UNIVERSITY OF WASHINGTON SCHOOL OF MEDICINE

SPINAL CORD INJURY Update

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Choosing a Wheelchair

Wheelchair seating evaluation has come a long way in the past decade. Not long ago, wheelchair choice was very limited. "Now, choosing your wheelchair is a very individual and personal decision, with many choices," says Kirk Hennig, who has a C6 SCI and recently decided to replace the manual wheelchair he has used for 14 years.

Finding a wheelchair that fits the physical, lifestyle and financial needs of the user begins with a thorough seating evaluation by a clinician who specializes in seating and positioning and who can guide the consumer through this often confusing and time-consuming process.

The goals of optimal wheelchair seating include protecting skin integrity; optimizing function and independence; and creating or maintaining normal anatomic alignment, with particular attention to the spine.[1] Since obtaining a properly fitting wheelchair can often take three-to-six months, it makes sense to be proactive and initiate the seating evaluation process before pain develops or skin or posture changes arise from a poorly fitting chair.

For newly injured individuals, seating evaluation begins during inpatient rehabilitation. The first wheelchair is usually suitable for several years with only minor modifications, unless there is a dramatic decline in medical status, a considerable change in growth (as in the case of a child) or a significant weight gain or loss.

Hennig's search for a new wheelchair began with an outpatient visit to his doctor, who was concerned about some skin and postural changes and referred him to the seating clinic at Harborview Medical Center. There he was evaluated by Dave Colescott, a physical therapist who specializes in seating and positioning.

Colescott takes a comprehensive approach to seating evaluation, gathering information about a client's personal goals and expectations, medical and surgical history, social and living situation, daily routines, recreational activities and insurance coverage. Often Colescott must strive to find a balance between the health care needs and the personal goals of each client. This was the case for Hennig, who wanted a manual wheelchair that would be light enough for him to fold up and place in the back seat of his car, but stable enough that he would be able to safely manage his own transfers.

Insurance coverage significantly influences the final choice of equipment. "You often have to make the best of (the insurance coverage) you are working with in a fee-driven health care system," Colescott says. "Many clients simply do not have the financial resources to obtain the 'ideal' wheelchair."

In the first evaluation visit, Colescott examined Hennig's neurological status and spasticity, as well as the range of motion of his legs, pelvis, and spine. He gave Hennig a detailed physical assessment in both the sitting and supine positions and made several measurements. He then observed Hennig's transfer and propulsion techniques before evaluating his sitting position with the pressure mapping system.

Pressure mapping is a relatively new addition to the seating evaluation process and is recommended for people at risk for skin breakdown, such as those who lack sensation in their buttocks and lower legs due to paralysis. A pressure mapping system consists of a computer, a single or multi-sensor pad, an electronics box, calibrations hardware, special software and a power supply. These systems digitize the pressure information taken while the patient sits on a thin bendable pad of sensors placed on top of the seat cushion. The

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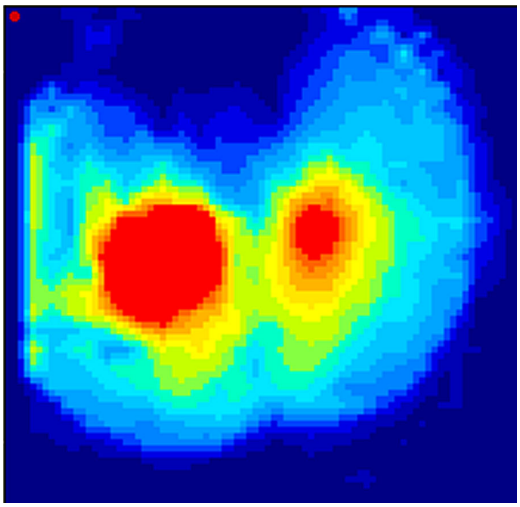

Pressure map images show areas of high (red) to low (blue) pressure on the buttocks while seated. This example indicates that high pressure over the ischial tuberosities is greater on one side.

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numbers and colors on the computer screen correspond to a pressure reading: blue signifies low pressure and red shows high pressure, indicating danger to the underlying skin.[2] (See photo on front page.)

Pressure mapping was originally developed for research purposes. Now clinicians use it to help make decisions about comfort, pressure ulcers or product differences. The system costs around $8,000, not including the computer; costly, but far less expensive than a single flap surgery (to treat a severe pressure ulcer).[2] Pressure mapping can provide dramatic visual feedback about proper seating and sleeping positions and effective pressure relief techniques. (Note: These systems only measure vertical or straight down pressure and do not capture shear (side-to-side) forces, which also contribute to pressure ulcers.) Pressure mapping can also be used to justify to an insurance carrier the need for an expensive seat cushion .

