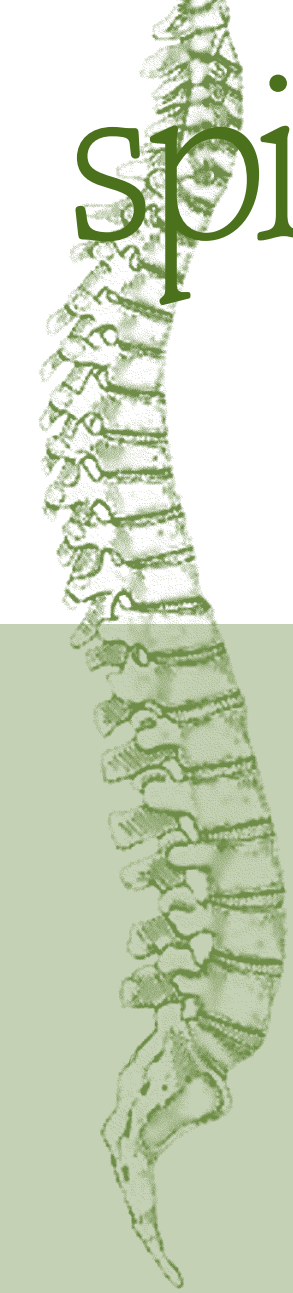
spinal cord injury UPDATE

Department of Rehabilitation Medicine

Volume 18 Issue 2 • Summer 2009

INSIDE:

UW Medicine
SCHOOL OF MEDICINE



SCI and the Risk for Heart Disease

By Joanne Lewin, ARNP and Cynthia Salzman, MHA

In the United States, cardiovascular disease (CVD) — also called "heart disease"— is the leading cause of death. In past years, people with SCI often died soon after their injury, so it was rare for someone to live long enough to develop CVD. Now that long-term survival is common after SCI, CVD has become one of the most frequent causes of death in the SCI population. There have not been many large studies to address important questions, however, and many controversies remain.

A recent review of the medical research showed that CVD may be no more common in SCI than it is in the general population and that screening and treatment should be the same for both populations (Wilt, 2008). However, factors that increase the risk for cardiovascular disease, such as obesity and physical inactivity, are very common in people with SCI. These factors are also more difficult to treat in people with SCI. Therefore, CVD risks may merit special attention in people with SCI.

What is cardiovascular disease?

Cardiovascular disease (CVD) is a broad term that includes many diseases affecting the heart and blood vessels. The most common form of CVD is the narrowing or blocking of the arteries or blood vessels that supply blood to the heart, called atherosclerosis. It is the major reason people have heart attacks. Understanding your risk for CVD is complicated because there are so many different risk factors involved and there is still so much that is not known about CVD in the SCI population.

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Aging with Spinal Cord Injury: Sleep Problems

By researchers at the University of Washington's Aging Rehabilitation Research and Training Center

One of the first things that people notice as they grow older is a change in their sleep patterns. They often say they sleep less or don't feel rested when they wake up. Adding a spinal cord injury into this equation can lead to more confusion about what exactly is causing the sleep problem in the first place and, perhaps more importantly, how to deal with it.

Fortunately, in recent years researchers have been focusing more on studying sleep problems in people with SCI. As a result, we are beginning to have a better understanding of these problems and what can be done about them.

Studies in the general population show that sleep problems increase as people age. One study found that 25% of people between the ages of 65 and 79 reported serious insomnia as compared to only 14% of people between 18 and 34. Common changes as people age include more awakenings during the night, more time spent in lighter sleep stages, less time spent in deeper sleep stages, and less total time spent asleep.

The problem seems to be worse in the SCI population. In a study completed by researchers at the University of Washington's Rehabilitation Research and Training Center (RRTC) on Aging with Disabilities, people with SCI reported more overall sleep problems than both the general population and persons with other chronic illnesses.

Why should we be concerned about the quality and quantity of the sleep we get? While sleep problems can be annoying and lead to feeling sluggish and less energized throughout the day, some researchers have found that poor sleep can lead to serious health problems such as heart disease, diabetes and stroke.[2, 3, 4]

What can you do to improve sleep? Knowing the cause of your sleep problems is the first step in getting the right treatment.

Physiological factors

Many medical problems can disrupt sleep in persons with SCI, such as pain, spasticity and breathing problems (sleep apnea, for

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Risk factors for cardiovascular disease

Some risk factors you are simply born with and can't do anything about, such as sex, ethnicity, and family history (father or brother who had a heart attack before age 55, or mother or sister who had one before 65). You also can't do anything about your age. Other risk factors are things you might be able to change through diet, exercise, medications and habits. The following are risk factors that can be changed.

