NARIC
National Rehabilitation Information Center

reSearch

A collection of research reviews on rehabilitation topics from NARIC and other information resources.

Volume 5, Issue 4, July 2010

Evidence-Based Practices in Spinal Cord Injury (SCI) Rehabilitation

In this edition of *reSearch* we explore evidence-based practices in spinal cord injury (SCI) rehabilitation. According to the National Spinal Cord Injury Association (NSCIA) there are approximately 250,000 to 400,000 individuals living with SCI or spinal cord dysfunction (Retrieved July 26, 2010 from http://www.spinalcord.org/news.php?dep=17&page=94&list=1191). The incident of SCI is greater is significantly greater for men than women and the greatest likelihood of injury occurs between the ages of 16 and 30 (Retrieved July 26, 2010 from http://www.spinalcord.org/news.php?dep=17&page=94&list=1191). The causes of SCI range from motor vehicle accidents (44 percent), acts of violence (24 percent), falls (22 percent), sports (8 percent of which 2/3 are diving related), and other (2 percent). The incident of injury from falls increases over the age of 45 (Retrieved July 26, 2010 from http://www.spinalcord.org/news.php?dep=17&page=94&list=1191).

There are two types of SCI: complete and incomplete. When an individual experiences a complete injury then they may lose voluntary movement, function, or sensation equally on both sides of the body below the level of injury. Individuals who experience an incomplete injury may experience some functioning and feeling on either side of the body such as movement in one limb versus another and/or sensation in another part of the body that cannot be voluntary moved. The terms paraplegia and quadriplegia refer to the level of impairment—the lower body and the upper and lower body, respectively. Often individuals with SCI experience secondary affects such as automonic dysreflexia, bladder and bowel function, depression, pain, respiratory function, sexual function, skin care (i.e. pressure sores), and spasticity (Retrieved July 26, 2010 from http://www.spinalcord.org/news.php?dep=17&page=94&list=1190). Establishing the best evidence-based practices and protocols for SCI rehabilitation enables healthcare and rehabilitation professionals to provide the best level of care and improve the quality of life for individuals affected by SCI. For over 40 years The National Institute on Disability and Rehabilitation Research (NIDRR) has funded research on SCI; this includes more than 35 years of Model Systems research.

This edition of reSearch provides a "snapshot" of research on evidence-based practices in SCI rehabilitation. This "snapshot" presents a general overview of evidence-based practices and protocols used in evaluating, managing, and treating SCI and its various secondary conditions. The combined search terms for this edition of reSearch included: Spinal Cord Injury, SCI, Best Practices, and Evidence-based. A listing of over 150 additional descriptor terms between the NARIC, Model Systems Knowledge Translation Center (MSKTC), National Guideline Clearinghouse (NGC), Cochrane, and PubMed databases can be found at the end of this document.

A search of the REHABDATA database resulted in 11 documents published between 2004 and 2010. The MSKTC and NGC database searches resulted in 3 documents between 2007 and 2009 and 14 documents between 1998 to 2009; respectively. The Cochrane database search resulted in three documents between 2000 and 2008. Finally, a search of the PubMed database resulted in 11 documents between 1999 and 2009. The complete citations are included in this research brief.

Table of Contents

Continued from page 1 ...

Citations:

National Spinal Cord Injury Association (NSCIA). (2007). Common Questions about Spinal Cord Injury. Retrieved from http://www.spinalcord.org/news.php?dep=17&page=94&list=1190.

National Spinal Cord Injury Association (NSCIA). (2007). Facts and Figures about SCI. Retrieved from http://www.spinalcord.org/news.php?dep=17&page=94&list=1191.

NIDRR Funded Projects Related to Evidence-Based Practices in SCI Rehabilitation

In addition to document searches, we searched our NIDRR Program Database to locate grantees/projects related to evidence-based practices in SCI Rehabilitation. The search resulted in 19 NIDRR currently funded projects — 4 evidence-based and knowledge translation related projects, the 14 SCI Model Systems, and the data collection center for all SCI Model System research. Project information and their publications are offered as additional resources for our patrons.

Advanced Rehabilitation Research Training Program
Project Number: H133P050004
Email: theodore.tsaousides@mountsinai.org
www.mssm.edu/tbinet
Phone: 212/241-6547

Center on Health Outcomes Research and Capacity Building for Underserved Populations with SCI and TBI
Project Number: H133A080064
Email: cokerj@musc.edu
www.musc.edu/chp/sciorg,
www.sciandtbiresearch.blogspot.com
Phone: 843/792-7051

Client-Centered Practices in Spinal Cord Injury (SCI) Rehabilitation
Project Number: H133F090053
Email: cpapadimitriou@niu.edu
Phone: 224/234-3211

Model Systems Knowledge Translation Center (MSKTC)
Project Number: H133A060070
Email: msktc@u.washington.edu
msktc.washington.edu
Phone: 206/543-3677

Rehabilitation Research and Training Center on Secondary Conditions in Spinal Cord Injury
Project Number: H133B090002
Email: inger.h.ljungberg@medstar.net
Phone: 202/877-1694

The following list are the current SCI Model Systems and National SCI Statistical Center:

Georgia Regional Spinal Cord Injury Care System
Project Number: H133N060009
Email: lesley_hudson@shepherd.org
www.shepherd.org
Phone: 404/350-7591

Midwest Regional Spinal Cord Injury Care System (MRSCIS)
Project Number: H133N060014
www.ric.org/research/centers/MidwestRegionalSpinalCordInjuryCareSystem/MRSCICS.aspx
Phone: 312/238-0764

Mount Sinai Spinal Cord Injury Model System
Project Number: H133N060027
Email: marcel.dijkers@mssm.edu
www.mssm.edu/rehab/spinal
Phone: 212/659-8587

National Capital Spinal Cord Injury Model System
Project Number: H133N060028
www.sci-health.org, www.ncscims.org
Phone: 202/877-1425

National Spinal Cord Injury Statistical Center (NSCISC)
Project Number: H133A060039
Email: nscisc@uab.edu
www.uab.edu/nscisc
Phone: 205/934-5049

The New England Regional Spinal Cord Injury Center
Project Number: H133N060024
Email: jane.wierbicky@bmc.org
www.bmc.org/spinalcordinjurycenter/research.htm
Phone: 617/638-7316

Northeast Ohio Regional Spinal Cord Injury System
Project Number: H133N060017
Email: mroach@metrohealth.org
rehab.metrohealth.org/norscis
Phone: 216/778-8781

Northern New Jersey Spinal Cord Injury System
Project Number: H133N060022
Email: dtulsky@kesslerfoundation.net
www.kmrrec.org/nnjscis
Phone: 973/243-6849, 973/243-6916

Northwest Regional Spinal Cord Injury System
Project Number: H133N060033
Email: scirehab@u.washington.edu
sci.washington.edu
Phone: 206/685-3999

Regional Spinal Cord Injury Center of the Delaware Valley
Project Number: H133N060011
Email: Mary.Patrick@jefferson.edu
www.spinalcordcenter.org
Phone: 215/955-6579

The Rocky Mountain Regional Spinal Injury System
Project Number: H133N060005
Email: susie@craighospital.org
www.craighospital.org/Research/SCIMain.asp
Phone: 303/789-8306 (V), 303/789-8575 (TTY)

Texas Model Spinal Cord Injury System
Project Number: H133N060003
Email: dgraves@bcm.tmc.edu
www.texasmscis.org
Phone: 713/797-5946 (V), 713/797-5790 (TTY)