In Hennig's case, pressure mapping revealed increased pressure over the sacral region, which coincided with the observed posture of sacral sitting (pelvis tilted back) and forward bending of the trunk. (Note: the photo on page 1 is not Hennig's pressure map image.) Colescott felt Hennig needed a chair that would correct this posture by positioning his pelvis properly in a neutral alignment and supporting the curvature of the spine.

After the initial evaluation, the number of follow-up visits varies by individual. Several appointments may be necessary to try out different wheelchairs. Researching wheelchair options ahead of time on the Internet, at medical equipment stores, or by talking to other wheelchair users with SCI can help speed the selection process. Hennig's final choice of wheelchair was an ultra-light model that corrected his postural problems while satisfying his lifestyle priorities.

To obtain insurance payment for a wheelchair, the clinician must submit a lengthy justification letter with the equipment order. First requests are often approved. If they are denied, however, they require appeals and additional justification letters. Once approved, delivery usually takes four-to-six weeks.

The wheelchair market is a complex, competitive and continuously evolving industry. Through consumer demand and knowledgeable practitioners, the market is beginning to respond to the requests of wheelchair users. Ultimately, this leads to better products and healthier, more comfortable consumers.

Debra Glazer, PT, MPH

(S*eating evaluations are available at Harborview and UW Medical Centers, and Children's Hospital and Regional Medical Center, with a physician's referral.)*

References

1. Hastings JD. Seating Assessment and Planning. *Topics in Spinal Cord Medicine* 2000 Feb;11(1):183-207.

2. Krizack M. Portable Interface Pressure Mapping Unit Could Save Lives Around the World. *Disability World,* Aug-Sept 2000;4. <http://www.disabilityworld.org/Aug-Sept2000/tech/IPM.htm>(5/6/03).

NWRSCIS Research Project Update

With funding from the National Institute of Disability and Rehabilitation Research (NIDRR), the Northwest Regional Spinal Cord Injury System (NWRSCIS) conducts research in different areas of SCI diagnosis and treatment. On March 13, 2003, members of the NWRSCIS Consumer Advisory Board and Scientific Advisors were invited to hear progress reports on these projects. Four projects are currently funded under the 2000-2005 NIDRR grant and one is a NIDRR-funded collaborative project.

"**Hydrophilic Catheters for the Prevention of Urinary Tract Infections**" is headed by **Dr. Diana Cardenas**, professor in the UW Department of Rehabilitation Medicine and director of the Northwest Regional Spinal Cord Injury System. Urinary Tract Infections (UTIs) are the most frequent medical complication during initial rehabilitation and a leading cause of rehospitalization.

Cardenas' study is investigating whether a hydrophilic catheter called the LoFric reduces the frequency and/or severity of UTIs in persons with SCI or Spina Bifida who use intermittent catheterization. The LoFric catheter has an outer layer of polyvinylpyrrolidone, a hydrophilic compound which binds with water to create a liquid surface that reduces friction. "Less friction is thought to reduce trauma in the urethra," Cardenas explained. "This decreases the chance that bacteria will invade the bladder system."

Subjects are randomly assigned to either the LoFric catheter (treatment) group or the standard catheter (control) group. Over a 12-month period, subjects periodically provide urine samples for laboratory analysis and complete UTI symptom questionnaires.

Data analysis will compare both the number of UTIs in each group and the rate of infection in the first six months versus the last six months. A previous study found no difference in UTIs using this catheter (Sunderland, 1996); in another there was no difference compared to baseline but a decreased rate of UTIs over 12 months (Vapnek, 2002). "If

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Spinal Cord Injury Update is supported by grant H133N000003 from the National Institute of Disability and Rehabilitation Research (NIDRR), U.S. Department of Education, Office of Special Education and Rehabilitative Services (OSERS), to the Northwest Regional Spinal Cord Injury System, one of 16 model SCI care systems nationwide. **Project Director:** Diana D. Cardenas, MD, MHA; **Project Co-Director:** Charles Bombardier, PhD.

To add your name to the mailing list or to request alternative formats, contact the editor, Cynthia Salzman, at the University of Washington Department of Rehabilitation Medicine, Box 356490, Seattle WA 98195-6490; 206-685-3999; *csalzman@u.washington.edu*.

Northwest Regional SCI System Web site: *http://depts.washington.edu/rehab/sci*

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it affects the urethra, it may take a while for the tissue to get better, and we may see improvement later on," Cardenas suggested.

