

University of Kentucky
Department of
Physical Medicine and
Rehabilitation

26th Annual PM&R
Research Day
May 22, 2014

Cardinal Hill Rehabilitation Hospital
Center of Learning
Lexington, Kentucky

CARDINAL
HILL® REHABILITATION
HOSPITAL

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UNIVERSITY OF
KENTUCKY®
College of Medicine

PROGRAM AND ABSTRACTS

26th Annual

Physical Medicine and Rehabilitation Research Day

May 22, 2014

Cardinal Hill Rehabilitation Hospital

Lexington, KY

UKHealthCare



26th Annual

**Physical Medicine and Rehabilitation
Research Day**

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Lexington, KY**

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**UNIVERSITY OF KENTUCKY
DEPARTMENT OF PHYSICAL MEDICINE & REHABILITATION
26th ANNUAL RESEARCH DAY AGENDA**

**CARDINAL HILL REHABILITATION HOSPITAL
CENTER OF LEARNING
May 22, 2014**

7:00 a.m. – 7:50 a.m. Dr. Kirshblum Breakfast Lecture and Roundtable with Residents
(Cardinal Hill Boardroom)

7:50 a.m. – 8:00 a.m. Opening Remarks (CL3): Susan McDowell, MD

PM&R RESIDENT RESEARCH PRESENTATIONS – CL3

8:00 a.m. – 8:15 a.m. Jamie Holt Key, DO, Physical Medicine & Rehabilitation
“Retrospective Review of Stroke Rehabilitation Patients Who
Required Return to Acute Care Hospital: a Quality Improvement
Project”

8:15 a.m. – 8:30 a.m. Vinod Muniswamy, MD, MPH, Physical Medicine & Rehabilitation
“Self-Regulation Intervention in Diabetic Amputees”

8:30 a.m. – 8:45 a.m. Vittal Nagar, MD, Physical Medicine & Rehabilitation
“Functional Improvement for Heart Failure Patients after Left
Ventricular Assistive Device Placement in a Free Standing
Rehabilitation Hospital”

8:45 a.m. – 9:00 a.m. Sarah Zalone, DO, Physical Medicine & Rehabilitation
“Mobility Options after Permanent Removal of Hip Arthroplasty
Hardware due to Chronic Dislocation with Development of Hip
and Knee Flexion Contractures”

9:00 a.m. – 9:15 a.m. Aaron Lyles, MD, Physical Medicine & Rehabilitation
“Changes in Ankle Muscular Strength after Anterior Tibialis
Tendon Transfer in Children with Clubfoot Deformities: a
Prospective Study”

9:15 a.m. – 9:30 a.m. John Ma, MD, PhD, Physical Medicine & Rehabilitation
“A Retrospective Study on Decreased Blood Pressure in Post-
CVA Patients with Hypertension Co-morbidity”

9:30 a.m. – 9:45 a.m.

BREAK

9:45 a.m. – 10:00 a.m. Kavita Manchikanti, MD, Physical Medicine & Rehabilitation
“A Retrospective Examination of Gait Changes Following
Selective Dorsal Rhizotomy in Different Age Groups”

10:00 a.m. – 10:15 a.m. Praveen Pakeerappa, MD, Physical Medicine & Rehabilitation
“Outcomes in Phase II Cardiac Rehabilitation: a Retrospective
Analysis Comparing Participants with CABG to Participants with
Non-Surgical Interventions”

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(Continued)

- 10:15 a.m. – 10:30 a.m. Francisco A. Parker, MD, Physical Medicine & Rehabilitation
“Kinematic Effects of Hamstring Lengthening in Children with Cerebral Palsy”
- 10:30 a.m. – 10:45 a.m. Radha Korupolu, MD, Physical Medicine & Rehabilitation
“Effects of Transvertebral Direct Current Stimulation in Healthy Humans: Early Results from an Ongoing Randomized Cross Over Study”
- 10:45 a.m. – 11:00 a.m. Jason Lee, MD, Physical Medicine & Rehabilitation
“Cervical Medial Branch Blocks versus Trigger Point Injections with Cervical Medial Branch Blocks in Patients with Concurrent Zygoapophyseal and Myofascial Pain”
- 11:00 a.m. – 11:15 a.m. Sankar Chirumamilla, MD, Physical Medicine & Rehabilitation
“Ultrasound Guided Access of Intrathecal Drug Delivery System: a Pilot Study”
- 11:15 a.m. – 11:30 p.m. Justin Hare, DO, Physical Medicine & Rehabilitation
“Ultrasound-Guided vs: Templated/Blind Intrathecal Pump Refills”

11:30 a.m. – 12:00 p.m. ***Buffet Lunch (CL2)***

FEATURE SPEAKER – CL3 & CL4

- 12:00 p.m. – 1:00 p.m. Steven Kirshblum, MD
Medical Director, Kessler Institute, West Orange Campus
Co-Project Director, Northern New Jersey Model Spinal Cord Injury System
Professor of PM&R and Program Director of Spinal Cord Injury Medicine Fellowship, Department of Physical Medicine and Rehabilitation Medicine, Rutgers New Jersey Medical School
- “Spinal Cord Injury Rehabilitation and Research: Past, Present and Future”**

POSTER PRESENTATIONS – CL1

- 1:00 p.m. – 1:45 p.m. 1 Sankar Rao Chirumamilla, MD, UK/PM&R
Effect of Athletics on Activities of Daily Living, Depression & Self-efficacy after Spinal Cord Injury
- 2 Melba Custer, PhD, OT/L, EKU
Comparing Constraint-Induced Therapy and Occupation-Based Interventions for Optimal Stroke Recovery
- 3 Zhangliang (John) Ma, MD, PhD, UK/PM&R
Suddenly Elevated International Normalized Ratio Associated with Infections: a Case Report

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DEPARTMENT OF PHYSICAL MEDICINE & REHABILITATION
26th ANNUAL RESEARCH DAY AGENDA
(Continued)

POSTER PRESENTATIONS – CL1 (Continued)

- 4 Vinod Muniswamy, MD, MPH, UK/PM&R
Rehabilitation Benefits in a Four-Year-Old Child with Anoxic Brain Injury: a Case Report
- 5 Vittal Nagar, MD, UK/PM&R
The Effects of Volitional Preemptive Abdominal Contraction on Postural Control Responses
- 6 Laurie Nichols, BS, OT/L, UK/PM&R
Enhancing Upper Extremity Motor Recovery with Brain Stimulation in Spinal Cord Injury: Pilot Data
- 7 Francisco Angulo Parker, MD, UK/PM&R
Knee Hyperextension after Hamstring Lengthening in Cerebral Palsy: Incidence, Predictive Factors and Cost in Gait Efficiency
- 8 Lakshmi Reddy, MBBS, UK/PM&R
Combining Brain Stimulation and Peripheral Nerve Stimulation to Improve Upper Extremity Function after Severe Stroke: Preliminary Results from an Ongoing Study
- 9 Marti Robinson, MD, UK/PM&R
Improvement in Chronic Regional Pain Syndrome Secondary to Stroke: a Case Report
- 10 Sridhar Sunderam, PhD, UK/Biomedical Engineering
Attempted Movement Detection from the EEG for Applications in Motor Rehabilitation using a Brain-Machine Interface
- 11 Erika Erlandson, MD, UK/PM&R
Rehabilitation after Recurrent Ependymoma in 13 Year-Old
- 12 Cheryl Carrico, MS, OT/L, UK/PM&R
Peripheral Nerve Stimulation Paired with Constraint-Induced Therapy to Enhance Post-Stroke Upper Extremity Motor Performance
- 13 KC Chelette, MS, UK/PM&R
Transcranial Direct Current Stimulation for Motor Recovery From Severe Post-Stroke Hemiparesis: Early Results from an Ongoing Clinical Trial
- 14 Megan Danzl, PT, NCS, PhD, CHRH, UK/PM&R
Non-Invasive Brain Stimulation Paired with a Novel Locomotor Training in Chronic Stroke: a Feasibility Study

**UNIVERSITY OF KENTUCKY
DEPARTMENT OF PHYSICAL MEDICINE & REHABILITATION
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(Continued)**

- 15 Zhangliang (John) Ma, MD, PhD, UK/PM&R
Hypotension and Hypertension after Cerebral Vascular Accident:
a Case Report

- 16 Vinod Muniswamy, MD, MPH, UK/PM&R
Neuro-Behcet's Disease – Challenges of this Non Traumatic
Spinal Cord Injury in a Rehabilitation Setting: a Case Report

AWARDS AND CLOSING REMARKS – CL3

1:45 p.m. – 2:00 p.m.

