

Date: September 5, 2014

Title: Early physical therapy/occupational therapy specific interventions for traumatic spinal cord injury (SCI)¹

Clinical Question

P (Population/Problem) Among children aged 5 to 21 years who sustain a traumatic SCI
I (Intervention) does early physical therapy/occupational therapy specific interventions
C (Comparison) compared to no intervention
O (Outcome) improve functional outcomes?

*Definitions for terms marked with * may be found in the Supporting Information section.*

Target Population for the Recommendation

Inclusions

- Diagnosis of acute SCI , traumatic onset as primary injury

Exclusions

- Congenital SCI (i.e. myelomeningocele)
- SCI secondary to tumor or infection
- SCI greater than 6 months post injury

Recommendation

It is recommended that the physical therapist/occupational therapist initiate early physical therapy/occupational therapy spinal cord injury interventions, as soon as medically possible, to facilitate improved long term functional outcomes and prevent medical and physical complications from immobilization in children and young adults (Scivoletto 2005 [4a], Sumida 2001 [4a], Greenberg 2009 [5b], Fries 2005 [5b]).

Note 1: Early therapy interventions are initiated within 30 days following SCI during the initial admission post injury (Scivoletto 2005 [4a], Sumida 2001 [4a], Fries 2005 [5b]).

Discussion/Synthesis of Evidence related to the recommendation

An in-depth literature review established a small body of evidence to support the benefits of early rehabilitation for individual's post traumatic SCI (Scivoletto 2005 [4a], Sumida 2001 [4a], Greenberg 2009 [5b], Fries 2005 [5b]). Early SCI rehabilitation may aid in maximizing participation in physical activities of daily living for motor function and positively impact motor recovery (Scivoletto 2005 [4a], Sumida 2001 [4a], Greenberg 2009 [5b], Fries 2005 [5b]). Additionally, a delay in rehabilitation following post traumatic SCI may negatively impact functional recovery (Scivoletto 2005 [4a], Sumida 2001 [4a]). Physical therapists and occupational therapists are specialists who provide therapeutic interventions aimed at augmenting motor potential and improving functional outcomes (Natale 2009 [5a], Ozelle 2009 [5a]). Their services are recognized as an integral part of a comprehensive SCI program (Natale 2009 [5a], Ozelle 2009 [5a]). It is important for physical therapists and occupational therapists to initiate early, medically appropriate rehab services with individuals with post traumatic SCI, in order to maximize functional outcomes.

¹ Please cite as: Strenk, M., Cincinnati Children's Hospital Medical Center: Best Evidence Statement Early physical therapy/occupational therapy intervention for traumatic spinal cord injury, <http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/best.htm>, BES 193, pages 1-8, September 5, 2014.

Primary limitations in the studies' methodology included small sample size and lack of control groups, which may limit the ability to draw conclusions (Scivoletto 2005 [4a], Sumida 2001 [4a]). The cited studies were conducted primarily on adults, which may limit applicability to a pediatric population (Scivoletto 2005 [4a], Sumida 2001 [4a], Fries 2005 [5b]). In addition the studies included a varied distribution of patients with different American Spinal Injury Association (ASIA) impairment scale levels, which may have affected recovery and made it difficult to assess outcomes (Scivoletto 2005 [4a], Sumida 2001 [4a]).

While the grade of the body of evidence is low, there is support for early SCI rehabilitation and additional study may be warranted. In addition, while the overall impact of rehabilitation has been examined, the most effective combinations or sequences of therapy interventions and patient education approaches have yet to be studied (Whiteneck 2009 [5a]).

