PROGRAM AND ABSTRACTS

30th Annual

Physical Medicine and Rehabilitation Research Day

May 24, 2018

Cardinal Hill Rehabilitation Hospital

Lexington, KY

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Table of Contents

UNIVERSITY OF KENTUCKY
DEPARTMENT OF PHYSICAL MEDICINE & REHABILITATION
30th ANNUAL RESEARCH DAY AGENDA

8:45 a.m. – 9:00 a.m.	Opening Remarks/Announcements (CL3): Susan McDowell, MD, Chairperson Lumy Sawaki, MD, PhD, Vice Chair of Research Physical Medicine & Rehabilitation

PM&R RESIDENT RESEARCH PRESENTATIONS – CL3

9:00 a.m. – 9:15 a.m.	Morgan Drake, MD, Physical Medicine & Rehabilitation Moyamoya Disease and Trisomy 21: a Case of Pediatric Stroke
9:15 a.m. – 9:30 a.m.	John Lopez, DO, Physical Medicine & Rehabilitation Enhancing Motor Recovery with Brain Stimulation in Spinal Cord Injury: a Case Series
9:30 a.m. – 9:45 a.m.	Joe Mallory, DO, Physical Medicine & Rehabilitation Middle-aged Male with Ramsey Hunt Syndrome
9:45 a.m. – 10:00 a.m.	Ruth Stanton, DO, MS, Physical Medicine & Rehabilitation Foot Drop in a Patient with Wilson's Disease and Liver Transplantation: a Case Study
10:00 a.m. – 10:15 a.m.	*BREAK*
10:15 a.m. – 10:30 a.m.	Brian Barnett, DO, Physical Medicine & Rehabilitation A Team-based Approach to Peri-operative Amputee Care at the Veterans Affairs Lexington
10:30 a.m. – 10:45 a.m.	Pooja Chopra, MD, Physical Medicine & Rehabilitation Effects of Non-invasive Brain Stimulation in Outpatient Treatment of Complex Regional Pain Syndrome: a Crossover Study
10:45 a.m. – 11:00 a.m.	Mike McGuirk, DO, Physical Medicine & Rehabilitation Differential Effects of Non-invasive Brain Stimulation in Chronic Neuropathic Pain: Preliminary Findings of an Ongoing Double-blind Randomized Controlled Trial
11:00 a.m. – 11:15 a.m.	Justin Huber, MD, Physical Medicine & Rehab Impact of Dynamic Body-weight Support on Inpatient Rehabilitation Outcomes in Non-Traumatic Spinal Cord Injury: Preliminary Findings of an Ongoing Study
11:15 a.m. – 11:30 a.m.	Wes Troyer, DO, Physical Medicine & Rehabilitation Injectable Amniotic Membrane Allograft for Treatment of Chronic Rotator Cuff Tears: a Case Series

UNIVERSITY OF KENTUCKY
DEPARTMENT OF PHYSICAL MEDICINE & REHABILITATION
30th ANNUAL RESEARCH DAY AGENDA
(Continued)

LUNCH & POSTER EVALUATIONS

11:30 a.m. – 12:45 p.m. Buffet Lunch (CL2)
Poster Evaluations (CL4)

POSTER PRESENTATIONS – CL4

1 Afnan S Gmmash, BSPT, MS, Rehabilitation Science
Early Intervention Services Provided by Physical and Occupational Therapists for Infants with or at Risk for Cerebral Palsy

2 Clay C. Guynn, DO, Physical Medicine & Rehabilitation
A Rare Cause of Dorsoradial Wrist Pain: a Case Report

3 Amy Hiller, DO, Physical Medicine & Rehabilitation
PCATS: Pediatric Care Across Transitions of Service. Caring for Pediatric Patients with Complex Chronic Conditions

4 Prasanth Bobby Katta, DO, Physical Medicine & Rehabilitation
Neuropathic Pain in High Level Spinal Cord Injury Effectively Controlled by Spinal Cord Stimulator: a Case Study