Awards & Closing Remarks
Joe Springer, PhD, Physical Medicine & Rehabilitation
Robert Nickerson, MD, Physical Medicine & Rehabilitation

PM&R Resident Presentations

ORAL PRESENTATIONS

Presenter:

Abstract Presentation:

Jamie Holt Key, DO

“Retrospective Review of Stroke Rehabilitation Patients Who Required Return to Acute Care Hospital: a Quality Improvement Project”

Vinod Muniswamy, MD, MPH

“Self-Regulation Intervention in Diabetic Amputees”

Vittal Nagar, MD

“Functional Improvement for Heart Failure Patients after Left Ventricular Assistive Device Placement in a Free Standing Rehabilitation Hospital”

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“Mobility Options after Permanent Removal of Hip Arthroplasty Hardware due to Chronic Dislocation with Development of Hip and Knee Flexion Contractures”

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“Changes in Ankle Muscular Strength after Anterior Tibialis Tendon Transfer in Children with Clubfoot Deformities: a Prospective Study”

John Ma, MD, PhD

“A Retrospective Study on Decreased Blood Pressure in Post-CVA Patients with Hypertension Co-morbidity”

Kavita Manchikanti, MD

“A Retrospective Examination of Gait Changes Following Selective Dorsal Rhizotomy in Different Age Groups”

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“Outcomes in Phase II Cardiac Rehabilitation: a Retrospective Analysis Comparing Participants with CABG to Participants with Non-Surgical Interventions”

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“Cervical Medial Branch Blocks versus Trigger Point Injections with Cervical Medial Branch Blocks in Patients with Concurrent Zygoapophyseal and Myofascial Pain”

Sankar Chirumamilla, MD

“Ultrasound Guided Access of Intrathecal Drug Delivery System: a Pilot Study”

Justin Hare, DO

“Ultrasound-Guided vs: Templated/Blind Intrathecal Pump Refills”

NOTES

PM&R RESIDENT PRESENTATION

Retrospective Review of Stroke Rehabilitation Patients Who Required Return to Acute Care Hospital: a Quality Improvement Project

Presenter:

Jamie Holt Key, DO^{1,2}

Faculty Mentors/Collaborators:

Erika Erlandson, MD¹

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

²Cardinal Hill Rehabilitation Hospital – Stroke Rehabilitation Unit

Abstract Text:

A retrospective chart review will be used to determine factors that place stroke patients at risk for return to acute care hospital (RTACH) after admission to an inpatient rehabilitation facility (IRF). The study will include 94 patients admitted to IRF between July, 2012 and November, 2013 who required RTACH due to medical or surgical complications requiring a higher level of care. The study will compare patient demographics, admission diagnoses including anatomic distribution of stroke, etiology, complications such as aphasia and dysphagia, and required surgical intervention for stroke. The study will also evaluate 1) which patients received consultation by the Rehabilitation Service during the initial acute care admission, 2) admission and discharge Functional Independence Measures (FIM) scores, 3) length of stay at acute care, 4) date and time of admission to IRF, 5) National Institutes of Health Stroke Scale (NIHSS) scores on initial stroke presentation and day of discharge to IRF, and 6) co-morbidities and risk factors of stroke as well as medications administered for secondary stroke prophylaxis at time of admission to IRF. The study is designed to identify risk factors that should be addressed prior to admission to IRF. If a set of risk factors can be identified, a protocol may then be developed for standardization of transition of care. Stage two of this study would include a prospective view of use of the new protocol in efforts to decrease transfers to acute care thereby potentially decreasing interruptions in rehabilitation, disability, and total healthcare costs.

Key Words: Stroke, Rehabilitation, Risk Factors, Functional Independence Measures, National Institutes of Health Stroke Scale

NOTES

PM&R RESIDENT PRESENTATION

Self-Regulation Intervention in Diabetic Amputees

Presenter:

Vinod Muniswamy, MD, MPH¹

Collaborators:

Joe Springer, PhD¹, Sara S Salles, DO¹

Departmental Affiliations:

¹Department of Physical Medicine & Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

Background: Diabetic conditions account for 50% or more of non-traumatic amputations, with nearly 34% requiring a second more extensive amputation within 16 weeks of the initial amputation. Diabetics develop lower extremity amputations for many reasons such as a prevalence and failure to heal foot ulcers. Research has shown that patients with diabetes can learn to use self-regulation to improve disease management behavior, and that a program based on this principle can result in positive health outcomes and quality of life.

Objectives: The specific aim of this pilot randomized controlled trial is to implement and evaluate an innovative self-regulation intervention (SRI) for a limited number of adult diabetic amputees. The sub-aims include:

1. Assess the effects of SRI on amputee health care utilization (emergency room (ER) visits, etc).
2. Assess the effects of the intervention on quality of life.
3. Evaluate the effects on outcomes, including blood sugar control, cost effectiveness, and foot care self-efficacy.

Methodology: The intervention will be based on social cognitive theory, particularly the principles of self-regulation. Self-regulation will involve blood sugar control, skin care, foot care, nail care, diet and physical activity monitoring. Participants will be introduced step-by-step to a self-regulatory problem-solving process. The self-regulatory steps will be complimentary to the therapeutic plan and clinical recommendations of the participant's clinician. Participants will be guided through a period of self-observation using blood sugar testing and a symptom diary, along with a checklist of physical activity, environmental factors, and other potential causes. It is hypothesized that, during this phase, subjects will realize the barriers to achieving the desired management practices and outcomes. The intervention will follow a self-regulation process in which the participant first selects a specific problem they would like to address, researches his/her routine to see how diabetes is preventing resolution of the problem, and finally identifies and develops a plan to achieve their objectives. Both theory-based health as well as general diabetes control education will be provided in an integrated fashion. The program will be individualized to each participant's level of self-regulation, determined at baseline. Patients will be followed at 1, 3, 6 and 12 month to see progress, monitor complications and assess awareness of self-regulation.

Anticipated results: With the proposed intervention in our pilot group we anticipate to see an improvement in the quality of life, as well as a decrease in 1) the complication rates of diabetic amputees, 2) subsequent amputations, 3) ER visits, and 4) health care management costs.

Key Words: Self-regulation, Diabetes, Diabetic Complications, Diabetic Amputees, Amputation

NOTES

PM&R RESIDENT PRESENTATION

Functional Improvement for Heart Failure Patients after Left Ventricular Assistive Device Placement in a Free Standing Rehabilitation Hospital

Presenter:

Vittal Nagar, MD¹

Collaborators:

Robert Nickerson, MD¹

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

Objective: The purpose of this study was to examine effectiveness of acute inpatient rehabilitation (AIR) in improving functional outcomes in people who have undergone left ventricular assist device (LVAD) placement.

Design: Retrospective review

Methods: 20 LVAD patients admitted to free-standing rehabilitation hospital, Cardinal Hill Rehabilitation Hospital, Lexington, KY over a 34-month period, between Jan 2011 and Nov 2013. The hospital records were reviewed and analyzed irrespective of initial admission diagnoses.

Results: LVAD patients with AIR had significantly higher Functional Independence Measure (FIM) scores from admission to discharge on several FIM categories. Specifically, two-tailed paired t-test demonstrated that AIR resulted in a significant increase in: (1) total FIM score ($p < 0.0001$); (2) motor ($p < 0.0001$) and cognitive ($p < 0.0001$) FIM components; (3) self-care ($p < 0.0001$), transfer-mobility ($p = 0.0001$), communication ($p < 0.0001$), and social cognition ($p < 0.0001$) sub-components. The mean \pm standard deviation (SD) for (a) length of stay was 12.3 ± 6.3 days; (b) total FIM gain was 27.05 ± 13.41 compared to the national mean of 23 for patients admitted to AIR for cardiac diagnosis; (c) total FIM efficiency was 2.454 ± 1.4 , compared to the national mean for cardiac-related AIR stay of 2.28. Ninety-five percent of patients were discharged directly to home.

Conclusions: Our findings suggest that patients with LVADs achieved both motor and cognitive functional gains from AIR stay. Beneficial effect of AIR stay promotes safe discharge home. Multidisciplinary rehabilitation approach used in a free-standing rehabilitation hospital improves overall functional activity of LVAD patients.

Key Words: Heart Failure, Left Ventricular Assist Device, Free Standing Rehabilitation Hospital, Functional Recovery

NOTES

PM&R RESIDENT PRESENTATION

Mobility Options after Permanent Removal of Hip Arthroplasty Hardware due to Chronic Dislocation with Development of Hip and Knee Flexion Contractures

Presenter:

Sarah Zalone, DO¹

Collaborators:

Oscar Ortiz, MD²

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

²Department of Physical Medicine and Rehabilitation, VAMC, Lexington, KY

Abstract Text:

There is very little scientific medical literature about rehabilitation treatments and outcomes for patients with permanent resection of hip arthroplasty. The purpose of this case study is to provide insight into the rehabilitation strategies for independent mobility in a bed-bound patient after hardware removal of a hip arthroplasty due to dislocation and the subsequent development of severe hip and knee flexion contractures. We will follow the progression of the treatment of the contractures, bed mobility and transfer skills, as well as household and community mobility. We will use the pictures of the patient's hip and knee to demonstrate the severity of the contractures, as well as goniometer measurements, and weekly physical therapy reports of level of function, to document interventions and progress.

