

Spinal Cord Injury SIG

Fall 2013



Letter from the Chair

Welcome to the Fall Edition of SCI SIG Newsletter!

I would like to welcome two 'new' members to our SCI SIG leadership team. **Meghan Joyce, PT, DPT** joins us from Craig Hospital in Colorado and will serve as our Vice Chair. And **Twala Maresh PT, DPT, NCS, ATP** from the University of Central Arkansas rejoins us on the Nominating Committee. Welcome Meghan and welcome back, Twala!

As you all know, the Affordable Care Act (ACA- Obamacare) was signed into law in March of 2010 with role-out implications happening while we speak! To read more about it and the impact on Physical Therapy Reimbursement, you can check out the AP- TA webpage ([apta.org](http://www.apta.org)) and select the advocacy tab, or go directly to <http://www.apta.org/healthcarereform/>. There you can read about the ACA and its overall impact on physical therapy. In addition, you can sign up to receive "PTemail" regarding updates on advocacy initiatives as they relate to Physical Therapy. After reading through these documents, it appears that the use of Electronic Medical Records is becoming more necessary every day! In addition, our Neurology Section recently convened a task force to make G code recommendations when billing for various neurologic diagnoses (SCI, Stroke, TBI, PD and Vestibular). See the following link for their recommendations structure <http://www.neuropt.org/about-us/news/2013/03/21/g-code-recommendations>. The website notes that "information on severity modifiers is forthcoming" so check back regularly!

This past year we have seen an explosion in internet-based resources for SCI care. (See our past newsletters for full descriptions of elearn.org and spinalcordessentials.ca). A new website has been launched that ad-

resses issues specific to the injured and their families *early* after SCI. The Facing-Disability.com website is funded by the Hill foundation as a resource for patients with a recent SCI. They have posted more than 100 videos of people with SCI and their families, with topics such as "Things I wish I knew when I first was injured" or "How did family members respond to the news of your injury?". This is another great resource for patients and families, so be sure to pass it along.

Our Spring 2013 Newsletter highlighted bowel management following SCI and for the current newsletter, **Erin Culverhouse, PT, DPT** coordinates our efforts on bladder control and management. We are very fortunate to have **Faiza Qureshi, MD and Sue Ann Sisto, PT, MA, Ph.D., FACRM** as our experts on bladder control after SCI. They have pulled together an amazingly comprehensive review of bladder function and management. See the latest on pharmacological and surgical management options following SCI. We hope you find this informative and useful! In addition, we are grateful to **Leah Barid OTR/L** for providing helpful hints for bladder management when clients are out in the community. Don't miss her insights in the *Clinician's Corner* Section on page 9! . And lastly, the CSM Programming Guide is now available: www.apta.org/CSM/Programming/2013/Neurology/ Make sure to click on the 2014 meeting tab. We hope to see you all at CSM in Feb 2014 in Las Vegas!

Until next time.....

Karen J. Hutchinson, SCI SIG Chair



KJ Hutchinson
SCI SIG Chair

SCI SIG Officers:

- Karen J. Hutchinson, Chair
- Meghan Joyce, Vice Chair
- Marcie Kern, Secretary
- Lauren McCullough, Chair Nominating Com.
- Twala Maresh, Nominating Com.
- Erin Culverhouse, Nominating Com.

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Academy of SCI Professionals September 2013 Recap



The Academy of Spinal Cord Injury Professionals (ASCIP) hosted the ASCIP Educational Conference on September 1st -4th with preconference sessions August 31, 2013. The conference was held at the Bally's Hotel, Las Vegas Nevada. The theme, *The Changing Face of SCI*, provided interest to all SCI professionals; physicians, psychologists, nurses, therapists, social workers, case management, and chaplains. The conference provided keynote and plenary

sessions, in-depth workshops, over 100 posters, vendor hall, and opportunities for specific clinical education on key areas of SCI practice and research. Additionally, clinicians had formal and informal opportunities to collaborate and network with each other. Next year should be another great conference and will be held at the Hyatt Regency St. Louis at the Arch in St. Louis, Missouri on August 31-September 3, 2014. For information on the ASCIP Educational Conference 2014 or membership, please click www.academyscipro.org.

Submitted by Julie Jennings, PT, MS, NCS



Modules for Therapists, Doctors, Nurses, and other professionals. Topics include assessment, acute management, respiratory, nutrition, bowel, bladder, sexual function, assistive technology, community inclusion, psychosocial, outcomes, vocational rehab, issues specific to women, cell transplant therapy and more!

