

Urinary Tract Infections

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Key points

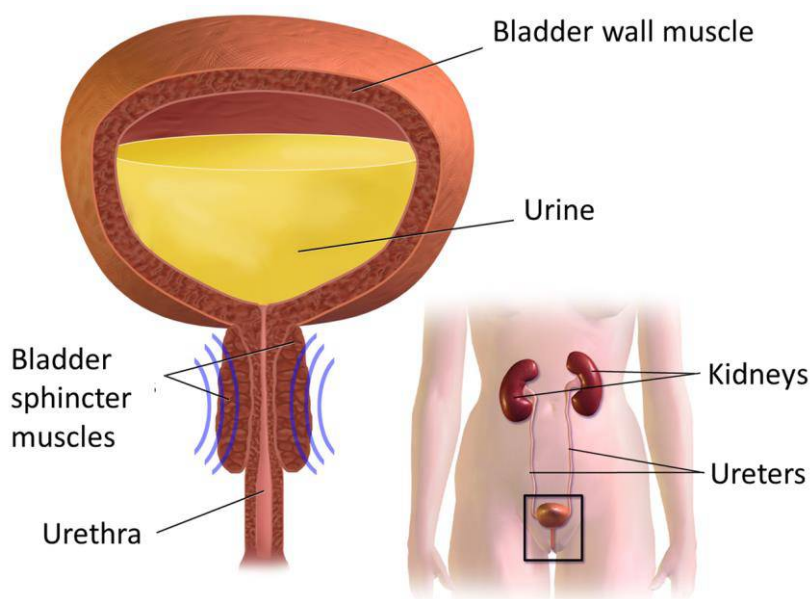
- A *urinary tract infection* (UTI) is an infection of the bladder, kidneys or their connecting tubes.
- UTIs are common after spinal cord injury (SCI) because of changes to how the bladder works, side effects of bladder treatments (such as use of urinary catheters), and other factors.
- Common symptoms of UTIs include cloudy, dark or bad-smelling urine and fever, chills, or fatigue. Symptoms may also involve increased muscle spasms which can cause leaking or autonomic dysreflexia. If you have sensation you may experience discomfort over the abdomen and back or when urinating.
- UTIs should be treated with antibiotics only if symptomatic, not just for the presence of bacteria in the urine. There are several things that can be done to prevent UTIs, such as maintaining an effective bladder routine, adequate water intake, seeking treatment for bladder problems, and staying healthy.
- UTIs can be very serious and even become life-threatening. If you suspect you might have a UTI, see your doctor as soon as possible.

What are urinary tract infections?

A *urinary tract infection* (commonly called a “UTI”) is an infection of part of the urinary tract. This may be the kidneys, the bladder, or the urinary tract’s connecting tubes (the *ureters* or *urethra*). Kidney infections are called *pyelonephritis* and bladder infections are called *cystitis*.

Urinary tract infections are common after SCI, affecting around 1 in 5 people early after injury, and as many as 7 in 10 people living with SCI long-term.

In severe cases, UTIs can progress to a life-threatening infection called *sepsis*. In the early days of SCI care, complications of UTIs were the most common cause of death after SCI.



Urinary tract infections can happen in the kidneys, bladder, or their connecting tubes.¹

Today, treatment and prevention of UTIs is much more effective and infections can be treated effectively in most cases. However, it is very important to take steps to prevent infections and to seek out treatment for new infections as soon as they are detected.

What do urinary tract infections look and feel like?

The symptoms of UTIs usually consist of whole body symptoms of infection (like fever), changes to urination (such as appearance or odour), or signs that indicate something is wrong below the injury (such as increased muscle spasms or autonomic dysreflexia).

However, UTIs are not always easy to recognize, especially if you don't have sensation in the area. If you suspect you might have a UTI, contact a health provider as soon as possible.