Key Words: Hip, Dislocation, Contractures, Mobility

NOTES

PM&R RESIDENT PRESENTATION

Changes in Ankle Muscular Strength after Anterior Tibialis Tendon Transfer in Children with Clubfoot Deformities: a Prospective Study

Presenter:

Aaron Lyles, MD¹

Collaborators:

Hank White, PT, PhD³, J.J. Wallace, MS³, Sam Augsburger, MS³, Janet Walker, MD^{2,3}, Henry Iwinski, MD^{2,3}, Erika Erlandson, MD¹

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

²Department of Orthopaedic Surgery, University of Kentucky, Lexington, KY

³Shriners Hospitals for Children, Lexington, KY

Abstract Text:

Anterior tibialis tendon transfer (ATTx) is a well-accepted treatment for children with recurrent clubfoot deformity in which dynamic foot supination results in abnormal ambulation on the anterolateral foot. The Ponseti casting method remains the primary initial treatment for clubfoot deformity, but recurrence of clubfoot occurs frequently after casting (14-40%) and ATTx is required in approximately 30% of children with clubfeet. ATTx is done to improve the imbalance between foot inverters (including the tibialis anterior) and weak foot everters, but tendon transfer surgery may weaken the transferred muscle, which may affect its primary function of dorsiflexion. Hand held dynamometers are a standard, unbiased way of measuring muscle strength and have been validated for use in young children. As part of a larger (yet to be published) prospective study designed to evaluate the effects of ATTx on pedobarograph parameters, hand held dynamometry measurements of muscle strength at the ankle were obtained in 16 patients (mean age 59 months) with 23 involved limbs and 9 uninvolved limbs prior to and 6 months after ATTx. All measurements were normalized to the patient's weight and the maximum value of three trials for each measurement was used for statistical analysis. As would be expected, ATTx feet were weaker than contralateral limbs for all parameters (inversion, eversion, dorsiflexion, and plantarflexion) both before and after surgery. Ankle dorsiflexion and inverter strength were unchanged in the ATTx limbs following surgery, suggesting that ATTx surgery does not cause weakening of the tibialis anterior.

Key Words: Clubfoot; Talipes Equinovarus; Anterior Tibialis Tendon Transfer; Hand Held Dynamometer

NOTES

PM&R RESIDENT PRESENTATION

A Retrospective Study on Decreased Blood Pressure in Post-CVA Patients with Hypertension Co-morbidity

Presenter:

John Ma, MD, PhD^{1,2}

Collaborators:

Robert Nickerson, MD¹, Joe Springer, PhD¹

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

²Cardinal Hill Rehabilitation Hospital, Lexington, KY

Abstract Text:

Cerebrovascular accidents (CVA) are the 4th leading cause of death annually affecting approximately 800,000 people in the United States. Hypertension (HTN) is considered to be one of the most important risk factors for stroke. Post-CVA, a patient's blood pressure (BP) may become difficult to manage. For example, some patients experience continuing HTN, some experience orthostatic *hypotension*, while others require a decrease in their anti-HTN medications. We have observed two CVA patients with a history of intractable HTN, both of whom experienced hypotension during their rehabilitation course. Their anti-HTN medications had to be tapered down/off in order to maintain a systolic blood pressure above 100. At the present time, there are no studies exploring conditions that contribute to alterations in HTN post-CVA, as well as guide physiatrists to limit or reduce anti-HTN medications. Our retrospective study will examine anti-HTN medications in patients at admission to and discharge from rehabilitation. Patients will be sorted into two groups based on (1) increasing or no change in anti-HTN medications, or (2) a significant decrease in dose or tapering off anti-HTN medications. We will also examine each patient's MRI/CT scans and test for a correlation between stroke lesion location and post-CVA hypotension. Patients from the general rehabilitation unit will be used as an internal control to rule out the role of any possible environmental factors on BP changes. The outcomes of this study may provide physiatrists with evidence-based insight for proper adjustment of anti-HTN medications in certain populations of post-CVA patients.

Key Words: Hypotension, Hypertension, CVA, Overmedicated

NOTES

PM&R RESIDENT PRESENTATION

A Retrospective Examination of Gait Changes Following Selective Dorsal Rhizotomy in Different Age Groups

Presenter:

Kavita Manchikanti, MD¹

Collaborators:

Hank White, MSPT, PhD², Henry Iwinski, MD², Sara Salles, DO¹

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

²Shriners Hospital for Children, Lexington, KY

Abstract Text:

Selective dorsal rhizotomy (SDR) is widely used in the treatment of children with cerebral palsy (CP) and has been shown to reduce spasticity and improve gait parameters. The recommended age for SDR varies between centers, but some suggest that it be performed at an age prior to irreversible neuromuscular changes and the need for orthopedic interventions. However, few studies have compared outcomes between age groups. This study seeks to examine changes in gait following SDR across different age groups. An IRB approved retrospective review of 46 patients with CP with spastic diplegia (GMFCS levels 1-4) who underwent SDR was performed. Participants who had gait analysis prior to and one year post-SDR were included. Age range was 3.5 to 15.8 years. Subjects were subdivided into two age groups: less than 6 (n= 21) and 6 or older (n=25) at time of SDR. Pre- and post-operative gait parameters in the groups were compared using a paired t test. Significance was set at 0.05. After SDR, statistically significant improvements in gait kinematics of decreased anterior trunk lean, hip flexion, and knee flexion during stance were noted in the younger group. Both groups demonstrated increased dorsiflexion during stance. Walking speed remained unchanged. Limitations of this study include lack of controls for other interventions and long-term follow up. The results suggest that further research should compare long-term outcomes following SDR between age groups. Duplication of these results would support that SDR should be pursued at a young age if improved gait is the desired outcome.

Key Words: Spasticity, Cerebral Palsy, Selective Dorsal Rhizotomy

NOTES

PM&R RESIDENT PRESENTATION

Outcomes in Phase II Cardiac Rehabilitation: A Retrospective Analysis Comparing Participants with CABG to Participants with Non-Surgical Interventions

Presenter:

Praveen Pakeerappa, MD¹

Collaborators:

Beth Cundiff, MS, CSCS², Robert Nickerson, MD¹, Alison Bailey, MD²

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

²Department of Cardiology, University of Kentucky, Lexington, KY

Abstract Text:

Background: Coronary artery disease (CAD) is one of the leading causes of morbidity and mortality in the United States. A sedentary lifestyle is one among the chief modifiable risk factors in the development of CAD. Physical activity not only aids in the prevention of CAD, but can also help mitigate further damage. Therefore a focused and structured cardiac rehabilitation exercise program following an acute coronary event is associated with the overall reduction in the risk for future cardiac events and is simultaneously correlated to improvement in the quality of life for the patient.

Proposed Objectives: The proposed objective for this study is to review the specific outcomes of a structured exercise program in the outpatient rehab setting following hospitalization for an acute coronary event. Data will be reviewed from patients that were referred to and also completed an outpatient cardiac rehabilitation exercise program.

Proposed Methods: Reviewing the exercise program data of patients who have completed a total of 24-36 sessions of outpatient cardiac rehabilitation. The data from the modalities of exercise include: treadmill, arm ergometer, bicycle ergometer, seated elliptical, elliptical, Schwinn Airdyne and strength training. Borg Rating of Perceived Exertion (RPE) and Talk Test during exercise are also utilized to scale and rate individual perception of the intensity of the exercises.

Anticipated Results: This study supports the use of a structured exercise cardiac rehabilitation program for improvements in both functional endurance and psychosocial wellbeing following a cardiac event for patients with CAD.

Key Words: CAD; Coronary Artery Disease, CPF; Cardiopulmonary Fitness, CR; Cardiac Rehabilitation.

NOTES

PM&R RESIDENT PRESENTATION

Kinematic Effects of Hamstring Lengthening in Children with Cerebral Palsy

Presenter:

Francisco Angulo Parker, MD¹

Collaborators:

Radha Korupolu, MD¹, Hank White, PhD², Henry J. Iwinski, MD³, Sara Salles, DO¹

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

²Shriners Hospital for Children, Lexington, KY

³Department of Orthopedic Surgery, University of Kentucky, Lexington, KY

Abstract Text:

Objective: To study the outcomes of hamstring lengthening in children with cerebral palsy with spastic diplegia, including knee hyperextension, proximal joint effects and changes in temporal-spatial parameters.

Design: A Retrospective study

Setting: A tertiary referral center for children with cerebral palsy

Participants: 147 ambulatory children with cerebral palsy spastic diplegia who underwent Hamstring Lengthening

Main Outcome Measures: Knee, hip and pelvic kinematics were collected by chart review from preoperative and postoperative gait analysis data. Regression analysis.

Results: There was no significant change in hip kinematics after HL. At mid-stance, a >10° increase in anterior pelvic tilt was noted in 18% (n=26) of the subjects, with a mean increase of 14.9° (p<0.001). In remaining subjects (n=121) mean change in pelvic tilt was 2° (p<0.001). Subjects with simultaneous rectus femoris transfer (RFT) were noted to have a smaller increase in mean anterior pelvic tilt compared to subjects without RFT (2.8° vs. 5.8°, p=0.01). Knee hyperextension was present in 11.5% of the population. Regression analysis showed that the main predictor of hyperextension after hamstring lengthening is knee flexion at midstance (mean of 23.9 degrees). There were no significant changes in oxygen consumption data when comparing children with hyperextended vs. non hyperextended knees.