Each sub-module includes a presentation of the topic, activity based learning exercises, references, and self-assessment questions. Sign-up is Free! www.elearnsoci.org

**Stay Tuned for the Winter 2014 newsletter which is slated to focus on sexuality and reproductive health after SCI !

Upcoming: American Congress of Rehabilitation Medicine 2013

One of the primary goals of the SCI iSIG has been to increase SCI-related programming at the ACRM Annual Meetings. Not only was this goal achieved at the 2012 Annual Meeting in Vancouver, it was a stunning success. The session was both informative and entertaining, as the speakers introduced participants to the latest advances in the clinical and basic research conducted by clinicians and scientists in British Columbia in collaboration with colleagues in Canada and across the globe in the area of spinal cord injury.

One of our goals for the upcoming few months is to solicit programming ideas and submissions for the 2014 Annual Conference. **Please consider submitting your work for a platform or poster, or even consider putting together a symposium of an area you feel needs to be represented in the SCI programming.**

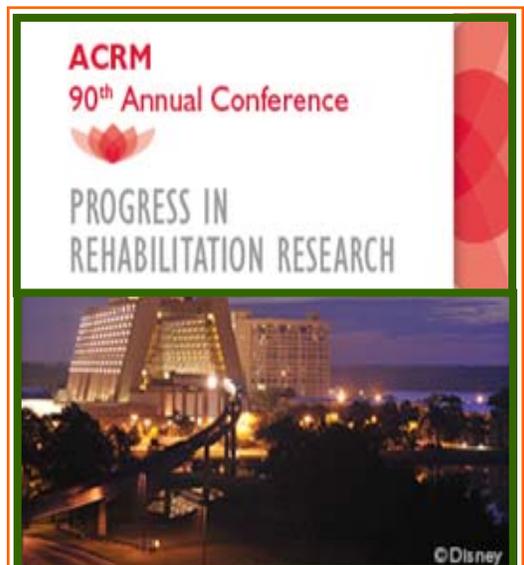
We also continue to seek ways to provide meaningful products to our consumers, in order to enhance the care, health, function and quality of life for people with SCI. We are interested in developing Education Pages for the *Archives of Physical Medicine and Rehabilitation*. These pages are to be designed to educate

clinicians or their patients with SCI and their caregivers, in topics related to their care. For instance, Therese Johnston and the FES Task Force are developing an education page to describe FES cycling, the benefits and the considerations of use. Susie Charlifue and the Caregiver Task Force are developing a brochure related to the needs of the caregiver that can be distributed in doctor's offices. **Let us know if you or your colleagues have an idea for an SCI-related product and we will help you get it done!**

We continue to look for active members! Task forces ready to put you to work:

- * Caregiving and Social Support Task Force
 - * Functional Electrical Stimulation (FES) Task Force
 - * Secondary Complications and Aging Task Force
 - * Fitness and Wellness Task Force
- Contact us at tcompos@acrm.org if you would like to Move Forward and get involved!

Submitted by Sue Ann Sisto, PT, MA, Ph.D.,
FACRM, President-Elect ACRM



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Neurogenic Bladder— Lessons from the Literature

By: Faiza Qureshi, MD and Sue Ann Sisto, PT, MA, Ph.D., FACRM



Dr. Faiza Qureshi



Dr. Sue Ann Sisto

Loss of bladder control is a major health problem in people with spinal cord injury (SCI). This includes not only physiological dysfunction like repeated urinary tract infections, bladder calculi, renal infections, renal failure affecting physical health but

also greatly impacts psychosocial domains. Management of bladder dysfunction after SCI is therefore stressed to reduce morbidity, as well as, improve quality of life.

In order to recognize the types of bladder dysfunction and the underlying pathophysiology in SCI, it is important for clinicians to understand the neural control of micturition.

NEURAL CONTROL OF MICTURITION:

The lower urinary tract (LUT) serves two major functions: urine storage (storage phase) and periodic elimination (voiding phase). These functions are dependent on the coordinated activity of smooth and striated muscles in the bladder (reservoir) and bladder neck, urethra and urethral sphincter (outlet). This coordinated activity is mediated by complex interaction of central, peripheral, autonomic and somatic (volitional) neuronal pathways.