Signs and symptoms of UTIs may include:

- Cloudy urine (from pus), dark-coloured or red urine (from blood), or bad-smelling urine
- Fever, chills, tiredness, or a feeling of unease
- More frequent or severe muscle spasms
- Autonomic dysreflexia (in people with injuries above T6)
- Leaking of urine or leakage around the catheter
- Reduced appetite

If you have sensation in the area, you may also experience:

- An urge to urinate often
- Pain or discomfort while emptying the bladder
- Pain in the abdomen or back

Watch for changes to your bladder function



As a part of your regular bladder care, keep an eye out for changes that could indicate a UTI. For example, monitoring changes in the colour or volume of urine emptied may help you detect infections earlier.

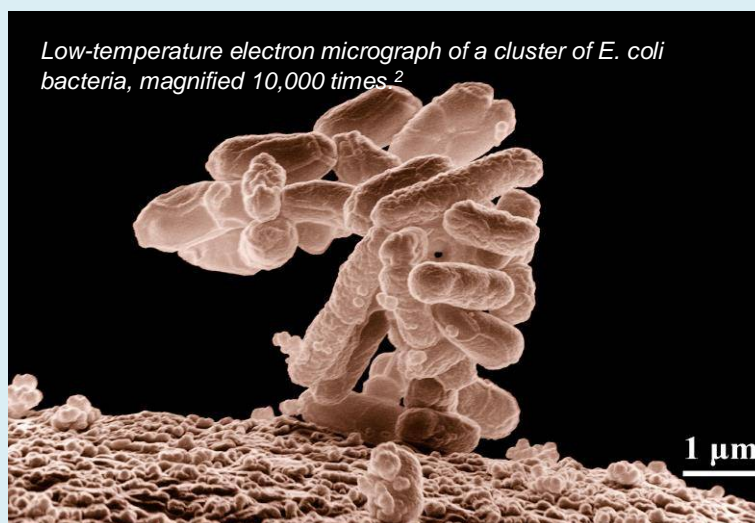
Why do urinary tract infections happen?

Urinary tract infections happen when bacteria or other microorganisms enter the urinary tract and start to multiply and grow. Most UTIs are caused by bacteria like *E. coli*. However, fungi, viruses, and parasites can also cause infections.

Although anyone can experience a UTI, people with SCI have a greater risk of developing one because of changes to how the bladder works, catheterization which may be used to manage the bladder, and a number of other factors.

What is *E.coli*?

Escherichia coli (*E. coli*) is a species of bacteria which is commonly found in the lower intestine of mammals. There are many types of *E.coli* and most are harmless to us, or even beneficial, as they are part of the normal gut flora and can produce beneficial compounds that we absorb and by preventing pathogenic bacteria from moving in. However, while *E. coli* normally resides in the gut it does not normally reside in the bladder and is responsible for most UTIs.



Changes to how the bladder works

- **Incomplete emptying**

If a person cannot fully empty the bladder, any bacteria that have entered into the urinary tract cannot be flushed out fully during emptying. The leftover urine in the bladder can create an environment that promotes growth of bacteria that can cause infection.

Refer to our article on [Bladder Changes After SCI](#) for more information.

- **Bladder overfilling**

Overstretching of the bladder due to overfilling can damage the bladder walls, which increases the risk of infection. Overfilling can also cause reflux which causes the urine to back up to the kidneys (see below).

- **Reflux**

Reflux occurs when urine flows backwards from the bladder to the kidneys and can increase the risk of infection in the kidneys and ureters. It can be caused by *detrusor sphincter dyssynergia*, where the coordinated action of two muscles (the detrusor of the bladder and the sphincter of the urethra) is disrupted. Instead of relaxing when urinating, the sphincter muscle contracts. This interrupts the outflow of urine causing pressure in the bladder to rise, which can result in reflux.

Use of urinary catheters

Urinary catheters (thin tubes that can be inserted into the bladder) are often used to drain the bladder after an SCI. However, catheters can also increase risk of infections because they provide a pathway for bacteria to enter the urinary tract. A catheter can pick up bacteria from contact with skin and surfaces and bring it into the bladder.