Conclusions: On average, only a 2° increase in anterior pelvic tilt was noted. A small percentage of subjects demonstrated greater than 10° increase in anterior pelvic tilt. However, HL combined with RFT when indicated appeared to counteract the effect on pelvic tilt. Temporal- spatial gait parameters, including cadence, velocity and stride length, improved after HL. Future research is needed to evaluate the long-term effects of HL to assist surgeons in predicting surgical outcomes. Knee hyperextension did not result in a significant change in oxygen consumption.

Key Words: Cerebral Palsy, Hamstring, Gait

NOTES

PM&R RESIDENT PRESENTATION

Effects of Transvertebral Direct Current Stimulation in Healthy Humans: Early Results from an Ongoing Randomized Cross Over Study

Presenter:

Radha Korupolu, MD¹

Collaborators:

Elizabeth Salmon, MS¹, Cheryl Carrico, MS, OT/L¹, Lakshmi Reddy, MBBS¹, Lumy Sawaki, MD, PhD^{1,2}

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

²Cardinal Hill Rehabilitation Hospital, Lexington, KY

Abstract Text:

Objective: Non-invasive transcranial direct current stimulation has been shown to modulate cortical excitability in various studies. Recent preliminary studies suggest transvertebral direct current stimulation (tvDCS) may engender a similar modulation effect on spinal neurons. Promising adjuvant treatment options when paired with locomotor training may therefore be possible for patients with neurological disorders. Our goal is to study the effects of tvDCS in healthy subjects in order to establish a reliable and reproducible tvDCS methodology to modulate spinal excitability in subjects with spinal cord injury (SCI). Long-term goals include evaluating effects of tvDCS paired with locomotor training for subjects with motor incomplete SCI.

Design: Randomized crossover study.

Participants: Five healthy subjects with no history of neurologic disorders.

Intervention: We randomized subjects to receive 1 of 3 tvDCS conditions (ie, anodal, cathodal, or sham) at an intensity of 2.0 mA for 20 minutes to spinal level T10-T11. For sham tvDCS, intensity was ramped up then ramped down over a thirty-second window in order to evoke a similar sensation as active tvDCS.

Main Outcome Measures: Bilateral triceps surae motor evoked potentials (MEP) elicited by transcranial magnetic stimulation and H_{\max}/M_{\max} ratio recorded over soleus muscle by stimulation of tibial nerve immediately before and after tvDCS.

Results: Preliminary results showed no significant difference in H_{\max}/M_{\max} ratio throughout all conditions. Recorded MEP amplitudes revealed high variability across all conditions before and after tvDCS.

Conclusions: Our preliminary results did not reveal any significant changes in MEPs and H_{\max}/M_{\max} ratio after a single session of tvDCS in healthy subjects. Further research is required to refine tvDCS methodology to modulate spinal excitability in subjects with spinal cord injury (SCI).

Key Words: Transcutaneous Spinal Direct Current Stimulation, Spinal Cord, Evoked Potentials, H Reflex

NOTES

PM&R RESIDENT PRESENTATION

Cervical Medial Branch Blocks versus Trigger Point Injections with Cervical Medial Branch Blocks in Patients with Concurrent Zygoapophyseal and Myofascial Pain

Presenter:

Jason Lee, MD¹

Collaborators:

Pravardhan Birthi, MD¹, Jay Grider, DO, PhD, MBA²

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

²Department of Anesthesiology Interventional Pain Medicine, University of Kentucky, Lexington, KY

Abstract Text:

Background: Chronic cervicgia secondary to cervical facet joint syndrome with associated chronic myofascial pain syndrome is unfortunately a very common and increasingly prevalent disorder. The prevalence of persistent neck pain, secondary to involvement of cervical facet or zygapophysial joints, has been described in controlled studies as varying from 39% to 67%. Cervical facet syndrome (a) is associated with mild-severe shoulder pain, neck pain, headache, suprascapular pain, scapula pain and upper arm pain. Myofascial pain syndrome is often associated with facet arthropathy and creates trigger points that are also significant pain generators. Myofascial pain generators are found in 85% of patients referred to pain clinics (a) emphasizing the importance of this study. We hypothesize that treating the facet pain and trigger points simultaneously will lead to more significant and lasting pain relief than merely treating zygoapophyseal pain generators alone.

Objectives: To determine the clinical effectiveness of therapeutic local anesthetic cervical medial branch blocks with or without trigger point injections in managing chronic neck pain of facet joint origin and concurrent myofascial pain.

Study Design: The study design will be a randomized single blinded controlled trial. Medial branch blocks will be performed using the same procedure in both groups. It is difficult to placebo control for myofascial trigger point injections because even saline injections and dry needling have been proven to be effective in the treatment of trigger points.

Key Words: Chronic Cervicgia, Myofascial Pain, Trigger Point Injection, Medial Branch Block

NOTES

PM&R RESIDENT PRESENTATION

Ultrasound Guided Access of Intrathecal Drug Delivery System: A Pilot Study

Presenter:

Sankar Chirumamilla, MD¹

Collaborators:

Sara S. Salles, DO¹, Justin Hare, DO¹, Erika Erlandson, MD¹

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

Intrathecal Drug Delivery Systems (IDDS) are used in the treatment of spasticity and chronic pain^{1,2}. IDDS require periodic scheduled refilling of its reservoir via Reservoir Port (RP). The RP can be localized by palpation using standard template. Occasionally, localization of the RP using the standard techniques is challenging and depends on the provider's level of training. Reported complications of IDDS refilling include pain, intrathecal granulomas, seromas, micro-hematomas, inadvertent placement of drug in pump pocket and death from infections, drug overdose or withdrawal^{3,4}. Using ultrasound guidance for needle placement and accurate access of the RP has been proposed; nevertheless, there is lack of any Standardized Operating Procedure (SOP)^{3,5}. Gofeld and McQueen have reported 100% positive and negative predictive value of an ultrasound guided RP access on a cadaver⁶. To our knowledge, there is no existing prospective randomized case control study to determine the safety and efficacy of ultrasound guidance for IDDS refill. Our objectives are to identify 1) the average amount of duration and average number of skin penetration it takes to access RP by health care providers with varying levels of experience, 2) individuals with "difficult to access port (DAP)" intrathecal drug delivery system and design 3) SOP for ultrasound guided RP access 5) a prospective, randomized case control study to identify safety and efficacy of ultrasound guided IDDS port access vs. template guided IDDS port access based on the outcomes of this pilot study. Individuals who receive IDDS refill at University of Kentucky Clinic and who 1) have had one minimum refill of IDDS, 2) are age 18 and above at the time of study, 3) are able to provide informed consent by themselves or by surrogate or by legal guardian, and 4) are able to speak and understand English will be invited to participate. The study will be conducted in two phases. During Phase I, we will identify minimum number of needle penetrations and minimum amount of time to access RP. And during Phase II, we will identify individuals with DAP and design SOP for ultrasound guided IDDS refill.

Key Words: Ultrasound, Intrathecal Drug Delivery System, Difficult to Access Port

NOTES

PM&R RESIDENT PRESENTATION

Ultrasound-Guided vs.: Templated/Blind Intrathecal Pump Refills

Presenter:

Justin Hare, DO¹

Faculty Mentors/Collaborators:

Erika Erlandson, MD¹, Sankar Chirumamilla, MD¹

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

Background: To my knowledge there have been no studies that clinically evaluate the use of ultrasound guidance to access and refill implanted intrathecal pumps. Ultrasound is being widely used to help limit procedural complications and allow appropriate localization of anatomic structures.

Hypothesis: Ultrasound-guided intrathecal pump refills will decrease amount of time to access pump, decrease number of sticks/maneuvers, decrease post-procedure pain, and increase patient satisfaction.

Objective: The aim of this study is to compare the efficacy, safety, duration, and patient satisfaction of Ultrasound-guided vs.: Blind/Templated intrathecal pump refills.

Design: Prospective, clinical trial comparing Ultrasound-guided vs.: Templated intrathecal pump refills. The study will include -patients from our University of Kentucky PM&R Clinic with intrathecal pumps. Subjects will be randomized to obtain an equal number of patients in each group. Patient/Physicians will not be blinded secondary to the use of ultrasound due to limited ability to blind that factor from either the patient or physician.

Study Population: Inclusion Criteria: patient with implanted intrathecal pumps who are 18 years or older and are willing to participate in the study. Exclusion Criteria: <18yrs, Infection/Hospitalization within last month, active fever or current infection, need for pump/battery exchange within next 3 months.