Abnormal blood lipids (fats)

Lipids are fat-like substances in the blood and include:

1. Cholesterol—essential for insulation of nerve fibers and brain tissue and for production of hormones. It comes from diet and is also produced by the liver. After the fat and dietary cholesterol are digested, the liver produces lipoproteins that travel through the blood. These include low density lipoprotein (LDL, the "bad cholesterol") and high density lipoprotein (HDL, the "good cholesterol"). LDL can cause plaque (fat deposits) to form in the artery walls, which over time can narrow, block or stiffen the arteries

2. Triglycerides are another form of fat transported by the blood. High levels of triglycerides also cause harm to artery walls.

Although more research is needed, there is some evidence that having an SCI increases the risk of abnormal blood lipids, such as the risk of having a low HDL cholesterol level.

Cholesterol: Understanding the Numbers

	Desirable	Borderline	High Risk
Total:	less than 200	200-239	240 or higher
HDL	40 or higher		lower than 40
LDL	less than 100	130-159	160 or higher
Triglycerides	less than 150	150-199	200 or higher

What you can do about it:

Have your lipid blood cholesterol checked annually. Ideal levels of blood lipids vary depending on your risks. The table "Cholesterol: Understanding the Numbers" provides general guidelines, but you should discuss your individual goals with your health provider. Treatment usually starts with therapeutic life changes, such as increasing physical activity and controlling diet. Choose unsaturated fats, which come from vegetable oils, fish and plant food such as nuts and seeds. Avoid saturated fat (mainly from animal products) and trans fats (found in many prepared foods). Cutting down on saturated fat can help lower your LDL level. Add fiber in the form of fruits and vegetables as it helps to move cholesterol and triglycerides out of the blood system. If changes in diet and exercise don't bring lipids into the desirable range after three months, medications are often recommended. The most commonly used class of medications is called "statins," which help to lower LDL.

Smoking

Smoking increases the risk of heart disease two- to four-fold. Smoking injures blood vessel walls, including those that supply blood to the heart muscle. Cholesterol tends to accumulate in the injured blood vessel walls. Smoking also may lower the "good" HDL levels and increase "bad" LDL levels.

What you can do about it:

Quit smoking! Ask your health provider or insurance company about programs that may be available to you for free. Go to *www.smokefree.gov* for more information on how to quit.

Diabetes and metabolic syndrome

Diabetes—a condition in which the body cannot make or correctly use insulin—increases LDL cholesterol and the risk for heart disease. Metabolic syndrome is a cluster of risk factors that, if left untreated, may develop into type 2 diabetes. People with metabolic syndrome also have a higher risk of heart disease and stroke. Metabolic syndrome is defined as having three or more of the following:

- Abdominal obesity (too much fat concentrated around the waist)
- High fasting triglycerides
- Low HDL cholesterol
- High blood pressure
- High fasting blood sugar

What you can do about it:

Increase physical activity and lose weight. Work with your health provider to manage these risks. Some studies have shown that the metabolic syndrome associated with SCI can be partially reversed by endurance training such as manual wheelchair or handcycle propulsion, upper body arm ergometry, functional electrical stimulation of the lower extremities, swimming and other adapted modes of training. For more information about fitness options, see our SCI Forum report "Universal Fitness" at *http://sci.washington.edu/info/forums/reports/universal_fitness.asp*

Physical inactivity

If you don't get enough exercise, your body stores extra fat. Too much fat leads to insulin resistance and lower HDL. Exercise can decrease your risk of diabetes, insulin resistance, heart disease and high blood pressure.

What you can do about it:

Get moderate-intensity exercise 5–7 times a week for 30 minutes a day. Exercise is more challenging when you have SCI because of the physical limitations of paralysis, difficulty raising heart rate with exercise, and lack of access to exercise opportunities. The National Center on Physical Activity and Disability Web site (*www.ncpad.org*) has many resources to help you become more active, such as exercise videos for people with paraplegia and tetraplegia. Consult with your health provider on ways you can safely increase you physical activity.

Overweight

Being overweight is a common problem in the SCI population, and excess fat increases the risk of high blood pressure and diabetes. Body mass index (BMI)—the ratio of height to weight—is often used to determine whether someone is overweight or obese. However, most people with SCI have lost "lean body mass" due to muscle atrophy (shrinking or wasting) and even due to loss of calcium from bones. Therefore, someone with SCI can have an excessive amount of body fat but still have a normal weight-to-height ratio. For this reason, BMI is not a good way to determine obesity in the SCI population. In general,

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people with SCI should weigh 10% less than people of similar height in the general population, but ideal standards have not been developed.