Indwelling catheters can sometimes get blocked, preventing urine flow and causing urine to remain in the urinary tract for too long. This can allow bacteria to grow and multiply. Proper care of catheters is important to reduce contamination and avoid blockages. An indwelling catheter is a foreign object in the bladder; this can increase the risk of bacteria or bladder stone formation as well.

Refer to our article on [Urinary Catheters](#) for more information.

Changes to bowel function

Most people also experience changes to bowel function after SCI which can cause bowel accidents and the need to perform regular bowel routines. This can lead to bacteria (often *E. coli*) from feces entering the urinary tract and causing infections.

Refer to our article on [Bowel Changes After SCI](#) for more information.



Poor hygiene

Poor hygiene when performing a bladder routine, such as not washing the hands or genitals before inserting a catheter, not using sterile technique when inserting an indwelling catheter, or wearing *condom catheters* for longer than 24 hours without cleaning the genitals, especially, can allow bacteria to enter the urinary tract. In addition, wetness from a poorly managed bladder can increase the risk of infections spreading.

Other factors

- Women are at greater risk for developing UTIs because female anatomy increases the risk of the natural bacteria from the vagina or anus to enter the urinary tract
- Older age (especially over 65) increases the risk of developing a UTI because of incomplete bladder emptying
- Obstruction of the urinary tract from something like a kidney or bladder stone, enlarged prostate, or narrowing of the urethra
- Sexual intercourse, including the use of protective equipment such as diaphragms or spermicides
- Other health conditions such as diabetes or conditions that reduce ability to fight infections such as HIV (human immunodeficiency virus)
- Reduced sensation, as sensation is one of the ways that early infections of the urinary tract are detected. This is usually experienced as pain when urinating or over the abdomen or back
- Other infections, such as infected wounds, can sometimes travel into the urinary tract
- Reduced functional abilities may result in difficulty performing clean technique in bladder management
- Reduced economic resources may result in reusing catheters or unclean environments or decreased care support
- Pregnancy
- Menopause
- Depression

How are urinary tract infections diagnosed?

Medical examination

Your doctor will ask you about your medical history and symptoms and perform a visual and physical inspection. If they suspect that you might have a UTI, they will likely take a urine sample and do additional testing, such as a dipstick test and urine culture. Since most people with SCI will have a positive dipstick test or urine culture, the inspection of the urine, physical examination and history is very important to assist with directing treatment.

Urine sample

Taking a urine sample can help to confirm whether there is a UTI. The sample is then tested for signs of infection, bacteria and other features.

Taking a good urine sample



Urine for a urine sample needs to be collected in a careful way to ensure that it provides accurate information. To take a good urine sample, the genital area should be washed first. Urine is collected in a sterile container midstream during urination or catheterization. If the sample is collected from an indwelling catheter, the catheter should be changed first. Samples are never taken from a urine drainage bag. These steps can help to prevent the sample from being contaminated.

Dipstick test

A *dipstick test* is a standard urine test strip that provides results in minutes. A positive result for leukocytes and nitrites indicates the need for a urine culture. Antibiotics would not be prescribed based on this test alone.

Urine culture

A *urine culture* may be done to determine the amount and type of bacteria causing the infection. This test is done using a urine sample that is left in conditions where bacteria can grow if they are present. It can later be tested to determine what type of bacteria are present, and a suitable antibiotic for treatment.



Bacteria in the urine alone does not require treatment

Although the bacteria in the urine can show a UTI, **antibiotic treatment is not recommended unless it is also accompanied by other symptoms.** People who use catheters often have some bacteria in the urinary tract, which does not indicate an infection. This is important because frequent use of antibiotics when they are not necessary can create antibiotic resistance (where antibiotics become less effective). However, people who are more vulnerable when they have an infection (such as pregnant women or young children) may still be treated in this situation.

