclude the ability to perform catheterization. However, these obstacles are difficult to overcome in some patients and caregivers (Moore et al., 2007). Teaching a patient with a spinal cord injury may be even more of a challenge because motor and sensory impairment may require changes to catheterization technique.

There is a lack of uniformity and standardization in nursing practice in terms of performing self-catheterization because most nurses use experience-based practice. Initially, many patients may be extremely reluctant to perform any procedure that involves the genitalia, but this is basically a “fear of the unknown.” Determining acceptance of intermittent catheterization is vital because non-compliance is seen in many patients, particularly adolescents (Holmdahl et al., 2007). Teaching components include how to handle the catheter, identify the urinary meatus, and care for the catheter. It is important that patients and/or caregivers demonstrate understanding and/or ability to perform catheterization under supportive supervision of the nurse. For patients performing long-term intermittent self-catheterization, monitoring patients for adverse events is advised.

An assessment of the patient’s personal hygiene (hand washing and cleansing of the genitalia) is important to avoid UTIs. Webster et al. (2001) found no benefit to the use of an antiseptic solution for daily periurethral cleansing prior to catheterization. A more recent study comparing the use of water versus providone-iodine solution for periurethral cleaning in women prior to an indwelling urinary catheter insertion found no significant differences in the rate of bacteriuria or UTIs 24 hours after insertion (Nasiriani et al., 2009).

Performing Intermittent Self-Catheterization

A cooperative, well-motivated patient or family member and/or caregiver is essential for

performing intermittent catheterization. Age should not be a deterrent to intermittent self-catheterization because older patients with adequate cognitive function, mobility, motivation, and manual dexterity can easily learn the technique. Patients who can feed themselves usually have the manual dexterity to self-catheterize.

Anatomic variations make self-catheterization difficult, particularly in obese women who are unable to reach the perineum (Williams, 2005). Similarly, men with large abdominal girths may be unable to visualize the urinary meatus or reach and grasp their penis. Some clinicians have taught men with large girths to catheterize by standing in front of a mirror. Women may find it difficult to perform intermittent self-catheterization in different locations and settings. Nurses can teach women to perform intermittent self-catheterization lying in bed using a mirror to see the meatus. Another technique recommends teaching women in the clinical setting by using a mirror to point out structures in the perineum (the vaginal opening, clitoris, and meatus). A mirror, however, is difficult to use in a toilet stall, so most women are also taught intermittent self-catheterization using the squatting technique. Lapidus and colleagues (1972) found that women may initially use a mirror, but after several days, can locate the urethral meatus by palpation without this aid. Women may facilitate self-catheterization by placing a tampon or having a finger of the opposite hand in the vagina to isolate the location of the meatus.

Aids, such as mirrors, and handles can assist women in seeing the meatal opening, which can be helpful for the person performing catheterization (see Figure 15) (Newman & Wein, 2009). For individuals with limited dexterity, using a handle to insert the catheter may allow the user to hold the catheter firmly and direct it into the correct position (see Figure 16). Another aid helpful for

women who have abductor spasms or inability to separate their thighs is the knee spreader with mirror (see Figure 17).

Schedule

The catheterization schedule or frequency should be based on frequency-volume records, functional bladder capacity based on urodynamics findings, ultrasound bladder scans for PVR, and the impact of catheterization on a patient’s quality of life. As a general rule, bladder volume should not exceed 500 mLs, and some advocate not exceeding 400 mLs. Based on an individual’s average output, catheterization is usually performed four to six times during the day. The bladder should be emptied completely with each catheterization. When starting intermittent catheterization, the patient and/or caregiver should record the amount of urine drained from the bladder. If the patient voids, catheterization should always be performed after voiding.

Catheter Use and Care

There are no clear guidelines about length of time for catheter use if the patient is re-using an uncoated catheter. Most patients re-use catheters for up to 7 days. The cleaning of the catheter between uses has no basis in research because there are no published randomized controlled clinical trials of cleaning methods. The comparative effectiveness of cleaning methods, therefore, is unknown. Actual practice is not well-understood. Woodbury et al. (2008) found close to 80% of all individuals in their sample who re-use their catheters do not disinfect them between uses.