Neuronal pathways controlling the lower urinary tract function are organized as simple on-off switching circuits maintaining a reciprocal relationship between the bladder and external urethral sphincter outlet. Storage reflexes are organized by the interneuronal circuitry in the spinal cord whereas voiding is

mediated by reflex mechanisms through the brain and is under voluntary control. The storage and voiding mechanisms are outlined below:

STORAGE: (Figure a) Distension of the bladder during storage of urine results in low level afferent firing from the bladder. This stimulates sympathetic outflow in the hypogastric nerve to the bladder outlet, as well as, pudendal (somatic) outflow to the external urethral sphincter (EUS) causing it to maintain its contractile state. These sympathetic fibers originating in the thoracolumbar cord (T11-L2) are involved in bladder relaxation during distension and urethral closure through post-ganglionic release of norepinephrine (NE). So normally your bladder is constantly filling with urine but remain continent.

VOIDING: (Figure b) During the elimination of the urine, there is intense firing in the pelvic parasympathetic nerves, (S2-S4). This activates spinobulbospinal reflex pathways that pass through the pontine micturition center (PMC). This in turn stimulates the parasympathetic outflow to the bladder and to the urethral smooth muscle. This occurs through the post ganglion release of acetylcholine that leads to contraction of detrusor (bladder) smooth muscle. The impulses from the PMC also inhibit the sympathetic and pudendal (somatic) outflow to the urethral outlet via the external urethral sphincter (EUS-striated muscle) leading to their relaxation.

Experimental and clinical evidence suggests that there are many neuronal terminal endings in the lower urinary tract that do not correspond to the cholinergic and adrenergic innervation. These non-adrenergic, non-cholinergic peptide containing fibers consist of small myelinated A δ and unmyelinated C fibers that play an important role in the lower urinary tract. This system is silent under normal conditions but becomes active under conditions of neurological injury. In patients with chronic spinal cord injuries, the afferent limb of micturition reflex is carried by unmyelinated C fibers whereas in normal controls it goes through myelinated A δ fibers. (Fowler, Griffiths, & de Groat, 2008, del Popolo, Mencarini, Nelli, & Lazzeri, 2012)

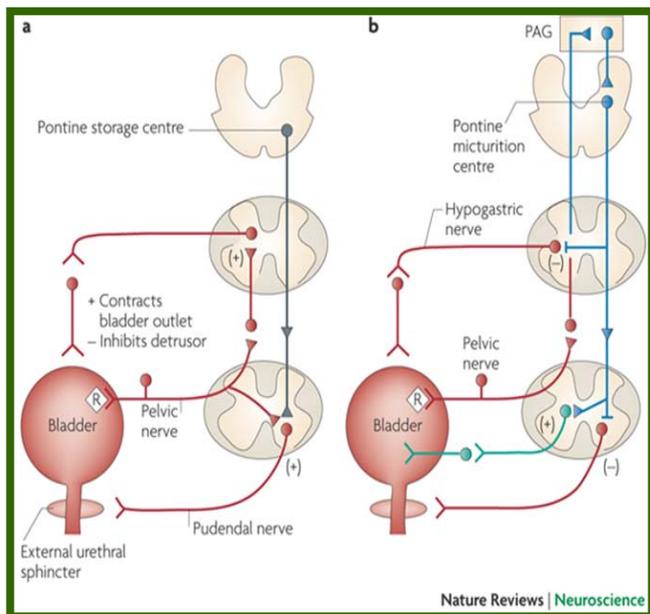


Fig. 1 Left figure (a) represents bladder storage pathways. Right figure (b) represents voiding pathways. PAG-Periaqueductal Grey. (Reprinted with permission from Fowler et al. 2008)

****Special thanks to Dr. Faiza Qureshi and Dr. Sue Ann Sisto. Dr. Qureshi is a foreign qualified physician. She is in her second graduate year of Rehabilitation and Movement Science concentration of the doctoral program at Stony Brook University. Dr. Sue Ann Sisto is her mentor as the Co-Chair of the Ph.D. program in Health and Rehabilitation Sciences and is also the Director of Rehabilitation Research and Movement Performance.**

Types of Bladder Dysfunction

Spinal cord injury at cervical or thoracic levels disrupts voluntary control of voiding as well as the normal reflex pathways that coordinate bladder and sphincter functions. Following spinal cord injury, the bladder is initially areflexic but then becomes hyperreflexic due to the emergence of a spinal micturition reflex pathway. Studies in animals indicate that the recovery of bladder function after SCI is dependent in part on plasticity of bladder afferent pathways and the unmasking of reflexes triggered by capsaicin-sensitive C-fiber bladder afferent neurons. The plasticity is associated with changes in the properties of ion channels and electrical excitability of afferent neurons, and appears to be mediated in part by neurotrophic factors released in the spinal cord and the peripheral target organs. (de Groat & Yoshimura, 2006) There is bladder dysfunction in both upper and lower motor neuron lesions.