Of the 35 subjects who have enrolled, 18 have completed the study—too few to draw conclusions (the goal is 75 subjects). The LoFric catheter is more expensive than a simple catheter. "If we can show that it significantly reduces the severity of infections, we can better justify insurance coverage," Cardenas said.

"**The Prevalence and Implications of Sleep Apnea in Acute, Traumatic Tetraplegia**" is led by **Dr. Stephen Burns**, assistant professor in Rehabilitation Medicine. Sleep apnea syndrome is a disorder characterized by frequent, brief pauses in breathing during sleep that result in reduced oxygen flow to the brain. It occurs in 3-4% of the general population, mostly middle-age males. It is a common cause of daytime sleepines and cognitive problems and is associated with increased rates of motor vehicle accidents, hypertension, depression and mortality.

Sleep apnea is ten times more common in the SCI population and is thought to be even more prevalent in newly injured patients. Burns believes that sleep apnea in acute SCI patients may impede the rehabilitation process and inhibit the attainment of optimal function, emotional health and quality of life.

Subjects are drawn from the population of all patients with acute tetraplegia admitted to Harborview Medical Center during the grant period. Eligible subjects found to have sleep apnea are offered treatment with a CPAP device (continuous positive airway pressure via a nasal/face mask). Information about the subject's symptoms, rehabilitation activities and treatment effectiveness is collected during the inpatient stay.

So far, nine subjects have been enrolled (the goal is 20) and six of these have been diagnosed with sleep apnea. Treatment with CPAP—effective in the general population—has not been well-tolerated in this group. "They don't like having something strapped to their faces that they can't reposition or adjust," said Burns, who hopes studies such as this will help identify treatments that address the specific needs of this population. "We might be able to have people do better in rehabilitation, attain their goals faster and be a little more independent when they leave, if they are learning rehabilitation skills while well-rested." Burns and his colleagues are also surveying physicians and patients to learn more about the extent and nature of sleep apnea in the chronic SCI population.

"**Neurologic Recovery After SCI**," directed by **Dr. Sohail Mirza**, associate professor of Orthopedic Surgery, is examining acute SCI cases that occurred in the last two decades to determine whether earlier spine surgery results in better neurological recovery than later surgery, how much improvement occurs with earlier intervention, and what the complication rates are. This study hopes to shed light on the controversy over timing of surgery: is it better to perform surgery very soon after injury, before further damage occurs, or later, after the patient has stabilized and risks from surgery have declined?

One of the primary goals of surgery after SCI is to reduce or prevent further damage caused by inflammation and other physiologic changes the body sets in motion in response to injury. "Most (of the destructive) changes happen in the first six hours after injury," Mirza said. "The majority of studies, however, have compared surgery within three days (of injury) to surgery after seven days. But three days might be too long a window." This may explain why previous studies didn't show much difference in results between "early" and "late" surgery.

Five hundred records from a database of all acute SCI admissions to the UW since 1985 are being reviewed. These cases are divided into early (within three hours) versus later (after day one) surgery. For each group, Mirza's research team is examining rates of recovery and complications. As of March 2003, 100 charts had been reviewed. "Our impression so far," Mirza said, "is that early decompression does make a difference and produces a better result." Studies such as this can have far-reaching implications for treatment of spine trauma.

Jason Doctor, PhD, Assistant Professor of Medical Education and Biomedical Informatics, Rehabilitation Medicine and Health Services, is the principal investigator of the study "**Measuring the Value of Spinal Cord Injury Health Outcomes Under Risk**." This study examines the way patients with SCI make decisions about high risk medical procedures that may or may not result in significant improvements in health and quality of life. In interviews, study participants are asked to make risky choices that quantify their preferences and assess their attitude toward taking medical risk under a variety of hypothetical conditions.

Findings suggest that persons with SCI demonstrate the common human tendency to over-weight the probability of a good medical outcome when the chance of such an outcome is small, and under-weight the probability of a good medical outcome when the chance of such an outcome is large. When preferences for health are assessed in the context of risk, the effect of this over- and under-weighting of probability is to misrepresent the value persons place on their health. Results of this research may help guide both researchers and patients as to the value of various risky treatments that target regeneration of spinal nerve cells.