Imaging

Various imaging tools can be used to visualize the urinary tract and detect structural abnormalities. Some examples are ultrasound or magnetic resonance imaging (MRI). A *cystoscopy* is a more invasive way to view the urinary tract in greater detail. It involves inserting a long thin camera through the urethra and up into the bladder.

How are urinary tract infections treated?

Urinary tract infections are treated with antibiotic medications (antibiotics). Antibiotics help kill bacteria that cause infections. Antibiotics are usually taken orally, but in severe cases, may be delivered directly into the veins through an intravenous (IV) line.

There are a wide range of antibiotics that may be used to treat urinary tract infections after SCI. The most common antibiotics used to treat urinary tract infections after SCI include:

- Fluorquinolones (such as Ciprofloxacin and Ofloxacin)
- Trimethoprim/sulfamethoxazole (TMP-SMX)
- Amoxicillin
- Nitrofurantoin
- Ampicillin

Fluorquinolones are the most common choice because they are effective for treating a wide range of different types of bacteria. The selection of antibiotic is individualized and based on various factors such as type of bacteria causing the infection, recent antibiotic use, allergies, and risk of side effects.

Length of treatment can vary depending on the health status of the individual and the severity of the infection. For catheter-related UTIs, the typical duration is about 2 weeks. Signs and symptoms should start to improve within a few days after starting treatment, but that does not mean the antibiotics should be stopped. **The full course of treatment should be finished to prevent recurrent infections.**

While there are many studies to support the effectiveness of antibiotics for UTI treatment in people with SCI, there is a lack of research on what the optimal dose and length of treatment is.

What can be done to prevent urinary tract infections?

A number of different practices may be used to prevent UTIs. A proper bladder routine and good hygiene is the first step. Some options such as antibiotics and bacterial interference are not usually encountered as a typical part of prevention, though there is research in these areas. Some of these are part of self-care and others involve working together with your healthcare team.

The bladder routine

A *bladder routine* is a regular schedule of bladder techniques and treatments done every day to maintain bladder function and health. To decrease the risk of a UTI, a bladder routine will take into account a number of items:

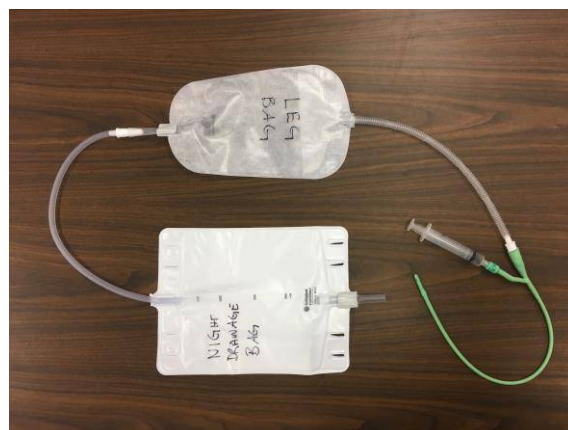
Catheterization method

Various studies on UTI prevention in SCI have been done on different types of catheterization with most research focusing on *intermittent catheterization*, which is one of the most common and preferred bladder-emptying methods for the *neurogenic bladder*. For a review of the different types of catheterization methods available please refer to our page on the topic.

There is moderate evidence that intermittent catheterization carries a lower risk of UTI than both *urethral indwelling* or *suprapubic indwelling catheters*. If an indwelling catheter is required, there is moderate evidence to show that a StatLock device to secure urethral and suprapubic catheters may lead to a lower rate of UTI.

Suprapubic catheters lead to a lower rate of UTIs than urethral catheters. There is weak evidence that where intermittent catheterization may not be viable as an approach to bladder management due to socioeconomic challenges, bladder management with a suprapubic as opposed to urethral catheter may lead to a lower rate of UTI.

Maintaining closed systems with indwelling catheters is recommended practice. This means not uncoupling links in the line where the catheter is connected to the urine collection bag as to do so creates an entry route for bacteria.