5 Elizabeth Powell, MS, Physical Medicine & Rehabilitation
Dose-response Relationship of Transcutaneous Spinal Direct Current Stimulation in Healthy Humans: a Proof of Concept Study

6 Andrew Savoie, DO, Physical Medicine & Rehabilitation
Chemotherapy-induced Peripheral Polyneuropathy: Monochromatic Infrared Light Energy Therapy Improves Symptoms and Mobility-related Function

7 Lumy Sawaki, MD, PhD, Physical Medicine & Rehabilitation
Non-invasive Brain Stimulation Paired with Robot-assisted Gait Training after Spinal Cord Injury

8 Camille Skubik-Peplaski, PhD, OTR/L BCP FAOTA
Kara Wade, OTS
Eastern Kentucky University, Occupational Science and Occupational Therapy
The Power of Play: Enhancing the Occupational Performance of Handwriting

9 Sarah Thomas, MS and Matt Ballard, MS, Biomedical Engineering
Recovery of Hand Function in Spinal Cord Injury Patients Augmented by BCI-driven Afferent Nerve Stimulation

10 Wesley Troyer, DO, Physical Medicine & Rehabilitation
An Atypical Cause of Lateral Shoulder Pain

KEYNOTE SPEAKER – CL3 & CL4

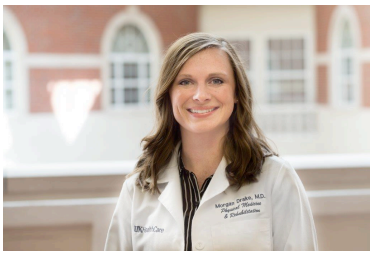
12:55 p.m. – 1:00 p.m.	Introductions Lumy Sawaki, MD, PhD, Vice Chair of Research Physical Medicine & Rehabilitation
1:00 p.m. – 2:00 p.m.	Cheri A. Blauwet, MD Assistant Professor of Physical Medicine & Rehabilitation Harvard Medical School Attending Physician – Brigham and Women's Hospital Spaulding Rehabilitation Hospital

Evidence Based Injury and Illness Prevention in Paralympic Sport

CLOSING REMARKS – CL3

2:00 p.m. – 2:15 p.m.	Jessica Colyer, MD, Residency Program Director Physical Medicine & Rehabilitation

PM&R RESIDENT PRESENTATION



Morgan Drake, MD

Moyamoya Disease and Trisomy 21: a Case of Pediatric Stroke

Presenter:
Morgan Drake, MD[1]

Collaborators:
Jamie Key, DO[1]

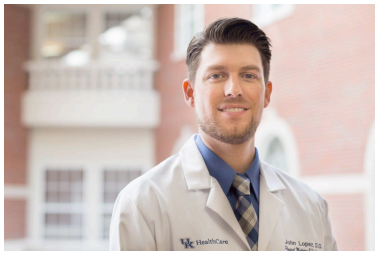
Departmental Affiliations:
[1]Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

We describe a case of a 7-year-old male with diagnosis of Trisomy 21 who presented to the emergency department with sudden onset of slurred speech, right-sided facial droop and right hemiplegia. Initial imaging revealed hypodensity in the left middle cerebral artery (MCA) territory and poorly delineated proximal and distal internal carotid arteries bilaterally. Angiogram revealed findings consistent with the Moyamoya Disease. He sustained a second stroke two months later when he presented with sudden onset aphasia and neuroimaging revealed a new infarct in the right MCA territory. Patient ultimately underwent encephaloduroarteriosynangiosis in April 2018. He has since returned to school but is requiring continued speech and physical therapy. Moyamoya disease is a rare vasculopathy characterized by progressive stenosis of the cerebral portion of the internal carotid arteries and their branches resulting in development of compensatory collateral arterial system. This disease often manifests as recurrent transient ischemic attacks (TIAs) or stroke. Moyamoya is known to have a bimodal age distribution with peak incidence in children around age 5 and again in the adult population around age of 40. The cause of Moyamoya disease is unknown. While it is a rare disease, it is often included as differential diagnosis in children presenting with sudden hemiparesis, sensory impairment and/or slurred speech. There has been no definite link found between Trisomy 21 and Moyamoya disease but it is known that patients with Trisomy 21 have a higher incidence of vascular dysplasia as well as a greater susceptibility of vascular disease. This case serves as a reminder of the importance of ruling out Moyamoya disease in cases of pediatric stroke and stroke in Trisomy 21 patients as there are surgical treatments available.

