spinal cord injury UPDATE

Department of Rehabilitation Medicine

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INSIDE:

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Fitness After SCI: *How to Get Started*

We all know physical activity is important for good health. This is as true for people with SCI as it is for the general population. But the barriers to getting exercise and staying fit are especially challenging for those with SCI .

Because moving about is difficult for people with SCI, they can easily fall into a "cycle of deconditioning" (Figure 1), whereby inactivity causes changes in the body that make it even harder to move about and be active, and this further dampens the motivation to be active.[1] The process of losing fitness may begin with the sudden changes in muscular function caused by SCI, but it is perpetuated and aggravated by lack of physical activity. Furthermore, long-term inactivity produces harmful effects on body function and structures: slowing bowel motility; weakening bones, joints, and muscles; and causing the heart and lungs to work harder.

Effects of Physical Activity

Research has shown that regular physical activity decreases the risk of heart disease, diabetes, high blood pressure and colon cancer; reduces depression and anxiety; helps control weight; and helps build and maintain healthy bones, muscles and joints.

In the SCI population, physical activity results in improved breathing ability; greater muscle strength and stamina; improved blood circulation; decreased body fat; more normal levels of fats (lipids) in the blood; improved self-esteem; decreased depression; improved immune system function; decreased risk of diabetes; slowing of bone loss, and better bowel function.

Physical activity also has been shown to help prevent common secondary conditions related to SCI, such as urinary tract infections, pressure sores, respiratory infections and constipation. These problems are more common in people who are inactive, and people with SCI who are most active (athletes) have fewer of these problems than those who are less active.[2]

There are some physiological responses to exercise that are unique to SCI. People with an injury at T-4 or above are less able to increase heart rate and control blood pressure while exercising, and blood in the legs does not return to the heart and lungs as easily. As a result, the positive cardiac effects are not as strong as they are in people who have more autonomic nervous system control.

SCI may cause changes in the sympathetic nervous system that can keep blood pressure low during very hard exercise. This low blood pressure may not be noticed and returns to normal after exercise ends. Such exercise responses need not prevent low to moderate level activity, but those wanting to do more strenuous continuous exercise (such as marathon wheeling or handcycling) should consult with a physical therapist or physician knowledgeable about SCI to get specific advice about how to minimize light-headedness or other problems related to low blood pressure or heart rate.

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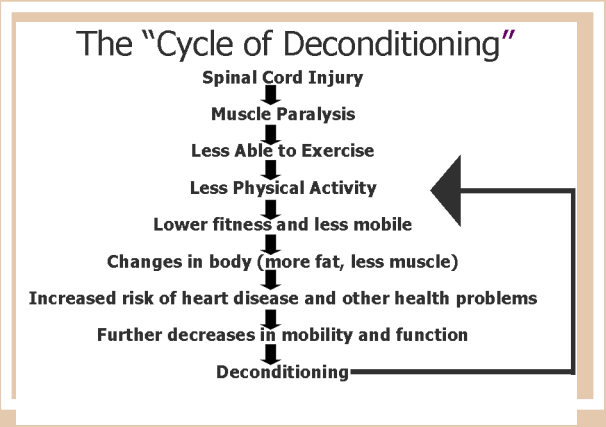

Figure 1

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Lifestyle Physical Activity—A Practical Approach to Exercise

Deciding to become more active raises many questions: What do I need to do to get fit? What will help me become more active? What things might get in the way? The answers may surprise you and help you take the first step toward increasing your activity levels.

In recent years health researchers have shown that fitness (defined as the physiological improvements that result from activity) can be achieved without embarking on a formal exercise program. Called "lifestyle physical activity," this approach includes any movement of the body that is produced by the muscles and uses energy.

While "exercise" is often a planned, structured, repetitive activity that may require knowing specific movements or skills, lifestyle physical activity can occur anywhere and be a part of whatever you are doing. One example is doing household chores that involve torso or arm movement, especially with the arms above the level of the heart. Adding "wheeling" time to your day is another way to increase activity.

Physical activity can range in intensity from low to high (see sidebar: *How to rate your exercise intensity.*). Low or moderate intensity activity is the best way to become active because it helps build confidence and reduces the chance of injury. Moderate activity produces the same health benefits as high intensity activity, and it does not have to be done all at once to be beneficial. Studies have shown that three 10-minute sessions of activity worked into the course of a day may have the same health benefits as longer sessions. People who begin physical activity with this approach (moderate intensity, short sessions) are more likely to adopt activity as a habit and may choose to pursue more vigorous activity (like exercise or sports) at a later time, often because they feel better and have more energy.