UAB Model Spinal Cord Injury Care System
Project Number: H133N060021
Email: mott@uab.edu
main.uab.edu/show.asp?durki=10712
Phone: 205/934-3283 (V), 205/934-4691 (TTY)

University of Michigan Model Spinal Cord Injury Care System
Project Number: H133N060032
Email: model.sci@umich.edu
www.med.umich.edu/pmr/modelsci/
Phone: 734/763-0971

University of Pittsburgh Model Center on Spinal Cord Injury
Project Number: H133N060019
Email: greekk@upmc.edu
www.upmc-sci.org, www.rehabmedicine.pitt.edu
Phone: 412/232-7949

NARIC National Rehabilitation Information Center

Documents from NARIC's REHABDATA search listed are listed below:

2010

Gardner-Elahi, C., Goodwin-Wilson, C., & Watkins, M. (2010). **Developing evidence-based process maps for spinal cord injury rehabilitation.** *Spinal Cord, 48*(2), 122-127.
NARIC Accession Number: J58405
ABSTRACT: Study created evidence-based care maps for rehabilitation services to different lesion categories of patients with spinal cord injury. Over a 5-year period, data for 280 newly injured patients aged 18 years or more were collected and analyzed. Data were collected from a functional independence measure (the Needs Assessment Checklist), patient records (paper and electronic), and patient goal planning records. The patients were grouped into different lesion categories. Standard milestones that patients in a given category would be expected to reach in rehabilitation were identified using goals set at goal planning meetings. Time when patients reached these milestones and variation between patients around time in reaching these milestones were calculated. Median times from onset to admission, onset to rehabilitation and length of rehabilitation were given for each lesion category. Pictorial representations of rehabilitation (rehabilitation maps) were produced, using goals identified, median times of achievement and variation. Examples of the maps produced are provided. Care maps can be used in a number of ways: to identify the need for service change; to audit service change; to provide evidence-based expectations for staff, patients and external parties; to look at variances affecting care; to make this service transparent; to provide figures for comparison with other philosophies of care; and to ensure consistency across the service.

2009

Bauman, W.A., Groah, S.L., & Spungen, M.I. (2009). **Cardiovascular disease in individuals with spinal cord injury: Toward best practice.** *Topics in Spinal Cord Injury Rehabilitation, 14*(3), 84-98.
NARIC Accession Number: J55874
ABSTRACT: Article examines best practice approaches for the assessment and management of cardiovascular disease (CVD) in people with spinal cord injury (SCI). Best practice is a process by which the available evidence, clinical experience and expertise, is compiled into a rational framework such that practice incorporates all elements of evidence and is acceptable to the patient and clinician. Several reports have documented disorders of carbohydrate and lipid metabolism in people with SCI that increase risk of CVD. However, a recent evidence-based report casts doubt on the presence of elevated risk of CVD or premature CVD in individuals with SCI. It is imperative that clinicians be able to reconcile disparate conclusions and evidence such that clinical care can be optimized using all evidence available. To accomplish this goal, an understanding of the population and disease process in question coupled with knowledge of the available evidence, recognition of a specific disease process as a significant issue, and acceptance of specific surveillance and/or treatments as relevant, is required. At the core of this process is knowledge translation, which serves as the logical catalyst between evidence, knowledge, and eventual best practice.

Felix, E.R., & Widerstrom-Noga, E.G. (2009). **Reliability and validity of quantitative sensory testing in persons with spinal cord injury and neuropathic pain.** *Journal of Rehabilitation Research and Development, 46*(1), 69-84.
NARIC Accession Number: J56769
ABSTRACT: Study investigated the ability of quantitative sensory testing (QST) to reliably characterize somatosensory dysfunction in subjects with spinal cord injury (SCI) and neuropathic pain by measuring mechanical, vibration, and thermal detection and pain thresholds. Test-retest reliability was determined based on data collected from ten subjects with SCI and neuropathic pain who underwent QST on two occasions approximately three weeks apart. The intraclass correlation coefficients for mechanical, vibration, warm, and cool detection thresholds were in the "substantial" range, while thresholds for cold pain and hot pain demonstrated "fair" stability. To determine the validity of QST in people with SCI-related neuropathic pain, the relationship between somatosensory thresholds and severity of neuropathic pain symptoms was evaluated with multiple linear regression analysis. Thermal pain threshold was the only QST variable significantly related to the severity of neuropathic pain symptoms. The findings provide preliminary evidence that QST is a reliable and valid adjunct measurement strategy for quantifying the neurological dysfunction associated with neuropathic pain in SCI.

2008

Bray, S.R., Buchholz, A.C., Ginis, K.A., Hayes, K.C., Hicks, A.L., Martin; L.A.E., McColl, M.A., Potter, P.J., Smith, K., & Wolfe, D.L. (2008). **Establishing evidence-based physical activity guidelines: Methods for the study of health and activity in people with spinal cord injury (SHAPE SCI).** *Spinal Cord, 46*(3), 216-221.
NARIC Accession Number: J54911
ABSTRACT: Article describes the rationale and methodology for the Study of Health and Activity in People with Spinal Cord Injury (SHAPE SCI). The study objectives are: (1) to describe physical activity levels of people with different injury levels and completeness; (2) to examine the relationship between physical activity, risk and/or presence of secondary health complications, and risk of chronic disease; and (3) to identify determinants of physical activity in the SCI population. Participants with SCI will complete self-report measures of physical activity, physical activity determinants, secondary health problems, and subjective well-being during a telephone interview. A representative subsample will participate in chronic disease risk factor testing for obesity, insulin, resistance, and coronary heart disease. Measures are taken at baseline, 6 months, and 18 months. It is anticipated that SHAPE SCI will provide a foundation for the development of evidence-based physical activity guidelines for people with SCI.

Chiodo, Anthony (Ed.). (2008). ***University of Michigan spinal cord injury rehabilitation guide for health professionals.***
NARIC Accession Number: O17300
ABSTRACT: This manual describes best practices in the care of people with spinal cord injury, presenting

evidence-based practices where evidence is available. Topics include: general guidelines, rehabilitation, transition to community, gastrointestinal care, skin care, pulmonary care, cardiovascular care, musculoskeletal care, orthotics and bracing, general care, and health and wellness.

Gronley, J.K., Haubert, L.L., Mulroy, S.J., Newsam, C.J., Perry, J., & Requejo, P.S. (2008). **Evidence-based strategies to preserve shoulder function in manual wheelchair users with spinal cord injury.** *Topics in Spinal Cord Injury Rehabilitation, 13*(4), 86-119.
NARIC Accession Number: J54318
ABSTRACT: Article reviews evidence-based strategies to reduce shoulder pain and injury in manual wheelchair users with spinal cord injury. Research is presented on shoulder joint loading and muscular demands during wheelchair propulsion, self-transfers, weight-relief raises, and overhead activities. The strategies discussed are aimed at preserving shoulder function by addressing environmental factors related to ergonomics, equipment selection, and performance technique and personal factors related to enhancement of the load-bearing capacity of shoulder structure through strengthening and resistance training.