Upper Motor Neuron (UMN) Lesion:

The type of bladder dysfunction involving UMN in SCI is called neurogenic detrusor overactivity (NDO) usually associated with detrusor sphincter dysynergia (DSD). Due to lack of control and inhibition from the pons and cortex, both EUS and detrusor are overactive and both contract when stretched. The detrusor reflexively contract at smaller volumes against an overactive sphincter resulting in high bladder pressures. This leads to incontinence, incomplete emptying and reflux with resultant recurrent bladder infections, stones, hydronephrosis, pyelonephritis and renal failure. ("Bladder Management review," 2013)

Lower Motor Neuron Lesion (LMNL):

During the acute phase after SCI the bladder is areflexic. The flaccid bladder prevents bladder emptying and leads to bladder wall damage from overfilling, urine reflux and an increase in infection risk due to stasis. The external urethral sphincter tone is also flaccid causing incontinence. ("Bladder Management review," 2013)

Bladder Dysfunction in SCI Affecting Quality of Life (QOL)

Due to physical disability the quality of life is greatly affected in individuals with SCI. There are several factors affecting QOL including personal, environmental, social factors, as well as participation in the community. (Post & Noreau, 2005)

Neurogenic bladder is a major cause of morbidity in SCI. Urinary tract infections (UTI) are reported to be the most frequent complication during the initial visit. According to 2011NSCISC Annual statistical report UTI's are the most frequent cause of re-hospitalizations. Repeated UTI lead to urine stasis, bladder calculi, large post void residual volumes, detrusor hyperreflexia, vesicoureteral reflux, (Cardenas & Hooton, 1995) renal stones,(Welk, Fuller, Razvi, & Denstedt, 2012) and bladder cancer. (Welk, McIntyre, Teasell, Potter, & Loh, 2013)

Bladder management is of utmost importance in improving the quality of life post SCI. The type of bladder management techniques greatly impacts QOL. In a multicenter cross sectional study to investigate different bladder management methods on QOL in SCI, it was found that individuals in the group with normal spontaneous micturition had the highest QOL whereas the ones in the intermittent catheterization by attendant/caregiver had the poorest QOL scores.(Akkoc et al., 2013)

Medical Management of Neurogenic Bladder

The main goals of bladder dysfunction management in SCI are:

- Achieving regular bladder emptying and avoiding stasis
- Avoiding high filling and voiding pressures
- Maintaining continence and avoiding frequency and urgency
- Preventing and treating complications like urinary tract infections (UTIs), stones, strictures and autonomic dysreflexia (AD). ("Bladder Management review," 2013)

Expected Outcomes:

Information on expected outcomes for bladder care by level of injury can be found in the Consortium for Spinal Cord Medicine's [Clinical Practice Guidelines](#) on neurogenic bladder management in adults with spinal cord injury.

www.pva.org (Click on publications and search for clinical practice guidelines; bladder management)

**Management of Neurogenic Bladder:
Current Therapies**

Current therapies are focused on either enhancing bladder volumes or promoting bladder emptying or both. These therapies have been broadly categorized under pharmacological and non-pharmacological. Current therapies also focus on treatment of urinary tract infections.

**Enhancing Bladder Volumes:
Pharmacological Methods**

Anticholinergic therapy: Propiverine, oxybutynin, tolterodine and trospium chloride are commonly used efficacious anticholinergic agents. Treatment with two of oxybutynin, tolterodine or trospium may be effective for those not previously responding to one of these medications. Tolterodine, Propiverine, or transdermal application of oxybutynin likely result in less dry mouth but are equally efficacious to oral oxybutynin in terms of improving neurogenic detrusor overactivity (NDO) ("Bladder Management review," 2013)

**Enhancing Bladder Volumes:
Intravesical Instillations**

Anticholinergics: oxybutynin or propantheline alone are ineffective for treating neurogenic bladder in SCI ("Bladder Management review," 2013)