The "lifestyle" approach to increasing physical activity was recently tested in a research study that included 16 people with SCI (C6 level or below) who were not regular exercisers.[3] The nurse researcher helped participants develop a personal plan for becoming more active based on preferences, schedules, opportunities, motivators, and barriers to becoming active.

After six weeks on their personalized programs, 60% of participants significantly increased their level of activity (recorded with an activity monitor). They had significant increases in upper extremity muscle strength and improvements in self-rated health, confidence, and motivation to exercise. Participants reported that the lifestyle physical activity approach was easy to do and did not interfere with other activities.

Study participants chose an interesting assortment of activities that fit their schedules: using exercise tubing while doing something inactive (watching television or taking a break from computer work); lifting weights or doing stretching exercises to break up an inactive period; increasing wheelchair wheeling time by mall wheeling, parking farther from a destination, or doing a lap during downtime at a youth sporting event. Some chose traditional exercise (exercise videos, upper extremity ergometry, mat exercises, bed push-ups, wheelchair arm "dips," using a standing table or a walker), sports (skiing, target shooting, swimming), or lifestyle

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How to rate your exercise intensity:

People with SCI usually cannot use heart rate as a measure of exercise intensity. In the absence of a standardized scale for the SCI population, a good way to gauge workout intensity is to pay attention to what your body tells you about how hard you are working; this is called "perceived exertion."

Rating exertion on a 0 to 10 scale—where 0 = no intensity, 2 = light intensity, 3 = moderate intensity, 5 = heavy or hard intensity, and 10 = very, very high intensity—has been shown to be a valid and reliable indicator of exercise intensity.[4]

Inactive people should begin with light intensity activity and gradually increase to moderate intensity. More fit folks can safely work in the 4 to 6 (high intensity) range.

Getting Started

◆ **Ask: What can I do now?** Begin by doing it three to four times a week, then increase duration or intensity by 10% to 20% each week. Gradually add new activities.

◆ **Consult a health care provider if you have arm or shoulder pain**. Overuse is often caused by doing things the wrong way rather than too much.

◆ **Prevent overuse syndromes:** Vary your activities from day to day, strengthen your upper back and posterior shoulder muscles, and stretch the muscles in front of your shoulders and chest.

◆ **If you have tetraplegia (quadriplegia):** Exercise in a cool environment to prevent overheating. Take measures to prevent low blood pressure by wearing support hose, ace wraps and an abdominal binder. Stop exercising if you develop dizziness, nausea, or light-headedness. Know the symptoms of autonomic dysreflexia (AD). Exercise does not commonly induce AD, but this can occur in some individuals.

◆ **Follow the START plan**:

1. **S**chedule: Where does activity or exercise fit into your day? When are you sitting still way too long? Could you add activity to an inactive task?
2. **T**iming: Is this the right time in your life to make a change?
3. **A**ctivity: What do you like to do? Do you prefer outside or indoors? Alone or in a group?
4. **R**esources: Determine whether you need equipment, classes, videos, a helper, etc.
5. **T**racking: Keep track of your activities. Create benchmark goals, and reward yourself when you follow through with your plan.

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activities (housework, gardening, arm movements during television, painting), or a combination of these. Those who had been the most inactive increased their activity levels by spending more time out of bed. While this study did not examine weight loss or cardiac fitness, it did demonstrate that the lifestyle activity approach is a feasible way to increase physical activity and exercise in people who have significant barriers to improving their physical fitness.

—Catherine Warms, PhD RN, ARNP, CRRN, UW School of Nursing, and Cynthia Salzman, MHA, UW Rehabilitation Medicine

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1. Washburn, R.A. & Figoni, S.F. (1999). High density lipoprotein cholesterol in individuals with spinal cord injury: The potential role of physical activity. *Spinal Cord, 37,* 685-695.

2. Stotts, K.M. (1986). Health maintenance: Paraplegic athletes and nonathletes. *Archives of Physical Medicine and Rehabilitation, 67,* 109-114.

3. Warms CA, Belza BL, Whitney JD, Mitchell PH, Stiens SA. (2004). Lifestyle physical activity for individuals with spinal cord injury: A pilot study. *American Journal of Health Promotion. 18*(4):288-291.