2007

Abramson, C., Aubut, J., Connolly, S., Eng, J.J., Hsieh, J.T.C., Konnyu, K., Miller, W.C., Teasell, R.W., Townson, A.F., & Wolfe, D.L. (2007). **Spinal cord injury rehabilitation evidence: Method of the SCIRE systematic review.** *Topics in Spinal Cord Injury Rehabilitation, 13*(1), 1-10.
NARIC Accession Number: J52750
ABSTRACT: Article describes the methods of the Spinal Cord Injury Rehabilitation Evidence (SCIRE) project, designed to inform health professionals of best practices to improve the health of people living with spinal cord injury (SCI). The SCIRE used a systematic and well-defined protocol to assess and synthesize the evidence of the effects of SCI rehabilitation interventions. Each article was evaluated for its methodological quality using either the Physiotherapy Evidence Database (PEDro) scale for randomized controlled trials or the Downs and Black tool for other types of studies. Following individual study assessment, conclusions were drawn about the accumulated studies for each topic of interest based on the levels of evidence, quality of studies, and concurring evidence.

Cardenas, D.D., & Felix, E.R. (2007). **Future directions for evidence-based pain management.** *Topics in Spinal Cord Injury Rehabilitation, 13*(2), 94-104.
NARIC Accession Number: J53496
ABSTRACT: Article addresses barriers to the advancement of spinal cord injury (SCI) pain research and describes specific approaches to pain management that deserve further investigation. Consensus on an SCI pain classification scheme and collection of standardized pain outcome measures in SCI would facilitate future research endeavors. Controlled trials of new pharmacological agents and promising drug combination treatments as well as alternative therapies such as massage, acupuncture, and exercise are recommended.

Cook, K.F., Engebretson, J.C., Hart, K.A., Mahoney, J.S., Robinson-Whelen, S., & Sherwood, A.M., Teal, C.R. (2007). **Development and validation of patient reported impact of spasticity measure (PRISM).** *Journal of Rehabilitation Research and Development, 44*(3), 363-372.
NARIC Accession Number: J52925
ABSTRACT: Based on semi-structured interviews with 24 veterans with spinal cord injury (SCI), the Patient Reported Impact of Spasticity Measure (PRISM) was developed to measure the impact of spasticity on quality of life. The developmental PRISM was administered to 180 people with SCI at 5 sites. Subscales were developed based on factor analysis results. Evidence for the reliability and validity of the scores was evaluated. Seven subscales were developed, including one that measures the positive effects of spasticity. Results of reliability and validity assessments indicate that PRISM subscale scores effectively measure the impact of spasticity in veterans with SCI.

2005

Biering-Sorensen, F. (2005). **Evidence-based medicine in treatment and rehabilitation of spinal cord injured.** *Spinal Cord, 43*(10), 587-592.
NARIC Accession Number: J49902
ABSTRACT: Article examines the use of evidence-based medicine (EBM) in treatment and rehabilitation of spinal cord injuries (SCI). EBM is the integration of the best research evidence with clinical expertise and patient values. The steps in the EBM process are: (1) convert the need for information into a question; (2)

find the best evidence; (3) critically evaluate the evidence; (4) integrate the critical appraisal with clinical expertise and the patient's unique biology, values, and circumstances; and (5) evaluate the process and seek ways to improve effectiveness and efficiency. For use of EMB in treatment and rehabilitation of SCI, MEDLINE is the most sensitive source for evidence due to its comprehensiveness and up-to-date maintenance, and the best pre-appraised evidence source is the Cochrane Library and Best Evidence. Clinical practice guidelines may provide a good summary of the actual evidence. Limitations related to the accumulation of evidence and the use and possible misuse of EBM in health care are discussed.

2004

Anderson, C.J., Betz, R.R., DeVivo, M.J., McDonald, C., Mulcahey, M.J., & Vogel, L.C. (2004). **Pediatric spinal cord injury: Evidence-based practice and outcomes.** *Topics in Spinal Cord Injury Rehabilitation*, *10*(2), 69-78.
NARIC Accession Number: J46822
ABSTRACT: Article describes the epidemiology of spinal cord injury (SCI) in children and discusses new surgical and rehabilitation techniques for select aspects of pediatric SCI care. Some of the outcomes of adults with childhood-onset SCI are discussed, the estimated lifetime costs of SCI in children are presented, and the priorities for rehabilitation and research teams are outlined.

Full-text copies of these documents may be available through NARIC's document delivery service.

To order any of the documents listed, please note the NARIC Accession Number (starts with a J, O, or R) and call an information specialist at 800/346-2742.

You may also order online at www.naric.com/services/requestform.cfm. There is a charge of five cents for copying and shipping with a $5 minimum on all orders. International shipping fees may apply.

MSKTC SCI TBI BURN

Documents from the Model Systems Knowledge Translation Center search at msktc.washington.edu are listed below:

2009

Dyson-Hudson, T.A., & Nash, M.S. (2009). **Guideline-driven assessment of cardiovascular disease and related risks after spinal cord injury.** *Topics in Spinal Cord Injury Rehabilitation*, *14*(3), 32-45.
Affiliated Model Systems Locations: The Northern New Jersey Spinal Cord Injury Model System
ABSTRACT: Screening for cardiovascular disease (CVD) risks is an essential process in pursuing effective primary and secondary prevention. Risks can be determined from patient history and fasting lipid levels. Use of a multi-factorial regression algorithm such as the Framingham model improves risk prediction but may contain quirks when used for risk estimation of persons with spinal cord injury (SCI). The gold standard for risk assessment and defining need for primary or secondary disease prevention is the National Cholesterol Education Program Adult Treatment Guidelines. Use of these tools by health practitioners will ensure best practice care of persons with SCI who require CVD disease intervention.

2008

Aito, S., Anderson, K., Atkins, M., Biering-Sorensen, F., Catz, A., Charlifue, S., Curt, A., Ditunno, J., Glass, C., Marino, R., Marshall, R., Mulcahey, M.J., Post, M., Savic, G., & Scivoletto, G. (2008). **Functional recovery measures for spinal cord injury: An evidence-based review for clinical practice and research.** *Journal of Spinal Cord Medicine*, *31*(2), 133-144.
Affiliated Model Systems Locations: The Rocky Mountain Regional Spinal Injury System
ABSTRACT: BACKGROUND/OBJECTIVE: The end goal of clinical care and clinical research involving spinal cord injury (SCI) is to improve the overall ability of persons living with SCI to function on a daily basis. Neurologic recovery does not always translate into functional recovery. Thus, sensitive outcome measures designed to assess functional status relevant to SCI are important to develop. METHOD: Evaluation of currently available SCI functional outcome measures by a multi-

national work group. RESULTS: The 4 measures that fit the pre-specified inclusion criteria were the Modified Barthel Index (MBI), the Functional Independence Measure (FIM), the Quadriplegia Index of Function (QIF), and the Spinal Cord Independence Measure (SCIM). The MBI and the QIF were found to have minimal evidence for validity, whereas the FIM and the SCIM were found to be reliable and valid. The MBI has little clinical utility for use in the SCI population. Likewise, the FIM applies mainly when measuring burden of care, which is not necessarily a reflection of functional recovery. The QIF is useful for measuring functional recovery but only in a subpopulation of people with SCI, and substantial validity data are still required. The SCIM is the only functional recovery outcome measure designed specifically for SCI. CONCLUSIONS: The multinational work group recommends that the latest version of the SCIM (SCIM III) continue to be refined and validated and subsequently implemented worldwide as the primary functional recovery outcome measure for SCI. The QIF may continue to be developed and validated for use as a supplemental tool for the non-ambulatory tetraplegic population.

