



spinal cord injury

UPDATE

Department of Rehabilitation Medicine

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Transitions program paves way to independence, quality of life

For someone with a spinal cord injury (SCI), appropriate rehabilitative care is the first step toward maximizing functioning and quality of life. But what happens when a patient leaves the hospital? Navigating a new life after release from the hospital can be a challenge for people with SCI.

“Promoting long-term health in a person with SCI hinges not only on good medical care, but on learning about and adopting healthful habits and lifestyle choices,” said Maria R. (Rina) Reyes, M.D., UW assistant professor in the Department of Rehabilitation Medicine and medical director of the UW Medicine SCI Rehabilitation Program. “Outside the health care setting, a person has the potential to fulfill physical, emotional, social and intellectual needs.”

Now, thanks to generous private support, participants in the new *Transitions* Health Maintenance and Wellness Program have access to services beyond the top-ranked rehabilitative care they receive at UW Medicine. These services aim to help patients make the transition to independence.

The newly launched *Transitions* program is made possible by a \$95,000 grant from the Craig H. Neilsen Foundation and a matching gift from Mr. Kenny Salvini, his family and friends. The Neilsen Foundation, which has provided UW Medicine with generous program and research funding in recent years, is dedicated to supporting treatment- and cure-based SCI research as well as innovative programs that improve quality of life with SCI.

“*Transitions* promotes lifelong wellness, independence and participation by introducing and encouraging healthful practices as individuals with SCI make the shift from acute, inpatient care to community living,” Reyes explained.

A resource for patients during the critical first two years after injury, *Transitions* will directly serve about 100 individuals each year — primarily Washington residents, but also patients from Alaska, Montana and Idaho — and is a resource for our broader SCI population as well.

The individualized program provides opportunities to participate in supervised adapted exercise, join community recreation programs, master adapted driving skills, make use of technology that promotes vocational exploration, and access counseling services. The program components, most of which are not funded by the majority of common insurers in Washington State, include:

- **Physical activity.** A twice-weekly group exercise class using specialized equipment helps to maximize independence and safety and motivates participants to integrate exercise into daily life.

- **Education.** A recurring educational series reviews medical complications, nutrition and weight management, coping and pain-management strategies, and vocational and social resources.

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Transitions exercise classes take place twice a week in the UWMC and Harborview rehab gyms.



Transitions paves way to independence, quality of life

“Long-term health in a person with SCI hinges not only on good medical care, but on healthful habits and lifestyle choices as well.” Maria R. Reyes, M.D.

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- **Adapted driving.** Scholarships offer eligible individuals the opportunity to complete adapted driving evaluation and training, thereby fostering independence.

- **Community recreation.** The program supports participation in community-based adapted exercise, yoga, aquatics (see photo on right), fishing and sailing trips.

- **Assistive technology.** A pool of laptop computers for short-term loan will encourage exploration of community resources and assist with pre-vocational preparation after discharge.

- **Rehabilitation psychology.** The program provides eligible individuals with rehabilitation psychology visits to address mood and adjustment, to provide strategies to manage pain and to maintain a healthy lifestyle.

Drawing on the expertise of the UW Medicine SCI Rehabilitation Program, *Transitions* provides a multidimensional and ground-breaking level of post-rehabilitative care in our community that integrates wellness and redefines health promotion after SCI.

For more information, visit the *Transitions* website at <http://sci.washington.edu/transitions> or email sciwell@uw.edu.



June 25th golf fundraiser will support *Transitions*

Brian Moore sustained a spinal cord injury from a fall on August 7, 2010 and since then has been working hard to recover as much function and independence as possible. His fraternity at Washington State University, Theta Chi, is now planning the first annual Birdies for Brian Golf Tournament in his honor to raise funds in support of UW Medicine’s new Spinal Cord Injury Transitions Health Maintenance and Wellness Program. The tournament will take place on June 25, 2011 at 2:00 PM at the Golf Club at Echo Falls in Snohomish, Washington.



Brian did his inpatient rehab at Harborview Medical Center and is now a client in the *Transitions* program, which helps people during the first two years after injury adjust to living with SCI, return to full participation in community life, and adopt life-long health habits to prevent the medical complications common to people with SCI (see story on page 1).