"**Collaborative Upper Limb Pain (CULP-SCI)**," a three-site collaborative study centered at the University of Pittsburgh, looks at the manual wheelchair propulsion and transfer techniques used by people with SCI that over time may be contributing to the high incidence of disabling upper limb pain in this population. The Seattle arm of the study is directed by **Dr. Michael Chang**, associate professor of Rehabilitation Medicine. Subjects receive an initial evaluation consisting of biomechanical studies in the UW's state-of-the-art Human Motion Analysis Laboratory that measure kinematics (joint motion) and kinetics (force through the joints) during wheelchair propulsion and transfer; shoulder MRI; nerve conduction study of the ulnar and median nerves; and physical exam. Over the next five years subjects are interviewed regularly about their upper limb pain and disability. "Upper limb pain is a very common problem that contributes significant disability and limitations on employment and activities of daily living," Chang said. This study will eventually enroll 225 subjects from the three centers (University of Pittsburgh, Kessler and UW).

The SCI Forum is an evening presentation and discussion series on topics of interest to persons with spinal cord injury and their friends and family members, held monthly at the University of Washington Medical Center during the fall, winter and spring.

Spasticity and Spinal Cord Injury

January 14, 2003— "It's said that the brain is the most complex structure in the universe," said James Little, MD, PhD, associate professor in the UW Department of Rehabilitation Medicine. "If that's true, then the spinal cord is the second most complex structure."

"The brain is made up of millions of neurons—nerve cells—and trillions of synaptic connections," he continued. "It's an incredibly compact structure. The spinal cord itself has millions of neurons and billions of synaptic connections."

Spasticity is a common problem after SCI and results from increased reflex activity that develops following damage to the spinal cord. In order to understand how this happens, Little described some of the basic workings of the spinal cord.

The brain and spinal cord are made up of complex circuits of neurons. Information is carried from one neuron down its axon, or nerve fiber, to the next neuron, by an electrical signal. This signal stimulates a chemical signal, called a neurotransmitter, which communicates across to the next cell, excites that cell, and so on down the pathway. This area of chemical transmission between one nerve cell and the next is called the synapse.

Neurons that carry messages from the brain down to the spinal cord are called upper motor neurons (UMNs). Lower motor neurons (LMNs) are the neurons that branch out from the spinal cord to the muscles and tissues of the body. The synapses allow the UMNs to communicate with the LMNs, carrying sensory information from the body up to the brain, and motor information from the brain to the muscles.

Communication from the body to the brain begins with sensory fibers that send messages about what the tissues are doing. There are many different kinds of specialized sensory fibers. One type carries information about velocity of stretch in the muscle, sending a signal to the brain that tells how quickly your muscle is being stretched at any given moment.

When a spinal cord is injured, LMNs also are damaged at the level of injury but are normal above and below. "We still have a reflex connection from the sensory fiber to the LMN, making a synaptic connection," Little said. "One of the things we think happens to explain spasticity is that the reflex inputs from the sensory fibers to the LMNs grow new synapses. Where before a fiber made only a few synaptic contacts with the LMN, now it's making many; it has grown more synapses and has a stronger reflex connection. So now, if someone stretches your muscle, it fires the reflex connection much more strongly than before."

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Spasticity can be beneficial or detrimental to persons with SCI.

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Reflex axons grow new synaptic connections over a period of months after injury. This is thought to occur because there are vacant synaptic sites on the neurons left by the degenerating fibers from above. "We think (the vacant sites) elicit some release of neurotrophins and other growth factors that stimulate synapse growth by whatever inputs are still out," Little said.

Spasticity appears in many varieties. With extensor spasms the legs straighten and become rigid; this can be severe enough to throw people out of their wheelchairs. Flexor spasms are the opposite: the legs pull up toward the chest. Clonus is the repetitive jumping of the muscle, most often the ankle, causing the foot to bounce repeatedly on the foot rest.

Little noted that spasticity can be beneficial or detrimental. It can interfere with function and quality of life in several ways: by impairing balance, endurance or transfers; by hindering the patient's or the partner's sleep, or both; by causing pressure sores; or by contributing to pain.

On the other hand, some people learn to use their spasms to assist with transfers or standing. Spasticity can help maintain muscle bulk, stimulate blood flow and increase bone strength. "When it comes to deciding how aggressive to be about treating spasticity, you have to look at the good aspects of it," he said. It is also important for the physician to sort out spasticity from other, possibly coexisting conditions that cause similar symptoms, such as contractures or weakness.

Treatment Options

"Like any medical condition, treatment for spasticity usually starts with a noninvasive procedure or treatment and then, if necessary, moves on to the more invasive methods," explained Fahrad Sepahpanah, MD, the UW SCI Medicine Fellow at the Veterans Affairs Medical Center.

Sometimes reducing pain will decrease spasticity, he said. "Even if the patient doesn't feel pain, giving pain medications can reduce spasticity and make a big difference."