A number of laboratory studies testing the sterility of catheters using different methods (for example, cleaning with soap and water, antiseptic soak, and microwave) have been documented. Prior to recent guidelines and policy changes, most clinicians instructed patients to clean catheters with soap and rinse with

water (Duffy et al., 1995). There did not appear to be an increase in UTI occurrence using these methods, but it should be noted that most of this research is outdated (Duffy, 1995; King, Carlson, Mervine, Wu, & Yarkony, 1992; Sims & Ballard, 1993).

A more recent study has tested a microwave method for catheter cleaning (Bogaert et al., 2004). The microwave method may be less practical than other methods due to the risk of catheter melting. If future research supports the re-use of catheters, there will be a greater need for comparing cleaning methods with symptomatic UTI as the primary outcome variable. Currently, catheter manufacturers do not provide instructions for catheter re-use or cleaning. Best practices do not support the re-use of single-use catheters at this time.

Cleaning techniques suggested by nurses and reported by patients include soap-and-water washing, boiling, microwave sterilization, and soaking in an antiseptic solution (peroxide and povidone-iodine or Betadine®). If the patient prefers re-using the catheter, use of dishwashing soap or an antibacterial waterless product when catheterizing outside the home are adequate in these authors' opinion. A home microwave oven may be used as a method to sterilize red rubber catheters for re-use, with a recommended time of 12 minutes at full power (Bogaert et al., 2004).

To minimize encrustations and to wash away bacteria, patients should be encouraged to forcefully rinse the catheter lumen with tap water. The catheter should then be allowed to dry and stored in a convenient container.

Kovindha and colleagues (2004) recommend the re-use of catheters to reduce catheter costs, especially in developing countries where these devices are scarce due to economic restraints. They investigated the re-use of a silicone catheter manufactured in Japan. Catheter use was studied in

men ($N = 28$) whose average usage time for one catheter was 3 years. Over this time period, 36% of men reported symptoms suggesting a UTI. In this study, patients soaked the catheter in an antiseptic solution (benzethonium chloride with sterile glycerine solution).

Urologic Follow Up

There are no set guidelines for monitoring patients performing intermittent self-catheterization, although many urologists advocate regular urine cytology and cystoscopy with random or targeted bladder biopsies (Casey et al., 2009). In reality, many patients performing intermittent catheterization are lost to urologic follow up.

Conclusion

Intermittent catheterization is the preferred method of emptying the bladder in patients with neurogenic bladder and is an integral part of urologic nursing care. Although it is the most common method used by patients with a spinal cord injury and other neurologic disorders, there is very little research on best practices for catheterization and long-term catheter use and care.

While there has been an attempt to develop guidelines, most nurses still use their clinical judgment to determine which technique and type of catheter to use. Clinicians need to be aware of current recommended guidelines as well as participate in evidence-based research to be knowledgeable and effectively educate patients on long-term CIC use, complications, and catheter care. ■

References

American Urological Association. (2008). *Best practice policy statement on urologic surgery antimicrobial prophylaxis*. Retrieved from www.auanet.org/resources.cfm?ID=459

Bennett, C.J., Young, M.N., Razi, S.S., Adkins, R., Diaz, F., & McCrary, A. (1997). The effect of urethral introducer tip catheters on the incidence of urinary tract infection outcomes in spinal cord injured patients, *Journal of*

Urology, 158(2), 519-521.

Biering-Sorensen, F., Bagi, P., & Hoiby, N. (2001). Urinary tract infections in patients with spinal cord lesions: Treatment and prevention. *Drugs*, 61, 1275-1287.

Bogaert, G.A., Goeman, L., De Ridder, D., Wevers, M., Ivens, J., & Schuermans, A. (2004). The physical and antimicrobial effects of microwave heating and alcohol immersion on catheters that are reused for clean intermittent catheterisation. *European Urology*, 46, 641-646.

Campbell, J.B., Moore, K.N., Voaklander, D.C., & Mix, L.W. (2004). Complications associated with clean intermittent catheterization in children with spina bifida. *Journal of Urology*, 171(6 Pt 1), 2420-2422.