“We chose the *Transitions* program for this fundraiser after talking with Brian and his parents about their experience,” says Brian’s friend Colin Dierckins, who is organizing the tournament. “Through the *Transitions* program, Brian and others with SCI are able to adapt to caring for themselves at home and participate in exercise and other programs to improve their health and quality of life.”

Tournament co-organizer Willie Cramer says the fraternity is working hard to promote the event and make it a success in honor of their friend. “We miss him. His determination and strong spirit continue to be an inspiration to all who know him.”

Registration and sponsorship information for the tournament can be found at www.birdiesforbrian.com. All proceeds from the event will benefit the *Transitions* program, and all donations are tax-deductible. For questions about the tournament, please visit the website or send an email to birdiesforbrian@gmail.com.

New research from the SCI Model Systems

The Northwest Regional Spinal Cord Injury (SCI) System (NWRSCIS) at the University of Washington is one of 14 federally funded SCI Model System centers around the country. These centers provide the highest standard of SCI care, conduct research, and gather ongoing information from SCI patients for the National SCI Model System database. If you have completed questionnaires for the NWRSCIS or another Model System since your injury, then you have participated in research that contributes to improvements in SCI care. Thank you for being part of these efforts.

The March 2011 issue of *Archives of Physical Medicine and Rehabilitation* focuses exclusively on SCI Model Systems research outcomes. Six of the 23 studies published in this issue are summarized here. Names of NWRSCIS researchers are in **bold face type**.

Depression common but under-treated after SCI

Depression is a harmful and sometimes deadly condition that affects about one in five people with SCI. In a study of 1,035 individuals with SCI, 21% had major depression one year after injury, and 18% had either continuing or new depression after 5 years. A significant minority of participants (8.7%) had chronic or recurring depression, much higher than the 2.7% rate of chronic depression in the general population. Pain and health problems increased a person's chances of being depressed. Depression is common in people with SCI and health providers need to be alert for possible signs and risks. (**Hoffman JM, Bombardier CH, Graves DE**, et al. A longitudinal study of depression from 1 to 5 years after spinal cord injury. *Arch Phys Med Rehabil*. 2011 Mar;92(3):411-8.)

In a separate study involving 947 individuals with SCI, 23% were depressed. Of these, only 29% were taking antidepressants and 11% had received counseling within the past three months. Far fewer had received enough antidepressants or counseling. Why are people with SCI receiving too little treatment for depression? People with SCI have more barriers to getting medical care, such as limited

transportation or inadequate insurance coverage. They may be too embarrassed to discuss or admit to being depressed. And health providers may not be screening their SCI patients for depression, possibly because other medical problems are more pressing or obvious. The researchers urge health providers to do a better job of screening patients with SCI for depression and, once treated, following up to see if the treatment is working. (**Fann JR, Bombardier CH, Richards JS, Tate DG**, et al. Depression after spinal cord injury: comorbidities, mental health service use, and adequacy of treatment. *Arch Phys Med Rehabil*. 2011 Mar;92(3):352-60)

Setting the stage for experimental treatments

How do we know if a new treatment really improves recovery? In the world of SCI recovery research, one of the challenges of conducting clinical trials is being able to tell whether any improvement in function was caused by the experimental treatment, or if the patient would have improved anyway, since most people with SCI have some natural recovery in the first year after injury.

The researchers looked at the changes in motor function that naturally occurred during the first year after injury in 1,436 individuals with tetraplegia (quadriplegia). They found that people with initially complete injuries converted to incomplete injuries at a somewhat higher rate (30%) than was previously thought, including 7.1% converting to ASIA Impairment Scale grade D. They identified neurological measures that would be appropriate outcome measures for future clinical trials. (**Marino RJ, Burns S, Graves DE**, et al. Upper- and lower-extremity motor recovery after traumatic cervical spinal cord injury: an update from the national spinal cord injury database. *Arch Phys Med Rehabil*. 2011 Mar;92(3):369-75.)