Botulinum toxin: In those patients who are not responding to anticholinergics or who cannot tolerate these medications on account of their side effects, Botulinum toxin offers an alternative option for bladder management. Clostridium botulinum has several serum types (A, B, C, D and so on). The neuromuscular blocking effect of BTX alleviates muscle spasm due to excess neural activity of central origin. Clinical trials have shown that BTXA is remarkably efficacious in NDO when given in a single injection dose of 100-300 U of Botox or of 500-1000 U of Dysport in an injection volume ranging from 0.1 ml-0.5ml per injection site. BTXA is usually given at 20-40 evenly distributed intramural sites. The clinical benefit seem to last for 6-9 months depending on the site and dose. Hematuria and pain are the most frequently reported symptoms after injection. Systemic symptoms like respiratory weakness, extremity weakness and hyposthenia are occasionally reported and disappear within 4-5 weeks. (del Popolo et al., 2012)

A recent meta-analysis was conducted by Mehta et al 2013 to examine the effectiveness of botulinum toxin A on NDO in individuals with SCI. The results of meta-analysis shows that BTXA injections were associated with improved reflex detrusor volume at first urge to void and

bladder capacity reducing catheterization frequency, decreasing episodes of incontinence, increased bladder capacity, compliance and post void residual volume. (Mehta et al., 2013)

Although further research is needed, BTXA seems to represent an established safe and effective treatment in patients with SCI.

Vanilloids: The concept of a therapeutic approach through modulation of the afferent arm of the micturition reflex led the investigators to study the effect of Capsaicin on sensory nerves. Capsaicin targets the transient receptor potential vanilloid -1 (TRPV1) expressed on small to medium sized afferent neurons mostly of the C type. The acute exposure to capsaicin depolarizes and excites the nerve fibers expressing TRPV1 receptors. This excitation is followed by a refractory period. The repeated log term high dose exposure to capsaicin desensitizes and ultimately damages the peripheral terminals that become unresponsive. Resiniferatoxin RTX is another vanilloid that is an ultra potent capsaicinoid. It is thousand times more effective than capsaicin. Some of the studies have revealed that RTX improves urodynamic parameters in some patients with SCI. Although chemical denervation by these vanilloids have proved to work in some settings, it remains an experimental alternative approach to the management of NB (del Popolo et al., 2012)

Nociceptin/Orphanin FQ-NOP receptor system: Nociceptin/Orphanin FQ is a naturally acting heptadecapeptide that is an endogenous ligand of a previously orphan G protein -coupled receptor now named N/OFQ peptide receptor. N/OFQ has potent inhibitory effects on primary afferent bladder fibers. A preliminary study followed by a randomized, placebo controlled, double blinded study showed an acute inhibitory effect of N/OFQ on micturition reflex after intravesical instillation. These findings and other studies indicate that N/OFQ and C fibers are involved in the pathophysiology of LUT symptoms and make them attractive for new therapies. (del Popolo et al., 2012)

**Enhancing Bladder Volumes:
Intrathecal Administration**

Intrathecal Baclofen and Clonidine has been used in few studies and have shown to be beneficial for bladder function improvement but further research is needed to establish evidence. Clinicians might consider using these therapies only if there are some contraindications to use of anticholinergics, BTXA that are relatively easy to use with fewer side effects. It can be an option when intrathecal therapy is required for other treatments like spasticity. ("Bladder Management review," 2013)

**Enhancing Bladder Volumes:
Non-Pharmacological Methods**

Electrical Stimulation: Anterior sacral root stimulation has been used to enhance bladder volume. This approach involves concomitant dorsal sacra rhizotomy and implantation of a sacral nerve stimulator. This results in a more compliant bladder with more storage capacity under low pressures. This in turn reduces incontinence without the need to catheterize.

Surgical Augmentation: Ileocystoplasty may result in enhanced bladder capacity under low filling pressures. This approach is helpful in persons with SCI who did not respond well to conservative approaches for overactive bladder. Extraperitoneal vs. intraperitoneal augmentation (enterocystoplasty) produces equivocal post operative continence with easier early post operative recovery. ("Bladder Management review," 2013)



**Paralyzed Veterans
of America**

The Paralyzed Veterans of America is looking for physical therapists to review submitted proposals for research grants. If you are interested, please contact Maureen Simonson at MaureenS@pva.org

**The 52nd Annual International
Spinal Cord
Society Meeting (ISCOS)**

October 28-30, 2013

Istanbul, Turkey

Themes include:
Pathophysiology of SCI
Natural Disasters and SCI
Acute care/management
Spinal Surgery
Free papers