Outcomes Measured: Time: Setup time: After timeout to beginning to access pump, access time: when template/US touches pump site to access and current pump medication is removed and first seen in the catheter, needle sticks and needle maneuvers per refill, number of traumatic taps, Pain: post-procedure: immediate, at follow-up visit for next refill, complications (infection, pump site bruising, pocket fills): immediate, at follow-up visit for next refill, and, Patient satisfaction: post-procedure.

Expected Outcome: Ultrasound will decrease pump access time, ultrasound will decrease needle maneuvers/number of sticks, pain will be improved by use of ultrasound post-procedure, less overall complications with ultrasound, and there will be improved Patient satisfaction with the use of ultrasound.

Key Words: Intrathecal, Ultrasound, Template, Pump

NOTES

POSTER PRESENTATIONS

<u>Presenter:</u>	<u>Poster #</u>	<u>Poster Presentation:</u>
Sankar Rao Chirumamilla, MD UK/PM&R	1	Effect of Athletics on Activities of Daily Living, Depression & Self-efficacy after Spinal Cord Injury
Melba Custer, PhD, OT/L EKU	2	Comparing Constraint-Induced Therapy and Occupation-Based Interventions for Optimal Stroke Recovery
Zhangliang (John) Ma, MD, PhD UK/PM&R	3	Suddenly Elevated International Normalized Ratio Associated with Infections: a Case Report
Vinod Muniswamy, MD, MPH UK/PM&R	4	Rehabilitation Benefits in a Four-Year-Old Child with Anoxic Brain Injury: a Case Report
Vittal Nagar, MD UK/PM&R	5	The Effects of Volitional Preemptive Abdominal Contraction on Postural Control Responses
Laurie Nichols, BS, OT/L UK/PM&R	6	Enhancing Upper Extremity Motor Recovery with Brain Stimulation in Spinal Cord Injury: Pilot Data
Francisco A. Parker, MD UK/PM&R	7	Knee Hyperextension after Hamstring Lengthening in Cerebral Palsy: Incidence, Predictive Factors and Cost in Gait Efficiency
Lakshmi Reddy, MBBS UK/PM&R	8	Combining Brain Stimulation and Peripheral Nerve Stimulation to Improve Upper Extremity Function after Severe Stroke: Preliminary Results from an Ongoing Study
Marti Robinson, MD UK/PM&R	9	Improvement in Chronic Regional Pain Syndrome Secondary to Stroke: a Case Report
Sridhar Sunderam, PhD UK/Biomedical Engineering	10	Attempted Movement Detection from the EEG for Applications in Motor Rehabilitation using a Brain-Machine Interface
Erika Erlandson, MD UK/PM&R	11	Rehabilitation after Recurrent Ependymoma in 13 Year-Old
Cheryl Carrico, MS, OT/L UK/PM&R	12	Peripheral Nerve Stimulation Paired with Constraint-Induced Therapy to Enhance Post-Stroke Upper Extremity Motor Performance
KC Chelette, MS UK/PM&R	13	Transcranial Direct Current Stimulation for Motor Recovery From Severe Post-Stroke Hemiparesis: Early Results from an Ongoing Clinical Trial
Megan Danzl, PT, NCS, PhD CHRH, UK/PM&R	14	Non-Invasive Brain Stimulation Paired with a Novel Locomotor Training in Chronic Stroke: a Feasibility Study

POSTER PRESENTATIONS

<u>Presenter:</u>	<u>Poster #</u>	<u>Poster Presentation:</u>
Zhangliang (John) Ma, MD, PhD UK/PM&R	15	Hypotension and Hypertension after Cerebral Vascular Accident: a Case Report
Vinod Muniswamy, MD, MPH UK/PM&R	16	Neuro-Behcet's Disease – Challenges of this Non Traumatic Spinal Cord Injury in a Rehabilitation Setting: a Case Report

POSTER PRESENTATION - 1**Effect of Athletics on Activities of Daily Living, Depression & Self-Efficacy after Spinal Cord Injury****Presenter:**Sankar Rao Chirumamilla, MD¹**Collaborators:**Sara S. Salles, DO¹**Departmental Affiliations:**¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY**Abstract Text:**

Major depression is the most common psychiatric disorder in individuals with spinal cord injury (SCI). In a recent longitudinal study, approximately 20 to 22% of individuals with SCI have probable major depression (5). The prevalence of depression ranges from 11% to 37% with significant symptoms (1, 2, 6). Physical activity and exercise are proven to improve overall mental health, prevent depression and are negatively related to depression (3, 4). The purpose of this study is to determine the effect of physical activity not only on depression but also on activities of daily living and self-efficacy in individuals with SCI. We also studied eleven different barriers for physical activity. Individuals with spinal cord injury greater than 18 years of age were included in the study. Participants were asked to complete a questionnaire about their ability to participate in athletic activities, age at the time of injury, income, perceived barriers for physical activity, perceived exertion scale, general self-efficacy scale, Zung Self-rated depression scale and Brunel Mood Scale. SPSS software was used to compare level of depression, mood, self-efficacy, exertion with Activities of Daily Living, level of community participation, and barriers to participation in both groups. Seventy six participants completed the survey. Of them 47 (61.8%) were male with mean age of 42.7 years and mean is 32 .8 years age at the time of injury. Forty (52.6%) identified themselves as athletes. The average score on Zung depression scale for athletes was 42 and for nonathletes was 38 ($p = 0.01$). The general self-efficacy of athletes was higher than non-athletes ($p = 0.024$). Athletes scored higher in perceived exertion scale with mean of 123 ($p = 0.013$), perhaps because of their involvement in more physical activity. The likelihood of overcoming barriers such as “nobody to go with” ($p=0.011$), “lack of local opportunities” ($p=0.019$) and “other causes” ($p=0.045$) is the key for participating in athletic activities. When compared the means of six mood categories on Brunel Mood Scale, athletes reported significantly higher “Vigor” ($p = 0.011$). Participating in athletics is associated with low depression in individuals with SCI. Overcoming perceived barriers such as lack of athletic partner, lack of local opportunities are important for individuals with SCI in participating in sports. Identifying these barriers and assisting them to overcome these barriers improves their quality of life.

Key Words: Spinal Cord Injury, Athletics, Depression**Reference:**

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POSTER PRESENTATION - 2

Comparing Constraint-Induced Therapy and Occupation-Based Interventions for Optimal Stroke Recovery

Presenter:

Melba Custer, PhD, OT/L¹

Collaborators:

Camille Skubik-Peplaski, PhD, OTR/L, FAOTA, BCP¹, Lumy Sawaki, MD, PhD², Cheryl Carrico, MS, OTR/L², Laurie Nichols, OTR/L², Robin Stroud, OTR/L¹, Elizabeth Salmon, MS², Emily Salyers²

Departmental Affiliations:

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²Department of Physical Medicine & Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

Objective: To investigate change in motor performance and the extent of neuroplastic change associated with occupation-based intervention and modified-constraint-induced therapy in the recovery of motor function following a stroke.

Rationale/Background: Two-thirds of stroke survivors experience upper-extremity (UE) impairment (Rosamond et al., 2008), leading to difficulty with UE motor function and performing meaningful life activities (Trombly & Ma, 2002). Evidence suggests that modified constraint-induced therapy (mCIT), a technique using high repetition movement patterns is effective in improving UE function (Liepart, 2000). In addition, occupation-based interventions appear highly concordant with principles of interventions to drive neuroplastic change (Skubik-Peplaski et al, 2012). Confusion exists for occupational therapists on which technique is more effective.

Methods: 16 participants that experienced a stroke greater than one year ago will be recruited for a mixed method study will be conducted including pre and post testing with the outcome tools: Fugl Meyer, Stroke Impact Scale, Canadian Occupational Performance Measure, Goal Attainment Scale and Transcranial Magnetic Stimulation. Participants will be randomized into one intervention group and receive 8 intervention sessions. Qualitative measures will consist of interviews and therapist journals with data being collected and analyzed simultaneously to achieve constant comparison (Creswell, 2007). Analysis will include axial coding to identify themes.

Results/Limitations/Conclusions: This study began August 2013 with 8 clients recruited to date. All clients have demonstrated gains in motor recovery and clinically relevant changes in their ability to resume desired roles.

Key Words: Stroke Recovery, Modified Constraint-Induced Therapy, Occupation-Based Interventions

POSTER PRESENTATION - 3

Suddenly Elevated International Normalized Ratio Associated with Infections

Presenter:

Zhangliang (John) Ma, MD, PhD¹

Collaborators:

Oscar Ortiz Vargas, MD^{1,2}, Joe Springer, PhD¹, Robert Nickerson, MD¹

Departmental Affiliations:

¹Department of Physical Medicine & Rehabilitation, University of Kentucky, Lexington, KY

²Department of Physical Medicine & Rehabilitation, VAMC, Lexington, KY

Abstract Text:

We report three different scenarios with suddenly elevated International Normalized Ratio (INR) in patients who were on anti-coagulation therapy with Coumadin. During our clinic observation, these three patients did not have any changes to their diet, medication or antibiotic treatments prior to elevated INR. In two stroke patients, one was later found to have an abdominal abscess as determined by abdominal CT at an acute care hospital. The second stroke patient was found to have acute parotiditis. The third patient had polytrauma due to a MVC and later was found to have abscess in her left thigh as determined by CT scan at an acute care hospital. These cases suggest that sudden INR elevation may be related to infections secondary to anti-coagulation treatment.