In determining the strength of the recommendation, the development group made a considered judgment in a consensus process which was reflective of critically appraised evidence, clinical experience, and these dimensions:			
<i>Given the dimensions below and that more answers to the left of the scales indicate support for a stronger recommendation, the recommendation statement above reflect the strength of the recommendation as judged by the development group. (Note that for negative recommendations, the left/right logic may be reversed for one or more dimensions.)</i>			
1. Grade of the Body of Evidence	<input type="checkbox"/> High	<input type="checkbox"/> Moderate	<input checked="" type="checkbox"/> Low
<i>Rationale:</i>			
2. Safety/Harm (Side Effects and Risks)	<input type="checkbox"/> Minimal	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Serious
<i>Rationale:</i> The patient should be medically stable prior to initiation of early rehab interventions in order to reduce risk of related medical complications (Carney 2006 [4b]).			
3. Health benefit to patient	<input type="checkbox"/> Significant	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Minimal
<i>Rationale:</i> Early SCI rehabilitation contributes to good physical activities of daily living for motor function and acceptable motor recovery (Sumida 2001 [4a]).			
4. Burden on patient to adhere to recommendation	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Unable to determine	<input type="checkbox"/> High
<i>Rationale:</i>			
5. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective
<i>Rationale:</i> Improved function and quality of life may contribute to decreased costs of medical care. This can be measured by decreased hospital admissions and use of health resources over time.			
6. Directness of the evidence for this target population	<input type="checkbox"/> Directly relates	<input checked="" type="checkbox"/> Some concern of directness	<input type="checkbox"/> Indirectly relates
<i>Rationale:</i> The cited studies involved adult subjects, so ability to generalize to a pediatric population may be impacted.			
7. Impact on morbidity/mortality or quality of life	<input type="checkbox"/> High	<input checked="" type="checkbox"/> Medium	<input type="checkbox"/> Low
<i>Rationale:</i> If individuals who receive early rehab services experience improved functional recovery, it is expected that this could contribute to improved quality of life.			

Reference List

(Evidence Level in []; See [Table of Evidence Levels](#))

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2. **Burns, A. S. M. D., and Ditunno, J. F. M. D.:** Establishing Prognosis and Maximizing Functional Outcomes After Spinal Cord Injury: A Review of Current and Future Directions in Rehabilitation Management. [Miscellaneous Article]. *Spine*, 26(24S): S137-S145, 2001, [5b] <http://www.ncbi.nlm.nih.gov/pubmed/00007632-200112151-00023>.
3. **Carney, M. L.; Ullrich, P.; and Esselman, P.:** Early unplanned transfers from inpatient rehabilitation. *American Journal of Physical Medicine & Rehabilitation*, 85(5): 453-60; quiz 461-3, 2006, [4b] <http://www.ncbi.nlm.nih.gov/pubmed/16628154>.
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5. **Costacurta, M. L. G.; Taricco, L. D.; Kobaiyashi, E. T.; and Cristante, A. R. L.:** Epidemiological profile of a pediatric population with acquired spinal cord injury from AACD: São Paulo/Brazil. *Spinal Cord*, 48(2): 118-121, 2010, [4b] <http://www.ncbi.nlm.nih.gov/pubmed/2010551338>. Language: English. Entry Date: 20100312. Revision Date: 20100312. Publication Type: journal article 10.1038/sc.2009.130.
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8. **Greenberg, J.; AT., R.; and H., K.:** Rehabilitation of pediatric spinal cord injury: From acute medical care to rehabilitation and beyond *Journal of Pediatric Rehabilitation Medicine*, 2(1): 13-27, 2009, [5b] 10.3233/PRM-2009-0059.
9. **Hayes, J. S., and Arriola, T.:** Pediatric Spinal Injuries. *Pediatric Nursing*, 31(No. 6): 464-467, 2005, [5b].
10. **Lee, J. H.; Sung, I. Y.; Kang, J. Y.; and Park, S. R.:** Characteristics of pediatric-onset spinal cord injury. *Pediatrics International*, 51(2): 254-257, 2009, [4b] <http://www.ncbi.nlm.nih.gov/pubmed/2010249191>. Language: English. Entry Date: 20090529. Revision Date: 20110513. Publication Type: journal article 10.1111/j.1442-200X.2008.02684.x.
11. **Local Consensus:** during the BES development timeframe. ed., [5].
12. **Martin, B. W.; Dykes, E.; and Lecky, F. E.:** Patterns and risks in spinal trauma.[see comment]. *Archives of Disease in Childhood*, 89(9): 860-5, 2004, [4a] <http://www.ncbi.nlm.nih.gov/pubmed/15321867>.
13. **Natale, A.; Taylor, S.; LaBarbera, J.; Bensimon, L.; McDowell, S.; Mumma, S. L.; Backus, D.; Zanca, J. M.; and Gassaway, J.:** SCIREhab Project Series: the physical therapy taxonomy. *J Spinal Cord Med*, 32(3): 270, 2009, [5a].
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19. **Whiteneck, G.; Gassaway, J.; Dijkers, M.; and Jha, A.:** New approach to study the contents and outcomes of spinal cord injury rehabilitation: the SCIREhab Project. *J Spinal Cord Med*, 32(3): 251, 2009, [5a].