ISCOS
INTERNATIONAL SPINAL CORD SOCIETY

Management of Neurogenic Bladder: Current Therapies

Enhancing Bladder Emptying: Pharmacological Methods

Alpha Adrenergic Blockers: have been used to target alpha adrenergic receptors which may be implicated in a variety of mechanisms in SCI like bladder neck dysfunction, increased bladder outlet resistance, detrusor sphincter dysynergia, autonomic hyperreflexia or upper tract stasis. *Tamsulosin* may improve urine flow in SCI individuals with bladder neck dysfunction. *Mosixylyte* is likely to decrease maximum urethral closure pressure at a dose of 0.75mg/kg. *Terazosin* may be an alternative for bladder neck dysfunction. However, side effects and drug tolerance should be monitored. *Phenoxybenzamine* may be useful as an adjunct for reducing residual volume in SCI neuropathic bladders maintained by Crede or tapping.

Botulinum Toxin: BTXA injected into the external urethral sphincter (EUS) is effective in assisting with bladder emptying by causing the EUS muscle to relax and improving drainage.

Phosphodiesterase-5 inhibitors: A single dose of Tadalafil is effective in improving urodynamic parameters in males with supra sacral SCI. However, more evidence is needed to support this as a treatment option.

Potassium Channel Blocker: 4-Aminopyridine at a sufficient dosage may return sensation and control of the bladder sphincter. However, more evidence is needed to support this as a treatment option. ("Bladder Management review," 2013)

Enhancing Bladder Emptying: Non-Pharmacological Methods

Bladder emptying must be conducted under low-pressure conditions to prevent upper urinary tract complications that may lead to renal failure. The choice of bladder management method should result in continence, be acceptable to the individual and facilitate independence.

Intermittent Catheterization (IC): is the mode of bladder management usually associated with fewest long-term complications. However, urethral complications and epididymo-orchitis occur more frequently in those with IC. Although both pre-lubricated and hydrophilic catheters have been associated with reduced incidence of UTI's as compared to conventional PolyVinyl Chloride catheters, less urethral micro-trauma may only be seen with pre-lubricated catheters. Bermingham et al. found that clean non-coated catheterization is the most cost effective method of IC. However, because of the limitations and gaps in the evidence base, the authors recommend offering the patients a choice between hydrophilic and gel reservoir catheters. (Bermingham et al., 2013)

Indwelling or suprapubic catheterization: may be an effective and satisfactory bladder management of choice for people who have inadequate hand function, severe spasticity, low bladder capacity with high detrusor pressures and pressure ulcers. However, ongo-

ing medical follow up is mandatory to avoid complications. There have been reports of increased risk of bladder cancers in users of *indwelling* catheters.

Condom Catheterization: is an option for bladder management in males. It is associated with relatively fewer complications than indwelling but more than IC. Patients using condom drainage should be monitored for complete emptying and low pressure drainage, to reduce UTI and upper tract deterioration. Sphincterotomy may ultimately be required. Penile implants may allow easier use of condom catheters and reduce incontinence.

Triggering Type or Expression Voiding: Valsalva or Crede' maneuver assist some individuals to void spontaneously but produce high intravesical pressure, increasing the risk of upper tract complications.

Surgical Approaches:

- Catheterizable abdominal stomas may increase the likelihood of achieving continence and independence in self catheterization especially in females and with tetraplegia who have limited hand function. This may result in a bladder management program that offers more optimal upper tract protection.
- Cutaneous Ileal Conduit Diversion may increase the likelihood of achieving continence but may be associated with a high incidence of various long-term complications.
- Sphincterotomy/Artificial Sphincters/Stents: Transurethral sphincterotomy, insertion of artificial sphincters, sphincteric stents or balloon dilation of external urinary sphincter are alternatives to overcome persistent dysynergia and for those in which IC is not an option due to lack of manual dexterity and other conservative approaches have been unsuccessful.

Electrical Stimulation: **a.** Sacral anterior root stimulation enhances bladder function though high surgical expertise is required. **b.** Direct bladder stimulation, Posterior sacral, pudendal, early sacral neural modulation may be effective but require further study.

