

Urinary Catheter Management

For centuries, the urethral catheter system consisted of a tube inserted through the urethra into the bladder and drained into an open container. The closed catheter system was developed in the 1950s and is still in use today.

The use of urinary catheters should be avoided whenever possible. Clean intermittent catheterization, when practical, is preferable to long-term catheterization. While clean handling of catheters is important, routine perineal cleaning and catheter irrigation or changing are ineffective in eliminating bacteriuria. Bacteriuria is inevitable in patients requiring long-term catheterization, but only symptomatic infections should be treated. Infections are usually polymicrobial, and seriously ill patients require therapy with two antibiotics. Patients with spinal cord injuries and those using catheters for more than 10 years are at greater risk of bladder cancer and renal complications; periodic renal scans, urine cytology and cystoscopy may be indicated in these patients.

Urinary catheterization can cause many health problems. Alternatives to catheterization should be used whenever possible. Studies have shown that universal bacteriuria occurs within four days when open catheters are used versus approximately 30 days with closed systems. Complications of long-term catheterization include chronic renal inflammation, chronic pyelonephritis, nephrolithiasis, cystolithiasis, symptomatic urinary tract infection with pyelonephritis, bacteremia, sepsis and death.

TABLE 1
Indications for Use of Urinary Catheters

Long-term catheterization	Short-term catheterization
Bladder outlet obstruction not correctable medically or surgically	Urologic surgery
Intractable skin breakdown caused or exacerbated by incontinence	Surgery on contiguous structures
Some patients with neurogenic bladder and retention	Critically ill patients requiring accurate measure of urinary output
Palliative care for terminally ill or severely impaired incontinent patients for whom bed and clothing changes are uncomfortable	Acute urinary retention
Preference of a patient who has not responded to specific incontinence treatments	

Accepted indications for urinary catheterization are listed in Table 1. An initial episode of acute urinary retention should be treated with an indwelling catheter to allow the bladder to regain its tone, with catheter removal and a voiding trial after 10 to 14 days. While catheters are frequently used in older patients, chronic indwelling catheterization is not a substitute for good nursing care in the management of incontinence. Because a single in-and-out catheterization may cause bacteriuria in as many as 20 percent of older people, catheterization is not recommended as a way of obtaining urine specimens for diagnostic testing in patients who could provide a voided specimen. In women undergoing total vaginal hysterectomy, even short-term use of urinary catheters has been associated with longer hospital stays.

Intermittent catheterization may be preferable to chronic indwelling catheterization in certain patients with bladder-emptying dysfunction. It has become the standard of care in patients with spinal cord injuries. Following surgical repair of a hip fracture, elderly patients regained satisfactory voiding more quickly on a program of intermittent catheterization every 6 to 8 hours compared with the use of indwelling catheters. Women undergoing total abdominal hysterectomy who had in-and-out catheterization at the time of surgery had a lower rate of bacteriuria than women with indwelling catheters.

In patients who require long-term intermittent catheterization, no difference in colonization or infection rates has been found between those using sterile single-use catheters and those using clean intermittent catheterization. Bacteriuria occurs in most patients in two to three weeks. Regular, frequent meatal cleansing offers no advantage in preventing bacteriuria or urinary tract infections in patients performing or using clean intermittent catheterization.

CATHETER CHOICES

External Catheters

Use of an external catheter should be considered in incontinent men without urinary retention who have severe functional disabilities. In this setting, external catheters are more comfortable and have a lower incidence of bacteriuria than indwelling catheters. Skin breakdown is common, whereas urethral diverticuli and penile ischemia occur only occasionally. To minimize sleep disruption and limit bacteriuria and other complications, external catheters can be used only at night. External catheters have also been developed for female patients, but their safety and effectiveness have not been determined in nursing home patients.

Urethral vs. Suprapubic Catheters

Suprapubic catheters are recommended by some physicians for short-term use when a catheter is needed for gynecologic, urologic and other surgeries. Theoretically there are fewer microbes on the abdominal wall than on the perineum, creating less risk for infection. Another advantage is easier catheter changes. Suprapubic catheters can also be clamped to test for adequate voiding. Some patients might also prefer a suprapubic catheter to enhance self-image and sexual functioning. Other patients prefer its comfort and convenience. Disadvantages of suprapubic catheters include the risk of cellulitis, leakage, hematoma at the puncture site, prolapse through the urethra and the psychologic barrier of insertion through the abdominal wall.