Cardenas, D.D., & Hoffman, J.M. (2009). Hydrophilic catheters versus noncoated catheters for reducing the incidence of urinary tract infections: A randomized controlled trial. *Archives of Physical Medicine & Rehabilitation*, 90(10), 1668-1671.

Casey, R.G., Cullen I.M., Crotty, T., & Quinlan, D.M. (2009). Intermittent self-catheterization and the risk of squamous cell cancer of the bladder: An emerging clinical entity? *Canadian Urological Association Journal*, 3(5), E51-E54.

Charbonneau-Smith, R. (1993). No-touch catheterization and infection rates in a select spinal cord injured population. *Rehabilitation Nursing*, 18(5), 296-299.

Clarke, S.A., Samuel, M., & Boddy, S.A. (2005). Are prophylactic antibiotics necessary with clean intermittent catheterization? A randomized controlled trial. *Journal of Pediatric Surgery*, 40, 568-571.

Clayton, D.B., Brock, J.W., & Joseph, D.B. (2010). Urologic management of spina bifida. *Developmental Disabilities Research Reviews*, 16, 88-95.

Cottenden, A., Bliss, D., Buckley, B., Fader, M., Getliffe, K., Paterson, J., Pieters, R., & Wilde, M. (2009). Management with continence products. In P. Abrams, L. Cardozo, S. Khoury, & A. Wein (Eds), *Incontinence* (pp. 1519-1642), Proceedings from the 4th International Consultation on Incontinence, Plymouth UK: Health Publication.

Day, R.A., Moore, K.N., & Albers, M.K. (2003). A pilot study comparing two methods of intermittent catheterization: Limitations and challenges. *Urologic Nursing*, 23(2), 143-147, 158.

Department of Veterans Affairs (VA). (2007 December 13). *Information letter on intermittent catheterization and the use of sterile catheters*. Author.

De Ridder, D.J., Everaert, K., Fernández, L.G., Valero, J.V., Durán, A.B., Abrisqueta, M.L., ... Sotillo, A.R. (2005). Intermittent catheterisation with hydrophilic-coated catheters