4. Borg, G. (1998). *Borg's Perceived Exertion and Pain Scales.* Champaign, IL: Human Kinetics.

Web Resource: The National Center on Physical Activity and Disability (*www.ncpad.org*) is a one-stop information center concerned with physical activity and disability, and offers resources, links, discussion forums, exercise guidelines, and more.

Why does everyone want my autograph?

If you have been to a doctor, dentist, or pharmacy in the past year, you may recall being asked to sign something called a HIPAA form. At first glance, these forms may look like many of the other documents you have had to sign over the years. The forms can sometimes be confusing, especially when they are written in legal jargon. You may be left wondering—what exactly am I agreeing to here?

Simply stated, the HIPAA regulations exist to protect patient privacy. HIPAA (pronounced "hippa") stands for the *Health Insurance Portability and Accountability Act*, which was passed by Congress in 1996 to establish nationwide privacy standards that protect patients' medical records and other health information provided to health plans, doctors, hospitals and other health care providers. These new regulations took effect on April 14, 2003.

In addition to requiring new safeguards to protect the security and confidentiality of health information, HIPAA regulations also provide patients with access to their medical records and more control over how their personal health information is used and disclosed. The regulations represent a uniform, federal level of privacy protections for consumers across the country.

Health insurers, doctors, and other health care providers must provide a notice to their patients describing how they will comply with HIPAA regulations and protect personal health information. Starting April 14, 2003, doctors, hospitals and other direct-care providers have been required to provide this HIPAA notice to their patients. The notice was provided to patients on their first visit after April 13, 2003, and is currently provided any time you go to a new health care provider. Patients are asked to sign, initial or otherwise acknowledge that they received this notice. Your signature means: "Yes, this provider notified me about how he/she will use my health information and protect my privacy."

The Northwest Regional Spinal Cord Injury System also must comply with HIPAA regulations. Many of you have been enrolled in our spinal cord injury follow-up study for 1, 5, 10 and even 20-plus years. When you first enrolled in the project, you signed consent forms to allow us to collect data on you and your spinal cord injury care. To comply with the new HIPAA regulations, we may be contacting you to read and sign one of our new HIPAA forms, if you have not already done so. The forms explain how information about you will be used and protected.

Your continued involvement in our follow-up study is very important—over the years, information from this national study has contributed to the improvement of SCI care all over the world. So please take the time to read, discuss, question and return the forms to us with your signature. The new regulations are in place for your protection.

—Norma Cole, MSW, LICSW
UW Rehabilitation Medicine

NWRSCIS Researchers Win Awards

The director and co-director of the Northwest Regional Spinal Cord Injury System (NWRSCIS) received awards at the 30th Annual Scientific Meeting of the American Spinal Injury Association (ASIA) on May 14-16, 2004, in Denver, Colorado.

Charles H. Bombardier, PhD (left), UW associate professor of rehabilitation medicine and co-director of the NWRSCIS, won first place for best poster, which was titled "Symptoms of major depression in people with spinal cord injury: Implications for screening." It will be published in a forthcoming issue of *Archives of Physical Medicine and Rehabilitation*.

Diana D. Cardenas, MD, MHA (right), UW professor of rehabilitation medicine and director of the NWRSCIS, received second place for best presentation. Her talk was titled "Rates and causes of rehospitalization after SCI" and will be published in the *Archives of Physical Medicine and Rehabilitation*.

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, and caregivers, held monthly at the University of Washington Medical Center during the fall, winter and spring. 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.

Home Modification After SCI

January 13, 2004—Returning home from the hospital for the first time after an SCI often means facing a host of accessibility problems: getting up the front stairs, through the front door, or into the bathroom may now require some kind of modification, such as new equipment or remodeling. In extreme cases, moving to a new home presents the only practical solution.

In the 20 years since he was injured, Kirk Hennig has remodeled his home three times. "Your needs likely will change over time," he said. "You can't expect one remodel to be perfect forever." Changes in health and family circumstances often require modifications over the years. Hennig cochairs the Northwest Regional Spinal Cord Injury System's Consumer Advisory Board (CAB) and served as moderator of this evening's forum.

Connie Hollerith, who also serves on the CAB, learned the hard way that "accessible home" means different things to different people. After her teenage son Nick Hart was injured several years ago, she rushed out to find an accessible dwelling for him to come home to. "I found a place that was called accessible," she recalled. "I brought him home, but the carpets were too thick for the wheelchair. Also, it was on the third floor, and the elevator kept breaking down."