What you can do about it:

A combination of diet, exercise and behavior modification have shown results, but currently little is known about the best way to manage obesity in the SCI population. You may want to talk with a nutritionist who has worked with SCI patients. Reduce calories by eating smaller portions. Limit alcohol if you drink. For more information, see our SCI Forum report "Nutrition Guidelines for People with SCI" at *http://sci.washington.edu/info/forums/reports/nutrition.asp.*

High blood pressure

High blood pressure (BP) increases the risk for heart disease and stroke if it is too high over months or years. This chronic high BP is different from the temporary increase in BP that occurs during episodes of autonomic dysreflexia (temporary BP elevation due to pain or noxious stimulation below injury level). These brief periods of BP elevation probably do not increase the long-term risk for cardiovascular disease.

What you can do about it:

Chronic high BP can be lowered through diet, exercise, weight loss and medications. If you have chronic high BP, talk with your health provider to determine your BP goals.

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Sleep Problems

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example), so treating these problems is an important first step in addressing sleep concerns. However, anyone with sleep problems should look closely at the following factors that can disrupt sleep:

• Caffeine

People who drink caffeine are less likely to sleep well than those who do not, so avoid caffeine or limit it to the morning if you are having problems sleeping for any reason. Caffeine is present not only in coffee and black tea, but also in many sodas, so check labels.

• Alcohol

Alcohol is a sedative. It may help you fall asleep, but it disrupts the sleep cycle and the quality of sleep, so you don't get as restful sleep. Avoid alcohol altogether if you have sleep problems, or limit it to earlier in the evening rather than right before bed.

• Sleeping pills

Like alcohol, many prescription drugs used for sleep can help you fall asleep, but they disrupt the sleeping cycle so you aren't as rested. Many of these medications are also addictive, especially the benzodiazapines (such as Valium). Because of these problems, sedatives usually should not be taken for longer than two weeks and are not recommended as long-term solutions for sleeping problems. If you are taking a sedative for sleep, talk to your doctor about eliminating it. *Getting off these medications must be done gradually and with medical supervision.* Stopping abruptly can be dangerous.

• Nicotine

Nicotine, whether smoked or chewed, is a stimulant and can contribute to sleep problems. (One more reason to quit!)

How to sleep better:

• Getting regular exercise and being aerobically fit can contribute to good sleep. However, people with sleep problems may want to limit exercise to the morning, since vigorous exercise late in the day may make it difficult for your body to start winding down for sleep. If you have sleeping problems and you aren't already exercising, start an exercise program. If you use a manual wheelchair, talk to your health provider about how you can exercise safely (so you don't over stress your shoulders, for example).

• Unlike sedatives, medications for depression can improve sleep and help you get back into a more normal sleep cycle.

Psychological factors

Anxiety, depression and ruminating (repetitive, worrying) thoughts at night can keep you from falling asleep or going back to sleep if you wake up. Antidepressant medication can be helpful, but cognitive-behavioral treatments such as counseling can be just as good, and both together are better than either one separately.

If anxious and ruminating thoughts are a problem at bedtime, spend five minutes sometime in the early evening well before bedtime to think about and write down the concerns that keep you up at night. If those thoughts return at night, you can tell yourself, "Oh, I have a plan to take care of that in the daytime. I won't forget because I wrote it down."

Behavioral/environmental factors

Many circumstances and behaviors can get in the way of falling asleep and getting a good night's sleep. If you have trouble falling asleep, try these "good sleep hygiene" tips:

• Restrict the bedroom to sleep and intimacy. Don't read, eat , watch TV, work or argue in bed.

• Turn the clock around so you can't see it during the night.

• If you're not asleep in 15-20 minutes, *get out of bed* and do something relaxing (like reading) until you get sleepy. Then go back to bed.

• Go to bed only when you are sleepy, otherwise you can lie in bed waiting to fall asleep, which can be upsetting and keep you awake longer.

• Try to get into a pattern of going to bed and especially getting up around the same time every day (even on weekends).

• Avoid naps, especially long naps (more than 30 minutes) later in the day.

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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 Web site at *http://sci.washington.edu/info/forums*. Contact Cynthia Salzman (email: *csalzman@u.washington.edu*; phone: 206-685-3999) if you wish to be added to the SCI Forum mailing list.

Osteoporosis in Spinal Cord Injury

By Jelena Svircev, MD, Department of Rehabilitation Medicine. Presented on October 9, 2007, at the University of Washington Medical Center.

What is osteoporosis?

Osteoporosis is a disease in which the bones lose density, become weak and brittle, and are more likely to break.

People often think of bone as a static structure or something dry and non-living. Actually, it's a very dynamic organ, constantly resorbing (reabsorbing) and recreating new bone tissue. In osteoporosis, there is an imbalance between bone formation and bone resorption, leading to thinner, more fragile bones that can fracture easily.