2007

Dreisbach, J., Dungan, D., Falci, S., Flanders, A., Lammertse, D., Marino, R., & Schwartz, E. (2007). **Neuroimaging in traumatic spinal cord injury: An evidence-based review for clinical practice and research.** *Journal of Spinal Cord Medicine, 30*(3), 205-214.
Affiliated Model Systems Locations: The Rocky Mountain Regional Spinal Injury System
ABSTRACT: OBJECTIVE: To perform an evidence-based review of the literature on neuroimaging techniques utilized in spinal cord injury clinical practice and research. METHODS: A search of the medical literature for articles on specific neuroimaging techniques used in SCI resulted in 2,302 published reports. Review at the abstract and full report level yielded 99 clinical and preclinical articles that were evaluated in detail. Sixty nine were clinical research studies subjected to quality of evidence grading. Twenty-three articles were drawn from the pre-clinical animal model literature and used for supportive evidence. Seven review articles were included to add an element of previous syntheses of current thinking on neuroimaging topics to the committee process (the review articles were not graded for quality of evidence). A list of clinical and research questions that might be answered on a variety of neuroimaging topics was created for use in article review. Recommendations on the use of neuroimaging in spinal cord injury treatment and research were made based on the quality of evidence. RESULTS: Of the 69 original clinical research articles covering a range of neuroimaging questions, only one was judged to provide Class I evidence, 22 provided Class II evidence, 17 Class III evidence, and 29 Class IV evidence. RECOMMENDATIONS: MRI should be used as the imaging modality of choice for evaluation of the spinal cord after injury. CT and plain radiography should be used to assess the bony anatomy of the spine in patients with SCI. MRI may be used to identify the location of spinal cord injury. MRI may be used to demonstrate the degree of spinal cord compression after SCI. MRI findings of parenchymal hemorrhage/ contusion, edema, and spinal cord disruption in acute and subacute SCI may contribute to the understanding of severity of injury and prognosis for neurological improvement. MRI-Diffusion Weighted Imaging may be useful in quantifying the extent of axonal loss after spinal cord injury. Functional MRI may be useful in measuring the anatomic functional/metabolic correlates of sensory-motor activities in persons with SCI. MR Spectroscopy may be used to measure the biochemical characteristics of the brain and spinal cord following SCI. Intraoperative Spinal Sonography may be used to identify spinal and spinal cord anatomy and gross pathology during surgical procedures. Further research in these areas is warranted to improve the strength of evidence supporting the use of neuroimaging modalities. Positron Emission Tomography may be used to assess metabolic activity of CNS tissue (brain and spinal cord) in patients with SCI.

Documents from the National Guideline Clearinghouse search at www.guideline.gov are listed below:

2009

(2009). **ACR Appropriateness Criteria® suspected spine trauma.** *American College of Radiology - Medical Specialty Society. 1999 (revised 2009). 15 pages.*
NGC:007777
Complete summary is available at
www.guideline.gov/summary/summary.aspx?ss=15&doc_id=15742&nbr=007777&string=7777.

(2009). **Guideline for prevention of catheter-associated urinary tract infections 2009.** *Centers for Disease Control and Prevention - Federal Government Agency [U.S.]. 2009. 67 pages.*
NGC:007596
Complete summary is available at
www.guideline.gov/summary/summary.aspx?ss=15&doc_id=15519&nbr=007596&string=7596.

(2009). **Spinal cord injury (SCI). Evidence-based nutrition practice guideline.** *American Dietetic Association - Professional Association. 2009. Various pages.*
NGC:007375
Complete summary is available at www.guideline.gov/summary/summary.aspx?ss=15&doc_id=14889&nbr=007375&string=7375.

2008

(2008). **Early acute management in adults with spinal cord injury: a clinical practice guideline for health-care professionals.** *Consortium for Spinal Cord Medicine - Private Nonprofit Organization Paralyzed Veterans of America - Private Nonprofit Organization. 2008 May. 77 pages.*
NGC:007157
Complete summary is available at www.guideline.gov/summary/summary.aspx?ss=15&doc_id=14281&nbr=007157&string=7157.

(2008). **Metastatic spinal cord compression. Diagnosis and management of adults at risk of and with metastatic spinal cord compression.** *National Collaborating Centre for Cancer - National Government Agency [Non-U.S.]. 2008 Nov. 39 pages.*
NGC:007194
Complete summary is available at http://www.guideline.gov/summary/summary.aspx?ss=15&doc_id=14326&nbr=007194&string=7194.

2006

(2006). **Bladder management for adults with spinal cord injury: a clinical practice guideline for health-care providers.** *Consortium for Spinal Cord Medicine - Private Nonprofit Organization. 2006 Aug. 50 pages.*
NGC:005846
Complete summary is available at http://www.guideline.gov/summary/summary.aspx?ss=15&doc_id=11083&nbr=005846&string=5846.

2005

(2005). **Preservation of upper limb function following spinal cord injury: a clinical practice guideline for health-care professionals.** *Consortium for Spinal Cord Medicine - Private Nonprofit Organization. 2005 Apr. 36 pages.*
NGC:004300
Complete summary is available at http://www.guideline.gov/summary/summary.aspx?ss=15&doc_id=7197&nbr=004300&string=4300.

(2005). **Respiratory management following spinal cord injury: a clinical practice guideline for health-care professionals.** *Consortium for Spinal Cord Medicine - Private Nonprofit Organization. 2005 Jan. 49 pages.*
NGC:004301
Complete summary is available at http://www.guideline.gov/summary/summary.aspx?ss=15&doc_id=7198&nbr=004301&string=4301.

2003

(2003). **Comprehensive evidence-based guidelines for interventional techniques in the management of chronic spinal pain.** *American Society of Interventional Pain Physicians - Medical Specialty Society. 2003 (revised 2009 Jul-Aug). 104 pages.*
NGC:007428
Complete summary is available at http://www.guideline.gov/summary/summary.aspx?ss=15&doc_id=15136&nbr=007428&string=7428.

2002

(2002). **Diagnosis and treatment of degenerative lumbar spinal stenosis.** *North American Spine Society - Medical Specialty Society. 2002 (revised 2007 Jan). 262 pages.*
NGC:005896
Complete summary is available at http://www.guideline.gov/summary/summary.aspx?ss=15&doc_id=11306&nbr=005896&string=5896.

2000

(2008). **Pressure ulcer prevention and treatment following spinal cord injury.** *Consortium for Spinal Cord Medicine - Private Nonprofit Organization Paralyzed Veterans of America - Private Nonprofit Organization. 2000 Aug (reviewed 2005). 80 pages.*
NGC:001815
Complete summary is available at http://www.guideline.gov/summary/summary.aspx?ss=15&doc_id=2589&nbr=001815&string=1815.

1999

(1999). **Prevention of thromboembolism in spinal cord injury.** *Consortium for Spinal Cord Medicine - Private Nonprofit Organization Paralyzed Veterans of America - Private Nonprofit Organization. 1997 Feb (updated 1999 Sep; reviewed 2005). 29 pages.*
NGC:002191
Complete summary is available at http://www.guideline.gov/summary/summary.aspx?ss=15&doc_id=2965&nbr=002191&string=2191.