Latex vs. Silastic Catheters

Silastic catheters have been recommended for short-term catheterization after surgery. Compared with latex catheters, silastic catheters have a decreased incidence of urethritis and, possibly, urethral stricture. However, use in animal models for longer than six weeks showed no difference in inflammatory response between latex and silastic catheters. Because of its lower cost and similar long-term outcomes, latex is the catheter of choice for long-term catheterization. The cost differential becomes less significant in patients who do not require frequent catheter changes. Silastic catheters should be used in latex-allergic patients.

Catheters impregnated with various substances have not proved to be beneficial in patients with long-term catheterization. Silver-impregnated catheters, antibiotic-coated catheters and electrified catheters may diminish bacteriuria for a few days but are costly and have no role in long-term catheterization. In one study, silver-impregnated catheters were associated with more frequent bacteriuria and an increased risk of staphylococcal bacteriuria.

ROUTINE MANAGEMENT

Catheter Size

Authorities recommend choosing "the narrowest, softest tube that will serve the purpose." Rarely is a catheter larger than 18 F required, and 14 or 16 F usually suffices.³ A size 12 F catheter was found to be successful in catheterizing men with acute urinary retention. In most patients, it is best to minimize bladder irritation by using a catheter with a 5 mL balloon inflated with 5 to 10 mL of fluid.

Minimizing Infection

Infection in catheterized patients is suggested by fever, unusually cloudy urine, more frequent blockage or detrusor spasms. Once the decision has been made to use an indwelling urinary catheter, efforts should be made to minimize problems. The catheter should be inserted using sterile technique. Once inserted, the catheter should be anchored to prevent urethral traction.

Every attempt should be made to keep the drainage system closed. Any break in the catheter-to-collection unit may invite earlier infection. Infection in the catheterized patient is suggested by signs or symptoms of pyelonephritis (fever greater than 38.3°C for more than one day, mental status changes, hypotension), unusually cloudy urine, more frequent blockage, and new or increased detrusor spasms.

Avoiding cross-contamination is most important in controlling nosocomial epidemics of catheter-related infections. Caretakers should wash hands before and after any manipulation of a patient's catheter or collection unit. If possible, devices used for emptying collection bags should be clean and patient-specific.

Catheters should not be changed routinely. Some physicians advocate monitoring patients for time-to-obstruction of urinary catheter, with the catheter changed just before the patient would be expected to obstruct. With this approach, some patients required catheter changes weekly, and others did not need them for several weeks. Such a policy will lead to fewer catheter changes than scheduled changes and will result in less trauma to the urinary system and fewer symptomatic infections. An obstructed catheter with cessation of urine flow for four to eight hours should obviously be changed. Some physicians recommend a catheter change when an episode of symptomatic urinary infection occurs.

Several procedures that have been used to decrease the risk of infection are of no benefit. For example, meatal disinfectants and antibacterial urethral lubricants are ineffective. Cleansing with soap and water during bathing suffices to remove accumulated debris. Prophylactic bladder irrigations using antibiotics, hydrogen peroxide or povidone-iodine are not helpful. The end result is colonization or infection with more resistant organisms.

Some physicians recommend diluted acetic acid irrigations in patients with frequent catheter obstructions who have had no response to increased fluid intake or acidification of urine. Pharmaceuticals, including systemic antibiotics, methenamine and acidifying agents have also not proved to be beneficial in minimizing bacteriuria or infection. Agents added to collection bags have also not proved effective. Table 3 provides the guidelines from the Centers for Disease Control and Prevention for preventing catheter-associated infections.

TABLE 3
 CDC Guidelines for Prevention of Catheter-Associated UTI
 CDC = Centers for Disease Control and Prevention; UTI = urinary tract infection.

Category I.	Category II.
Strongly recommended Catheterize only when necessary. Educate personnel in correct techniques of catheter insertion and care. Emphasize handwashing. Insert catheter using aseptic technique and sterile equipment. Secure catheter properly. Maintain closed sterile drainage. Obtain urine specimens aseptically. Maintain unobstructed urine flow.	Moderately recommended Periodically re-educate personnel in catheter care. Use smallest suitable catheter bore. Avoid irrigation unless needed to prevent or relieve obstruction. Refrain from daily meatal care. Do not change catheters at arbitrary intervals.