Stretching can be a very effective treatment for spasticity, Sepahpanah noted, "but we need to pay attention to two things." First, the stretch must be held for 45 to 90 seconds; less than that is usually ineffective. Second, it should be done several times a day and become a routine part of the patient's daily life. Stretching only reduces spasticity for a few hours, however. "If you stop stretching," Sepahpanah warned, "spasticity will return."

Sometimes special equipment can help prevent spasticity. For example, spasticity that is triggered when doing pressure releases can be avoided by using a reclining system that tilts the patient in space.

Medications such as diazepam, baclofen, clonidine and tizanidine can be effective against spasticity because they act like naturally occurring inhibitory neurotransmitters to screen out unneces-

sary sensory messages coming from the environment. Baclofen can also be delivered directly to the target nerve cells in the spine using an intrathecal catheter and a pump device implanted under the skin. This method reduces side effects, and only very tiny doses are needed. The downside is that surgery is required to implant the system, and the pump needs to be refilled every two-to-three months. The entire pump needs to be replaced every four-to-five years.

Chemical nerve blocks are used to suppress either the muscle or the nerve involved in the spasticity. Botox injections reduce spasticity by paralyzing the muscle. Botox is very safe and effective, but it is expensive and wears off after four-to-six months, so it requires repeated injections.

Alcohol and phenol injections are used to block nerves locally, reducing spasticity in the muscle stimulated by those specific nerves. Nerve blocks are inexpensive, effective, and relatively long-lasting (about six months).

The most invasive spasticity treatment option is a myelotomy, a surgical procedure in which the reflexive nerves are cut. This method effectively eliminates spasticity, Sepahpanah explained, but is always a last resort because it permanently and irreversibly changes the anatomy of the spinal cord. Also, it eliminates all reflexes, including the helpful reflexes used for bladder emptying, erection and bowel movements.

Avenues of Research

A major focus of spasticity research today is in the area of weight-supported ambulation, Little said. In this method, patients are supported in a harness and assisted to make stepping motions on a treadmill (see the Spring 2003 issue of our newsletter, *SCI Update*, at *http://depts.washington.edu/rehab/sci/updates/03_spring.html* for more information on body-weight-supported ambulation). "There is some evidence to indicate that this can result in enhanced recovery and may improve spasticity," Little said.

"One area of interest is the idea that spasticity may be interfering with recovery in someone with incomplete injury by blocking some synaptic growth that might allow recovery," Little said. UMNs that are spared might be able to grow new synaptic connections and mediate some recovery, but they may be competing for vacant synaptic sites with the reflex inputs, which are growing new synapses as well. Little and others wonder, therefore, whether spasticity—resulting from the growth of too many reflex inputs—may interfere with the potential for recovery of voluntary movement.

Little has seen this process at work in some of his patients. For example, a patient with C4 incomplete tetraplegia started getting some recovery back in his left elbow extensor muscle. But 90 days post injury this progress stopped, and at the same time spasticity started to develop. "We decided to try a low concentration alcohol block in the triceps muscle. It has the ability to reduce spasticity and spare most voluntary movement," Little said. "And the patient did improve his voluntary movement. It supported the idea that spasticity that develops in someone with an incomplete injury might possibly be interfering with the potential for voluntary recovery." Little has received a grant from the Paralyzed Veterans of America to investigate whether early spasticity treatment may yield some additional recovery.

Spasticity treatment may play an important role in spinal cord regeneration modalities.

There is some evidence, Little continued, that spasticity treatment may play an important role in spinal cord regeneration modalities. Recent breakthroughs in axonal regeneration research have determined that neurons do not regrow across the damaged area of the spinal cord because the myelin (the insulation surrounding the axon of the nerve cell) in the central nervous system has proteins that inhibit long-distance growth. By contrast, the myelin in the peripheral nerves does support long-distance growth. Speculating that a grid of peripheral nerve cell myelin might be able to guide spinal axons across the area of injury, researchers grafted peripheral nerve sections to the damaged spinal cords of rats, adding growth factors to encourage axonal regrowth. As a result, these rats were able to voluntarily move their legs. "It wasn't functional walking," Little noted, "but it's huge progress from what was possible 10 to 20 years ago."

Once these axons have grown across the area of injury, the next problem is getting them to make new synaptic connections with the normal neurons on the other side. Growth factors can assist with this, but Little and others conjecture that by the time the axons grow across the gap, all the vacant synaptic sites may be taken up by the excess reflex connections that cause spasticity. Some researchers theorize that destabilizing the reflex synapses will make more synaptic sites available for axons to make functional connections. "If we get to the point that we could regenerate axons," Little said, "one aspect of recovery might be to reduce spasticity at the critical time, to destabilize some of those reflex synapses causing spasticity, and try to open up vacant synaptic sites."