1998

(1998). **Depression following spinal cord injury: A clinical practice guideline for primary care physicians.** *Consortium for Spinal Cord Medicine - Private Nonprofit Organization Paralyzed Veterans of America - Private Nonprofit Organization. 1998 (reviewed 2005). 35 pages.*
NGC:000903
Complete summary is available at http://www.guideline.gov/summary/summary.aspx?ss=15&doc_id=1677&nbr=000903&string=903.

(1998). **Neurogenic bowel management in adults with spinal cord injury.** *Consortium for Spinal Cord Medicine - Private Nonprofit Organization Paralyzed Veterans of America - Private Nonprofit Organization. 1998 Mar (reviewed 2005). 39 pages.*
NGC:000394
Complete summary is available at http://www.guideline.gov/summary/summary.aspx?ss=15&doc_id=850&nbr=000394&string=394.

Documents from the Cochrane Database of Systematic Reviews search at www.thecochranelibrary.org are listed below:

2008

Kugler J., Mehrholz J., & Pohl M. (2008). **Locomotor training for walking after spinal cord injury.** *Cochrane Database of Systematic Reviews: Reviews 2008 Issue 2 John Wiley & Sons, Ltd Chichester, UK DOI: 10.1002/14651858.CD006676.pub2.*
ID: CD006676
ABSTRACT: BACKGROUND: Locomotor training for walking is used in rehabilitation after spinal cord injury (SCI) and might help to improve walking. OBJECTIVES: To assess the effects of locomotor training on improvement in walking for people with traumatic SCI. SEARCH STRATEGY: We searched the Cochrane Injuries Group Specialized Register (last searched June 2007); the Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library 2007, Issue 2); MEDLINE (1966 to June 2007); EMBASE (1980 to June 2007); National Research Register (2007, Issue 2); CINAHL (1982 to June 2007); AMED (Allied and Complementary Medicine Database) (1985 to June 2007); SPORTDiscus (1949 to June 2007); PEDro (the Physiotherapy Evidence database) (searched June 2007); COMPENDEX (engineering databases) (1972 to June 2007); INSPEC (1969 to June 2007); and the National Research Register, Zetoc, and Current Controlled Trials research and trials registers. We also handsearched relevant conference proceedings, checked reference lists and contacted study authors in an effort to identify published, unpublished and ongoing trials. SELECTION CRITERIA: We included randomized controlled trials (RCT) that compared locomotor training to any other exercise provided with the goal of improving walking function after SCI or to a no-treatment control group. DATA COLLECTION AND ANALYSIS: Two review authors independently selected trials

for inclusion, assessed trial quality and extracted the data. The primary outcomes were the speed of walking and walking capacity at follow up. MAIN RESULTS: Four RCTs involving 222 patients were included in this review. Overall, the results were inconclusive. There was no statistically significant effect of locomotor training on walking function after SCI comparing bodyweight supported treadmill training with or without functional electrical stimulation or robotic-assisted locomotor training. AUTHORS' CONCLUSIONS: There is insufficient evidence from RCTs to conclude that any one locomotor training strategy improves walking function more than another for people with SCI. Research in the form of large RCTs is needed to address specific questions about the type of locomotor training which might be most effective in improving walking function of people with SCI. PROVIDING LOCOMOTOR TRAINING TO PEOPLE WITH SPINAL CORD INJURY TO IMPROVE WALKING ABILITY: There is insufficient evidence to conclude that one locomotor training strategy is more effective than another for improving walking ability in people with spinal cord injury (SCI).Improvement of locomotor function is one of the primary goals for people with SCI. Many strategies exist to improve this function, such as treadmill training with and without body weight support, robotic-assisted gait training and functional electrical stimulation. This review found insufficient evidence to conclude which locomotor training strategy improves walking function most for people with SCI.

2001

Bunn, F., Kwan, I., & Roberts, I.G. (2001). **Spinal immobilization for trauma patients.** *Cochrane Database of Systematic Reviews: Reviews 2001 Issue 2 John Wiley & Sons, Ltd Chichester, UK DOI: 10.1002/14651858.CD002803.*
ID: CD002803
ABSTRACT: BACKGROUND: Spinal immobilization involves the use of a number of devices and strategies to stabilize the spinal column after injury and thus prevent spinal cord damage. The practice is widely recommended and widely used in trauma patients with suspected spinal cord injury in the pre-hospital setting. OBJECTIVES: To quantify the effect of different methods of spinal immobilization (including immobilization versus no immobilization) on mortality, neurological disability, spinal stability and adverse effects in trauma patients. SEARCH STRATEGY: We searched the Cochrane Central Register of Controlled Trials (CENTRAL), the Cochrane Injuries Group's specialized register, MEDLINE, EMBASE, CINAHL, PubMed, National Research Register and Zetoc. We checked reference lists of all articles and contacted experts in the field to identify eligible trials. Manufacturers of spinal immobilization devices were also contacted for information. Searches were last updated in July 2007. SELECTION CRITERIA: Randomized controlled trials comparing spinal immobilization strategies in trauma patients with suspected spinal cord injury. Trials in healthy volunteers were excluded. DATA COLLECTION AND ANALYSIS: We independently applied eligibility criteria to trial reports and extracted data. MAIN RESULTS: We found no randomized controlled trials of spinal immobilization strategies in trauma patients. AUTHORS' CONCLUSIONS: We did not find any randomized controlled trials that met the inclusion criteria. The effect of spinal immobilization on mortality, neurological injury, spinal stability and adverse effects in trauma patients remains uncertain. Because airway obstruction is a major cause of preventable death in trauma patients, and spinal immobilization, particularly of the cervical spine, can contribute to airway compromise, the possibility that immobilization may increase mortality and morbidity cannot be excluded. Large prospective studies are needed to validate the decision criteria for spinal immobilization in trauma patients with high risk of spinal injury. Randomized controlled trials in trauma patients are required to establish the relative effectiveness of alternative strategies for spinal immobilization. SPINAL IMMOBILIZATION FOR TRAUMA PATIENTS: Spinal cord damage from injury causes long-term disability and can dramatically affect quality of life. The current practice of immobilizing trauma patients before hospitalization to prevent more damage may not always be necessary, as the likelihood of further damage is small. Means of immobilization include holding the head in the midline, log rolling the person, the use of backboards and special mattresses, cervical collars, sandbags and straps. These can cause tissue pressure and discomfort, difficulty in swallowing and serious breathing problems. The review authors could not find any randomized controlled trials of spinal immobilization strategies in trauma patients. It is feasible to have trials comparing the different spinal immobilization strat-

egies. From studies of healthy volunteers it has been suggested that patients who are conscious, might reposition themselves to relieve the discomfort caused by immobilization, which could theoretically worsen any existing spinal injuries.