MANAGEMENT OF COMPLICATIONS

Obstruction

The material that obstructs urinary catheters consists of bacteria, glycocalyx, protein and precipitated crystals. Patients who tend to develop blocked catheters excrete more calcium, protein and mucin, and have a higher urine pH level than patients with infrequent blockage. *Proteus mirabilis* bacteriuria may also be associated with catheter obstruction. Its potent urease splits ammonia, causing alkaline urine, which in turn precipitates crystals of struvite and apatite in the catheter lumen. Methenamine preparations may be beneficial in reducing episodes of obstruction. Irrigation may prevent repeated obstructions that are not responsive to increased fluid intake and urine acidification. However, obstructed catheters must be removed.

Leakage

Bladder spasms are not uncommon in patients with long-term catheterization. The force generated by spasms commonly overwhelms the drainage capacity of the catheter, creating leakage around the catheter. This type of leakage should not be corrected by using a larger diameter catheter. Infection or catheter obstruction, if present, should be treated. Antispasmodics, such as oxybutynin and flavoxate, can be effective in alleviating spasm due to detrusor instability.

Colonization vs. Infection

Virtually every patient with chronic catheterization is colonized with bacteriuria within six weeks. Bacteriuria also occurs within a few months in the majority of patients using clean intermittent catheterization. Asymptomatic bacteriuria does not require treatment. Antibiotic prophylaxis simply promotes emergence of antibiotic-resistant microbes. Slight pyrexia is not uncommon in patients with chronic indwelling urinary catheters and often lasts only a day. An isolated incident should not prompt initiation of antibiotic therapy. In the noncatheterized population, no evidence has been shown of a causal relationship between asymptomatic bacteriuria and mortality.

Asymptomatic bacteriuria occurs frequently after the removal of a short-term indwelling catheter. It is currently not clear what the proper treatment should be. Some physicians recommend treatment of asymptomatic bacteriuria, but it may be more reasonable to treat only symptomatic episodes. If treatment is chosen, a single dose of trimethoprim-sulfamethoxazole is effective in asymptomatic younger women and those with lower urinary tract symptoms. Duration of antibiotic treatment should probably be at least 10 days in women 65 years and older. While no studies have addressed this issue in men, it seems reasonable to use this approach in men with short-term catheterization. Only symptomatic infection should be treated in patients undergoing long-term catheterization. Periodic urine cultures in chronically catheterized patients are not warranted. The bacterial flora changes over time, and serial cultures offer no benefit in determining correct antibiotic choice for future acute infection episodes.

When a patient undergoing long-term catheterization develops fever, a source of infection should be sought. When urinary infection is suspected, culture should be obtained to guide therapy. Some physicians recommend inserting a new catheter and collecting a fresh urine sample for culture, to more accurately determine the source of bladder infection, although no data support this practice. Blood cultures may be helpful if bacteremia is suspected. Infections are usually polymicrobial and may include bacteria such as *Pseudomonas*, *Proteus*, *Providencia*, *Enterobacteriaceae*, *Morganella* and *Enterococci*.

The usual duration of therapy is five to 14 days or longer. When multidrug-resistant pathogens are not likely and the patient is not critically ill, trimethoprim-sulfamethoxazole or a second-generation cephalosporin will generally suffice. Seriously ill or septic patients require a two-drug combination of ampicillin plus a third-generation cephalosporin such as ceftriaxone, aztreonam, an aminoglycoside or a quinolone.

Complications of urinary tract infections may occur. Increasing renal dysfunction and recalcitrant or recurring bacteremia should prompt a search for urinary stones or other causes of obstruction. Men may develop urethritis, urethral fistula, epididymitis, scrotal abscess, prostatitis and prostatic abscess.

Special Circumstances

Renal calculi are common in patients with spinal cord injury and affect at least 8 percent of patients. Renal failure is the cause of death in 20 to 68 percent of these patients. Thirty-nine percent of those who died from renal failure had urolithiasis at autopsy compared with 18 percent of those who died from nonrenal causes. Secondary prevention measures include annual urinary tract evaluation with creatinine clearance and a renal sonogram with urologic evaluation every three years, or more frequently if indicated.

Periodic surveillance for urolithiasis and removal of stones is recommended to maintain renal function. Patients who have had an indwelling catheter for longer than 10 years have an increased risk of bladder cancer. In these people, annual cytology or cystoscopy is recommended as a secondary prevention strategy. However, none of these strategies has been systematically evaluated in a clinical trial.