Mechanical ventilation and quality of life

The goal of this study was to learn more about how people on ventilators feel about their health and quality of life. Earlier

research found that people on ventilators reported quality of life that was as good or even better than similar patients with SCI who did not require ventilators. In this study of 1,635 people with tetraplegia, participants completed questionnaires one year after injury. Their responses showed that although the ventilator users reported lower quality of life and health than non-ventilator users, they generally said their quality of life was good. It is possible that reported quality of life improves over time, as the earlier studies included patients with longer duration of ventilator dependence than in this study. These findings are important because many health care providers incorrectly expect that ventilator-dependent patients will have a poor quality of life. (**Charlifue S, Apple D, Burns SP**, et al. Mechanical ventilation, health, and quality of life following spinal cord injury. *Arch Phys Med Rehabil*. 2011 Mar;92(3):457-63)

Cell phones

In a group of almost 8,000 people with SCI, 27% did not own a cell telephone (in contrast to only 13% in the general population). Those who owned cell phones were more socially connected and involved in activities outside the home and more likely to have jobs than those who did not own cell phones.

Owning a cell phone has many benefits, and better access to cell phone technology is needed for this population. (**Roach MJ, Harrington A, Powell H, Nemunaitis G**. Cell telephone ownership and social integration in persons with spinal cord injury. *Arch Phys Med Rehabil*. 2011 Mar;92(3):472-6.)

Driving

In a study of 3,726 individuals with SCI, 36.5% reported they drove their own (modified) vehicle. This group had greater participation in the community, were more likely to be employed, and had greater independence than those who did not drive. They also had better mental and physical health, life satisfaction and higher incomes than non-drivers.

Since anyone with SCI below C4 has good potential for driving a modified vehicle, better driving rehabilitation and

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forum report

The SCI Forum is an evening presentation and discussion series on topics of interest to persons with spinal cord injury and their family members, friends, caregivers and health care providers, held monthly at the University of Washington Medical Center. To learn about upcoming SCI Forums, read reports of past forums, or view forum videos, consult our website at <http://sci.washington.edu/info/forums>. Contact Cynthia Salzman (email: csalzman@uw.edu; phone: 206-685-3999) if you wish to be added to the SCI Forum mailing list.

Management of Urinary Complications Caused by SCI: Part 2

By Stephen Burns, MD, SCI Service, VA Puget Sound Health Care System, and associate professor, Department of Rehabilitation Medicine, University of Washington (based on the SCI Forum presentation at the University of Washington Medical Center on October 13, 2009).

This is the second of a two-part report. Part 1 described the different urinary problems that can occur after SCI and the methods used to treat them. Part 2 describes the secondary and long-term complications that can occur with neurogenic bladder and the tests used to detect them. To read the full report, go to http://sci.washington.edu/info/forums/reports/urinary_problems.asp.

Introduction

Before 1940, most people with spinal cord injuries died from urinary tract infections in the first few months after injury. After the introduction of antibiotics in the 1940's, people started surviving longer, but renal complications continued to be a problem and kidney failure became the leading cause of death.

With current management practices and periodic testing, things have improved greatly, and now fewer than 3% of people with SCI die from kidney failure.

Following are common urinary complications that can occur in people with SCI.

Kidney & bladder stones

Stones are common in people with SCI. They can develop early on because large quantities of calcium leave the bones in the first few months after injury. It is more common to get stones later, and this is due to infections over the long term. Bacteria break down urea into chemicals that form stones, which can cause blockages, kidney damage and serious infections.

Hydronephrosis & reflux

These are similar conditions involving either a blockage of urine or a backwards flow of the urine up toward the kidney. It can have multiple causes, and the treatment is to remove whatever is blocking the system and to reduce the bladder pressure.

Bladder cancer

There is a small risk of bladder cancer for individuals using indwelling catheters. Screening recommendations are contro-

versial since we don't know who needs to be screened, how often, and how soon after injury. Unfortunately, these tend to be aggressive cancers that grow very fast, and even yearly screening won't catch all of them. Fortunately, bladder cancer is not very common.

Screening tests

We use a variety of tests to detect problems in the urinary system.