Normal bone structure is defined as the peak bone mineral density achieved at about 20 years of age, but this varies by ethnicity and gender. Comparing bone density to this standard tells us whether a person has osteoporosis and if so, how severe it is.

Osteoporosis and SCI

Osteoporosis is a common consequence of SCI. In the general population, the most common pattern of osteoporosis is in the post-menopausal female, who often fractures in the vertebrae, the hips and the wrist. Osteoporosis in SCI is quite different.

■ Bone loss occurs below the level of the spinal cord injury, with preservation of bone mass above the level of the injury.

■ Studies vary, but generally there is about 30% to 40% decrease in bone density in the legs after SCI. The areas most affected are the spongy bone above and below the knee.

■ Bone loss is rapid after SCI and can be detected on x-ray as early as six weeks after injury. Most researchers feel that bone loss slows down and levels out around two years after injury, but some studies suggest bone loss continues at a very slow rate.

■ Bone mineral density in the lumbar spine remains normal or above normal after SCI, possibly due to the substantial weight-loading on the spine that comes from sitting. Weight-loading may stimulate bone-building activity. The non-weight bearing lower limbs (legs) don't have this stimulation, contributing to bone mineral density loss.

■ Injury level:

Individuals with tetraplegia have more bone loss because there's more area below the level of injury.

Individuals with paraplegia usually have bone mineral density preserved in their arms. Weight bearing through the arms during transfers and manual wheelchair propelling may help maintain bone mineral density.

In the bone that is affected, the severity of bone loss is the same in both paraplegia and tetraplegia.

■ Extent of injury: individuals with complete injuries have more bone loss than those with incomplete injuries.

■ Spasticity may play a role in maintaining bone mass after SCI due to muscles pulling on the bone, which is similar to the effect of weight-bearing.

■ Duration of injury: the longer time since injury, the greater the bone loss is likely to be.

Causes of osteoporosis in SCI

1. Disuse — lack of weight-loading on the bone inhibits stimulation of bone-building cells.

2. Sluggish blood flow to limbs (called disordered vasoregulation) may contribute to a decrease in bone mass.

3. Poor nutritional status — inadequate consumption of a healthy, well balanced diet.

4. Hormonal changes and metabolic disturbances that occur after SCI can influence the balance of bony formation and resorption.

5. Impaired control by the self-regulating nervous system (called autonomic disregulation) can lead to greater imbalance between bone formation and resorption.

Fractures and SCI

As bone mineral density decreases, the risk of fractures increases. The incidence of fractures of the lower limbs in SCI is high, up to 34% of the SCI population in some studies.

Most fractures in SCI occur during routine activities, such as transferring, if there is twisting or pulling on an extremity, or from direct trauma, such as bumping into a stationary object. Sometimes the person with SCI cannot recall any sort of incident, but just notices a symptom such as swelling that, upon examination, turns out to be a fracture.

Treatment of fractures

Upper limb (arm, hand, shoulder) fractures in chronic SCI are treated similarly to the able-bodied population. Most medical providers advocate that lower limb (leg) fractures be treated conservatively, meaning without surgery, in order to avoid surgical complications.

The fractured area should be immobilized as soon as possible using soft removable splints. A plaster cast does not allow you to check the skin underneath for possible rubbing wounds that can't be felt.

The treatment goal is to make sure the patient keeps the same level of function as before the fracture, which means all equipment and activities of daily living should be assessed during and after healing.

Medications

■ **Calcitonin** is a hormone that may prevent early bone resorption, but there's very limited research to support this. Calcium levels have been found to be normal in chronic SCI, so we don't generally recommend extra calcium intake in order to prevent osteoporosis unless someone is getting insufficient levels of calcium in their diet.

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■ **Vitamin D or parathyroid hormone** supplementation is controversial. Some research studies suggest that both of these substances are depressed in SCI and need supplementation. Others found that parathyroid hormone is normal and that vitamin D levels are elevated.

■ **Bisphosphonates** (etidronate, tiludronate, alendronate) are medications that strongly inhibit bone resorption, but again studies are inconclusive — they didn't include large enough study groups so we cannot recommend their use in SCI.

Exercise and osteoporosis

Studies of standing and Functional Electrical Stimulation (FES) with cycle ergometry to treat or prevent osteoporosis so far haven't shown significant benefit in research studies. These activities do have other benefits, however. Standing, for example, can reduce spasticity, improve range of motion and circulation, and provide psychological improvements. FES ergometry does all that in addition to providing cardiac benefits.

Recommendations

■ Return to as much physical activity and as large a variety of activity as possible after injury, while being careful to not increase the risk for fractures.

■ Consume a healthy diet, including 1000 to 1500 mg of calcium.