Example of an indwelling catheter. Uncoupling the line above the 'leg bag' is not recommended. An optional 'night drainage bag' that attaches to the "leg bag" may be attached and detached as needed.⁴

Specially coated catheters

There is strong evidence that using a pre-lubricated or hydrophilic catheter for intermittent catheterization is more effective in reducing the risk of UTI or need for antibiotic treatment compared to non-coated catheters.

Catheterization hygiene

Washing your hands thoroughly with soap and hot water before catheterization is the first step regardless of whether you use the clean technique, the sterile technique, or something in between.

Clean technique	Sterile technique
More common and less expensive	Less common and more expensive
Often performed in the community	Often performed in the hospital/rehab centre
Usually done for intermittent catheterization	Usually done for indwelling catheterization
Requires thoroughly washed hands	Requires thoroughly washed hands and sterile gloves to be worn.
Intermittent catheterization is often done with a single-use sterile catheter	Intermittent catheterization is done with a single-use sterile catheter
The genital area is cleaned with soap and water	The genital area is cleaned with a disinfectant
	Requires a sterile catheterization kit that will include gloves, draping, an underpad, lubricant, swabs, a syringe, and a urine collection receptacle

There is moderate evidence that intermittent catheterization using the clean technique or sterile technique is equally effective in reducing UTI risk during inpatient rehabilitation for SCI.

The use of single use catheters is recommended over multiple use catheters as there may be a lower incidence of UTI in people who use single use catheters. For those who still use multiple use catheters for intermittent catheterization, properly cleaning the catheter and allowing it to dry completely before reuse is important.

Do not apply a multiuse tube of lubricant directly to the catheter. To prevent contamination, dispense lubrication on to a sterile napkin included with the catheter, then apply it to the catheter. Alternatively, you can use a small one-time use tube of lubrication. If the catheter touches any unsterilized surfaces during the bladder routine, a new catheter must be used.

Catheterization schedule

Perform intermittent catheterization when necessary. Usually a person will catheterize four to six times a day and collect less than 500mL of urine each time. If there is more than 500mL collected, one should consider more frequent catheterizations or review their fluid intake. This reduces the risk of having an overfilled bladder which can damage the bladder and cause reflux of fluid up towards the kidneys. Both these factors increase the risk for UTI. The amount of urine left over after catheterization does not seem to play a role in UTI occurrence in individuals with SCI. However, emptying the bladder completely is desired as performing more catheterizations than required may increase UTI risk as each catheterization is an opportunity for bacteria to be introduced into the urinary tract.

Genital hygiene

Keeping the genital and perineal area clean may reduce bacterial growth in that area that could contribute to a UTI.

This involves a bowel routine to minimize the occurrence of bowel accidents which can increase UTI risk as fecal matter may gain access to the urethra. When cleaning up after a bowel movement, wipe from front to back. Also, preventing bowel accidents and bladder leaks will keep the area dry and help keep the skin healthy.

Women should avoid using douches and similar feminine hygiene products.

Individuals who are able to urinate should empty their bladder after sexual activity. For those who catheterize, clean the genital and perineal area after sexual activity.

Fluid intake and diet

Research in the general population suggests that adequate hydration may contribute to the prevention of UTIs. There is no SCI specific research investigating the relationship between water intake and UTI risk.

What is known is that dehydration can have numerous short and long-term negative effects on one's physical and mental health. Therefore, (unless directed by your physician) decreasing fluid intake for the convenience of less catheterizations is unwise if doing so dehydrates you.



How much water do you need to prevent UTIs?

While there is some evidence that adequate hydration prevents UTIs, there is no guideline for *how much* is adequate. Even research in the general population for what constitutes adequate hydration is an unsettled question.

Based on the best evidence so far, guidelines for the general population indicate that adequate intake of water is between 2.2 litres for women to 2.9 litres for men. This includes water from all beverages and food. We get between $\frac{1}{3}$ to 1 litre of water from the food we eat.