Lab tests

- Serum creatinine (blood test): Creatinine is filtered out by the kidneys. A high level in the blood means the kidneys are not filtering enough. To be useful, results must be monitored over time to see if there are changes. If it starts rising, it's a sign something is wrong with the kidneys.
- Creatinine clearance: 24-hour urine collection to see how much filtering the kidneys are doing over time. This test may not give reliable results. Other lab tests are being studied as well to see what is best for screening.

Imaging tests

- Ultrasound is a radiation-free, risk-free way to pick up on stones or blockages.
- CT scan of the kidneys, ureters and bladder (CT-KUB): uses lots of radiation and may carry a one in 3000 chance of producing a fatal cancer, although the actual level of risk is uncertain. While not recommended as a routine test, it is useful in specific situations.

- Renal scan: used to show kidney function, but image is fuzzy.

How often should the tests be done?

Research has not established what testing should be done for everyone and how often. To some extent it should depend on the patient and what kinds of problems he or she is having.

Early screening is not necessary for those who have fairly normal control of bladder, good sensation and no symptoms. However, most people with spinal cord injury should have some sort of periodic testing of their urinary tract to detect problems before they become big problems.

The Consortium for Spinal Cord Medicine publishes a guideline for physicians stating that screening is usually done annually. Since research has not established the necessary frequency for the screening tests, the guideline does not make a strong recommendation about how often the tests must be done. (*Bladder Management for Adults with Spinal Cord Injury: A Clinical Practice Guideline for Health-Care Professionals*, www.pva.org).

UTIs and antibiotics

When considering the use of antibiotics for UTIs, it is important to distinguish between actual infections and colonization.

- If you have bacteria in the urine (found through a lab test) AND have symptoms (fever, pain, spasticity), then you have an infection that needs to be treated with antibiotics.

- If you have bacteria in the urine but have NO symptoms, then you have what is called “colonization” and you should not be treated with antibiotics.

In general, treatment should be based on symptoms, rather than on bacterial count alone. Some bacteria don’t cause any symptoms, and their presence in the urine might even be keeping out other bacteria that could cause problems.

In fact, there is currently some promising research into this idea of “bacterial interference” to determine whether inoculating people with a specific, relatively harmless bacteria will keep harmful bacteria away.

Prophylactic antibiotics, or taking antibiotics all the time to prevent UTIs, have not proven to be beneficial in research studies and can result in the proliferation of resistant bacteria that are hard to treat. A substance called methenamine, which turns into formaldehyde in the bladder, is used by some patients to try and reduce infections.

Cranberry (juice or tablets) has also been studied as a way of preventing UTIs. Usually the tablet form is used since drinking cranberry cocktail is so full of sugar and calories. Although cranberry has not proven effective in clinical trials with people who have SCI, it does seem to help some individuals. As with many aspects of bladder management after SCI, finding what works is often a matter of trial and error.



Bladder Success Stories

Tammy sustained a T5 complete spinal cord injury as a result of a car accident when she was 17. She also lost her right kidney in the accident, and this had important implications for her bladder management.

“For the first couple of years after my injury, I had a lot of problems with cathing,” she said. “I was still not independent in cathing myself when I went home after two months in rehab. This was very frustrating. I was incontinent all the time. No medications were working for me. I wasn’t drinking enough because I didn’t

want to pee in my pants. Women have smaller bladders, and mine was completely spastic.”

She went back to her senior year in high school wearing diapers and having frequent bladder accidents. At night she had to wake up every four hours to cath and couldn’t sleep through the night.



As with many aspects of bladder management after SCI, finding what works to help you avoid UTIs is often a matter of trial and error.



Tammy heard about bladder augmentation and looked into it. “It’s a big surgery, so you need to research it and make sure it’s going to be the right thing for you,” she said. She was living in New England at the time and found a doctor with a lot of experience with these surgeries.

A piece of her intestine was used to enlarge her bladder, and her appendix was used to create a canal from her bladder to a stoma (opening) on her abdomen.

“The stoma just looks like a little second belly button. It kind of works like a sphincter, where I insert the catheter. Nothing leaks out of the stoma. I’m on no bladder medications, and only have a couple of UTIs a year.”