Miscellaneous Treatments: **a.** Intranasal Desmopressin acetate (DDAVP) has been used as an adjunctive therapy to manage the overactive bladder otherwise refractory to conventional approaches. **b.** Early Electroacupuncture may be used as an adjunctive therapy. **c.** Nerve cross over surgery - Anastomosis of T11, L5 or S1 to the S2-S3 spinal nerve roots may result in improved bladder function in chronic SCI. ("Bladder Management review," 2013)

Management of Urinary Tract Infections

Urinary tract infections (UTI) are a common secondary health condition and a major cause of morbidity following SCI. Both limited and full microbial investigation may result in adequate clinical response to UTI treatment with antibiotics. Indwelling or suprapubic catheters should be changed just prior to urine collection so as to limit the amount of false positive results. Urinalysis and urine culture results of SCI patients are not likely to be affected by sample refrigeration (up to 24 hrs.). It is uncertain if dipstick testing for nitrates or leukocyte esterase is useful in screening for bacteriuria to assist treatment and decision making.

Pharmacological Approach to UTI Management

Antibiotic Prophylaxis: Due to issues of adverse effects and emergence of resistant organisms, different investigators have conflicting opinions about using prophylactic antibiotics for the management of UTI in SCI. However, it also depends on the type of antibiotic used. Ciprofloxacin or Co-trimoxazole TMX-SMX has been commonly used in studies for prophylaxis in SCI but further research is needed to support its use. A weekly oral cyclic antibiotic (WOCA) program customized to the individual has been shown effective in one study which can help reduce antibiotic consumption, decreasing the number and length of hospitalizations, fewer adverse effects and reducing the risk of emergence of multi drug resistant bacteria.

Antibiotics for the treatment of UTI: It is generally recommended that persons with SCI be treated only if they have symptoms as many individuals especially with indwelling or suprapubic catheters typically have asymptomatic bacteriuria. Once symptomatic UTI is confirmed, the first line of empirical treatment is via antibiotics and the most common antibiotics chosen for UTI treatment include fluoroquinolones (e.g. ciprofloxacin), TMX-SMX, amoxicillin, nitrofurantoin and ampicillin.

Bacterial Interference: There has been insufficient evidence reported in a single RCT that bacterial interference in the form of E-Coli bladder inoculation may prevent UTI.

Antiseptic Agents: delivered via bladder irrigation (5% hemiacidrin solution combined with oral methenaminemandelate) may be effective for UTI prevention. Daily body washing with chlorhexidine and application of chlorhexidine cream after every catheterization instead of using standard soap may reduce bacteriuria and perineal colonization.

Non-Pharmacological Approach to UTI Management

Cranberry juice: There is conflicting evidence to support the effectiveness of cranberry in preventing UTI in patients with neurogenic bladder due to SCI

Bladder Management Education: A variety of bladder management education programs are effective in reducing UTI risk in community-dwelling persons with SCI. These programs range from classes, reading material, written examinations, demonstra-

tion of acquires skills, review by a nurse and physician and a follow up telephone call. ("Bladder Management review," 2013)

Bladder Management: Novel Approaches

Investigators have been working on developing techniques for spinal cord regeneration to induce axonal regrowth to restore original circuitry. These novel approaches tested to promote recovery of sensorimotor function should be further investigated to assess efficacy.

- Neutralizing the NOGO protein (Myelin derived inhibitory protein) or blocking the NOGO receptor
- Neutralizing the MAG and OMgp protein (Myelin derived inhibitory proteins)
- Interference with the glycosyl moiety of these glycoproteins leads to improved re growth of spared neuronal processes
- Transplantation of undifferentiated or genetically modified cells
- Infusion with neurotrophic factors.
- Olfactory ensheathing cells (OECs) have axonal growth stimulating properties. (Cruz & Cruz, 2011)

Future Clinical Trials for Bladder Management

Researchers have been trying to treat SCI-induced bladder dysfunction by investigating several other approaches.

- Increasing GABAergic transmission by using replication defective HSV vector transporting genes.
- Targeting NGF levels and NGF-related molecular events. (Cruz & Cruz, 2011)

Bladder Management in Pregnancy with SCI

Pregnancy is known to have an impact on the lower urinary tract function in neurologically intact women. Thus, pregnant women with SCI and LUT dysfunction are a high risk group for UTI. Following acute SCI there is a phase of amenorrhea lasting for about 4 months after which return of ovulation has been demonstrated. Pannek and Bertschy (2011) found in their systematic review that there was a much higher incidence of UTI in women using indwelling catheters during pregnancy as compared to those using other methods like intermittent catheterization, Crede' technique or voiding spontaneously. The review found paucity of data to provide any recommendations for the urologic management of women with SCI during pregnancy since some of the treatment options for LUT are contraindicated in pregnancy (anticholinergics) or have not been thoroughly studied.