IMPLEMENTATION**Applicability & Feasibility Issues**

Members of the health care team will need to partner to facilitate early referral of appropriate patients with spinal cord injury (*Local Consensus [5]*). A coordinated effort by the medical team is needed to identify potential candidates post traumatic SCI and enable the transition to early rehabilitation services.

Physical therapy and occupational therapy specific intervention should be provided by specially trained physical therapists (PTs) and occupational therapists (OTs) that are knowledgeable about spinal cord injury and early rehabilitation. These specially trained PTs and OTs should individualize the treatment based on the patient injury and presenting problems. Consideration should be given for therapist staffing, because this patient population demands high utilization of therapy resources (*Local Consensus [5]*).

Relevant CCHMC Tools

Health Topic: Autonomic Dysreflexia

Outcome Measures and Process Measures

Outcomes Measures:

The percent of individuals age 5-21 years with traumatic spinal cord injury that receive early rehabilitation services (physical therapy and occupational therapy intervention) who demonstrate a reduction in dependency in functional skills.

The percent of individuals age 5-21 years with traumatic spinal cord injury that receive early rehabilitation services (physical therapy and occupational therapy intervention) who demonstrate improved strength.

The percent of individuals age 5-21 years with traumatic spinal cord injury that receive early rehabilitation services (physical therapy and occupational therapy intervention) who demonstrate improved QoL.

Process Measure:

The percent of individuals age 5-21 years with traumatic spinal cord injury that receive early rehabilitation services (physical therapy and occupational therapy intervention) who have an individualized treatment plan, documented in the medical record, that minimally addresses any of the following components:

- Strength
- Endurance
- Physical function
- Patient/caregiver education

Outcome measures were chosen to assess improvements in functional independence in individuals who initiated early physical therapy/occupational therapy intervention. Reduction of dependency (level of caregiver assistance needed) on a functional skill assessment would be indicative of improved functional outcome. Improved muscle strength would positively impact an individual's ability to perform functional skills and thereby also improve functional outcome. In addition, QoL measures provide a subjective assessment of satisfaction with current function from individuals in this population.

The process measure was chosen to record documentation of early physical therapy and occupational therapy interventions. Process measures support that interventions aimed at improving function and strength are occurring in the early rehab period (during the first 30 days of the initial hospital admission post injury).

SUPPORTING INFORMATION

Background/Purpose of BEST Development

There are approximately 12,000 new spinal cord injuries each year (NSCISC 2013 [5b]). The incidence of spinal injuries in children is reported to be 1-10% of all spinal cord injuries, with most injuries occurring between age 16 and 30 years (Costacurta 2010 [4b], Nau 2010 [4b], NSCISC 2013 [5b], Hayes 2005 [5b]). Despite the low frequency of spinal cord injury in children, the mortality rate is higher and life expectancy is shorter than for adults. Family, social and economic impacts are greater than in the adult population (Costacurta 2010 [4b]).