She doesn’t have to pull down her pants and transfer to a toilet. She can sleep through the night. It makes things like traveling much easier. And she can drink all the water she needs without worrying about accidents. “It has really improved my quality of life.”

This procedure was a big surgery and required a long recovery, “but the result is that I’m healthier, and my kidney is healthy,” Tammy said. “It’s just been great.”

Todd has C4 complete tetraplegia (quadriplegia) due to a gunshot wound in 1987 when he was eight years old.

Todd requires assistance with his bladder program. He started with the condom catheter, which added about 45 minutes to his morning routine and didn’t always keep him dry. He also had recurrent UTIs. These became increasing problems over the years and interfered with his work and health. He was on antibiotics almost all the time, but they weren’t working.

After many consultations with urologists, Todd decided in 2007 to have suprapubic (SP) catheter surgery. “It’s been just one huge blessing from that point forward,” he said. “There was lots to learn, and it took me about six months to get comfortable with the SP tube, trying to understand how much water to drink, what size catheter do I put in there, etc.”

“I feel very comfortable with it now, he continued. “I’m able to tell if my bladder is becoming spastic. I can tell if I need antibiotics for a couple days, and when my SP tube needs to be changed.” He doesn’t worry about incontinence, and he is able to be more independent. “It’s been a huge, huge asset for me.”



Missed a Forum?

Many of our SCI Forums are available online as streaming videos. We currently have 25 videos on a variety of topics related to living with SCI, including pain management, osteoporosis, sexuality, bladder management, autonomic dysreflexia, home modification, and recovery research. Visit our videos page:

http://sci.washington.edu/info/forums/forum_videos.asp

literature review

The articles previewed below were selected from a recent screening of the National Library of Medicine database for articles on spinal cord injury. In the judgment of the editors, they include potentially useful information on the diagnosis or management of spinal cord injury. You may obtain copies of the complete articles through your local medical library or from UW Health Sciences Library Document Delivery Service (call 206-543-3436 for fee schedule).

FERTILITY

■ Semen quality remains stable during the chronic phase of spinal cord injury: a longitudinal study.

Semen samples from 87 men with SCI were analyzed on at least 2 occasions, with at least 3 years between first and last sample. Semen was collected by masturbation, penile vibratory stimulation or electroejaculation. Subjects were on average 30 years old and 7 years post injury (at time of first sample). Sperm concentration decreased slightly with time, but all other parameters were unchanged, including total sperm count. Semen quality does not show clinically significant progressive changes during years after injury in men with SCI. This information is relevant for urologists who counsel these patients on family planning. Also, routine sperm freezing for fertility preservation is not necessary in this patient population.

Iremashvili V, Brackett NL, Ibrahim E, et al.

J Urol. 2010 Nov;184(5):2073-7.

PAIN

■ Effectiveness of transcranial direct current stimulation and visual illusion on neuropathic pain in spinal cord injury.

Pain was assessed in 40 study subjects with SCI who had neuropathic pain for at least 6 months. Subjects were randomly assigned to one of four treatment groups: transcranial direct current stimulation (DCS) while watching a walking visual illusion (combined treatment group); transcranial DCS + control (not walking) visual illusion (transcranial DCS group), transcranial DCS sham + visual illusion (visual illusion group) and transcranial DCS sham + control illusion (placebo group). Each person received ten treatment sessions, 20 minutes each, during 2 consecutive weeks. Their pain was assessed before and after the two-week program, at 2 and 4 weeks follow-up and after 12 weeks. The combined treatment reduced the intensity of neuropathic pain significantly more than any of the other interventions. At 12 weeks the combined treatment group still had significant improvement on the overall pain intensity perception, whereas no improvements were reported in the other three groups. Results demonstrate that transcranial direct current stimulation combined with walking visual illusion can be effective in the management of neuropathic pain following SCI, with minimal side effects and good tolerability.

Soler MD, Kumru H, Pelayo R, et al.

Brain. 2010 Sep;133(9):2565-77.