■ Some people suggest that vitamin D supplementation should be considered for individuals who live in the Pacific Northwest because they may not get enough sun (a natural source of vitamin D) over the winter months. The recommended dose is generally 400 to 800 IU per day.

■ Smoking, alcohol and caffeine contribute to osteoporosis. Individuals should quit smoking and try to limit their alcohol (to one or two drinks per day) and caffeine intake.

■ Avoid falls and situations that may increase the risk of fracture. Make sure your equipment and environment are safe and you practice good transfer technique. If you walk at all, remove throw rugs and other obstacles that may increase your chances of falling.

Read the complete report and watch the video of this SCI Forum presentation at:
http://sci.washington.edu/info/forums/reports/osteoporosis.asp.

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6. Osteoporosis and bone physiology, at *http://courses.washington.edu/bonephys/*. Educational site for physicians and patients, run by Susan Ott, MD, Associate Professor, Department of Medicine, University of Washington.

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Read past SCI Forum reports and view SCI Forum videos on our Web site at *http://sci.washington.edu/info/forums*.

Sleep Problems

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• Establish a bedtime ritual that you do every night before bed, such as locking the doors, brushing teeth, reading for 10 minutes, or some other sequence of relaxing nighttime activities. This trains your mind to associate these behaviors with bedtime and to start drifting into "sleepy" mode.

What is normal?

People have different sleep requirements. Don't get anxious about having to get eight hours of sleep. Some people need five, some need ten.

People also differ as to when the body needs sleep and when they get tired. Some people really are night owls. So if you can, let your body sleep when it wants. People often learn what their ideal sleep schedules are when they go on vacation (as long as it's in the same time zone).

As people age, it is normal to have less efficient sleep, stay in bed longer, sleep less, be more restless and wake up more often. These changes are not necessarily something to be concerned about. However, if you're feeling tired during the day, it's a good idea to look at your sleep-related behaviors, make changes, and consult a health care provider if necessary. Adequate sleep is important to your health.

The contents of this article were developed under a grant from the Department of Education, NIDRR grant number H133B080024.

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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).

BLADDER & BOWEL

■ **Long-term outcomes of external sphincterotomy in a spinal injured population.**
External sphincterotomy surgery is often the treatment of choice for people with SCI and detrusor-sphincter dyssynergia (bladder spasticity) who cannot use intermittent catheterization. This study followed 84 individuals with SCI who had undergone external sphincterotomy. The mean duration of success was 81 months. A second procedure was required in 30 patients and mean duration of success thereafter was 80 months. Recurrent symptomatic episodes of urinary tract infection, recurrent detrusor-sphincter dyssynergia or upper tract dilatation eventually occurred in 57 of 84 patients (68%). Renal failure did not develop in any patients. External sphincterotomy protects the upper renal tracts and provides extended periods of satisfactory bladder emptying. However, it may require ongoing revision and should potentially be regarded as an ongoing intervention.
Pan D, Troy A, Rogerson J, et al.
J Urol. 2009 Feb;181(2):705-9. Epub 2008 Dec 16.

■ **Efficacy of functional magnetic stimulation in neurogenic bowel dysfunction after spinal cord injury.**
In this longitudinal, prospective before-after trial, 22 patients with chronic SCI and intractable neurogenic bowel dysfunction received a three-week protocol of functional magnetic stimulation (FMS), a noninvasive method of stimulating nerves and muscles. Treatment consisted of 20-minute FMS sessions twice a day. Colonic transit time was assessed before and after FMS. Symptoms (such as frequency and difficulty of bowel movements, time needed for evacuation, pain, discomfort, etc.) were evaluated using a standardized questionnaire administered before and after FMS and at two-week intervals for three months. After FMS, mean colonic transit time decreased significantly. Symptom scores also improved following stimulation, and this improvement was maintained overall, with a slight drop over the three-month follow-up. The improvements in bowel function indicate that FMS can be incorporated successfully into other therapies as an optimal adjuvant (supplemental) treatment for neurogenic bowel dysfunction resulting from SCI.
Tsai PY, Wang CP, Chiu FY, et al.
J Rehabil Med. 2009 Jan;41(1):41-7.