Roles and Resources

Role of Primary Care Physician

Family physicians play an important role as a coordinator linking patients with SCI and multiple health care providers. In a literature review by McColl and colleagues suggest that the optimal care for patients with spinal cord injury might include annual comprehensive health evaluation, multidisciplinary follow up to address issues that accompany long term disability, accessible premises, access to specialists to treat secondary complications like pain, bowel and bladder and awareness in areas of unmet needs like psychological concerns, sexual and reproductive health. (McColl, Aiken, McColl, Sakakibara, & Smith, 2012)

Although primary care physicians can play a pivotal role in the health care of people with SCI, they feel unprepared to meet the medical needs of these patients. Autonomic dysreflexia (AD) is a serious medical condition that effects many patients with SCI. It is a medical emergency requiring a high index of suspicion, quick assessment and immediate treatment to prevent complications such as seizure, stroke, cardiac complications or death. AD can normally be resolved if the noxious stimulus (originating from bladder, bowel, skin) is removed. Patient should be monitored 2-48 hrs. post AD. The patient should carry an AD bracelet and a visible note should be made in the patients chart to clarify symptoms and management plan. (Milligan, Lee, McMillan, & Klassen, 2012)

Role of Physical Therapist

Physical Therapists should base their patient training and education on the patient's level of injury and extent of loss of normal urinary system function. It should be determined the client's susceptibility to infection, including overall medical and surgical history. PTs should provide input to the rehabilitation team or to the PCP regarding how likely it is that the client can/will adhere to the program based on the person's hand function and lifestyle. Hand function should be assessed by the PT and the OT to determine the client's ability to perform self-catheterization, as well as their ability to sit, stand and walk. These functional activities may guide they type and frequency of bladder management and may result in less bladder complications when there is greater upright activity. The lifestyle is important in determining the client's bladder management approach given their level of activity, or whether they are in school, working, traveling etc. The PT should be aware of the signs and symptoms of bladder complications and educate the client to see the appropriate medical practitioner for the appropriate testing (urine culture, urodynamic testing, etc.). PTs should educate the client in the management of appropriate volumes for optimum overall health. Methods of bladder retraining are supplemented by monitoring fluid intake to prevent UTIs and control urine volume and concentration, developing scheduled times for urination and using body positions to facilitate voiding. Finally, the PT should educate the client/caregiver of the importance of medication management and discuss the availability of clinically effective products/systems/procedures.

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Clinician's Corner: Tips for Community Bladder Management By Leah Barid, OTR/L



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Prepare ahead of time....

- Clean supplies
- Pre-connect catheter and tubing
- Have an easily accessible bag to hold supplies
- Restock supplies regularly

Clothing management....

- Wear clothing easy to manage
- Cut the tops off of tights to turn them into thigh highs
- Wear skirts
- Shorts or loose/wide-legged pants to drain bladder without removing pants



Where to store supplies....

- In backpack or purse
- Under chair
- In side pocket of chair

Positioning....

- Scoot hips WAY forward
- Hang one leg over padded break extension or prop one or both legs on the toilet
- Position mirror, if needed, after positioning clothing and self
- Bring pillowcase to slide over toilet seat to keep foot from falling into the toilet
- Prop one or both feet on the calf strap
- Tilt/recline power chair after pulling person's hips forward and moving clothing out of way



Sliding pants under ischial tuberosities: Tilt the chair, lift the leg, tuck as much of pants as possible.



Lean client forward to take weight off bottom. Pull up the pants, just fed under ischials, leaning to the side until pants are up.



Alternate position: Cross legs, lean to side for easier access to pull up pants.

How to manage supplies without a table....

- Place supplies in lap
- Bring a trash bag or pillow case to slide over the toilet seat to set supplies
- Find a spot on the wheelchair to hang a bag or have a hook fabricated
- Use the space created on wheelchair cushion after you scoot forward to position to catheterize

What if a bathroom isn't accessible? Instead, try a....

- Different, private room
- Blanker over your lap, ensuring the blanket doesn't contaminate your supplies
- Van or Car
- Face a corner in the most private area around
- Urinal
- Empty directly into drain on the floor of bathroom
- Empty into an empty container

Other tricks...

- Use catheter packaging as tubing
- Females can use male catheter instead of extra tubing or bag
- Transfer directly to the toilet
- Attach rubber band to leg bag to hang it off brake extension so you don't have hold bag while draining
- Previously set up connections and store in brown paper sack