■ Oxycodone improves pain control and quality of life in anticonvulsant-pretreated spinal cord-injured patients with neuropathic pain.

Fifty-four persons with SCI and moderate to severe neuropathic pain were treated with oxycodone, either in combination with anticonvulsant medication (83% of subjects) or alone (17%). Pain intensity and interference with life, which were measured at baseline and one and three months, decreased significantly from baseline to month three. A total of 53.7% patients showed at least one treatment-related adverse event, most often constipation (33.3%). Oxycodone treatment, mostly in combination with anticonvulsants, in SCI patients with neuropathic pain decreases pain intensity, improves health-related quality of life and diminishes the impact of pain on physical activity and sleep.

Barrera-Chacon JM, Mendez-Suarez JL, Jáuregui-Abrisqueta ML, et al.

Spinal Cord. 2011 Jan;49(1):36-42.

■ Effect of dronabinol on central neuropathic pain after spinal cord injury: a pilot study.

This was a randomized, double-blind, crossover, controlled study comparing the effectiveness of the cannabinoid (a chemical constituent of marijuana) dronabinol, to that of diphenhydramine in managing

central neuropathic pain below the level of injury in persons with SCI. Diphenhydramine was selected as an active control because it does not have pain relief properties but mimics some of the possible side effects of dronabinol. The primary outcome measure was the change in average pain intensity from baseline to the end of the maintenance phase of each medication. For the five adults with SCI and neuropathic pain who completed this study, dronabinol was no more effective than diphenhydramine for relieving chronic neuropathic pain below the level of injury. The most common side effects were dry mouth, constipation, fatigue, and drowsiness for both medications.

Rintala DH, Fiess RN, Tan G, Holmes SA, Bruel BM.

Am J Phys Med Rehabil. 2010 Oct;89(10):840-8.

SKIN CARE & PRESSURE SORES

■ Effect of Wheelchair Tilt-in-Space and Recline Angles on Skin Perfusion Over the Ischial Tuberosity in People With Spinal Cord Injury.

Eleven wheelchair users with SCI sat without tilt or recline for 5 minutes and then sat in 1 of 6 tilted and reclined wheelchair positions, including (1) 15° tilt-in-space and 100° recline, (2) 25° tilt-in-space and 100° recline, (3) 35° tilt-in-space and 100° recline, (4) 15° tilt-in-space and 120° recline, (5) 25° tilt-in-space and 120° recline, and (6) 35° tilt-in-space and 120° recline. A 5-minute washout period (at 35° tilt-in-space and 120° recline) was allowed between protocols. Laser Doppler flowmetry was used to measure skin perfusion (blood flow to the skin) over the ischial tuberosity (sitting bones) in response to these different body positions. Combined with 100° recline, wheelchair tilt-in-space at 35° resulted in a significant increase in skin perfusion compared with the upright seated position (no tilt/recline), whereas there was no significant increase in skin perfusion at 15° and 25° tilt-in-space. Combined with 120° recline, wheelchair tilt-in-space at 15°, 25°, and 35° showed a significant increase in skin perfusion compared with the upright seated position. For best blood flow to the skin over the ischial tuberosity, wheelchair tilt should be at least 35° when combined with recline at 100° and at least 25° when combined with recline at 120°.

Jan Y-K, Jones MA, Rabadi MH, Foreman RD, Thiessen A

Arch Phys Med Rehabil. 2010 Nov;91(11):1758-64

■ Poor nutrition is a relative contraindication to negative pressure wound therapy for pressure ulcers: preliminary observations in patients with spinal cord injury.

Negative-pressure wound therapy (NPWT) has been shown to improve wound healing in some populations. This is the first study in patients with SCI to compare the addition of NPWT to the recommended standards of wound care. Subjects were 86 SCI inpatients in 10 VA centers being treated for severe (Stage III/IV) pressure sores over a 28-day period. Subjects were not assigned to treatment groups; rather, they received standard wound therapies as well as additional therapies (including NPWT) at the discretion of the attending physician. Wounds were measured several times over the 28-day period. No significant difference was found in the rate of wound healing between the 33 patients who received NPWT and those who did not. In malnourished individuals (defined as low serum albumin levels), NPWT was not helpful. Healing outcomes in the NPWT group were significantly influenced by albumin levels, this was not true for the non-NPWT group. Nutritional status appears to be important in the effectiveness of NPWT.