BONE HEALTH

■ **Effect of detraining on bone and muscle tissue in subjects with chronic spinal cord injury after a period of electrically-stimulated cycling: a small cohort study.**
Five subjects with motor-sensory complete paraplegia who took part in a previous study of a high-volume functional electrical stimulation (FES) cycling program (up to 5 sessions per week for one year) participated in this follow-up investigation. Four had stopped FES cycling completely after the training phase and one continued reduced FES-cycling (2-3 times/week, for 30 min). Bone and muscle parameters were assessed in the legs using peripheral quantitative computed tomography at 6 and 12 months after the training ended. Gains achieved in the distal femur (thigh bone) by high-volume FES-cycling were partly maintained one year after stopping the program. The subject who continued reduced FES-cycling maintained 96.2% to 95.0% of the previous gain in bone mineral density and 98.5% of the increase in muscle tissue. Bone and muscle benefits achieved by one year of high-volume FES-cycling are partly preserved after 12 months of detraining, whereas reduced cycling maintains bone and muscle mass gained. This suggests that high-volume FES-cycling has clinical relevance for at least one year after detraining.
Frotzler A, Coupaud S, Perret C, et al.
J Rehabil Med. 2009 Mar;41(4):282-5.

BREATHING & COUGH

■ **Lower thoracic spinal cord stimulation to restore cough in patients with spinal cord injury: results of a National Institutes of Health-Sponsored clinical trial. Part II: clinical outcomes.**
Nine individuals with cervical SCI who were unable to produce a cough strong enough to expel secretions underwent implantation of a spinal cord stimulation (SCS) cough system to activate the expiratory (exhaling) muscles. Three weeks after implantation, participants were trained in the SCS cough system and instructed to use it every 30 seconds for 5 to 10 minutes, 2 to 3 times a day or more if needed. Follow-up at 28 and 40 weeks after implantation showed significant improvement in participants' ability to raise secretions. The need for alternative methods of secretion removal was virtually eliminated. Participants reported greater control of breathing problems and improved quality of life related to breathing issues and had fewer acute respiratory tract infections. Side effects were either short-lived or mild and well-tolerated. Restoration of cough via SCS is safe, improves life quality and has the potential to reduce the morbidity and mortality associated with recurrent respiratory tract infections in this patient population.
DiMarco AF, Kowalski KE, Geertman RT, et al.
Arch Phys Med Rehabil. 2009 May;90(5):726-32.

EXERCISE AND FITNESS

■ **Screening and habituation of functional electrical stimulation-leg cycle ergometry for individuals with spinal cord injury: a pilot study.**
Functional electrical stimulation-leg cycle ergometry (FES-LCE) has many benefits for people with SCI, including increased muscle mass, improved cardiovascular fitness, slower rate of bone density loss, decreased pressure sores and pain, and improved energy and self-image. A pre-training or habituation period is often needed to build up to the ideal program of 30 minutes of sustained cycling at >35 rpm. Thirteen subjects with SCI (mean years since injury, 7; mean age, 34.8 years; injury range, C4-T10; 7 males) were screened for this study, but six were excluded due to pain, autonomic dysreflexia, excessive spasticity or other problems and one dropped out. Following a program of three 30-minute FES-LCE sessions per week, time to attain target cycle speed for 30 continuous minutes ranged from 30 to 779 minutes (1-31 training sessions) among the 6 participants who completed the training. Despite the small sample size, demographic diversity, and varying adherence rates, the habituation process was achieved in all six participants.
Tawashy AE, Eng JJ, Krassioukov AV, et al.
J Neurol Phys Ther. 2008 Dec;32(4):164-70.

MALE FERTILITY

■ **Anejaculation: an electrifying approach.**
Men with anejaculation (inability to ejaculate) due to SCI are excellent candidates for ejaculation induction procedures and low-level assisted reproductive techniques. In many men with SCI, penile vibratory ejaculation can be performed by the patient himself, making home insemina-

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tion possible as a very low cost alternative. For this reason, surgical sperm retrieval and intracytoplasmic sperm injection should not be first-line therapy in anejaculatory men with SCI.
Ohl DA, Quallich SA, Sønksen J, et al.
Semin Reprod Med. 2009 Mar;27(2):179-85. Epub 2009 Feb 26.

■ **Is sperm cryopreservation an option for fertility preservation in patients with spinal cord injury-induced anejaculation?**
SCI in men often results in impaired erection, ejaculation, and semen quality, and for this reason only 10% of males with SCI can father children without medical assistance. While semen can be retrieved using electroejaculation (EEJ) and penile vibratory stimulation (PVS), there is often a decrease in semen quality in men with SCI, notably low sperm motility. Cryopreservation can further reduce sperm quality. To learn more about its effects, this study compared sperm samples from 14 men with SCI and 14 men without. Before cryopreservation, there was no difference in concentration or total sperm count between the two groups; however, the SCI group had significantly lower ejaculate volume, decreased sperm morphology, and an increase in the round cell and neutrophils counts. In both groups, cryopreservation resulted in increased DNA fragmentation, a decrease in mitochondrial activity, and a decrease in motility. However, cryopreservation did not bring more damage to sperm from infertile men with SCI than to sperm from control subjects.
da Silva BF, Borrelli M Jr, Fariello RM, et al.
Fertil Steril. 2009 May 5. [Epub ahead of print]