Pediatric spinal cord injury is most commonly caused by motor vehicle accidents followed by sporting injuries, falls, and violence (Costacurta 2010 [4b], Nau 2010 [4b], Brown 2001 [4b], NSCISC 2013 [5b]). Thoracic level injuries are more common than cervical or lumbar level injuries; however, cervical spinal cord injuries are more common in children under 8 years of age due to biomechanical features (i.e. large head size, increased spinal flexibility, incomplete ossification of vertebrae, shallow angulation of facet joints, weaker neck musculature) (Cirak 2004 [4a], Martin 2004 [4a], Eleraky 2000 [4a], Lee 2009 [4b], Hayes 2005 [5b]). The incidence of injury is similar in boys and girls under age 13 years, but in older children and teenagers, males sustain SCI at a higher rate (Lee 2009 [4b], NSCISC 2013 [5b]).

A challenge that may impact participation in early rehabilitation in the management of spinal cord injury is the difficulty distinguishing the extent of spinal cord injury in pediatric patients (Hayes 2005 [5b]). Neurogenic shock complications experienced following traumatic spinal cord (including hypotension, bradycardia, and peripheral vasodilatation) can also interfere with early mobilization and rehabilitation (Hayes 2005 [5b]). Additionally, in the early course of management it may be difficult to discern if the spinal cord injury is complete or incomplete, thus impacting rehabilitation (Hayes 2005 [5b]).

Optimal management of pediatric traumatic spinal cord injuries requires the comprehensive expertise of an interdisciplinary health care team (Fries 2005 [5b]). The goal of treatment for a child with a traumatic spinal cord injury is to maximize function and provide necessary family education to allow optimal home management (Burns 2001 [5b]). Treatment intervention should be planned and organized to minimize both hospitalization and family disruption. Occupational therapy and physical therapy interventions should be provided throughout the continuum of care for individuals with spinal cord injury. In order to provide optimal interventions for individuals with SCI, it is important to identify appropriate timing of therapy services.

Definitions

ASIA Impairment Scale: The American Spinal Injury Association's method of assessing the functional impairment of a person who has sustained a spinal cord injury.

Physical Therapy specific interventions appropriate for individuals with SCI may include:

- bed mobility
- transfers
- wheelchair mobility
- acclimation to upright
- pre-gait activities
- gait
- range of motion/stretching
- strengthening
- balance
- endurance
- musculoskeletal treatments/modalities

- skin management
- wound care
- equipment evaluation/provision/education
- complementary approaches
- airway/respiratory management
- aquatic exercise
- education not covered by other areas

(Natale 2009 [5a])

Occupational therapy specific interventions appropriate for individuals with SCI may include:

- activities of daily living, including self-feeding, grooming, bathing, dressing, toileting (clothing management and hygiene)
- bowel management
- bladder management
- strengthening/endurance
- therapeutic activities
- equipment evaluation
- home management skills
- bed mobility
- transfers
- assessment/evaluation of shoulder function
- range of motion/stretching
- balance
- modalities
- wheelchair management
- mobility
- community reintegration
- skin management
- communication and assistive technology
- splint/cast fabrication
- airway/respiratory management
- education not covered by other activity area

(Ozelle 2009 [5a])

Search Strategy

Databases: OVID MEDLINE, OVID CINAHL, WorldCat@OSU

Search Terms: Pediatric; School age; Adolescent; Spinal cord injury; Trauma; Critical care; Intensive care; Physical therapy; Exercise therapy; Physical activities; Physical performance; Mobility; Positioning; Supervised exercise program; Strengthening; Range of motion; Skin integrity; Occupational therapy; Functional status; Acute Care; Early Rehabilitation; Rehabilitation

Limits, Filters, Search Date Parameters: None

Date most recent search was completed: 4/1/2014

Group/Team Members

Multidisciplinary Team

Team Leader/Author:

Mariann Strenk, PT, DPT, MHS, Division of Occupational Therapy and Physical Therapy