Ho CH, Powell HL, Collins JF, et al.

Adv Skin Wound Care. 2010 Nov;23(11):508-16.

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REGENERATION RESEARCH

■ Neural stem cells in regenerative medicine: bridging the gap.

Repair of the chronically injured spinal cord presents multiple challenges, including neuronal/axonal loss and demyelination as a result of primary injury (usually a physical insult), as well as secondary damage, which includes ischemia, inflammation, oxidative injury and glutamatergic toxicity. A promising therapeutic intervention for SCI is the use of neural stem cells. Cell replacement strategies using neural precursor cells (NPCs) and oligodendroglial precursor cells (OPCs) have been shown to replace lost/damaged cells, secrete trophic factors, regulate gliosis and scar formation, reduce cystic cavity size and axonal dieback, and enhance plasticity, axonal elongation and neuroprotection. These progenitor cells can be obtained through a variety of sources, including adult neural tissue, embryonic blastocysts and adult somatic cells via induced pluripotent stem cell (iPSC) technology. The use of stem cell technology - especially autologous cell transplantation strategies - in regenerative therapy for SCI holds much promise; these therapies show high potential for clinical translation and for future disease treatment.

Ruff CA, Fehlings MG.

Pain. 2010 Jun;52(2):125-47.

BLADDER MANAGEMENT

■ Botulinum toxin-A injections into neurogenic overactive bladder--to include or exclude the trigone? A prospective, randomized, controlled trial.

A total of 38 individuals with urinary incontinence and overactive bladder due to SCI were randomly assigned to receive either botulinum toxin-A (BTX-A) injections into the detrusor (bladder muscle) only or BTX-A injections into both the detrusor and trigone area of the bladder. Participants were using clean intermittent catheterization and were not using anticholinergic medications during the study. Analysis included 18 patients per group, with no significant baseline differences. At baseline and during the study period, several parameters were evaluated, including number of incontinence episodes, number of subjects who became completely dry, quality of life, and the need to start taking anticholinergics again. Both groups had improvements, but those who received BTX-A injections in both the detrusor and trigone area had superior dryness, incontinence and reflex volume.

Abdel-Meguid TA.

J Urol. 2010 Dec;184(6):2423-8.

SPASTICITY

■ Tolerance to continuous intrathecal baclofen infusion can be reversed by pulsatile bolus infusion.

Intrathecal baclofen (ITB) therapy is a safe and effective treatment for severe spasticity, but some patients develop tolerance and require continued increasing doses. A drug holiday—tapering off baclofen and substituting an alternate drug—is the standard way to reverse this tolerance, but this requires close monitoring to avoid withdrawal symptoms. For this study, data on dosages and effectiveness were gathered from four patients who were switched from continuous to pulsatile bolus infusion (given in a series of separate large doses rather than a continuous flow) of ITB because of ITB tolerance. This switch resulted in a decrease of the daily ITB dose, while spasticity symptoms remained stable, without causing adverse symptoms. Therefore, pulsatile bolus infusion of ITB seems to be an effective and safe way to reverse the need for increasing ITB dosages in patients who have developed tolerance to ITB.

Heetla HW, Staal MJ, van Laar T.

Spinal Cord. 2010 Jun;48(6):483-6.

WEIGHT MANAGEMENT

■ Feasibility of functional electrical stimulated cycling in subjects with spinal cord injury: an energetic assessment.