MORTALITY

■ **Behavioral risk factors of mortality after spinal cord injury.**
Behavioral information was collected via a survey mailed to 1,251 individuals with SCI at least one year post injury. Eight years later, 188 of these individuals had died. Data were analyzed to determine which behavioral factors were associated most strongly with mortality, and a predictive model was created. The best behavioral predictors were: smoking, binge drinking (number of episodes with 5 or more drinks), prescription medication use, and number of hours out of bed per day. Inclusion of these variables improved prediction of survival compared with biographic and injury variables alone. The results affirm the importance of avoiding basic risk behaviors, such as smoking and alcohol misuse, and affirm their importance as targets of intervention during SCI rehabilitation.
Krause JS, Carter RE, Pickelsimer E.
Arch Phys Med Rehabil. 2009 Jan;90(1):95-101.

NUTRITION

■ **Nutrient intake and body habitus after spinal cord injury: an analysis by sex and level of injury.**
Seventy-three individuals with SCI (C5-T12; ASIA A or B) were divided into 4 groups: male tetraplegia (N = 24), male paraplegia (N = 37), female tetraplegia (N =1), and female paraplegia (N = 11). Mean age was 38 years; 34% were white, 41% were African American, and 25% were Hispanic. Participants completed a 4-day food log examining habitual diet. Dietary composition was analyzed. Excluding the one woman with tetraplegia, total calorie intake was below the average for the general population. The female paraplegia group tended to have a healthier diet than the other groups, with lower total calorie intake and recommended macronutrient intake. The male tetraplegia group, male paraplegia group, and the one woman with tetraplegia all had higher than recommended fat, sodium and alcohol intake but inadequate intake of several vitamins, minerals, and macronutrients. Using adjusted BMI tables, 74.0% of participants were overweight or obese. Most people with SCI would benefit from nutritional counseling to prevent secondary conditions associated with overweight and inadequate diet.
Groah SL, Nash MS, Ljungberg IH, et al.
J Spinal Cord Med. 2009;32(1):25-33.

WHEELCHAIR SEATING & PROPULSION

■ **Seat height: effects on submaximal hand rim wheelchair performance during spinal cord injury rehabilitation.**
Twelve persons with SCI (age range 19-77 years; C5/C6-L2; 7 men; 8 incomplete) performed eight submaximal hand rim wheelchair exercise tests on a computer-controlled wheelchair ergometer at eight different seat heights. Elbow angle was used as a measure of seat height. Physical strain and mechanical efficiency changed significantly when seat height changed. Optimal elbow angle was between 100-130 degrees. Lower seat heights were clearly harmful. Forces on the hand rims were also affected by seat height, such that increasing seat height resulted in lower forces. Findings suggest that optimal seat height during SCI rehabilitation may lead to more efficient and less straining conditions for manual wheeling.
van der Woude LH, Bouw A, van Wegen J, et al.
J Rehabil Med. 2009 Feb;41(3):143-9.

■ **Implanted electrical stimulation of the trunk for seated postural stability and function after cervical spinal cord injury: a single case study.**
A 44-year-old man with complete C4 SCI, 20 years post injury, received a surgically implanted neuroprosthesis to stimulate the hip and trunk muscles. The subject was trained to use the device and perform conditioning exercises independently at home. Testing to determine the physical and functional effects of the neuroprosthesis started six months after implant surgery and continued every month for four months. Outcomes were assessed with and without stimulation, so the subject served as his own control. Stimulation improved control of the paralyzed torso and had a positive impact on spinal alignment, seated posture, pulmonary function, trunk stability, and reach. Stimulation of hip and trunk muscles can improve performance of activities of daily living as well as enable independent wheelchair and bed mobility.
Triolo RJ, Boggs L, Miller ME, et al.
Arch Phys Med Rehabil. 2009 Feb;90(2):340-7.

■ **Biomechanical Analysis of Functional Electrical Stimulation on Trunk Musculature During Wheelchair Propulsion.**
Eleven participants with SCI propelled their own wheelchairs on a dynamometer for three 5-minute trials. During each trial, 1 of 3 stimulation levels (HIGH, LOW, and OFF) was randomly applied to the participant's abdominal and back muscle groups with a surface functional electrical stimulation (FES) device. Propulsion kinetics, trunk kinematics, metabolic responses, and surface electromyographic (EMG) activity of 6 shoulder muscles were collected. Kinetic, kinematic, and EMG variables were recorded during 3 time intervals (30 seconds each) within a 5-minute trial. Metabolic variables were recorded through the entire 5-minute trial. Participants with HIGH stimulation increased their gross mechanical efficiency during wheelchair propulsion. No differences were found in shoulder EMG activity, energy expenditure, and trunk motion between stimulation levels. FES on the trunk may help manual wheelchair users with SCI improve propulsion efficiency without placing additional demands on shoulder musculature.
Yang YS, Koontz AM, Triolo RJ, et al.
Neurorehabil Neural Repair. 2009 Mar 4. [Epub ahead of print]

Spinal Cord Injury Update is supported by grant H133N060033 from the National Institute on 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 14 model SCI care systems nationwide. Project Director: Charles Bombardier, PhD.