How do these guidelines change for individuals with SCI? It has been suggested that individuals with neurogenic bowel dysfunction require additional fluid compared to other people. For those who use intermittent catheterization 2 litres per day is recommended. For those who have indwelling catheters, 3 litres per day is recommended. One way to easily gauge your hydration is to look at your urine colour. While no precise relationship between urine color and hydration level exists, dehydration creates concentrated urine which is darker in colour while adequate hydration usually yields light coloured urine, so aim to consistently produce light coloured urine. Note that diet, vitamin supplements, and medications may affect the colour to your urine independent of your hydration.

What should you drink to prevent UTI?

There is no SCI specific information regarding the role of choice of fluids in UTI prevention. There is also very little research regarding the role of choice of fluids in UTI prevention in the general population. From an overall health perspective, the optimal amount of soda and alcohol is none.



Juices and blended drinks (Frappuccino, etc) are best avoided because of the high amount of sugar and/or calories. If you are drinking coffee and tea for its health benefits, consider omitting dairy products from the beverage as milk blocks the absorption of phytonutrients into the body. Caffeinated beverages like coffee and tea can have a diuretic effect in people not used to drinking them, and this will need to be accounted for in how it may affect one's catheterization

schedule. Also, alcohol has a diuretic effect and hard alcohol has an additional dehydrating effect which will increase water requirements.

Consider that what you eat can also affect your hydration levels. Whole foods like fruits and vegetables have high water content and will increase your hydration level more than processed foods. For information on cranberries for prevention of UTIs in SCI, see the oral antiseptic section below.



Finally, while there is no SCI specific information on these topics, there is some evidence that compounds in green tea, which are protective against *E. coli* that causes UTIs, make their way to the bladder. Also, there is evidence in the general population that suggests poultry may be a source of pathogenic *E. coli* that populates the gut and serves as a reservoir to infect the urinary tract.

Physical exercise

Based on one study with moderate evidence, regular moderate physical activity may prevent UTI following SCI. This may be due to strengthening of the immune system, one of the benefits of regular exercise.

Antibiotics as prevention

Certain antibiotics have been investigated for their role in preventing UTIs in SCI. However, there is evidence that taking antibiotics as a preventive measure cause an increase in antimicrobial resistant bacteria. With increasing antibiotic resistance becoming a major public health issue over the past decade, non-antibiotic strategies are recommended before considering antibiotics as a UTI prevention tool.

There is moderate evidence that ciprofloxacin, but not trimethoprim/sulfamethoxazole, may be an appropriate antibiotic for UTI prevention. There is weak evidence from one study which found that customizing therapy to the SCI individual and alternating between two antibiotics on a weekly basis is helpful in UTI prevention.

Antiseptics

Antiseptics rid bacteria differently than antibiotics. Many factors play a role in determining the effectiveness of antiseptics for UTI prevention such as the specific antiseptic, whether they are used in combination, and the methods of delivery. Antiseptics may be used during body washing, bladder irrigation, or by mouth in tablet form as described in more detail below.

Oral antiseptics



Cranberries contain a substance that reduces the ability of *E. coli* bacteria to initially stick to the wall of the bladder. There is conflicting evidence for the effectiveness of cranberry products in preventing UTI in patients with neurogenic bladder due to SCI. It is worth noting that cranberry is relatively high in oxalate, a chemical that may raise the risk of kidney stones in some people. Also, cranberry may increase the risk of bleeding for those on anticoagulant medication like Warfarin.



D-mannose is a naturally occurring sugar similar to glucose. Only small amounts of d-mannose are used by the body and the rest is excreted by the bladder. Once in the bladder, D-mannose is believed to dislodge bacteria from the bladder wall. One study of able-bodied women and another in individuals with multiple sclerosis showed that D-mannose supplementation reduced UTI incidence. However, no research is yet published regarding D-Mannose and UTI incidence in individuals with SCI.

Dietary supplementation with vitamin C (ascorbic acid) is thought to reduce UTIs by increasing urine acidity. However, no clinical studies indicate vitamin C improves symptoms or UTI incidence.