2000

Adone, R., Pagliacci, C., Taricco, M., & Telaro, E. (2000). **Pharmacological interventions for spasticity following spinal cord injury.** *Cochrane Database of Systematic Reviews: Reviews 2000 Issue 2 John Wiley & Sons, Ltd Chichester, UK DOI: 10.1002/14651858.CD001131.*
ID: CD001131
ABSTRACT: BACKGROUND: Spasticity is a major health problem for patients with a spinal cord injury (SCI). It limits their mobility and affects their independence in activities of daily living (ADL) and work. Spasticity may also cause pain, loss of range of motion, contractures, sleep disorders and impair ambulation in patients with an incomplete lesion. The effectiveness of available drugs is still uncertain and they may cause adverse effects. Assessing what works in this area is complicated by the lack of valid and reliable measurement tools. The aim of this systematic review is to critically appraise and summarize existing information on the effectiveness of available treatments, and to identify areas where further research is needed. OBJECTIVES: To assess the effectiveness and safety of baclofen, dantrolene, tizanidine and any other drugs for the treatment of long-term spasticity in SCI patients, as well as the effectiveness and safety of different routes of administration of baclofen. SEARCH STRATEGY: We searched the Cochrane Injuries Group Specialized Register, CENTRAL, MEDLINE/PubMed, EMBASE, Zetoc, Web of Knowledge, CINAHL and Current Controlled Trials. We also checked the reference lists of relevant papers to identify any further studies. The searches were last conducted in July 2008. SELECTION CRITERIA: All parallel and cross-over randomized controlled trials (RCTs) including spinal cord injury patients complaining of 'severe spasticity'. Studies where less than 50% of patients had a spinal cord injury were excluded. DATA COLLECTION AND ANALYSIS: Methodological quality of studies (allocation concealment, blinding, patient's characteristics, inclusion and exclusion criteria, interventions, outcomes, losses to follow up) was independently assessed by two investigators. The heterogeneity among studies did not allow quantitative combination of results. MAIN RESULTS: Nine studies met the inclusion criteria. Study designs were: 8 cross-over and 1 parallel-group trial. Two studies (14 SCI patients), showed a significant effect of intrathecal baclofen in reducing spasticity (Ashworth Score and ADL performances), compared to placebo, without any adverse effects. The study comparing tizanidine to placebo (118 SCI patients) showed a significant effect of tizanidine in improving Ashworth Score but not in ADL performances. The tizanidine group reported significant rates of adverse effects (drowsiness, xerostomia). For the other drugs (gabapentin, clonidine, diazepam, amytal and oral baclofen) the results did not provide evidence for clinically significant effectiveness. AUTHORS' CONCLUSIONS: There is insufficient evidence to assist clinicians in a rational approach to anti-spastic treatment for SCI. Further research is urgently needed to improve the scientific basis of patient care. NOT ENOUGH EVIDENCE ABOUT THE EFFECTS OF DRUGS USED TO TRY AND REDUCE SPASTICITY IN THE LIMBS AFTER SPINAL CORD INJURY: A major problem after spinal cord injury is muscle resistance to having the arms or legs moved (spasticity). There can also be spasms. This can severely limit a person's mobility and independence, and can cause pain, muscle problems, and sleep difficulties. Treatments to try and reduce spasticity include exercise, and drugs to try and decrease the muscle tone. The review found there was not enough evidence from trials to assess the effects of the range of drugs used to try and relieve spasticity after spinal cord injury. The authors of the review call for more research and make recommendations as to how this research should be conducted.

Documents from the National Library of Medicine PubMed search at www.pubmed.com are listed below:

2009

ASIPP, Benyamin, R.M., Boswell, M.V., Datta, S., Fellows, B., Hayek, S.M., Helm, S., Manchikanti, L., & Singh, V. (2009). **An algorithmic approach for clinical management of chronic spinal pain.** *Pain Physician*, *12*(4), E225-64.
PMID #: 19668283
ABSTRACT: Interventional pain management, and the interventional techniques which are an integral part of that specialty, are subject to widely varying definitions and practices. How interventional techniques are applied by various specialties is highly variable, even for the most common procedures and conditions. At the same time, many payors, publications, and guidelines are showing increasing interest in the performance and costs of interventional techniques. There is a lack of consensus among interventional pain management specialists with regards to how to diagnose and manage spinal pain and the type and frequency of spinal interventional techniques which should be utilized to treat spinal pain. Therefore, an algorithmic approach is proposed, providing a step-by-step procedure for managing chronic spinal pain patients based upon evidence-based guidelines. The algorithmic approach is developed based on the best available evidence regarding the epidemiology of various identifiable sources of chronic spinal pain. Such an approach to spinal pain includes an appropriate history, examination, and medical decision making in the management of low back pain, neck pain and thoracic pain. This algorithm also provides diagnostic and therapeutic approaches to clinical management utilizing case examples of cervical, lumbar, and thoracic spinal pain. An algorithm for investigating chronic low back pain without disc herniation commences with a clinical question, examination and imaging findings. If there is evidence of radiculitis, spinal stenosis, or other demonstrable causes resulting in radiculitis, one may proceed with diagnostic or therapeutic epidural injections. In the algorithmic approach, facet joints are entertained first in the algorithm because of their commonality as a source of chronic low back pain followed by sacroiliac joint blocks if indicated and provocation discography as the last step. Based on the literature, in the United States, in patients without disc herniation, lumbar facet joints account for 30 percent of the cases of chronic low back pain, sacroiliac joints account for less than 10 percent of these cases, and discogenic pain accounts for 25 percent of the patients. The management algorithm for lumbar spinal pain includes interventions for somatic pain and radicular pain with either facet joint interventions, sacroiliac joint interventions, or intradiscal therapy. For radicular pain, epidural injections, percutaneous adhesiolysis, percutaneous disc decompression, or spinal endoscopic adhesiolysis may be performed. For non-responsive, recalcitrant, neuropathic pain, implantable therapy may be entertained. In managing pain of cervical origin, if there is evidence of radiculitis, spinal stenosis, post-surgery syndrome, or other demonstrable causes resulting in radiculitis, an interventionalist may proceed with therapeutic epidural injections. An algorithmic approach for chronic neck pain without disc herniation or radiculitis commences with clinical question, physical and imaging findings, followed by diagnostic facet joint injections. Cervical provocation discography is rarely performed. Based on the literature available in the United States, cervical facet joints account for 40 to 50 percent of cases of chronic neck pain without disc herniation, while discogenic pain accounts for approximately 20 percent of the patients. The management algorithm includes either facet joint interventions or epidural injections with surgical referral for disc-related pain and rarely implantable therapy. In managing thoracic pain, a diagnostic and therapeutic algorithmic approach includes either facet joint interventions or epidural injections.

Cipher, D.J., Goetz, L., McGeough, C., Ottomanelli, L., Sinnott, P., Sippel, J., Suris, A., & Wagner, T.H. (2009). **Methods of a multisite randomized clinical trial of supported employment among veterans with spinal cord injury.** *Journal of Rehabilitation Research & Development*, *46*(7), 919-30.
PMID #: 20104414
ABSTRACT: This article compares the methods of a randomized multisite clinical trial of evidence-based supported employment with conventional vocational rehabilitation among veterans with spinal cord injury (SCI). The primary hypothesis is that, compared with conventional vocational rehabilitation (i.e., standard care), evidence-based supported employment will significantly improve competitive employment outcomes and general rehabilitation outcomes. The secondary hypothesis is that evidence-based supported employment in SCI will be more cost-effective than standard care. The current article describes the clinical trial and presents baseline data. The present sample includes 301 veterans with SCI, which includes paraplegia (50 percent), high tetraplegia (32 percent), and low tetraplegia (18 percent). Baseline data indicate that 65 percent of this

sample of employment-seeking veterans with SCI had never been employed post-injury, despite the fact that nearly half (41 percent) had received some type of prior vocational rehabilitation. These rates of unemployment for veterans with SCI are consistent with the rates reported for community samples of persons with SCI. Forthcoming outcome data will provide much needed insights into the best practices for helping these veterans restore vocational goals and improve overall quality of life.