Team Member/Co-Author:

Jody Raugh, PT, DPT, Division of Occupational Therapy and Physical Therapy

Other BES Development Support

Support/Consultant:

Michelle Kiger, OTR/L, Division of Occupational Therapy and Physical Therapy

Mary Gilene, MBA, Division of Occupational Therapy and Physical Therapy

Conflicts of Interest were declared for each team member and:

- No financial or intellectual conflicts of interest were found.
- The following conflicts of interest were disclosed:

Note: Full tables of the [LEGEND evidence evaluation system](#) are available in separate documents:

- [Table of Evidence Levels of Individual Studies by Domain, Study Design, & Quality](#) (abbreviated table below)
- [Grading a Body of Evidence to Answer a Clinical Question](#)
- [Judging the Strength of a Recommendation](#) (dimensions table below and Rationale)

Table of Evidence Levels (see note above):

Quality level	Definition
1a† or 1b†	Systematic review, meta-analysis, or meta-synthesis of multiple studies
2a or 2b	Best study design for domain
3a or 3b	Fair study design for domain
4a or 4b	Weak study design for domain
5a or 5b	General review, expert opinion, case report, consensus report, or guideline
5	Local Consensus

†a = good quality study; b = lesser quality study

Table of Language and Definitions for Recommendation Strength (see note above):

Language for Strength	Definition
It is strongly recommended that... It is strongly recommended that... not...	When the dimensions for judging the strength of the evidence are applied, there is high support that benefits clearly outweigh risks and burdens. (or visa-versa for negative recommendations)
It is recommended that... It is recommended that... not...	When the dimensions for judging the strength of the evidence are applied, there is moderate support that benefits are closely balanced with risks and burdens.
There is insufficient evidence and a lack of consensus to make a recommendation...	

Copies of this Best Evidence Statement (BEST) and related tools (if applicable, e.g., screening tools, algorithms, etc.) are available online and may be distributed by any organization for the global purpose of improving child health outcomes.

Website address: <http://www.cincinnatichildrens.org/service/j/anderson-center/evidence-based-care/bests/>

Examples of approved uses of the BEST include the following:

- Copies may be provided to anyone involved in the organization’s process for developing and implementing evidence based care;
- Hyperlinks to the CCHMC website may be placed on the organization’s website;
- The BEST may be adopted or adapted for use within the organization, provided that CCHMC receives appropriate attribution on all written or electronic documents; and
- Copies may be provided to patients and the clinicians who manage their care.

Notification of CCHMC at EBDMinfo@cchmc.org for any BEST adopted, adapted, implemented, or hyperlinked by the organization is appreciated.

Please cite as: Strenk, M., Cincinnati Children's Hospital Medical Center: Best Evidence Statement Early physical therapy/occupational therapy intervention for traumatic spinal cord injury, <http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/best.htm>, BEST number 193, pages 1-8, September 5, 2014.

This Best Evidence Statement has been reviewed against quality criteria by two independent reviewers from the CCHMC Evidence Collaboration. Conflict of interest declaration forms are filed with the CCHMC EBDM group.

The BEST will be removed from the Cincinnati Children’s website, if content has not been revised within five years from the most recent publication date. A revision of the BEST may be initiated at any point that evidence indicates a critical change is needed.

Review History

Date	Event	Outcome
September 5, 2014	Original Publication	New BEST developed and published

For more information about CCHMC Best Evidence Statements and the development process, contact the Evidence Collaboration at EBDMinfo@cchmc.org.

Note

This Best Evidence Statement addresses only key points of care for the target population; it is not intended to be a comprehensive practice guideline. These recommendations result from review of literature and practices current at the time of their formulation. This Best Evidence Statement does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the recommendations to meet the specific and unique requirements of individual patients. Adherence to this Statement is voluntary. The clinician in light of the individual circumstances presented by the patient must make the ultimate judgment regarding the priority of any specific procedure.