Individuals with SCI have difficulty getting enough exercise to reduce their risk for high blood pressure, obesity, diabetes and cardiovascular disease. The aim of this study was to determine how much functional electrical stimulated (FES) cycling is necessary to reach the generally recommended weekly exercise caloric expenditure of 1000–2200 kcal. Eight (7 males, 1 female) subjects performed an FES-training session at their highest level of effort for 60 minutes. Gas exchange was measured while exercising, allowing the calculation of mean fat and carbohydrate oxidation rates and of total energy expenditure by means of indirect calorimetry. Mean energy expenditure per session was 288 kcal/h, corresponding to a mean oxidation rate of 49.5 g/h for carbohydrate and 8.5 g/hour for fat. Findings suggest that 4 to 8 hours of FES-cycling per week are necessary to reach the recommended weekly exercise caloric expenditure that seems to be essential to produce ongoing health benefits. FES-cycling is a feasible and promising training alternative to upper body exercise for individuals with SCI.

Perret C, Berry H, Hunt KJ, et al.

J Rehabil Med. 2010 Oct;42(9):873-5.

■ Prospective analysis of body mass index during and up to 5 years after discharge from inpatient spinal cord injury rehabilitation.

In this multi-center study of 184 persons with SCI in the Netherlands, body mass index was calculated at the beginning of rehabilitation, 3 months later, at discharge, and 1, 2 and 5 years after discharge. The percentage of persons who were overweight/obese increased over the years from 56% to 75%. The absolute BMI did not significantly increase during rehabilitation, but showed a significant increase the year after discharge. Men, persons with paraplegia and older people had more chance of being overweight/obese compared with women, persons with tetraplegia and younger people. The BMI of people with SCI gradually increases during and after inpatient rehabilitation, with significant increases in the first year after discharge. Clinicians should encourage an active lifestyle and give proper dietary advice to patients with SCI.

de Groot S, Post MW, Postma K, et al.

J Rehabil Med. 2010 Nov;42(10):922-8.

ELECTRICAL STIMULATION FOR COUGH

■ Posterolateral Surface Electrical Stimulation of Abdominal Expiratory Muscles to Enhance Cough in Spinal Cord Injury.

Spinal cord injury (SCI) patients have respiratory complications because of abdominal muscle weakness and paralysis, which impair the ability to cough. This study aimed to enhance cough in 11 high-level (T6 and above) SCI subjects using surface electrical stimulation of the abdominal muscles via 2 pairs of electrodes placed posterolaterally. Subjects performed maximum expiratory pressure (MEP) efforts against a closed airway and voluntary cough efforts with and without electrical stimulation. In every subject, electrical stimulation improved peak expiratory flow during cough efforts. The improvements were 2 to 3 times greater than improvements reported in other studies. Wearing an abdominal binder did not improve stimulated cough flows or pressures. These findings suggest that posterolateral electrical stimulation of abdominal muscles is a simple noninvasive way to enhance cough in individuals with SCI.

Butler JE, Lim J, Gorman RB, et al.

Neurorehabil Neural Repair. 2010 Oct 15.

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assistive technology services are needed for people with SCI so they can reap the many benefits of driving. (Norweg A, Jette AM, Houlihan B, et al. Patterns, predictors, and associated benefits of driving a modified vehicle after spinal cord injury: findings from the National Spinal Cord Injury Model Systems. *Arch Phys Med Rehabil.* 2011 Mar;92(3):477-83.)

Weight matters

In a group of 1,381 people with chronic SCI, 7.5% were underweight, 31.4% were overweight, and 22.1% were obese. Pain and unplanned hospitalizations were more common among those who were either obese or underweight. Participation in the community was also lower in these two groups. Living alone, a cervical injury and less education increased the risk for weight-related problems. Greater efforts are needed to prevent and manage underweight and overweight in persons with SCI in order to reduce the risk of secondary complications. (Chen Y, Cao Y, Allen V, Richards JS. Weight matters: physical and psychosocial well being of persons with spinal cord injury in relation to body mass index. *Arch Phys Med Rehabil.* 2011 Mar;92(3):391-8.)



Generous gift supports those with SCI

We would like to thank Ernie Franz for his generous gift of \$5,000 toward SCI peer support at the Northwest Regional Spinal Cord Injury System. Ernie was hit by a car in 2004 while out riding his bicycle. He was airlifted to Harborview with multiple injuries, including C4 incomplete SCI, and was treated and received rehab there. Since then he has recovered a good deal of function and returned to cycling. His gift has allowed us to pay for parking for individuals attending the monthly SCI Forums.

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