We will look at recent research directed at concerns of individuals with spinal cord injury (SCI) related to bladder management. Included are new methods and technology that allow for efficient and safe emptying of the bladder and a healthy urinary system. Because of each person's unique physical differences when it comes to his/her bladder management, it is recommended that one discuss all options fully with his/her primary care physician and with a urologist who has experience working with individuals with spinal cord injury (SCI).

Each person can take steps to prevent or correct problems that occur in managing urinary tract functions. These can help avoid surgery or more costly options later.

**Concern:** The incidence of bladder cancer associated with the use of indwelling catheters (Foley).

An indwelling catheter is used when other methods are not effective or the individual does not have the ability or assistance to carry out an alternative program. This type catheter remains in place and is usually changed at least once a month. One problem associated with the use of an indwelling catheter is bladder cancer.

The most commonly quoted overall incidence of bladder cancer in individuals with spinal cord injury seems to be around 150 in every 5000, or 3%.\(^{(1)}\) While this is considerably higher than what occurs in the general population, it still is very uncommon. It is thought that chronic irritation to the bladder may be a contributing factor to cancer.

In research at Craig Hospital in Colorado, a study of 2660 SCI survivors found that indwelling catheters increased the risk of cancer by 3.8 times, compared with SCI survivors who did not use indwelling catheters. Their pamphlet on bladder cancer discusses ways to decrease the amount of irritation to the bladder.\(^{(1)}\)

In a recent article by West et. al. (1999), the data still suggest that when able, the individual with SCI should select another method for bladder management because of the increased risk for developing bladder cancer.\(^{(2)}\)


**Concern:** The occurrence of urinary stones among people with SCI.

A recent research project at the UAB RRTC by Yu-Ying Chen, MD, PhD, examined the concentration of particles in the urine and drinking water quality (hardness, alkalinity, calcium and magnesium) on the development of urinary stones among persons with SCI.\(^{(3)}\) The study provides evidence that more dilute urine protects SCI patients from calculi, reducing the incidence and reoccurrence of urinary stones.

In the cases reviewed, the individuals with stones tended to have more severe neurologic deficits and were more likely to be women and Caucasians, but the difference was not statistically significant (p>0.10). The frequency of symptomatic urinary tract infection (UTI), occurrence of significant bacteriuria, urine pH, and the quality of community water supply did not differ significantly between cases with stones and stone-free controls.

Other observations in this study were that there were higher proportions of stone cases in those using indwelling or intermittent catheters vs. those
using condom catheters or those who were catheter-free. The study did not provide statistically significant data to support findings from ecologic studies of the water quality that persons living in areas with hard and very hard water had lower stone risk than those with soft water.

A recommendation resulting from this study is that individuals can easily measure urine concentration by using a test dipstick as a feedback tool. This, along with monitoring one’s appropriate fluid intake, is an easy, cost-effective method to use to help prevent urinary stones and their recurrence. Further study is needed to determine the effects this monitoring would have on urinary stones and their prevention.

In a related study, Dr. Chen also looked at the interrelation of beverage type with the risk of stone formation in persons with SCI. (4) This investigation suggests that beverage type should have the potential to determine the risk of stone formation among persons with SCI, even after adjusting for total fluid intake. Increased consumption of tea and juice, particularly cranberry and orange juice, had a protective effect but this needs verification by further large-scale prospective studies. It might lead to an effective fluid regimen for stone prevention in the SCI population. The complete study is reported in the Research Update Newsletter, April, 2000 (5).

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Concern: The development of urethral strictures due to intermittent catheterization.

Though clean intermittent catheterization (CIC) has a low complication rate overall, the risk of urethral stricturing (the decrease in the diameter of the urethra) does increase the longer one uses CIC. The trauma from CIC may be due to abrasion, especially in those who do not have control of the sphincter muscle, when the external sphincter contracts against the advancing catheter.

Dr. L. Keith Lloyd of the UAB Division of Urology recently completed a study on “Membranous Urethral Strictures due to Intermittent Straight Catheterization”. (6) Data on forty-six males (2 with tetraplegia, 44 with paraplegia) who have been performing CIC for over 5 years were analyzed. Four individuals (8.3%) who presented with difficulty catheterizing were found to have distal membranous urethral strictures. Upon initial presentation of difficulty catheterizing, cystoscopy was helpful in making a diagnosis. Most patients will respond to dilatation or urethrotomy and can continue CIC. To help prevent this complication it is recommended that the individual use ample lubrication, gentle pressure when inserting the catheter, and coude’ tipped catheters.

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Concern: The need to maintain a low pressure bladder.

Individuals who use an intermittent catheterization program need to maintain a low-pressure bladder to prevent problems that result from urine backing up the ureters to the kidney. The best way to do this is to monitor fluid intake and output.