- (SpeediCath) reduces the risk of clinical urinary tract infection in spinal cord injured patients: A prospective randomized parallel comparative trial. *European Urology*, 48, 991-995.
- Diokno, A.C., Mitchell, B.A., Nash, A.J., & Kimbrough, J.A. (1995). Patient satisfaction and the LoFric catheter for clean intermittent catheterization. *Journal of Urology*, 153(2), 349-351.
- Duffy, L.M., Cleary, J., Ahern, S., Kuskowski, M.A., West, M., Wheeler, L., & Mortimer, J.A. (1995). Clean intermittent catheterization: Safe, cost-effective bladder management for male residents of VA nursing homes. *Journal of the American Geriatrics Society*, 43(8), 865-870.
- Fader, M., Moore, K.N., Cottenden, A.M., Petterson, L., Brooks, R., & Malone-Lee, J. (2001). Coated catheters for intermittent catheterization: Smooth or sticky? *British Journal of Urology International*, 88, 373-377.
- Getliffe, K., Fader, M., Allen, C., Pinar, K., & Moore, K.N. (2007). Current evidence on intermittent catheterization: Sterile single-use catheters or clean reused catheters and the incidence of UTI. *Journal of Wound Ostomy Continence Nursing*, 34(3), 289-296.
- Giannantoni, A., DiStasi, S., Scivoletto, G., Virgili, G., Dolci, S., & Porena, M. (2002). Intermittent catheterization with a prelubricated catheter in spinal cord injured patients: A prospective randomized crossover study. *Journal of Urology*, 166, 130-133.
- Gray, M. (2009). Are all urethral catheters created equal? *Journal of Urology*, 182, 2561-2562.
- Gould, C.V., Umscheid, C.A., Agarwal, R.K., Kuntz, G., Pegues, D.A., and the Healthcare Infection Control Practices Advisory Committee (HIC-PAC). (2009). *Guideline for the prevention of catheter-associated urinary tract infections 2009*. Retrieved from http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/CAUTI_Guideline2009final.pdf
- Heard, L., & Buhner, R. (2005). How do we prevent UTI in people who perform intermittent catheterization? *Rehabilitation Nursing*, 30, 44-45.
- Hedlund, H., Hjelmås, K., Jonsson, O., Klarskov, P., & Talja, M. (2001). Hydrophilic versus non-coated catheters for intermittent catheterization. *Scandinavian Journal of Urology and Nephrology*, 35(1), 49-53.
- Hess, M.J., Hess, P.E., Sullivan, M.R., Nee, M., & Yalla, S.V. (2008). Evaluation of cranberry tablets for the prevention of urinary tract infections in spinal cord injured patients with neurogenic bladder. *Spinal Cord*, 46(9), 622-626.
- Holmdahl, G., Sillén, U., Abrahamsson, K., Hellström, A., Kruse, S., & Sölsnes, E. (2007). Self-catheterization during adolescence. *Scandinavian Journal of Urology and Nephrology*, 41(3), 214-217.
- Hudson, E., & Murahata, R.I. (2005). The 'no-touch' method of intermittent urinary catheter insertion: Can it reduce the risk of bacteria entering the bladder? *Spinal Cord*, 43(10), 611-614.
- Igawa, Y., Wyndaele, J.J., & Nishizawa, O. (2008). Catheterization: Possible complications and their prevention and treatment. *International Journal of Urology*, 15(6), 481-485.
- Jepson, R.G., & Craig, J.C. (2008). Cranberries for preventing urinary tract infections. *Cochrane Database System Review*, 2, CD001321.
- Katrancha, E.D. (2008). Clean intermittent catheterization in the school setting. *Journal of School Nursing*, 24(4), 197-204.
- King, R.B., Carlson, C.E., Mervine, J., Wu, Y., & Yarkony, G.M. (1992). Clean and sterile intermittent catheterization methods in hospitalized patients with spinal cord injury. *Archives of Physical Medicine and Rehabilitation*, 73(9), 798-702.
- Kovindha, A., Mai, W.N.C., & Madersbacher, H. (2004). Reused silicone catheter for clean intermittent catheterization (CIC): Is it safe for spinal cord injured (SCI) men? *Spinal Cord*, 42, 638-642.
- Lapides, J., Diokno, A.C., Silber, S.J., & Lowe, B.S. (1972). Clean, intermittent self-catheterization in the treatment of urinary tract disease. *Journal of Urology*, 107(3), 458-461.
- Lindehall, B., Abrahamsson, K., Jodal, U., Olsson, I., & Sillén, U. (2007). Complications of clean intermittent catheterisation in young female patients with myelomeningocele: 10 to 19 years follow up. *Journal of Urology*, 178, 1053-1055.
- Linsenmeyer, T.A., Bodner, D.R., Creasey, G.H., Green, B.G., Groah, S.L., & Joseph, A., for the Consortium for Spinal Cord Medicine. (2006). Bladder management for adults with spinal cord injury: A clinical practice guideline for health-care providers. *Journal of Spinal Cord Medicine*, 29, 527-573.
- Martins, G., Soler, Z.A., Batigalia, F., & Moore, K.N. (2009). Clean intermittent catheterization: Educational booklet directed to caregivers of children with neurogenic bladder dysfunction. *Journal Wound Ostomy Continence Nursing*, 36(5), 545-549.
- Moore, K.N., Burt, J., & Voaklander, D.C. (2006). Intermittent catheterization in the rehabilitation setting: A comparison of clean and sterile technique. *Clinical Rehabilitation*, 20, 461-468.
- Moore, K.N., Day, R.A., & Albers, M. (2002). Pathogenesis of urinary tract infections: A review. *Journal Clinical Nursing*, 11(5), 568-574.
- Moore, K.N., Fader, M., & Getliffe, K. (2007). Long-term bladder management by intermittent catheterisation in adults and children. *Cochrane Database System Review*, 4, CD006008.
- Moy, L.M., & Wein, A.J. (2007). Additional therapies for storage and emptying. In A.J. Wein, L.R. Kavoussi, A.C. Novick, A.W. Partin, & C.A. Peters (Eds.), *Campbell's urology* (9th ed., pp. 2288-2304). Philadelphia: Elsevier Saunders.
- Muller, N. (2009). Medicare coverage of catheters. *Ostomy Wound Management*, 55(3), 10.
- Nasiriani, K., Kalani, Z., Farnia, F., Motavasslian, M., Nasiriani, F., & Engberg, S. (2009). Comparison of the effect of water vs. povidone-iodine solution for periurethral cleaning in women requiring an indwelling catheter prior to gynecologic surgery. *Urologic Nursing*, 29(2), 118-121, 131.
- Newman, D.K., (2008). Internal and external urinary catheters: A primer for clinical practice. *Ostomy Wound Management*, 54(12), 18-35.
- Newman, D.K., Fader, M., & Bliss, D.Z. (2004). Managing incontinence using technology, devices and products. *Nursing Research*, 53(6, Suppl.), S42-S48.
- Newman, D.K., & Wein, A.J. (2009). *Managing and treating urinary incontinence* (2nd ed). Baltimore: Health Professions Press.
- Pohl, H.G., Bauer, S.B., Borer, J.G., Diamond, D.A., Kelly, M.D., Grant, R., ... Retik, A.B.. (2002). The outcome of voiding dysfunction managed with clean intermittent catheterization in neurologically and anatomically normal children. *British Journal of Urology International*, 89(9), 923-927.
- Prieto-Fingerhut, T., Banovac, K., & Lynne, C.M. (1997). A study comparing sterile and nonsterile urethral catheterization in patients with spinal cord injury. *Rehabilitation Nursing*, 22, 299-302.
- Saint, S., & Chenoweth, C.E. (2003). Biofilms and catheter-associated urinary tract infections. *Infectious Disease Clinics of North America*, 17, 411-432.