Key Words: *Down Syndrome, vasculopathy, stroke, rehabilitation*

PM&R RESIDENT PRESENTATION



John Lopez, DO

Enhancing Motor Recovery with Brain Stimulation in Spinal Cord Injury: a Case Series

Presenter:
John Lopez, DO[1]

Collaborators:
Elizabeth Powell, MS[1], Sara Salles, DO[1], Lumy Sawaki, MD, PhD[1]

Departmental Affiliations:
[1]Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

Case/Program Description:

Objective: Spinal cord injury (SCI) is a devastating ailment that can cause lifelong detriment as patients suffer from varying levels of functional compromise. It is imperative that research is completed to aid in recovery and maximizing function in these individuals. The primary objective of this research was to evaluate the effects of a non-invasive form of brain stimulation called transcranial direct current stimulation (tDCS) paired with upper extremity motor training in subjects with SCI.

Following written informed consent, two subjects (Age 30 and 62; American Spinal Injury Association Impairment Scale C; neurological level C5-C6) with chronic SCI were enrolled. Selected subjects received 12 sessions (3 sessions per week) of sham tDCS paired with task-oriented motor training or 12 sessions of anodal tDCS paired with task-oriented motor training in a cross-over, randomized, double blinded design. Outcome measures for motor performance included Spinal Cord Independence Measure-III (SCIM-III), Canadian Occupational Performance Measure (COPM), and Medical Research Council scale (MRC), administered at baseline, at midpoint, and immediately post-intervention. tDCS was the only independent variable.

Anodal tDCS yielded greater improvement in SCIM-III, COPM and MRC scores (mean±SE: 4.2±3.0, 2.0±0 and 31.0±2.0, respectively) compared to sham tDCS (mean±SE: -0.5±0.5, 0.3±0.3 and 12.6±4.5, respectively).

This research provides evidence supporting tDCS as a relevant intervention to enhance the effects of motor training and recovery for people with motor incomplete SCI. Larger trials to substantiate the preliminary findings are warranted.

Key Words: *transcranial direct current stimulation, neuromodulation, tetraplegia, human*

PM&R RESIDENT PRESENTATION

Joe Mallory, MD

Middle-aged Male with Ramsey Hunt Syndrome

Presenter:
Joe Mallory, MD[1]

Collaborators:
Jessica Colyer, MD[1]

Departmental Affiliations:
[1]Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

This is case presentation describes a middle-aged male with history of anxiety/panic disorder, hypothyroidism, chronic pain, and disc disease with left-side weakness who was diagnosed with Ramsay Hunt syndrome. Initial presentation of left facial droop, inability to close his left eye, and change in taste led to his admission as a stroke alert. Neuroimaging was negative for acute bleed or infarct. After extensive workup and development of vesicular lesions on left face/mouth, he was diagnosed and treated appropriately for Ramsay Hunt syndrome with involvement of left cranial nerves VII/VIII and possible left cranial nerve V. Following brief hospitalization at UK, he was transferred to Cardinal Hill Rehabilitation Hospital for acute rehabilitation to address left facial palsy, disequilibrium, gait/balance deficits, and generalized weakness secondary to debility and rhabdomyolysis.