To learn about upcoming SCI Forums, consult our Web site at ***http://depts.washington.edu/rehab/sci/forum.html****, or contact Cynthia Salzman (Email: csalzman@u.washington.edu; Phone: 206-685-3999) and ask to be added to the SCI Forum mailing list.*

SCI Forum Reports

Due to space limitations, we cannot publish all SCI Forum reports in the print version of this newsletter. More SCI Forum reports are published on our Web site at:

http://depts.washington.edu/rehab/sci/forum_reports.html.

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).

BOWEL MANAGEMENT

Silent autonomic dysreflexia during a routine bowel program in persons with traumatic spinal cord injury: a preliminary study.

Ten subjects with chronic, complete SCI with a neurologic level of injury above T6, stable bowel program, and no known history of autonomic dysreflexia (AD) were fitted with an automated vital sign-recording device that monitored systolic (SBP) and diastolic (DBP) blood pressures and heart rate during a routine bowel program. The mean resting blood pressure for the subject group was 104/65 mmHg. During the bowel program, no subject reported any of the classic symptoms of AD. The mean maximum blood pressure recorded during the bowel program was 160/90 mmHg. All of the patients had an increase in SBP greater than 20 mmHg above baseline; 70% had an increase in SBP greater than 40 mmHg above baseline; 60% had an increase in SBP greater than 150 mmHg; and 40% reached an SBP greater than 170 mmHg at least once during their bowel program. Silent AD occurs frequently in SCI during bowel programs.

Kirshblum SC, House JG, O'connor KC.
Arch Phys Med Rehabil 2002 Dec;83(12):1774-6

Decreased colonic motility in persons with chronic spinal cord injury.

Colonoscopy was performed on 8 subjects with SCI (4 with paraplegia and 4 with tetraplegia) and 6 age-matched spinally intact (SI) controls with the proximal end of a solid state pressure transducer catheter (four sensors each separated by 10 cm) tethered to the splenic flexure using endoclips. Baseline colonic activity of the SCI group was significantly less than in SI subjects. During meals, the motility index, mean amplitude of the waves, percent activity, and number of waves was significantly less in the SCI group. In both groups, a postprandial colonic response was observed. However, in the SCI group, the response was seen only in the descending colon and not in the rectosigmoid region.

Fajardo NR, Pasiliao RV, Modeste-Duncan R, et al.
Am J Gastroenterol 2003 Jan;98(1):128-34

The effects of colostomy on the quality of life in patients with spinal cord injury: a retrospective analysis.

A quality of life (QOL) questionnaire was given to 27 persons with SCI who had undergone colostomies for chronic bowel dysfunction. All 27 patients were "satisfied" and 16 (59%) were "very satisfied" with colostomy; 19 (70%) would have preferred colostomy earlier and 3 (11%) wished it reversed. Colostomy reduced the number of hospitalizations caused by chronic bowel dysfunction by 70.4% and reduced the average time spent on bowel care from 117.0 min/day to 12.8 min/day. Stoma prolapse and wound dehiscence were the most common complications of stomal surgery. Colostomy is a safe, effective and well-accepted treatment for chronic bowel dysfunction in patients with SCI and significantly improves QOL and bowel management procedures.

Rosito O, Nino-Murcia M, Wolfe VA, et al.
J Spinal Cord Med 2002 Fall;25(3):174-83

COMPLICATIONS

Shoulder biomechanics and muscle plasticity: implications in spinal cord injury.

Overall, 51% of persons with spinal cord injury have shoulder problems. These begin with muscle imbalance that can lead to glenohumeral instability, impingement disease, rotator cuff tears and subsequent degenerative joint disease, and can be attributed to functional demands such as overhead activities, wheelchair use and transfers. Despite preventive exercises, shoulder problems in persons with SCI remain a significant problem, causing pain and functional limitations. This article reviews the biomechanics of the shoulder resulting from changes in muscle plasticity, and addresses the effects of scapular protraction that can result from muscle imbalance, the age-dependent properties of the anterior band of the inferior glenohumeral ligament, and the influence of the dynamic restraints around the shoulder.

Lee TQ, McMahon PJ.
Clin Orthop 2002 Oct;(403 Suppl):S26-36

Posttraumatic syringomyelia: predisposing factors.