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Visit our Web site: *http://sci.washington.edu.*

Announcements

Project to Improve Symptoms and Mood after SCI

Do you have a spinal cord injury? Do these symptoms bother you: poor sleep, low energy, little interest in usual activities, low mood, feelings of worthlessness or pain? The Project to Improve Symptoms and Mood after Spinal Cord Injury (PRISMS) is the first federally funded clinical trial of an antidepressant for people with traumatic spinal cord injury (SCI). If you have an SCI, are 18-64 years old, have several of these symptoms, are not taking venlafaxine XR and live within 100 miles of Seattle, WA, Birmingham, AL, Chicago, IL, Ann Arbor, MI or Dallas, TX you may qualify for this trial. Please contact Christian Buhagiar at (866) 577-8067 if interested.

We want your feedback!

Help us improve our newsletter. Please complete the enclosed one-page reader survey and mail it in as soon as possible. No postage necessary.

If you prefer to complete the survey online, please go to: *https://catalysttools.washington.edu/webq/survey/csalzman/79160.*

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Read or subscribe to this newsletter at *http://sci.washington.edu/info/newsletters.*

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Summer 2009 • Volume 18, Number 2
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Spinal Cord Injury Update Reader Survey

1. Please tell us whether you are a (check only one):

- ❑ Person with a spinal cord injury.
- ❑ Family member or friend of someone with a spinal cord injury.
- ❑ Physician
- ❑ Other health care provider
- ❑ Other: _____

2. How long have you been receiving or reading this newsletter? (Check one.)

- ❑ This is my first issue.
- ❑ Less than one year.
- ❑ About 1–2 years
- ❑ About 2–5 years
- ❑ More than five years

3. Where do you live? (Check one.)

- ❑ Western Washington
- ❑ Eastern Washington
- ❑ Alaska, Montana, Wyoming, or Idaho
- ❑ Other State in U.S.
- ❑ Outside U.S.

4. For each of the questions below, please **check the box** that most closely matches your opinion.

a. The information in the newsletters has been generally useful to me, my family or my patients.

❑ Strongly disagree ❑ Disagree ❑ Unsure ❑ Agree ❑ Strongly Agree

b. I have learned new information from the newsletters.

❑ Strongly disagree ❑ Disagree ❑ Unsure ❑ Agree ❑ Strongly Agree

c. I have changed a behavior or taken some action based on information from the newsletters.

❑ Strongly disagree ❑ Disagree ❑ Unsure ❑ Agree ❑ Strongly Agree

d. For persons with SCI only: Information in the newsletters has helped improve my health or quality of life.

❑ Strongly disagree ❑ Disagree ❑ Unsure ❑ Agree ❑ Strongly Agree

e. For all others: Information in the newsletters has helped improve the health or quality of life of my family member, friend, patient(s) or client(s) with SCI.

❑ Strongly disagree ❑ Disagree ❑ Unsure ❑ Agree ❑ Strongly Agree

5. How would you rate the newsletter overall?

❑ Poor ❑ Fair ❑ Good ❑ Very good ❑ Excellent

6. How often have you visited our Web site **in the past year**?

❑ Never ❑ 1–2 times ❑ 3–5 times ❑ 6 or more times

7. We currently have 16 videos on our Web site. How many of our videos have you watched? (Please write a number between 0 and 16.) _____

8. We want to make SCI information available in the most useful format(s) for you. From the list below, please rank each item according to how likely you are to use each one (1= most likely to use, 2 = next most likely, etc.).

_____ Written information on the Web
_____ Videos on the Web
_____ DVDs or CDs sent to you in the mail
_____ Newsletters and other written materials sent to you in the mail
_____ Attending in-person forums (such as our SCI Forums) or other presentations or meetings
_____ Podcasts of video presentations
_____ YouTube videos
_____ Other: _____

9. To help us plan future programs and research, please let us know your top concerns having to do with living with a spinal cord injury.

1. _____
2. _____
3. _____

10. Please feel free to add any further comments or suggestions.

_____

_____

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Please fold here, tape shut (no staples!) and mail with address on outside.

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