Varicella-zoster virus (VZV) is a virus that can cause two forms of disease. The primary form of VZV is known as varicella, or chickenpox. Following resolution of the primary infection, the virus remains dormant within the cranial and dorsal root ganglia. The virus can become reactivated and present as Herpes zoster, or shingles. When VZV in the geniculate ganglion is re-activated, affecting the facial nerve; this is known as Herpes zoster oticus or Ramsay Hunt syndrome. This typically presents as triad of facial paralysis, ear pain, and vesicles in auricle. In his case, the sequela of clinical symptoms led him to be initially admitted and treated as a stroke patient.

Key Words: *Herpes zoster oticus, Varicella-zoster virus (VZV), Shingles*

PM&R RESIDENT PRESENTATION

Ruth Stanton, MD

Foot Drop in Patient with Wilson's Disease and Liver Transplantation: a Case Study

Presenter:
Ruth Stanton, MD[1]

Collaborators:
Nancy Stiles, MD[1]

Departmental Affiliations:
[1]Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

Wilson's Disease is a potentially fatal genetic liver disorder that usually strikes individuals in their youth, most commonly in adolescence or in early twenties. It is caused by faulty copper metabolism leading to its accumulation in the liver and subsequent spread in the blood. The copper causes hemolytic anemia and results a variety of physical signs and symptoms, such as jaundice and malaise, and can lead to cirrhosis. It can elicit psychological/neurological problems such as ataxia, behavioral changes, and depression. If untreated, it progresses to liver failure and death. Liver transplantation is generally necessary. Our patient, a 20-year-old female, presented to her physician with malaise and jaundice; workup revealed that she was in acute liver failure. She was diagnosed with Wilson's Disease and received a liver transplant shortly after. Her post-operative course was complicated with hemoperitoneum, acute kidney failure requiring dialysis, and multifactorial shock. Foot drop and severe neuropathic pain on the left side developed. Electromyography revealed polyneuropathy in all limbs which was attributed to the post-transplant medication Tacrolimus. The cause of the foot drop remained unclear. Eventually, she was transferred to acute inpatient rehabilitation where she made significant functional gains and was discharged home. This case represents the benefits of acute inpatient rehabilitation to promote functional improvement and quality of life.

Keywords: *Liver failure, neuropathy, polyneuropathy, rehabilitation*

PM&R RESIDENT PRESENTATION

Brian Barnett, DO

A Team-based Approach to Peri-operative Amputee Care at the Veterans Affairs Lexington

Presenter:
Brian Barnett, DO[1]

Collaborators:
Robert M. Worthing, MD, FAAPMR[2]

Departmental Affiliations:
[1]Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY
[2]Department of Physical Medicine and Rehabilitation, VAMC, Lexington, KY

Abstract Text:

Literature suggests an interdisciplinary team approach to perioperative care of the amputee can reduce hospital length of stay, healing rate, time to prosthetic fitment, and improve functional outcomes. Preliminary data suggests such utilization of interdisciplinary services at VAMC Lexington is below ideal. Measurable goals include: 1) utilization of a perioperative interdisciplinary team for all major amputations; 2) utilization of rigid dressings on all below knee amputations; 3) reduction of acute length of stay to 72 hours for uncomplicated admissions; 4) inpatient rehab admission for all appropriate amputees; 5) reduction of time to suture removal to 30 days post-operatively (non-vascular) or 45 days (vascular); and 6) reduction of average time to prosthetic Rx to 60 days. The planning phase was completed according to VA QI “Deep Dive” tactics in three stages: 1) review relevant baseline data from FY2015; 2) coordinate interdisciplinary education across stakeholders (Vascular/Orthopaedic Surgery, PM&R, Mental Health, Nursing/OR staff, Prosthetics & Orthotics, Social Work, Nutrition, etc.); and 3) formulate an interdisciplinary action plan for implementation across said stakeholders. Interdisciplinary coordination resulted in identification of six action items: 1) create a pre-operative amputee order set; 2) stock the OR with rigid compression dressings; 3) utilize amputee care wall placards 4) implement ongoing education and competency assessment for acute inpatient and rehabilitation staff; 5) create a “fast track” system for admit of rehab candidates to Community Living Center; and 6) provide outcomes feedback to surgical services on an annual basis. Analysis of outcomes remains ongoing.