Key Words: INR, Elevation, Infection

POSTER PRESENTATION - 4

Rehabilitation Benefits in a Four-Year-Old Child with Anoxic Brain Injury: a Case Report

Presenter:

Vinod Muniswamy, MD, MPH¹

Collaborators:

Marti Robinson, MD¹, Sarah Zalone, DO¹, Erika Erlandson, MD¹

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

A four-year-old male with multiple ventricular septal defects, a patent foramen ovale, and pulmonary hypertension underwent primary closure of his cardiac defects. Post-operative complications included mediastinal bleeding, hypotension, decompensation requiring extracorporeal membrane oxygenation, cardiopulmonary arrest, and significant anoxic brain injury. Subsequently, he developed profound neurologic impairment, seizures, autonomic instability, spasticity, dysphagia, and neurogenic bowel and bladder. Acute inpatient rehabilitation was arranged for family teaching.

Upon initial evaluation, medical and rehabilitation prognosis remained guarded due to significant neurologic injury. Presenting with primitive reflexes, unremitting nystagmus, and quadraparesis, he lacked head and trunk control, a visual startle, vocalization, and visual tracking. He underwent intense comprehensive inpatient rehabilitation with multimodal stimulation and medical management for dysautonomia, spasticity, dystonia, paroxysmal dyskinesia, seizures, and neurogenic bowel. Additionally, he developed persistent masseter and gastrocnemius-soleus spasms requiring onabotulinum toxin A injections.

Inpatient rehabilitation provided significant gains in visual tracking and focus, head and trunk control, and purposeful extremity movement. He began vocalizing, swallowing, expressing emotions, and conveying his needs. Finally, his nystagmus resolved, and his primitive reflexes disappeared. This is the first reported case, to our knowledge, exhibiting promising rehabilitation potential of pediatric anoxic brain injury due to cardiac arrest. Inpatient rehabilitation with achievable goals may be beneficial for this population.

Acute inpatient rehabilitation may be appropriate for pediatric patients who suffer acute anoxic brain injury, as there could be potential for recovery. Our patient shows daily measurable improvements. This case illustrates the need for more research concerning the rehabilitation potential of children with anoxic brain injury.

Key Words: Anoxic Brain Injury, Pediatric Rehabilitation, PFO

POSTER PRESENTATION - 5

The Effects of Volitional Preemptive Abdominal Contraction on Postural Control Responses

Presenter:

Vittal R. Nagar, MD^{1,2}

Collaborators:

Steven Sawyer, PT, PhD¹, C Roger James, PhD¹, Jean-Michel Brismee, PT, ScD¹, Troy L. Hooper, PT, ATC¹, Phillip S. Sizer, PT, PhD¹

Departmental Affiliations:

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Abstract Text:

Objective: To investigate the effect of a volitional preemptive abdominal contraction (VPAC) using Abdominal Bracing Maneuver (ABM) on postural control responses.

Design: A within-subjects, repeated measure experimental design.

Setting: Laboratory

Participants: Sixty-Five subjects (between 18 to 50 years) were recruited for this study. Subjects were able to stand independently for at-least 60 minutes.

Methods: Subjects performed ABM alternating with No-ABM during two rounds of three Computerized Dynamic Posturography (CDP) tests: Postural Evoked Response (PER) Test; Motor Control Test (MCT) and Sensory Organization Test (SOT). The order of conditions were randomized for PER and SOT.

Main Outcome Measurements: In the study we assessed: (1) The muscle Electromyography (EMG) onset latencies and Root Mean Square (RMS) amplitude for the vastus lateralis (VL), semitendinosus (ST), medial gastrocnemius (MG), anterior tibialis (TA), gluteus maximus (GM) on the dominant side during PER testing; (2) MCT latency, amplitude scaling and strength symmetry; and (3) the SOT equilibrium score (ES) and strategy scores (SS).

Results: The Wilcoxon signed rank test showed: significant increase in PER Test EMG amplitude for VL ($p = 0.018$); significant decrease in MCT latency ($p = 0.001$) and amplitude scaling ($p = 0.001$); significant reduction in SOT strategy scores for condition 1 ($p = 0.004$) and condition 2 ($p = 0.001$) with ABM versus No-ABM.

Conclusion: Our findings suggest that individuals can incorporate VPAC using the ABM for performance enhancement as it sharpened several postural control variables during quiet standing and perturbations, suggesting an enhanced protective role during function.

Key Words: Computerized Dynamic Posturography, Postural Control, Electromyography, Abdominal Bracing Exercise

POSTER PRESENTATION - 6

Enhancing Upper Extremity Motor Recovery with Brain Stimulation in Spinal Cord Injury: Pilot Data

Presenter:

Laurie Nichols, BS, OT/L¹

Collaborators:

Lumy Sawaki, MD, PhD¹, Elizabeth Salmon, MS¹, Cheryl Carrico, MS, OT/L¹, Lakshmi Reddy, MBBS¹, Sara Salles, DO¹

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

Several lines of evidence indicate that a non-invasive form of brain stimulation called transcranial direct current stimulation (tDCS) can facilitate motor recovery after stroke. However, there is no available data about how tDCS may enhance upper extremity (UE) motor function in people with spinal cord injury (SCI). Moreover, there is a lack of effective interventions to enhance recovery of UE motor function after SCI, especially in chronic cases. Thus, we are conducting a double-blind, randomized, controlled study of how tDCS paired with intensive task-oriented training affects UE motor function in subjects with motor incomplete cervical SCI. Our central hypothesis is that subjects who receive *active* tDCS paired with intensive task-oriented UE training will have significantly more improved motor performance and quality of life than controls receiving *sham* tDCS paired with identical training. Furthermore, such improvement will correlate with corticospinal reorganization measured by transcranial magnetic stimulation (TMS). Other outcome measures include Spinal Cord Independence Measure-III, Canadian Occupational Performance Measure, and Medical Research Council scale administered at 3 time points (at baseline; at midpoint; and immediately post-intervention). Here, we present our preliminary results (n=2) of this ongoing study.

Key Words: Neuroplasticity, Neuromodulation, Motor Function, Motor Training, Humans

POSTER PRESENTATION - 7

Knee Hyperextension after Hamstring Lengthening in Cerebral Palsy: Incidence, Predictive Factors and Cost in Gait Efficiency

Presenter:

Francisco Angulo Parker, MD¹

Collaborators:

Hank White, PhD², Henry Iwinski, MD^{2,3}

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

²Shriners Hospital for Children, Lexington, KY

³Department of Orthopedic Surgery, University of Kentucky, Lexington, KY

Abstract Text:

Primary objective: To establish the incidence of knee hyperextension after hamstring lengthening in children with cerebral palsy with spastic diplegia.

Secondary objectives: Identify the variables in physical examination and gait analysis that can predict knee hyperextension after hamstring lengthening. Assess the cost of knee hyperextension in gait efficiency.

Design: Retrospective, cohort. Regression analysis

Setting: Pediatric Orthopedic Hospital Participants: 142 subjects who had received hamstring lengthening surgery and had gait analysis pre and post surgery.

Interventions: None

Main Outcome Measures: Number and percentage of patients with knee hyperextension after hamstring lengthening. Oxygen consumption in walking test pre and post hamstring lengthening
Results or Clinical Course: 11.5 percent of our population presented with knee hyperextension after hamstring lengthening. Regression analysis showed that the main predictor of hyperextension after hamstring lengthening is knee flexion at midstance (mean of 23.9 degrees). Analysis of oxygen consumption data did not reveal any significant changes in children with hyperextended knees vs. non-hyperextended knees.

Conclusions: Incidence of knee hyperextension after hamstring lengthening in our population is 11.5 percent. Pre operative knee flexion at midstance was correlated with the presence of knee hyperextension post surgery. Interestingly, there was no significant change in gait efficiency as measured by oxygen consumption in hyperextended knees vs non-hyper extended knees.