"So I went into a condo that already had a ramp," she continued. "I was so excited. But it turned out the ramp was too steep, and he couldn't go up it by himself." She also quickly discovered that her son's wheelchair was wider than the prior occupant's had been and wouldn't fit through some of the doorways. So she had to give up on that place, too. Listings for accessible homes or apartments only tell part of the story, Hollerith said. They need to be investigated thoroughly.

Hollerith now brings this personal experience to her business, Pyramid Affiliates, a real estate, mortgage and escrow firm in Edmonds, Wash. (866-672-8575; *www.pyramidaffiliates.com)*. She and her son, who now works with her, help clients with disabilities find homes that meet their accessibility needs.

"If you know what (modifications) a home needs, you can write up a purchase and sale based on that contingency," said Hollerith. "You can write it into the financing as well." She and Hart have worked with a variety of creative loan programs that can be used to pay for modifying an existing dwelling or purchasing an accessible home. "Some don't even require a down-payment," Hart said.

For many people, getting inside their homes is their biggest accessibility problem. Jerry Otis teamed up with Snohomish County United Way in 2002 to create the Regional Access Mobility Program (RAMP) "so folks can get into the home they want to live in." This program builds ramps for people in Snohomish, Island, Skagit and King Counties of Washington State (RAMP; 2812 Lombard Ave., #207, Everett, WA 98201; 425-259-7922; *Jerry12102@aol.com*).

Architect Garreth Schuh began his career as a traditional architect, but after his spinal cord injury more than a decade ago he started working with clients who are disabled, elderly, or facing disabling illnesses like Parkinson's disease. Schuh subscribes to a design philosophy he calls "transgenerational design," also known as "universal design." By definition, these designs are accessible to everyone, regardless of age, ability level, or health, and can accommodate a person comfortably from the prime of life to the frailty of old age. Now in the thick of remodeling his own home, he is acutely attuned to home accessibility issues. (Garreth Schuh Architectural Design can be reached at 206-988-5956 or *garrethschuh@yahoo.com.*)

Bill Morrell's company, Adaptive Installations (800-765-1969 or 206-762-1969; *medsurgsys@aol.com*; *www.adaptiveinstallations.com*), specializes in accessible home modification and the installation of specialty equipment. When doing a home modification assessment, he first looks at entrances. Ramps are often the best solution to getting up the front stairs, "but not always. For every one foot of rise you need 30 feet of ramp," he explained. "If you have five steps up to the front door, each seven inches high, you'll need 35 feet of ramp. Plus, for every 30 feet you need a level landing area or a switchback, adding to the length (and cost) of the ramp." A ramp this long could easily overwhelm the entire front yard, detracting significantly from the home's appearance and taking a big bite out of your budget.

Morrell tries to find creative solutions to access problems that are both economical and attractive. He has created ramps that masquerade as paved pathways through gardens or between trees. When ramps are impractical, he may use a wheelchair lift, often tucking it behind vine-covered screens or lattices. The break-even cost of a ramp versus a lift is about 35 feet. Ramps more than 30 inches off the ground also require a railing—an added cost. While costs vary somewhat between different homes, Morrell installs an enclosed lift for about $22,000, an unenclosed lift for half that, and a small porch lift for $5,000 or less. He noted that every home should have a second wheelchair-accessible exit for emergencies.

Bathrooms are a frequent problem for the wheelchair user. Morrell often must widen doorways, install new sinks, replace tubs with roll-in-showers, and/or knock down walls. According to PVA guidelines (see Resources, page 5), accessible showers should be 48 by 48 inches. But the space left after ripping out the tub may not be big enough. Morrell often builds custom roll-in showers because he works with spaces that won't accommodate ready-made fiberglass basins and shower stalls, which only come in limited sizes.

Since wall-hung shower benches can eventually damage the wall, Morrell prefers four-legged benches that fold up against the wall. He often installs a collapsible water-retaining edge for the shower that allows a wheelchair to roll across, then pops right up again to keep the water inside while showering. Morrell often has to fashion one-of-a kind sinks, such as cutout counter tops to accommodate joysticks, offset faucet fixtures,

and creative under-sink plumbing arrangements to allow space for a wheelchair to roll in.