Dietrich, W.D., III. (2009). **Therapeutic hypothermia for spinal cord injury.** *Critical Care Medicine, 37*(7 Suppl.), S238-42.
PMID #: 19535953
ABSTRACT: In this article, the role of modest hypothermia for the treatment of experimental and clinical spinal cord injury (SCI) is discussed. While early investigations evaluated the beneficial effects of more profound levels of local hypothermia treatment following SCI, recent studies have concentrated on the benefits of mild hypothermia in protecting and promoting functional recovery in established animal models. In this regard, using preclinical models of both thoracic and cervical contusive SCI, early cooling strategies using systemically administered mild hypothermia (33 degrees C) have been reported to improve locomotive function as well as forelimb gripping strength and coordination. Recently, the effects of modest hypothermia in severely injured SCI patients have also been tested. Modest systemic hypothermia was reported to be both safe and achievable in severely injured SCI patients. This evidence-based review summarizes both experimental and clinical data to support the use of modest hypothermia in the acute SCI setting.

2008

Adkins, R., Atkins, M.S., Baumgarten, J.M., Leung, P., Requejo, P., Waters, R.L., & Yasuda, Y.L. (2008). **Mobile arm supports: Evidence-based benefits and criteria for use.** *The Journal of Spinal Cord Medicine, 31*(4), 388-93.
PMID #: 18959356
ABSTRACT: BACKGROUND/OBJECTIVE: To collect data from therapists regarding criteria for use and activities that individuals with C4-C5 tetraplegia can perform using a mobile arm support (MAS) that they otherwise could not. Reasons for nonuse, equipment design limitations, and therapist training needs were also studied. METHODS: A modified Delphi approach was used to conduct an e-mail survey for which the response to each question was analyzed and used to formulate the subsequent question. SETTING: Rehabilitation centers. PARTICIPANTS: Eighteen occupational therapists (most affiliated with 1 of the federally designated Model Spinal Cord Injury Systems) with extensive experience in the treatment of individuals with spinal cord injury (SCI). RESULTS: The key physical prerequisite for successful use of the MAS was at least minimal strength of the deltoid and biceps muscles; 92 percent of respondents indicated that they would fit an MAS for motivated patients having very weak (<2/5) biceps and deltoid muscles. According to the therapists, 100 percent (n = 30) of their clients were able to perform at least 1 activity using a MAS that they were unable to perform without the device. These activities included (in descending frequency) eating, page turning, driving a power
wheelchair, brushing teeth, keyboarding, writing, name signing, drawing, painting, scratching nose, playing board games, accessing electronic devices, drinking, and grooming. Equipment design limitations included increased wheelchair width and problems managing the arms while reclining. CONCLUSIONS: Mobile arm supports allow persons with C4-C5 tetraplegia to engage in activities that they otherwise cannot perform with their arms.

2007

Fehlings, M.G., & Furlan, J.C. (2007). **Role of screening tests for deep venous thrombosis in asymptomatic adults with acute spinal cord injury: An evidence-based analysis.** *Spine, 32*(17), 1908-16.
PMID #: 17762301
ABSTRACT: STUDY DESIGN: Systematic review. OBJECTIVE: To examine the evidence to support practice guidelines for screening for DVT in asymptomatic adults with acute traumatic spinal cord injury (SCI) who undergo pharmacologic thromboprophylaxis. SUMMARY OF BACKGROUND DATA: Despite the fact that pharmacologic thromboprophylaxis has been widely used since the 1980s, deep venous thrombosis (DVT) and subsequent pulmonary embolism (PE) still account for approximately 10 percent of deaths during the first year following SCI. METHODS: MEDLINE and EMBASE were searched from the earliest achievable date to December 2005. We only included clinical studies that used a screening test for DVT and the gold standard diagnostic tests for DVT (i.e., lower limb venography) and for PE (i.e., lung arteriogram) in adults with

traumatic SCI who underwent drug thromboprophylaxis during the acute stage after SCI. RESULTS: The search yielded 188 articles, of which 9 articles fulfilled the criteria to be included in our review. Screening for DVT was performed in three randomized clinical trials and six case series. The protocol of these studies included the use of D-Dimer (1 of 9), I-labeled fibrinogen (2 of 9), ultrasound (1 of 9), impedance plethysmography (1 of 9), impedance plethysmography and Doppler in combination (1 of 9), Duplex (1 of 9) or venography (2 of 9) as screening test for DVT. Based on the pooled data of these studies, asymptomatic DVT was detected in 16.9 percent of SCI population. Only four studies reported the occurrence of PE in 4.4 percent of cases. CONCLUSION: There is insufficient evidence to support (or refute) a recommendation for routine screening for DVT in adults with acute traumatic SCI under thromboprophylaxis. However, there is level II-2 evidence that screening could detect asymptomatic DVT in 22.7 percent of those individuals. Although additional investigation is needed, we hypothesize that weekly screening for DVT during the first 13 weeks post-SCI could detect most of the asymptomatic DVT events in this patient population. D-Dimer, ultrasound, and MR venography could be considered as potentially useful screening tests for DVT in the SCI population in future research studies.

2005

Fehlings, M.G., & Perrin, R.G. (2005). **The role and timing of early decompression for cervical spinal cord injury: Update with a review of recent clinical evidence.** *Injury, 36* (Suppl. 2), B13-26.
PMID #: 15993113
ABSTRACT: It remains controversial whether early decompression following spinal cord injury conveys a benefit in neurological outcome. The goal of this paper is to provide evidence-based recommendations regarding spinal cord decompression in patients with acute spinal cord injury. We performed a Medline search of experimental and clinical studies reporting on the effect of decompression on neurological outcome following spinal cord injury. Animal studies consistently show that neurological recovery is enhanced by early decompression. One randomized controlled trial showed no benefit to early (<72 hours) decompression, however, several recent prospective series suggest that early decompression (<12 hours) can be performed safely and may improve neurological outcomes. A recent meta-analysis showed that early decompression (<24 hours) resulted in statistically better outcomes compared to both delayed decompression and conservative management. Currently, there are no standards regarding the role and timing of decompression in acute spinal cord injury. We recommend urgent decompression of bilateral locked facets in patients with incomplete tetraplegia or in patients with spinal cord injury experiencing neurological deterioration. Urgent decompression in acute cervical spinal cord injury remains a reasonable practice option and can be performed safely.

Myslinski, M.J. (2005). **Evidence-based exercise prescription for individuals with spinal cord injury.** *Journal of Neurologic Physical Therapy, 29*(2), 104-6.
PMID #: 16386166
ABSTRACT: PURPOSE: Individuals with spinal cord injury can benefit from regular exercise. Exercise prescription for these individuals is based on the same four principles of exercise used for nondisabled individuals. The purpose of this paper is to describe a process by which physical therapists may generate an exercise prescription for individuals with SCI. DESCRIPTION: Examination of the individual with SCI to identify occult disease and/or impairments that can cause adverse events or limit participation in the exercise session is outlined. The four principles of exercise: overload, specificity, individuality, and reversibility are defined. Guidelines for achieving overload, which include both aerobic and anaerobic training, are outlined in detail. The literature on specificity of training for individuals with SCI is highlighted.