Level of Evidence - Abstract Submission Role: Level III

Key Words: Hyperextension, Hamstring Lengthening, Gait Efficiency

POSTER PRESENTATION - 8

Combining Brain Stimulation and Peripheral Nerve Stimulation to Improve Upper Extremity Function after Severe Stroke: Preliminary Results from an Ongoing Study

Presenter:

Lakshmi Reddy, MBBS¹

Collaborators:

Elizabeth Salmon, MS², Cheryl Carrico, MS, OT/L², Laurie Nichols, BS, OT/L^{1,2}, Kenneth Chelette, MS², Lumy Sawaki, MD, PhD^{1,2}

Departmental Affiliations:

¹Cardinal Hill Rehabilitation Hospital, Lexington, KY

²Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

This double-blind, randomized, controlled study (target n=40) is the first-ever investigation of how transcranial direct current stimulation (tDCS) combined with peripheral nerve stimulation (PNS) affects outcomes of intensive upper extremity (UE) motor training for people with severe post-stroke hemiparesis. tDCS and PNS are non-invasive brain stimulation techniques. Each technique can modulate neuroplasticity and enhance outcomes of motor training after stroke. Only limited research (ie, 1 small-scale study in *mild* stroke) has addressed whether PNS and tDCS have adjuvant effects. Our ongoing study of combined tDCS/PNS follows subjects with severe post-stroke hemiparesis. Each subject receives 1 of 4 conditions: 1) active tDCS paired with active PNS; 2) active tDCS with sham PNS; 3) sham tDCS with active PNS; or 4) sham tDCS with sham PNS. For each subject, PNS lasts 2 hours; and tDCS lasts 20 minutes, followed by 2 hours of intensive upper extremity motor training. Our outcome measures include Fugl-Meyer Assessment (FMA), Stroke Impact Scale (SIS), and cortical reorganization as measured using transcranial magnetic stimulation. We used ANOVA to analyze changes in FMA (UE total score as well as motor score alone) and SIS for the 19 subjects who have completed intervention to date. The active tDCS + active PNS group showed decreased FMA scores after intervention, which suggests this combination may downregulate neuroplasticity in our target population. The active tDCS + sham PNS group showed significantly better SIS scores compared with the active tDCS + active PNS group. Final analyses will substantiate these trends and show neurophysiological correlations.

Key Words: Motor Recovery, Robot-assisted Therapy, Neurorehabilitation, Neuromodulation

POSTER PRESENTATION - 9

Improvement in Chronic Regional Pain Syndrome Secondary to Stroke: a Case Report

Presenter:

Marti Robinson, MD¹

Collaborators:

Vinod Muniswamy, MD, MHP¹, Radha Korupolu, MD¹, Erika Erlandson, MD¹

Departmental Affiliations:

¹Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

A twenty-eight-year-old woman with a nine year history of complex regional pain syndrome, CRPS type 1 originating from a moderate fall presented with chronic swelling, burning, throbbing, aching 7/10 pain in her right lower extremity, RLE accompanied by flaking skin, skin breakdown and daily color changes with baseline erythema as compared to the left. For uncontrolled symptoms she underwent spinal cord stimulator placement.

After 2 years she presented with acute stroke and right hemiparesis. Imaging revealed Left Middle and Anterior Cerebral Artery infarcts with midline shift and mild subfalcine herniation. Work-up revealed a patent foramen ovale and an abnormal EEG. She progressed, and was transitioned to inpatient rehabilitation.

It was observed that her CRPS improved after the stroke to the extent that the spinal cord stimulator was turned off and continued to remain so. At follow-up visits of seven and twelve months following her stroke, her CRPS was much improved; she denied pain and any other issues with her RLE.

CRPS is a multifactor disorder characterized by spontaneous or stimulus-induced pain that is disproportional to the inciting event and is accompanied by features of neurogenic inflammation, nociceptive sensitization, vasomotor dysfunction and maladaptive neuroplasty. Treatment is complicated with drugs, physical therapy, physiologic treatments, and neuromodulation with minimal relief.

Conclusion: To our knowledge, there is not another comparable case in the literature wherein a cerebral vascular accident has preceded improvement to the point of near resolution of a chronic case of complex regional pain syndrome. This novel observation therefore warrants further investigation.

Key Words: CRPS, Complex Regional Pain Syndrome, L MCA Infarct, ACA Infarct, CVA

POSTER PRESENTATION - 10

Attempted Movement Detection from the EEG for Applications in Motor Rehabilitation using a Brain-Machine Interface

Presenter:

Sridhar Sunderam¹

Collaborators:

Khang Si Le¹, Elizabeth Salmon, MS², Lumy Sawaki, MD, PhD²

Departmental Affiliations:

¹Department of Biomedical Engineering, University of Kentucky, Lexington, KY

²Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

Brain-machine interfaces (BMIs) decode brain signals into control commands for external devices. In doing so, they provide an alternate means of interaction with the environment for individuals with severe motor impairment resulting from neural injury or degenerative disorders. Apart from assistive functions, BMIs may also aid in rehabilitation by providing sensory feedback in response to user effort. In such applications, smooth BMI function relies on timely and accurate detection of attempted movement. The sensorimotor “mu” rhythm of the electroencephalogram (EEG) is commonly used for BMI control. This idling rhythm (seen at rest) is suppressed by actual/imagined movement. Here, we attempt early detection of cued hand movements from continuously recorded EEG. We measured EEG and grasping force in five healthy volunteers over three weekly sessions with IRB approval. Subjects responded to intermittent visual cues by squeezing a hand dynamometer. Their EEG was classified offline in 125 ms intervals based on EEG spectral features using a hidden Markov model into rest and movement-related states, estimated for each subject from a training session and tested on two subsequent sessions. Excluding one subject with poor signal quality, the onset of movement was detected with a mean sensitivity of 78% (64-86%) and specificity of 70% (59-77%); on average, true positive detections preceded movement by 31 ms (-191 to 278 ms). Hence, movement-related brain activity can be detected in close temporal correlation with effort, thus enabling timely sensory feedback to the user.

Key Words: Brain-Machine Interface, Rehabilitation, Motor Injury, Hidden Markov Model

POSTER PRESENTATION - 11

Rehabilitation after Recurrent Ependymoma in a 13 Year-Old

Presenter:

Erika Erlandson, MD¹

Collaborators:

Sara S. Salles, DO¹

Departmental Affiliations:

¹Department of Physical Medicine & Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

Purpose: Describe the rehabilitation of a 13 year old girl with recurrent ependymoma with leptomeningeal spread after multiple surgical resections, chemotherapy and radiation treatments resulting in significant morbidity.

Background: Ependymoma is a rare cause of tumors in children, with spinal cord lesions being the most uncommon location of presentation.² Metastatic Ependymoma is even rarer, with incidence ranging from 9-20%.¹ Research to date on ependymoma has clearly shown surgery to be the mainstay of treatment. However, despite the evidence for radical surgical clearance of ependymoma, there is little data on the cost of surgery in terms of neurologic deficit.⁴ Halmorsen, et. Al found 28% of patients with spinal cord ependymoma had either newly discovered neurologic deficit and/or deterioration of a preexisting deficit in the immediate postoperative period. These were permanent in 67% of cases and transient in 33%.³ Regardless of this evidence there have been no studies on rehabilitation of neurologic deficits and other morbidities associated with the treatment of ependymoma. This case study describes the rehabilitation of a 13 year-old female with multiple morbidities associated with treatment of her recurrent spinal cord ependymoma.

Significance for SCI practice: Ependymoma is a rare but important cause of spinal cord injury in children and adults. Spinal Cord Rehabilitation is an important aspect to the multidisciplinary treatment and recovery of these patients and to maintain their functional independence.

Key Words: Rehabilitation, Ependymoma, Spinal Cord Injury, Pediatrics

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POSTER PRESENTATION - 12

Peripheral Nerve Stimulation Paired with Constraint-Induced Therapy

Presenter:

Cheryl Carrico, MS, OT/L¹

Collaborators:

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Abstract Text:

Sensory input in the form of peripheral nerve stimulation (PNS) can enhance upper extremity (UE) motor performance following stroke. Likewise, intensive task-oriented motor training can significantly enhance UE motor performance after stroke. Constraint-induced therapy (CIT) is an example of intensive task-oriented motor training. CIT compels use of the paretic UE while constraining the non-paretic UE during performance of motor tasks. No studies in stroke have evaluated whether PNS enhances the effects of CIT. Therefore, we investigated whether *active* PNS paired with CIT leads to significantly more improved UE motor function after stroke than *sham* PNS paired with CIT. Outcome measures included the Fugl-Meyer Assessment Scale (FMA; primary outcome measure), the Wolf Motor Function Test (WMFT), and the Action Research Arm Test (ARAT). Nineteen subjects with chronic, mild-to-moderate post-stroke motor deficit received 2 hours of either active (n=10) or sham (n=9) PNS preceding 4 hours of a modified form of CIT, for 10 consecutive weekdays. We used factorial ANOVA to analyze changes in FMA, WMFT, and ARAT. All outcomes showed significance at completion and 1-month follow-up compared with baseline ($p < 0.05$). These results indicate that in cases of mild to moderate post-stroke UE motor deficit, pairing PNS with intensive task-oriented motor training can lead to more improved UE motor performance than intensive task-oriented training alone. We will finalize this study after analyzing our data collected from transcranial magnetic stimulation, which measures the neurophysiological effects of our intervention. Future research should investigate strategies to accelerate clinical translation of our findings.