Bedroom solutions may include cabinets that swing around a pedestal in place of drawers, closets with low bars for hanging, and lots of closet organizers. "With medical supplies and such, you can never have too much storage," Morrell said. Vertical floor-to-ceiling poles that accommodate a horizontal bar or trapeze can help with transfers in and out of bed. Overhead lift systems can be permanently mounted into a track, or they can be portable and attach to other tracks installed throughout the house. "The lift can be hooked up to a track in the bathroom, in the family room to lift a person into a chair, or into the hot tub or Miata convertible," he added, playfully. Some portable systems can be packed into a bag and brought along on trips.

In homes with more than one floor, Morrell frequently installs stairway lifts. "You can avoid putting in a (more costly) elevator if a person can transfer to a lift chair and onto another chair at the next level," he said.

If a basement laundry room is inaccessible, the solution may be a compact all-in-one washer-dryer combo in an upstairs closet that works on 110 watts and doesn't need a vent, Morrell said. "The unit is $1,100, but that's less expensive than installing a stairway lift" to access the basement.

Morrell installs a number of environmental control systems that use voice commands or switches to answer the phone, change the heat, turn on the lights. "It's not difficult technology," he said. He recommends keypads for home security rather than locks, because changing the code is easier than replacing locks every time you change caregivers or hired help.

Some insurance companies may cover modifications if they are considered medically necessary and documented in a letter of justification written by an occupational therapist. Funds for modifications may also be available from civic and government organizations (see Resources, below).

Home Modification Resources

Rebuilding Together This nonprofit home repair and rehabilitation program (with local affiliates around the country) helps low-income seniors and persons with disabilities to remodel or repair their homes. National office: 800-473-4229; *info@rebuildingtogether.org; www.rebuildingtogether.org/*. **Rebuilding Together Seattle**, 306 Westlake Ave N, Ste 400, Seattle, WA 98109; 206-682-1231; *info@rtseattle.org*; *www.rtseattle.org*.

Pyramid Affiliates, a real estate, mortgage and escrow firm experienced in serving clients with disabilities, at 8117 240th ST SW, Edmonds, WA; 866-672-8575; *www.pyramidaffiliates.com*.

Regional Access Mobility Program (RAMP; 2812 Lombard Ave., #207, Everett, WA 98201; 425-259-7922; *Jerry12102@aol.com*.

Garreth Schuh Architectural Design specializes in home remodel and new construction designs for persons with disabilities. (206-988-5956 or *garrethschuh@yahoo.com*.)

Adaptive Installations (800-765-1969/206-762-1969; *medsurgsys@aol.com*; *www.adaptiveinstallations.com)* specializes in accessible home modification and the installation of specialty equipment.

Paralyzed Veterans of America (PVA) guideline *Accessible Design: Architectural Solutions for the Wheelchair User* costs $22.95; to order, call 888-860-7244 or order online at *www.pva.org/livingsci/architecture/archindex.htm*.

King County's Home Accessibility Modification (H.A.M.) Program provides financial assistance for low and moderate income tenants to make accessibility modifications to their rental unit (206-296-7640; *www.metrokc.gov/dchs/csd/Housing/RepairHAM.htm*).

Master Builders Care Foundation builds free wheelchair ramps at their annual spring **Rampathons** for qualifying low-income disabled and elderly homeowners. For information and applications, contact Master Builders Care Foundation, 335 116th SE, Bellevue, WA 98004; 425-451-7920; *mbcare@mbaks.com*.

Centers for Independent Living are federally funded programs that provide information, referral and other assistance relating to accessibility and other issues for persons with disabilities. There are several centers in Washington State, including the WA Coalition Of Citizens With Disabilities (4649 Sunnyside North, Suite 100; Seattle, WA 98133; 206-545-7055 or 206-632-3456; Web: *http://www.wccd.org*; email: *info@wccd.org)*. To find the center nearest you, look in the blue U.S. Government Offices pages of the local phone book under "Disabilities" or "Education, Department of."

Habitat for Humanity is a nonprofit housing organization that builds affordable houses in partnership with persons who lack adequate shelter. Find the affiliate nearest you by visiting *www.habitat.org/* or call 800-422-4828.

Easter Seals of Washington assists persons with disabilities (children and adults) and their families with access, mobility, assistive technology and other needs, through a nationwide network of more than 450 service sites. (*www.easterseals.com/*; Washington State office: Mabel Dilley, 260-281-5700 or 800-678-5708 Ext. 123.)

Community Access Washington State has a "Quick Guide to Accessible Housing for People with Disabilities" at *http://depts.washington.edu/caws/guide_ho.shtml*.