Urologic Nursing Editorial Board Statements of Disclosure

In accordance with ANCC-COA governing rules *Urologic Nursing* Editorial Board statements of disclosure are published with each CNE offering. The statements of disclosure for this offering are published below.

Susanne A. Quallich, ANP-BC, NP-C, CUNP, disclosed that she is on the Consultants' Bureau for Coloplast.

All other *Urologic Nursing* Editorial Board members reported no actual or potential conflict of interest in relation to this continuing nursing education article.

continued on page 48

**Answer/Evaluation Form:
Review of Intermittent Catheterization and Current Best Practices**

Deadline for Submission: February 28, 2013

COMPLETE THE FOLLOWING

This test may be copied for use by others.

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Preferred telephone: (Home) _____ (Work) _____

SUNA Member Expiration Date: _____

Check Enclosed Visa Mastercard

Credit Card Number: _____ Exp. Date _____

Registration fee: SUNA Member: \$12.00
 Regular: \$20.00

ANSWER FORM:

1. If you applied what you have learned from this activity into your practice, what would be different?

Evaluation	Strongly disagree			Strongly agree
2. By completing this activity, I was able to meet the following objectives:				
a. Explain bladder management programs for initiating voiding or ensuring complete emptying of the bladder.	1	2	3	4 5
b. Discuss intermittent catheterization as the preferred method of catheterization in patients with bladder dysfunction.	1	2	3	4 5
c. Describe the various types and designs of catheters used for intermittent catheterization.	1	2	3	4 5
3. The content was current and relevant.	1	2	3	4 5
4. The objectives could be achieved using the content provided.	1	2	3	4 5
5. This was an effective method to learn this content.	1	2	3	4 5
6. I am more confident in my abilities since completing this material.	1	2	3	4 5
7. The material was (check one) ___new ___review for me				
8. Time required to complete the reading assignment: _____minutes				

I verify that I have completed this activity: _____
Signature

Comments _____

OBJECTIVES

This continuing nursing educational (CNE) activity is designed for nurses and other health care professionals who care for and educate patients and their families regarding intermittent catheterization. For those wishing to obtain CNE credit, an evaluation follows. After studying the information presented in this offering, you will be able to:

1. Explain bladder management programs for initiating voiding or ensuring complete emptying of the bladder.
2. Discuss intermittent catheterization as the preferred method of catheterization in patients with bladder dysfunction.
3. Describe the various types and designs of catheters used for intermittent catheterization.