Key Words: *Amputee, Postoperative Protocols, Rigid Dressing, Interdisciplinary Team, Outcomes*

PM&R RESIDENT PRESENTATION

Pooja Chopra, MD

Effects of Non-invasive Brain Stimulation in Outpatient Treatment of Complex Regional Pain Syndrome: a Crossover Study

Presenter:
Pooja Chopra, MD[1]

Collaborators:
Michael McGuirk, DO[1], Lumy Sawaki, MD, PhD[1]

Departmental Affiliations:
[1]Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Case/Program Description: A 72-year-old woman with a history of complex regional pain syndrome (CRPS) after surgery for carpal tunnel syndrome. At enrollment in this research study, this patient reported a history of refractory pain in left upper extremity. The onset was associated with casting after surgical approach for carpal tunnel syndrome. More specifically, a month after surgery to address carpal tunnel syndrome, she was diagnosed with CRPS. At the time of enrollment, she was receiving levothyroxine sodium, zolpidem, estrogen, gabapentin and pregabalin. Physical examination revealed preserved muscle strength in upper extremities but with decreased temperature in the left hand and hypersensitive to touch. Study intervention consisted of transcranial direct current stimulation (tDCS) to M1 for the first 2 weeks and tDCS to dorsolateral prefrontal cortex (DLPFC) during the following 2 weeks.

Setting: Outpatient Neurorehabilitation Research lab

Results: On the Visual Analog Scale (VAS) and the physical component of SF-36, stimulation of M1 yielded greater improvement compared to the DLPFC stimulation. However, stimulation to the DLPFC showed greater improvement in the mental component of SF-36 compared to stimulation to M1.

Discussion: This is the first research case study of the effects of tDCS delivered to M1 and DLPFC in a cross over design. Results indicate there are differential effects according to the cortical region stimulated.

Conclusions: This case illustrates the application of tDCS in refractory CRPS. For physical pain, M1 stimulation appears to optimize benefit; whereas DLPFC stimulation may optimize benefits for symptoms related to emotion (i.e., depression). This work paves the way for larger studies with long-term follow-up to corroborate these findings

Key Words: *chronic pain, neuromodulation, neuropathic pain, human*

PM&R RESIDENT PRESENTATION

Mike McGuirk, DO

Differential Effects of Non-invasive Brain Stimulation in Chronic Neuropathic Pain: Preliminary Findings of an Ongoing Double-blind Randomized Controlled Trial

Presenter:
Mike McGuirk, DO[1]

Collaborators:
Elizabeth Powell, MS[1], Pooja Chopra, MD[1], Lumy Sawaki, MD, PhD[1]

Departmental Affiliations:
[1]Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Case/Program Description:

Objective: Determine and compare the anatomical site-specific effects of transcranial direct current stimulation (tDCS), a form of non-invasive brain stimulation, on chronic neuropathic pain and associated quality of life.

Design: Randomized, double-blinded, controlled study

Participants: 9 subjects diagnosed with chronic neuropathic pain (7 subjects with complex regional pain syndrome and 2 subjects with pain associated with spinal cord injury).

Interventions: Subjects received 10 consecutive weekdays of tDCS. Each subject was randomly assigned to receive tDCS at 1 of 3 anatomical sites: 1) primary motor cortex (M1); 2) dorsolateral prefrontal cortex (DLPFC); or 3) sham tDCS.

Main Outcome Measures: Visual Analog Scale (VAS) and SF-36 Health Survey at pre-intervention, midpoint, and post-intervention.

Results: On the physical component of SF-36, the M1 group had greater improvement compared to the DLPFC and sham groups. On the mental component of SF-36, the DLPFC and sham groups had greater improvement than the M1 group. On the VAS, the M1 group yielded greater improvement than DLPFC and sham groups.