Analysis of all symptomatic posttraumatic syringomyelia (PTS) patients (n = 58) treated at the Univ. of Toronto over 30 years found that 28 patients had cervical and 30 had thoracic and lumbar SCI; 40 (69%) had complete injuries (compared with 43% complete injuries in the general SCI population). Onset of PTS was earlier with increasing age, cervical and thoracic levels of injury (compared with lumbar injuries), and dislocated fractures and spinal instrumentation without decompression. Mean time to onset of PTS has decreased in recent years. PTS follows complete SCI more often than incomplete and is frequently associated with arachnoiditis..

Vannemreddy SS, Rowed DW, Bharatwal N.
Br J Neurosurg 2002 Jun;16(3):276-83

Quantitative ultrasound assessment of acute bone loss following spinal cord injury: a longitudinal pilot study.

This longitudinal pilot study assessed bone changes in 15 males with SCI over a 6-week period using quantitative ultrasound (QUS) and dual-energy X-ray absorptiometry (DXA). Mean time since SCI was 110.3 days. DXA assessment showed decreases in bone mineral density of the calcaneus and proximal tibia by 7.5% and 5.3%, respectively. QUS was sensitive to these changes. Calcaneal broadband ultrasound attenuation decreased by 8.5%, and speed of sound decreased by 1.5%. Overall, this study confirmed the rapid onset of bone loss following SCI and showed QUS to be a useful portable measure of acute bone changes soon after injury, a period when traditional axial DXA assessment is limited by practical constraints.

Warden SJ, Bennell KL, Matthews B, et al.
Osteoporos Int 2002 Jul;13(7):586-92

Interface pressure characteristics of alternating air cell mattresses in persons with spinal cord injury.
A force-sensing array system was used to examine interface pressure characteristics of two alternating air cell mattresses used for pressure ulcer prevention and treatment in the SCI population. Analyses were performed on 15 subjects with SCI in the supine and 45-degree upright positions for both mattresses. The sacrum was chosen as the area of interest. Maximum and average interface pressures and interface pressure ranges were significantly higher, whereas minimum interface pressures were significantly lower on the Pegasus Airwave Mattress vs the Dynamic Flotation System (DFS) mattress. For either mattress, the 45-degree position resulted in significantly greater interface pressures. Twelve subjects preferred the DFS, 2 preferred the Pegasus, and 1 had no preference. The most clinically relevant interface pressure characteristic remains undetermined. Avoidance of the 45-degree sitting position is recommended.
Goetz LL, Brown GS, Priebe MM.
J Spinal Cord Med 2002 Fall;25(3):167-73

GENITOURINARY

The mesh wallstent in the treatment of detrusor external sphincter dyssynergia in men with spinal cord injury: a 12-year follow-up.
Twelve men with tetraplegia underwent external striated sphincter stenting with the UroLume wallstent instead of external sphincterotomy for detrusor external sphincter dyssynergia (DESD). Urodynamic follow-up of the seven patients who completed 12-year follow-up showed a significantly sustained reduction in maximum detrusor pressure and duration of detrusor contraction. Five patients developed bladder neck dyssynergia and were successfully treated with bladder neck incision. There were no problems with stent migration, urethral erosion, erectile dysfunction or autonomic dysreflexia. Permanent urethral stenting using the UroLume wallstent is effective in managing DESD and provides an acceptable long-term alternative to sphincterotomy. The procedure is also reversible, minimally invasive and requires a shorter hospital stay.
Hamid R, Arya M, Patel HR, Shah PJ.
BJU Int 2003 Jan;91(1):51-3

Efficacy and safety of sildenafil citrate (Viagra) in men with erectile dysfunction and spinal cord injury: a review.
A literature search identified 2 randomized controlled trials and 4 prospective case series that evaluated sildenafil treatment for erectile dysfunction from SCI. For general efficacy, the proportion of patients who reported improved erections and ability to have intercourse was as high as 94%. Up to 72% of intercourse attempts were successful. For measures of erectile function, 5 of the 6 studies showed statistically significant improvements among sildenafil-treated versus placebo-treated patients. Erectile response rates were generally higher in patients with incomplete versus complete SCI and in patients with upper versus lower motor neuron lesions. Sildenafil was well tolerated; no symptoms of autonomic dysreflexia were reported.
Derry F, Hultling C, Seftel AD, Sipski ML.
Urology 2002;60(Suppl 2B):49-57

OTHER

Military gunshot wound-induced spinal cord injuries.
Data were prospectively reviewed on 105 consecutive male patients with military gunshot-caused SCI admitted to the rehabilitation unit of a military medical school in Turkey over a two-year period. Military gunshot wounds are made by high-velocity weapons and have a greater wounding capacity than low-velocity, civilian weapons. As compared with Model Systems data on civilian gunshot-caused SCIs, the subjects in this study had a higher percentage of complete injuries and a higher rate of spinal surgery. Contrary to expectations, high-velocity gunshot wounds did not have more SCI-related medical complications than low-velocity wounds, and only bladder calculi had a higher incidence.
Alaca R, Yilmaz B, Goktepe AS, Yazicioglu K, Gunduz S.
Mil Med 2002 Nov;167(11):926-8