CNE INSTRUCTIONS

1. To receive continuing nursing education credit for individual study after reading the article, complete the answer/evaluation form to the left.
2. Photocopy and send the answer/evaluation form along with a check or credit card order payable to **SUNA** to *Urologic Nursing*, CNE Series, East Holly Avenue Box 56, Pitman, NJ 08071-0056.
3. Upon completion of the answer/evaluation form, a certificate for **1.3** contact hour(s) will be awarded and sent to you.
4. CNE forms can also be completed online at www.suna.org.

This activity has been provided by the Society of Urologic Nurses and Associates (SUNA).

SUNA is accredited as a provider of continuing nursing education by the American Nurses' Credentialing Center's Commission on Accreditation (ANCC-COA).

SUNA is a provider approved by the California Board of Registered Nurses, provider number CEP 05556. Licenses in the state of CA must retain this certificate for four years after the CNE activity is completed.

Accreditation status does not imply endorsement by SUNA or ANCC of any commercial product.

This article was reviewed and formatted for contact hour credit by Sally S. Russell, MN, CMSRN, CPP, SUNA Education Director; and Jane Hokanson Hawks, PhD, RN, BC, Editor.

I am an (check one)

RN APN LPN/LVN PA

Other _____

Intermittent Catheterization

continued from page 28

- Sims, L., & Ballard N. (1993). A comparison of two methods of catheter cleansing and storage used with clean intermittent catheterization. *Rehabilitation Nursing Research, 2*, 87-92.
- Stensballe, J., Loom, D., Nielsen, P.N., & Tvede, M. (2005). Hydrophilic-coated catheters for intermittent catheterisation reduce urethral microtrauma: A prospective, randomised, participant-blinded, crossover study of three different types of catheters. *European Urology, 48*, 978-983.
- Vaidyanathan, S., Mansour, P., Soni, B.M., Singh, G., & Sett, P. (2002). The method of bladder drainage in spinal cord injury patients may influence the histological changes in the mucosa of neuropathic bladder – A hypothesis. *BMC Urology, 2*, 1-7.
- Vapnek, J.M., Maynard, F.M., & Kim, J. (2003). A prospective randomized trial of the LoFric hydrophilic coated catheter versus conventional plastic catheter for clean intermittent catheterization. *Journal of Urology, 169*, 994-998.
- Waller, L., Jonsson, O., Norlén, L., & Sullivan, L. (1995). Clean intermittent catheterization in spinal cord injury patients: Long-term follow up of a hydrophilic low friction technique. *Journal of Urology, 153*(2), 345-348.
- Webster, J., Hood, R.H., Burrige, C.A., Doidge, M.L., Phillips, K.M., & George, N. (2001). Water or antiseptic for periurethral cleaning before urinary catheterization: A randomized controlled trial. *American Journal of Infection Control, 29*, 389-394.
- Weld, K.J., & Dmochowski, R.R. (2000). Effect of bladder management on urological complications in spinal cord injured patients. *Journal of Urology, 163*(3), 768-772.
- Williams, M.E. (2005). How do we teach clean intermittent self-catheterization using touch technique? *Rehabilitation Nursing, 30*, 171-172.
- Witjes, J.A., Popolo, G.D., Marberger, M., Jonsson, O., Kaps, H.P., & Chapple, C.R. (2009). A multicenter, double-blind, randomized, parallel group study comparing polyvinyl chloride and polyvinyl chloride-free catheter materials. *Journal of Urology, 169*, 994-998.
- Woodbury M.G., Hayes K.C., & Askes H.K. (2008). Intermittent catheterization practices following spinal cord injury: A national survey. *Canadian Journal of Urology, 15*(3), 4065-4071.
- Wyndaele, J.J. (2002). Complications of intermittent catheterization: Their prevention and treatment. *Spinal Cord, 40*(10), 536-541.

Additional Reading

- Lapides, J., Diokno, A.C., Silber, S.M., & Lowe, B.S. (2002). Clean, intermittent self-catheterization in the treatment of urinary tract disease. *Journal of Urology, 167*, 1584-1586.
- Lindehall, B., Abrahamsson, K., Jodal, U., Olsson, I., & Sillén, U. (2007). Complications of clean intermittent catheterisation in young female patients with myelomeningocele: 10 to 19 years follow up. *Journal of Urology, 178*, 1053-1055.