There is moderate evidence from one study that an oral form of antiseptic known as *methenamine* was not found to be effective for UTI prevention when used alone or in combination with cranberry.

Body washing

Moderate evidence from one study suggests that daily body washing with the application of chlorhexidine cream to the penis after every catheterization is more effective in reducing bacteria in the urine than standard soap, which may be helpful for UTI prevention.

Bladder irrigation

Antiseptics can be used to flush out the bladder through a process called *bladder irrigation*. However, only certain antiseptics are effective in preventing UTIs, based on moderate evidence:

- 5% hemiacidrin solution combined with oral methenamine
- Trisdine
- Kanamycin-colistin

Other agents delivered via bladder irrigation that are **not effective** in UTI prevention, based on moderate evidence or weak evidence, include:

- Neomycin/polymyxin
- Acetic acid
- Ascorbic acid
- Phosphate supplementation

Bacterial interference

Bacterial interference involves introducing harmless bacteria (usually a safe strain of *E. coli*) into the bladder to compete with and replace infection-causing bacteria. This is done via *intravesical installation* where the bacteria are pumped into the bladder via catheter. Although effectiveness depends on the specific type of bacteria used, there is moderate evidence that this method is useful for preventing UTIs. There is no evidence for the use of oral probiotics for the prevention of UTI in SCI.

Botulinum toxin injections

There is weak evidence from one study that botulinum toxin injected into the detrusor results in fewer UTIs. It is thought that this is a result of decreased detrusor pressure.

Electrical stimulation

There is weak evidence showing that *sacral anterior root stimulation* achieved via an implanted electrical device may be associated with reduced UTIs. In most cases this was accompanied with *posterior sacral rhizotomy*.

There is moderate evidence from one study which shows that *sacral nerve stimulation* within the first half-year after injury results in improvements in urinary tract issues. These improvements included prevention of detrusor overactivity and urinary incontinence, normal bladder capacity, and reduced UTI rate. In this less invasive intervention, there was no accompanying rhizotomy.

The bottom line

Urinary tract infections are a common complication after SCI that requires individualized antibiotic treatment. Proper hygiene and a proper bladder management routine are the primary parts of UTI prevention. In terms of bladder management for UTI prevention, intermittent catheterization with pre-lubricated or hydrophilic catheters and clean technique are most supported by research evidence.

Additional preventive techniques that are part of self-care include proper hydration and physical exercise. Additional preventive techniques that require consulting with your healthcare team include antibiotics, some forms of antiseptics, bacterial interference, botulinum toxin, and electrical stimulation.

Further SCI-specific research is needed to better understand which techniques are most effective. Discuss treatment options with your health providers to find out which treatments are suitable for you.

For a list of included studies, please see the Reference List. For a review of what we mean by “strong”, “moderate”, and “weak” evidence, please see [SCIRE Community Evidence Ratings](#).

Related resources

Bladder Changes after Spinal Cord Injury: <https://community.scireproject.com/topic/bladder/>

Spinal Cord Injury BC UTI Prevention and Detection Wallet Card: <https://sci-bc.ca/resource/uti-prevention-and-detection-wallet-card/>

Abbreviated reference list

Parts of this page have been adapted from the SCIRE Project (Professional) “Bladder Management” Chapter:

Hsieh J, McIntyre A, Iruthayarajah J, Loh E, Ethans K, Mehta S, Wolfe D, Teasell R. (2014). Bladder Management Following Spinal Cord Injury. In Eng JJ, Teasell RW, Miller WC, Wolfe DL, Townson AF, Hsieh JTC, Connolly SJ, Noonan VK, Loh E, McIntyre A, editors. Spinal Cord Injury Rehabilitation Evidence. Version 5.0: p 1-196.

Available from: <https://scireproject.com/evidence/bladder-management/>

Full reference list available from: <https://community.scireproject.com/topic/urinary-tract-infections/#reference-list>

Glossary terms available from: <https://community.scireproject.com/topics/glossary/>

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