There is now a new device available by Diagnostic Ultrasound Corp, the BladderManager PCI 5000. It is a hand-held portable ultrasound device ideal for home use and for active individuals. It measures and displays the actual bladder volume and indicates when the bladder should be emptied or catheterized. It also verifies that the bladder is completely empty. Research by the Ultrasound Corp. showed 67% of timed intermittent catheterizations were performed prematurely and 16% too late. (7) This device requires a prescription...
from the individual’s physician. The drawback for most individuals is the cost, $4295.\(^8\)


**Concern:** A backward flow of urine from the bladder to the kidney (vesico-ureteral reflux - VUR).

Individuals with neurogenic bladder can prevent vesico-ureteral reflux by lowering the intravesical storage pressure. Conservative approaches such as anticholinergic medications and intermittent catheterization may work for some individuals. A surgical procedure of ureteral re-implantation has not been very successful in individuals with neurogenic bladders.

A more conservative treatment being used and studied by L. Keith Lloyd, MD at UAB Division of Urology is a sub-trigonal injection of collagen.\(^9\) The injection causes the coaptation of the ureteral orifice edges. Though the success rate is lower than ureteral re-implantation, it is safe, repeatable and takes little time to perform. Bladder augmentation may be required for successful resolution of reflux in patients with low capacity, high pressure bladders. It is imperative to continue to follow these patients long term, even if their reflux resolves with treatment, as they will still be at risk for renal deterioration.


**Concern:** Maintaining continence.

Individuals with significant spastic bladder or small-capacity bladder may face the problem of maintaining urinary continence with various bladder emptying methods. Bladder augmentation is often an effective procedure used for those who fail to respond to anticholinergic medications and who experience difficulty maintaining continence with various bladder-emptying methods. This surgical procedure provides a way to enlarge the bladder by grafting a detached segment of the intestine to the bladder muscle.

In a retrospective study by L. Keith Lloyd, MD, UAB Division of Urology, records of 27 SCI patients (15 female & 12 males) who underwent augmentation cystoplasty over the past 10 years were reviewed. Upper tract studies either improved or were stable in all patients. All patients performed intermittent straight catheterization 4-6 times per day and 24 of 27 were completely continent with 4 requiring anticholinergic therapy.\(^10\)

Augmentation cystoplasty provides a low pressure, adequate capacity bladder in most patients. Vesico-ureteral reflux resolves in the majority without ureteral re-implantation and upper tract preservation is excellent. Longer follow-up will be required but results with 3.5 years follow-up are very encouraging.


**Concern:** Lack of control of the sphincter muscle which controls the emptying of the bladder.

After a spinal cord injury the damage to the nerves can result in a lack of coordination between the bladder and the sphincter muscle. This is referred to as detrusor-external sphincter dyssynergia (DESD). When this happens the bladder is not able to empty completely. A surgical procedure sometimes used with males is a sphincterotomy. The sphincter muscle is cut to allow the urine to flow. Once this is done the bladder will empty continuously requiring the use of a condom catheter and leg bag system. Since this is an invasive procedure, it is usually used as last resort. Even with this procedure there is a long term potential that the obstruction can recur.

A recent alternative for treatment of DESD is the use of an implantable stainless steel wire mesh tube placed within the urethra. The FDA has recently approved the UroLume® Endoprosthesis for use.\(^11\) This device presses outward on the urethral wall with a constant, gentle force.

A recent study done in Spain by Garcia (1999) using the Memotherm® prosthesis\(^12\) reported limited complications. All patients were able to achieve spontaneous reflex voiding with the use of condom catheter.\(^13\)
This procedure provides a potentially reversible treatment for DESD in SCI patients.


Concern: Loss of control to empty the bladder.

Early in 1999 the world’s first commercially available implanted device that restores bladder function to people with spinal cord injury was approved by the U.S. Food and Drug Administration (FDA). The V o-Care Bladder System® is a neuroprosthetic device for people with complete spinal cord injury at any level. It allows these individuals to empty their bladder without the use of catheters, medications or adaptive equipment. Vo-Care Bladder System® is a surgically implanted device that, through the use of a pacemaker-type receiver-stimulator, restores bladder control.

Individuals are able to empty their bladder on demand. Individuals with a complete SCI and intact reflex bladder contractions are candidates for this system.

For additional information see: VOCARE Bladder System at www.neurocontrol.com.

Concern: The use of antibiotics for urinary tract infection during initial hospitalization.

Within days of initial hospitalization of persons with spinal cord injury, there is colonization of Gram-negative bacteria on the external genitalia that can result in urinary tract infections. Inpatients who have positive urine cultures are often treated with antibiotics even though they are asymptomatic because of the concern for developing symptomatic infections that can delay or impair their rehabilitation process and prolong hospitalization.

In a recent study(14) by Ken Waites, MD at the UAB RRTC, the efficacy of ciprofloxacin in eradicating susceptible organisms from the urine, urethra and perineum was determined. The 25 men who had urine \( \geq 100,000 \) bacterial colonies/ml of urine were treated with 500 mg ciprofloxacin twice a day for 10 days. While the susceptible bacteria disappeared from urine in all subjects, at follow-up 12 had cultures positive for ciprofloxacin-resistant bacteria. While the authors support the use of ciprofloxacin for treatment of urinary tract infections in persons with SCI, in view of the supercolonization with resistant organisms, the drug should be reserved for symptomatic persons not likely to respond to other oral agents. Asymptomatic persons with positive urine cultures should not receive antibiotics.

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