Gabapentin effect on neuropathic pain compared among patients with spinal cord injury and different durations of symptoms.
Thirty-one patients with neuropathic pain and SCI or cauda equina syndrome were divided into two groups: 13 with less than 6 months pain duration (Group 1) and 18 with more than 6 months (Group 2). Pain in these patients was refractory to conventional analgesics. In this study, conventional analgesics were continued at a therapeutic level, and gabapentin was administrated for an 18-day titration period followed by a 5-week maintenance period at a dosage of 1800 mg/day (up to 3600mg/day as tolerated). The efficacy of gabapentin administration was gauged by a pain score and a sleep interference score every 2 weeks using a visual analogue scale. A significant reduction in mean pain and sleep interference scores occurred in both groups (with the largest reduction in Group 1) after 2 weeks, and a further reduction after 4 weeks that continued at that level to 8 weeks. Some mild or moderate adverse effects were noted.
Ahn SH, Park HW, Lee BS, et al.
Spine 2003 Feb 15;28(4):341-6; discussion 346-7

Long-term exercise training in persons with spinal cord injury: effects on strength, arm ergometry performance and psychological well-being.
Thirty-four men and women (aged 19-65 years) with SCI (C4-L1; ASIA A-D) of 1-24 years duration were randomized into exercise (EX; n=21) and control (CON; n=13) groups. Subjects were assessed for one repetition maximum (1RM) strength, arm ergometry performance, and several indices of quality of life (QOL) and psychological well-being at baseline, 3, 6 and 9 months. At baseline, there were no significant differences between groups in age, submaximal arm ergometry performance, muscle strength, or psychological well-being. Following progressive exercise training twice-weekly for 9 months, the EX group had significant increases in submaximal arm ergometry power output (81%), and upper body muscle strength (19-34%). No significant changes occurred in the CON group, which received bi-monthly education sessions about exercise. Participants in the EX group reported significantly less pain, stress and depression after training, and scored higher than CON in indices of satisfaction with physical function, level of perceived health and overall QOL.
Hicks AL, Martin KA, Ditor DS, et al.
Spinal Cord 2003 Jan;41(1):34-43

Bulletins…

Christopher Reeve Grant

The Christopher Reeve Paralysis Foundation (CRPF) awarded $10,000 to the Northwest Regional SCI System (NWRSCIS) to develop and pilot a new SCI Peer Support Program. The program will consist of a part-time coordinator and a group of trained peer counselors with SCI who will be matched with newly injured patients at the UW and Harborview Medical Centers.

"We believe that trained peer counselors who have long-standing SCI not only can provide emotional support, practical guidance and advocacy, but can serve as role models for the newly injured, who may be unable to imagine a satisfying or fulfilling future for themselves," said Diana Cardenas, MD, MHA, director of the NWRSCIS.

While the UW has used peer volunteers for SCI patients in the past, there has not been an organized system of formally trained peer counselors that is available to all SCI inpatients and can be evaluated for effectiveness and appropriateness.

"This grant is a one-year award that will enable us to pilot the program, evaluate it, and if it's successful, look for permanent funding," Cardenas added. The NWRSCIS also received a CRPF grant in 2001 to support its SCI Forum program.

Top Ratings for UW Rehab

The University of Washington Medical Center was ranked third in the nation for rehabilitation hospitals in the *US News and World Report's* 2003 annual guide to "America's Best Hospitals," published in the July 23, 2003 issue. Rankings were based on a reputational survey of physicians. For more information on the rankings, go to *http://www.usnews.com*.

MEDCON

24-hour, toll-free consultation and referral service for health care professionals and persons with SCI.
Seattle: **206-543-5300**
Long Distance: **800-326-5300**

Pain and Relaxation Study

Researchers in the Departments of Anesthesiology, Psychiatry and Behavioral Sciences, and Rehabilitation Medicine are seeking participants for a study investigating the effectiveness of relaxation treatments on pain in persons with SCI and other disabilities. Participation involves 10 one-hour sessions and telephone interviews. For information, contact Amy Hoffman at 206-616-9058 or 800-377-9707, or by email at *painstudy@u.washington.edu*. (Note: Confidentiality of information sent by email cannot be guaranteed.)

Also published online at http://depts.washington.edu/rehab/sci/update.html

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