Key Words: Occupational Therapy, Task-Oriented Training, Neurorehabilitation

POSTER PRESENTATION - 13

Transcranial Direct Current Stimulation for Motor Recovery From Severe Post-stroke Hemiparesis: Early Results from an Ongoing Clinical Trial

Presenter:

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Collaborators:

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Abstract Text:

To determine the best transcranial direct current stimulation (tDCS) electrode configuration to enhance upper extremity (UE) motor function in subjects with severe post-stroke hemiparesis, we conducted a randomized, double-blind, placebo-controlled clinical trial. Here, we present data from 26 of (projected) 44 chronic stroke subjects with severe UE motor deficit (i.e, virtually no wrist and hand movement). Subjects were assigned to 1 of 4 groups: 1. anodal tDCS to excite ipsilesional hemisphere, 2. cathodal tDCS to inhibit contralesional hemisphere, 3. dual: a simultaneous combination of anodal and cathodal tDCS, or 4. sham tDCS. All subjects participated in 10 treatment sessions consisting of 20 minutes of tDCS followed by 3 hours of occupational therapy. The primary outcome measure was the Fugl-Meyer Assessment. Secondary outcome measures included the Action Research Arm Test and Stroke Impact Scale. Evaluations were performed at baseline and post-intervention. Preliminary results indicate substantially greater improvement in the cathodal group than in other groups. Our results differ from findings in subjects with mild hemiparesis. This disparity may be due to the larger lesions of subjects with severe hemiparesis which may change tDCS current flow compared to subjects with mild hemiparesis. Furthermore, in subjects with severe hemiparesis, comparatively less ipsilesional neuronal substrate may be available for stimulation. Therefore, the anodal and the dual configurations, which rely on ipsilesional stimulation, may not prove optimal.

Key Words: Stroke, Rehabilitation, Transcranial Direct Current Stimulation, Neuroplasticity

POSTER PRESENTATION - 14

Non-invasive Brain Stimulation Paired with a Novel Locomotor Training in Chronic Stroke: a Feasibility Study

Presenter:

Megan Danzl, PT, NCS, PhD¹

Collaborators:

KC Chelette, MS², Kara Lee, PT, DPT¹, Dana Lykins, PT, DPT¹, Lumy Sawaki, MD, PhD²

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Abstract Text:

Objective: To determine the feasibility of combining transcranial direct current stimulation (tDCS) of the lower extremity (LE) motor cortex with novel locomotor training to facilitate gait and neuroplastic change in subjects with chronic stroke.

Methodology: Double-blind, randomized controlled study. We enrolled 10 subjects with chronic stroke; outpatient rehabilitation setting. Subjects were stratified according to baseline LE motor function then randomized to either active tDCS (20 min; 2mA) or sham tDCS for 12 sessions over 1 month. Both groups participated in identical locomotor training following each tDCS session. Training protocol (robot-assisted treadmill (Lokomat)) was designed to harness corticospinal neuroplasticity. Primary outcome measure: 10-Meter Walk Test (10MWT). Other outcome measures: Functional Ambulation Category (FAC), Timed Up and Go (TUG), Berg Balance Scale (BBS), Stroke Impact Scale-16 (SIS); cortical excitability (transcranial magnetic stimulation (TMS)).

Results: Eight subjects completed the study (4 men; mean age 67.8 years; mean years post-stroke: 4). ANOVA trended towards improvement for both groups. Active tDCS group showed more marked improvement than sham in all measures (FAC $p=0.028$; 10 MWT $p=0.19$; TUG $p=0.066$; SIS $p=0.062$) except BBS ($p=0.919$). TMS recruitment curves demonstrated increased cortical excitability at completion and 1-month follow-up. Important Findings: It is feasible to combine tDCS targeting the LE motor cortex with novel locomotor training. It appears that tDCS has the potential to improve gait in chronic stroke. Our novel locomotor training also appears to enhance corticospinal excitability. Results warrant larger studies applying tDCS and locomotor training, particularly regarding stroke survivors with low ambulation.

Key Words: Transcranial Direct Current Stimulation, Hemiparesis, Neuroplasticity, Motor Recovery, Robotics, Lower Extremity

POSTER PRESENTATION - 15

Hypotension and Hypertension after Cerebral Vascular Accident: a Case Report

Presenter:

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Collaborators:

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Abstract Text:

Blood pressure (BP) management post CVA is complicated due to the various presentations ranging from extreme hypertension to hypotension. Case presentation: Antihypertensive medicines of two CVA patients were decreased gradually during rehabilitation due to hypotension. One patient was receiving Metoprolol (75 mg) twice daily and Lisinopril (20 mg) once daily on admission; discharged on 12.5 mg Metoprolol once daily. A second patient was receiving HCTZ (50 mg) once daily, Coreg (3.125 mg) and Amlodipine (10 mg) twice daily on admission; discharged on Coreg (3.125 mg) once daily. Conclusion: Monitoring BP of post-CVA patients closely is recommended and adjusting medications to avoid hypotension is prudent.

Key Words: Hypotension, Hypertension, Stroke

POSTER PRESENTATION - 16

Neuro-Behcet's Disease – Challenges of this Non Traumatic Spinal Cord Injury in a Rehabilitation Setting: a Case Report

Presenter:

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Collaborators:

Marti Robinson, MD¹, Sara S Salles, DO¹

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Abstract Text:

A previously healthy thirty-two-year-old male presented with acute headache, photophobia, neck stiffness, fever, bilateral lower extremity weakness, and positive Brudzinski's and Kernig's signs. MRI demonstrated pons and cerebellum meningeal enhancement with patchy hyperintense signals in the thoracic cord and conus. After investigations he was treated for presumed bacterial meningitis. In 2 months, his paraplegia worsened with numbness below T7, incontinent bowel and bladder and blurry vision. Extensive work-up was negative. Differential diagnosis included multiple sclerosis, aseptic meningitis among others. MRI findings progressed, and a positive heterozygous HLA-B51 allele prompted the diagnosis of Neuro-Behcet's disease.

Behcet's disease is a rare chronic relapsing inflammatory disease of unknown etiology. Neuro-Behcet's disease entails neurologic manifestations, occurs in less than 1/5th of Behcet's patients, commonly involves CNS, and is typically confirmed by imaging and/or CSF analysis. Genetic predisposition with familial clustering often occurs. Parenchymal forms generally manifest as meningoencephalitis: non-parenchymal forms involve vascular complications.

Upon transfer to inpatient rehabilitation, he was challenged with intense comprehensive daily therapies and he was medically managed to optimize independence despite his non-traumatic spinal cord injury, paraplegia, spasticity, and neurogenic bowel and bladder. He achieved measurable improvements in making transfers, wheelchair locomotion, and ADLs.

Neuro-Behcet's disease is rare cause of non traumatic SCI. This report will discuss the challenges faced due to a difficult to diagnose neurological condition and will provide an opportunity to investigate the range of manifestations of the disorder and the potential benefits that patients could glean from acute inpatient rehabilitation.

Key Words: Neuro-Behcet's Disease, Multiple Sclerosis, Meningitis, and Rehabilitation

KEYNOTE SPEAKER PRESENTATION

**“Spinal Cord Injury Rehabilitation and Research:
Past, Present and Future”**



STEVEN KIRSHBLUM, MD

Dr. Steven Kirshblum is nationally recognized for his work in the area of spinal cord injury rehabilitation and research. He joined Kessler Institute in 1990 and currently serves as Medical Director of the West Orange campus, as well as the Director of the Spinal Cord Injury Program.

Dr. Kirshblum received his medical degree from the University of Health Sciences/Chicago Medical School and completed a residency in physical medicine and rehabilitation (PM&R) at Mt. Sinai Hospital in New York City, where he was a chief resident. He became board certified in PM&R in 1991 and was one of the first physicians in the country to receive special certification in spinal cord injury medicine in 1998.

As the Co-Project Director of the Northern New Jersey Model Spinal Cord Injury System, one of only 14 federally-designated model systems in the country, Dr. Kirshblum oversees the rehabilitation research and patient care in collaboration with our research affiliates. He is also a professor of rehabilitation medicine at Rutgers New Jersey Medical School and serves as the program director for the Spinal Cord Injury Medicine Fellowship program. He is also on staff at Saint Barnabas Medical Center, Livingston, NJ.

A prolific writer and researcher, Dr. Kirshblum has written and co-authored more than 100 articles in peer-reviewed publications and has completed over 20 book chapters, 80 abstracts, and monographs on his major research interests in spinal cord injury and education issues. He is editor of the textbook, *Spinal Cord Medicine* and has also written a children's book on spinal cord injury.

One of the most widely respected physicians in his field, Dr. Kirshblum has delivered more than 500 lectures nationally and internationally. He graduated with the Deans award from medical school and is a member of Alpha Omega Alpha. He has been honored for both his clinical and administrative work, including being named a leading doctor in a number of medical guides, including the "Best Doctors in America," "Best Doctors in New York" and "Best Doctors in New Jersey" every year for the last decade.

Dr. Kirshblum has been honored by many spinal cord injury societies, and organizations including the American Paraplegia Society, Association of Academic Physiatrists, World Congress of Rehabilitation International and Cerebral Palsy Society of New Jersey. He is the President of the Academy of Spinal Cord Injury Professionals, Chair of the International Standards Committee for the American Spinal Association and a member of numerous advisory boards and foundations for spinal cord research.

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