Universal Design Home Modification, a resource on the AARP Web site, gives a room-by-room tour of home modification solutions using the principles of universal design. Visit *www.aarp.org/universalhome/* or call the AARP at 888-687-2277.

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*

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).

COMPLICATIONS

■ Is there a relationship between chronic pain and autonomic dysreflexia in persons with cervical spinal cord injury?

Of 181 persons with chronic cervical SCI who reported pain in a previous study, 117 (64.6%) completed a mail-in survey on autonomic dysreflexia (AD), demographic factors, clinical characteristics of pain, and affective symptoms. The only difference between those who did and did not respond to the survey was that responders tended to be injured longer (average 2.5 years) than non-responders. Thirty-five people (29.9%) reported AD. Those with AD reported more painful areas, had more anxiety and sadness, and more common aggravation of pain due to muscle spasms, infections, full bladder, and constipation. A combination of having widespread pain, experiencing aggravation of pain due to infections, having a complete injury, and experiencing anxiety, significantly predicted AD. Since the mechanisms underlying pain may also elicit AD, attention to pain as a triggering factor appears to be warranted.

Widerstrom-Noga E, Cruz-Almeida Y, Krassioukov A.
J Neurotrauma. 2004 Feb;21(2):195-204.

■ Cost-effectiveness of duplex ultrasound surveillance in spinal cord injury.

A retrospective review of 369 subjects with SCI who received duplex ultrasound on admission for inpatient rehabilitation found that 37 (10.03%) had deep venous thrombosis (DVT) during their inpatient stay. A statistical model analyzing costs and mortality (from pulmonary embolism) found that the cost of one life saved when performing admission duplex ultrasound surveillance is calculated to be $61,542, with cost per life-year gained between $1,193 and $9,050, depending on age at time of injury and severity of injury. Since this compares favorably with the cost-effectiveness of other currently accepted mass screening programs, duplex ultrasound is considered to be a cost-effective tool for DVT surveillance in individuals with acute traumatic SCI.

Kadyan V, Clinchot DM, Colachis SC.
Am J Phys Med Rehabil. 2004 Mar;83(3):191-7.

■ Gabapentin is a first line drug for the treatment of neuropathic pain in spinal cord injury.

To determine the efficacy, effective dose, and side-effect profile of gabapentin (GBP) in the treatment of neuropathic pain related to SCI, 20 patients with paraplegia participated in an 18-week, prospective, randomized, double blind, placebo-controlled, crossover clinical trial consisting of a 4-week GBP /placebo titration period; 4-week stable dosing; 2-week washout; followed by two 4-week periods of crossover titration and dosing. GBP significantly reduced the intensity and frequency of pain; relieved all neuropathic pain descriptors except itchy, sensitive, dull, and cold types; and improved quality of life. GBP had minor adverse effects in this study and all subjects completed the trial.

Levendoglu F, Ogun CO, Ozerbil O, et al.
Spine. 2004 Apr 16;29(7):743-51 Spine. 2004 Apr 16;29(7):743-51

■ Effects of regular use of neuromuscular electrical stimulation on tissue health.

Eight subjects with SCI (C6-T12) with implanted neuromuscular electrical stimulation (NMES) systems (for participating in a standing and transfer study) had their tissue health evaluated through 1) monitoring tissue oxygen levels in the ischial region, and 2) measuring interface pressures at the seating support interface. Baseline assessments were done at study enrollment and repeated on completion of an 8-week conditioning exercise program that included several stimulation patterns. Unloaded tissue oxygen levels in the ischial region tended to increase following the NMES exercise program but was not statistically significant. While overall mean interface pressure showed no significant differences between baseline and after the exercise program, pressures in the ischial region showed a significant decrease, indicating a quantifiable benefit to tissue health.

Bogie KM, Triolo RJ.
J Rehabil Res Dev. 2003 Nov-Dec;40(6):469-75.

MUSCULOSKELETAL

■ Longitudinal analysis of cartilage atrophy in the knees of patients with spinal cord injury.

The right knees of 9 patients with complete SCI were examined shortly after the injury (mean +/- SD 9 +/- 4 weeks) and at 6 and 12 months postinjury. Three-dimensional morphology of the patellar, tibial, and femoral cartilage (mean and maximum thickness, volume, and surface area) was determined from coronal and transversal magnetic resonance. Total knee cartilage volume (patella, medial and lateral tibia, and medial and lateral femur) was reduced by 7% at 6 months and by 10% at 12 months postinjury. In this study, knee cartilage atrophied at a higher rate than that observed in osteoarthritis (OA). Cartilage thinning after SCI may affect stress distribution in the joint and render it vulnerable to OA. Future studies should focus on specific exercise and rehabilitation programs to prevent cartilage thinning.