2003

Gutierrez, C.J., Haines, F., & Harrow, J. (2003). **Using an evidence-based protocol to guide rehabilitation and weaning of ventilator-dependent cervical spinal cord injury patients.** *Journal of Rehabilitation Research & Development, 40*(5, Suppl. 2), 99-110.
PMID #: 15074456
ABSTRACT: An evidence-based clinical protocol was developed to improve ventilatory muscle strength and endurance of ventilator-dependent cervical spinal cord injury (SCI) patients. The goal was to help these patients discontinue mechanical ventilation. The protocol, based on findings from other studies in the literature, consisted of pre-training optimization, as well as progressive resistance and endurance training. Following the protocol, mean maximal inspiratory pressure for low tetraplegic patients improved 75 percent, mean maximal expiratory pressure improved 71 percent, mean vi-

tal 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 patients improved their ability to spontaneously ventilate for short periods in case of accidental disconnection from the ventilator, while low tetraplegic patients were able to discontinue mechanical ventilation, which was the desired clinical outcome for this preliminary study.

2002

Barker, E., & Saulino, M.F. (2002). **First-ever guidelines for spinal cord injuries.** *RN*, *65*(10), 32-7.
PMID #: 12432709
ABSTRACT: How spinal cord injuries (SCI) are managed — especially in the critical early stages — has a profound effect on a patient's outcome. The publication of the first comprehensive SCI treatment guidelines is an important step in standardizing evidence-based care.

2001

Hurlbert, R.J. (2001). **The role of steroids in acute spinal cord injury: An evidence-based analysis.** *Spine*, *26*(24, Suppl.), S39-46.
PMID #: 11805608
ABSTRACT: STUDY DESIGN: Literature review. OBJECTIVES: The purpose of this article is to review the available literature and formulate evidence-based recommendations for the use of methylprednisone in the setting of acute spinal cord injury (SCI). SUMMARY OF BACKGROUND DATA: Since the early 1990s, methylprednisolone has become widely prescribed for the treatment of acute SCI; arguably, it has become a standard of care. METHODS: Through an electronic database search strategy and by cross-reference with published literature, appropriate clinical studies were identified. They were reviewed in chronologic order with respect to study design, outcome measures, results, and conclusions. RESULTS: Nine studies were identified that attempted to evaluate the role of steroids in non-penetrating (blunt) spinal cord injury. Five of these were Class I clinical trials, and four were Class II studies. All of the studies failed to demonstrate improvement because of steroid administration in any of the a priori hypotheses testing. Although post hoc analyses were interesting, they failed to demonstrate consistent significant treatment effects. CONCLUSIONS: From an evidence-based approach, methylprednisolone cannot be recommended for routine use in acute non-penetrating SCI. Prolonged administration of high-dose steroids (48 hours) may be harmful to the patient. Until more evidence is forthcoming, methylprednisolone should be considered to have investigational (unproven) status only.

1999

Fehlings, M.G., Rao, S.C. (1999). **The optimal radiologic method for assessing spinal canal compromise and cord compression in patients with cervical spinal cord injury. Part I: An evidence-based analysis of the published literature.** *Spine*, 24(6), 598-604.
PMID #: 10101828
ABSTRACT: STUDY DESIGN: An evidence-based analysis of published radiologic criteria for assessing spinal canal compromise and cord compression in patients with acute cervical spinal cord injury. OBJECTIVES: This study was conducted to determine whether literature-based guidelines could be established for accurate and objective assessment of spinal canal compromise and spinal cord compression after cervical spinal cord injury. SUMMARY OF BACKGROUND DATA: Before conducting multicenter trials to determine the efficacy of surgical decompression in cervical spinal cord injury, reliable and objective radiographic criteria to define and quantify spinal cord compression must be established. METHODS: A computer-based search of the published English, German, and French language literature from 1966 through 1997 was performed using MEDLINE (U.S. National Library of Medicine database) to identify studies in which cervical spinal canal and cord size were radio-graphically assessed in a quantitative manner. Thirty-seven references were included for critical analysis. RESULTS: Most studies dealt with degenerative disease, spondylosis, and stenosis; only 13 included patients with acute cervical spinal cord injury. Standard lateral radiographs were the most frequent imaging method used (23 studies). T1- and T2-weighted magnetic resonance imaging was used to assess spinal cord compression in only seven and four studies, respectively. Spinal cord size or compression was not precisely measured in any of the cervical trauma studies. Inter-observer or intra-observer reliability of the radiologic measurements was assessed in only 7 (19 percent) of the 37 studies. CONCLUSIONS: To date, there are few quantitative, reliable radiologic outcome measures for assessing spinal canal compromise or cord compression in patients with acute cervical spinal cord injury.

Search Terms for Evidence-Based Practices in Spinal Cord Injury (SCI) Rehabilitation

- Access to Care
- Activities of Daily Living
- Acute Care/Disease
- Alternative Medicine
- Ambulation
- Assistive Technology
- Attitudes
- Barriers
- Behavior
- Best Practices
- Cardiovascular Function
- Case Management
- Cervical Vertebrae/Injuries
- Children with Disabilities
- Chronic Disease/Illness
- Circulatory System
- Classification Systems
- Client Characteristics
- Clinical Management/Protocols/Trials
- Critical Care
- Data Collection
- Decompression/Methods/Surgical
- Devices/Selection
- Disability Management
- Drug Therapy
- Electrical Stimulation
- Electrophysiology
- Employment
- Ergonomics
- Evaluation/Techniques
- Evidence-Based Medicine
- Exercise/Therapy
- Functional Evaluation/Status
- Health Care/Promotion
- Hypothermia/Induced
- Imaging
- Immobilization
- Infections
- Inflammation
- Information Resources
- Injections/Epidural
- Intervention
- Joints
- Limbs
- Literature Reviews
- Long-Term Care
- Measurements
- Model Programs
- Motor Skills
- Muscles
- Musculoskeletal Disorders
- Nerves
- Orthotic Devices
- Outcomes
- Pain/Diagnosis/Measurement/Therapy
- Paraplegia
- Physical Therapy
- Practice Guidelines
- Pressure Sores
- Prevalence
- Prevention
- Program Evaluation
- Pulmonary/Embolism/Function
- Quadriplegia
- Quality of Life
- Quantitative Analysis
- Recovery of Function
- Rehabilitation/Research/Services
- Research Design/Methodology/Utilization
- Respiration/Artificial
- Respiratory Disease
- Risk Assessment/Factors
- Safety
- SCI
- Secondary Conditions
- Service Delivery
- Sexuality
- Skin Disorders
- Spasticity
- Spinal Cord Injuries
- Time Factors
- Transition
- Treatment
- Urinary Disorders
- Venous Thrombosis
- Ventilator Weaning
- Veterans
- Vocational Rehabilitation
- Walking
- Wheelchairs

About ***reSearch****:*

reSearch is an information product from the National Rehabilitation Information Center (NARIC). Each issue is based on real-world queries received by our information specialists from researchers, educators, and rehabilitation professionals around the world.

We search several sources both in-house and online, to fill these requests including:

- 🕮 REHABDATA and the NIDRR Program database
- 🕮 Education Resources Information Center
- 🕮 National Clearinghouse of Rehabilitation Training Materials
- 🕮 Campbell and Cochrane Collaborations
- 🕮 PubMed and other National Library of Medicine databases
- 🕮 Agency for Health Care Policy and Research databases
- 🕮 Center for International Rehabilitation Research Information and Exchange
- 🕮 and other reputable, scholarly information resources.

We hope you find these *reSearch* briefs informative in your own research.

- NARIC Information and Media Team

NARIC is operated by HeiTech Serivces, Inc., for the National Institute on Disability and Rehabilitation Research under contract number ED-OSE-10-0074.