Vanwanseele B, Eckstein F, Knecht H, et al.
Arthritis Rheum. 2003 Dec;48(12):3377-81.

■ Increased blood pressure can reduce fatigue of thenar muscles paralyzed after spinal cord injury.

Eight subjects with cervical SCI (C4-C6) and low blood pressure (64 +/- 2 mmHg) performed two experiments in random order in which the fatigability of the thenar muscles was assessed in response to repetitive electrical stimulation of the median nerve. In one test, a concurrent sustained voluntary contraction of the contralateral elbow flexors was used to increase resting mean arterial pressure (MAP) (by 22%, on average). The second test had no voluntary contraction. In seven subjects, changes in MAP with exercise correlated with changes in thenar muscle fatigue. For every 10% increase in MAP, fatigue was reduced by approximately 3%. The data suggest that low blood pressure after chronic cervical SCI and poor blood pressure control during exercise exacerbate the fatigability of paralyzed muscles.

Butler JE, Ribot-Ciscar E, Zijdewind I, et al.
Muscle Nerve. 2004 Apr;29(4):575-84.

■ Shoulder pain and its consequences in paraplegic spinal cord-injured, wheelchair users.

Of 56 individuals with SCI (≥1 year duration) who responded to a questionnaire, 21 (37.5%) reported having shoulder pain in the last month. Subjects who reported shoulder pain did not differ from those without pain regarding age, gender, years of wheelchair use, weekly hours of work, number of transfers per day, participation in sports, or time spent in the wheelchair per day. Thirteen of the respondents with pain received further examination by a physical therapist and standardized questionnaires on the

effect of shoulder pain on activity and participation. Fifty-two problems with occupational performance due to shoulder pain were identified, and 54% of these were related to self-care activities that involved wheelchair use, such as loading the wheelchair into the car, pushing up ramps, and transferring.
Samuelsson KA, Tropp H, Gerdle B.
Spinal Cord. 2004 Jan;42(1):41-6.

■ **Bone density loss after spinal cord injury: elite paraplegic basketball players vs. paraplegic sedentary persons.**
Seventeen male basketball players and 17 sedentary males—all with paraplegia—were matched for age and time since injury. Bone mineral densities (BMD) of the distal third of the radius of the dominant arm, L2-L4 spine, and the trochanters, Ward's triangles, and femoral necks of both hips were measured using Lunar DPX-MD dual x-ray absorptiometry. Below the lesion level, no significant difference was found between the two groups. Radial BMD was significantly higher in the athletes than the sedentary group, whereas the groups were not significantly different for lumbar density.
Goktepe AS, Yilmaz B, Alaca R, et al.
Am J Phys Med Rehabil. 2004 Apr;83(4):279-83

OUTCOME

■ **High Rates of Neurological Improvement Following Severe Traumatic Pediatric Spinal Cord Injury.**
Of 4,876 pediatric trauma cases at a Los Angeles hospital between 1993 and 2001, 30 involved SCI (7 craniocervical, 12 cervical, 5 thoracic, and 6 thoracolumbar) with neurologic deficit (20 ASIA grade A, two ASIA B, six ASIA C, two ASIA D). Of the 22 patients who survived their injuries, 14 (64%) made some functional improvement. Younger age, incomplete impairment, and SCI without radiographic abnormality was associated with likelihood to improve. Five of the 20 patients who initially presented with complete injuries eventually became ambulatory. Recovery of neurological function after severe injury occurs with a significantly greater incidence in children than adults, and improvements can occur over a prolonged postinjury period. These results suggest that physicians caring for this unique trauma population should exercise aggressive measures in both acute and rehabilitative phases of recovery.
Wang MY, Hoh DJ, Leary SP, et al.
Spine. 2004 Jul 1;29(13):1493-1497

■ **Outcomes after spinal cord injury: comparisons as a function of gender and race and ethnicity.**
In this multi-site, cross-sectional study, 475 participants with SCI completed questionnaires on subjective well-being (SWB), community integration and participation, health behaviors, and health. There were relatively equal portions of whites, African Americans, American Indians, and Hispanics. Approximately 40% of the sample were women. The majority of racial and ethnic differences in SWB related to specific life areas (eg, economics, employment), rather than more global outcomes (eg, community engagement, health), with whites generally reporting the best outcomes, followed by African Americans. American Indians and whites generally reported the highest participation scores, whereas limited differences were noted between the racial and ethnic groups on health indicators. Women reported lower satisfaction with health, more poor mental health days, and lower SWB related to home life, but higher SWB related to interpersonal relations.
Krause JS, Broderick L.
Arch Phys Med Rehabil. 2004 Mar;85(3):355-62

REHABILITATION THERAPIES

■ **Functional electric stimulation to augment partial weight-bearing supported treadmill training for patients with acute incomplete spinal cord injury: A pilot study.**
Fourteen inpatients with acute incomplete SCI (ASIA C or D) participated in a before-after crossover trial of partial weight-bearing (PWB)-supported treadmill gait training with functional electric stimulation (FES) augmentation. The intervention consisted of walking on a treadmill for up to 25 minutes a day, 5 days a week for 4 weeks, and this was compared with a 4-week control period in which standard PT was given. Subjects were randomly assigned to an intervention-control or control-intervention sequence. Several parameters were measured at the end of each period. A greater increase in overground walking endurance and speed was achieved after the intervention period as compared with standard PT, indicating that PWB-supported treadmill gait training with FES had a positive effect and could accelerate gait training in persons with incomplete SCI.
Postans NJ, Hasler JP, Granat MH, et al.
Arch Phys Med Rehabil. 2004 Apr;85(4):604-10.

■ **Using an evidence-based protocol to guide rehabilitation and weaning of ventilator-dependent cervical spinal cord injury patients.**
Seven ventilator-dependent males with SCI (C2 to C7) participated in a pilot study of an evidence-based clinical protocol to improve ventilatory muscle strength and endurance in order to discontinue mechanical ventilation. The protocol consisted of pretraining optimization, as well as progressive resistance and endurance training. Following the protocol, mean maximal inspiratory pressure for low tetraplegic (C4-7) patients improved 75 percent, mean maximal expiratory pressure improved 71 percent, mean vital capacity increased 59 percent, mean on-vent endurance time increased 91.6 percent, and mean off-vent breathing time increased 76.7 percent. Both high and low tetraplegic patients achieved gains in inspiratory and expiratory muscle strength, vital capacity, on-vent endurance, and off-vent breathing times. High tetraplegic (C2) patients improved their ability to spontaneously ventilate for short periods in case of accidental disconnection from the ventilator. Low tetraplegic patients were able to discontinue mechanical ventilation.
Gutierrez CJ, Harrow J, Haines F.
J Rehabil Res Dev. 2003 Sep-Oct;40(5 Suppl 2):99-110.

UROLOGY

■ **Bladder cancer in patients with spinal cord injuries.**
Records were reviewed for 1,324 patients with SCI in a U.K. medical center; dates of SCI or first attendance at the center were between 1940 and 1998. The length of follow-up and age-specific incidence rates of bladder cancer were calculated using 5-year age bands. Overall incidence rate was also calculated. The 1,324 patients contributed a total of 12,444 person-years of follow-up. There were four cases of bladder cancer, giving an age-standardized incidence rate of 30.7 per 100,000 person-years, which is not statistically different from that of the general population. Histochemical analysis confirmed a squamous cell phenotype in these tumors.
Subramonian K, Cartwright RA, Harnden P, et al.
BJU Int. 2004 Apr;93(6):739-43.

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

UW Rehab Program Ranked Second in Nation

U.S. News & World Report's 2004 annual guide to "America's Best Hospitals" has ranked the University of Washington's rehabilitation program second in the nation and the UW Medical Center ninth overall among the 2,113 major medical centers considered in this year's survey. The UW's program is based at both UW Medical Center and Harborview Medical Center and has consistently ranked among the top ten programs for many years.

Web Site News

- Our **SCI Web Resources** page has been expanded and updated! Visit us at *http://depts.washington.edu/rehab/care/resources_sci.html* for links to sites on SCI research, medical complications, finding a rehabilitation medicine physician, women with disabilities, information in Spanish, chat rooms connecting people around the world who have SCI, and more.
- **Subscribe** to the online version of our newsletter and receive email notification each time a new issues is posted on our Web site. Send an email with your name, email address, and the reason for your interest in spinal cord injury to *scirehab@u.washington.edu*.

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**

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