Conclusions: There are differential effects of tDCS on chronic neuropathic pain according to neuroanatomical site of stimulation. The most improvement on the physical component of SF-36 Health Survey and VAS occurred with M1 stimulation. More improvement on the mental component of SF-36 occurred with DLPFC stimulation and sham stimulation compared with M1 stimulation. Future studies are recommended to build on these results, in part because these results show high variability.

Key Words: *chronic pain, neuromodulation, human*

PM&R RESIDENT PRESENTATION

Justin Huber, MD, MS

Impact of Dynamic Body-weight Support on Inpatient Rehabilitation Outcomes in Non-traumatic Spinal Cord Injury: Preliminary Findings of an Ongoing Study

Presenter:
Justin Huber, MD, MS[1]

Collaborators:
Lumy Sawaki, MD, PhD[1]

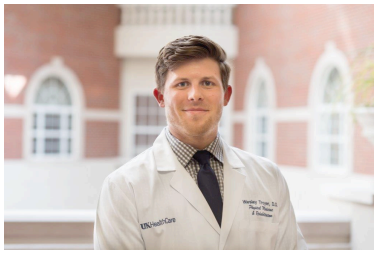
Departmental Affiliations:
[1]Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

For patients suffering debilitating injuries, rehabilitation must balance the intensity of intervention with the risk to patient safety. Risk mitigation requires timely progression of therapy, a multitude of therapists, and an increasing reliance on technology. Dynamic Body-weight Support (DBWS) represents ongoing efforts by technologists to enhance patient recovery by permitting more aggressive therapy without sacrificing safety. The present study evaluates use of DBWS during inpatient rehabilitation of patients with non-traumatic spinal cord injury (NTSCI). To gauge impact, a prospective study is described which involves patients diagnosed with NTSCI undergoing therapy with DBWS at a freestanding inpatient rehabilitation hospital. Gains in patient Functional Independence Measure (FIM) scores are calculated and compared to a historical control group of patients with NTSCI who underwent standard-of-care (i.e. no DBWS). Preliminary data based on three DBWS patients (of a proposed 50 patients) indicates a mean FIM gain of 45 points from admission to discharge (standard deviation ±9.5 points). For the historical control group, patient's receiving standard-of-care achieved a mean FIM gain of 36 points. Based on preliminary data, DBWS during inpatient rehabilitation of patients with NTSCI appears to yield greater FIM score improvements than the standard-of-care applied to a historical control group. DBWS may facilitate a safer environment for intensive, repetitive practice of real-world tasks in a simulated daily living context. Completion of the current prospective study will further benefit from subsequent larger prospective and randomized studies to substantiate these preliminary findings.

Key Words: *locomotor training, task-oriented therapy, functional independence measure*

PM&R RESIDENT PRESENTATION



Wesley Troyer, DO

Injectable Amniotic Membrane Allograft for Treatment of Chronic Rotator Cuff Tears: a Case Series

Presenter:
Wesley Troyer, DO[1]

Collaborators:
Michael McGuirk, DO[1], Robert Worthing, MD[2]

Departmental Affiliations:
[1]Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY
[2]Veterans Affairs Hospital, Lexington, KY

Abstract Text:

Chorioamniotic products have a well-established history of use for complex tissue regeneration in the fields of wound care, plastic surgery, ophthalmology and podiatry. There is growing interest in the utility of such products for non-operative interventions within the field of musculoskeletal medicine. A recent 40 patient case series was the first peer-reviewed publication to describe successful use of amniotic membrane allograft for treatment of joint and tendon pathology. The series included only three shoulder cases involving rotator cuff tendinosis (no tears). The proposed 10 person case series is the first to describe use of amniotic membrane allograft in the treatment of chronic rotator cuff tears recalcitrant to conservative treatment.

Key Words: *Prolotherapy, Regenerative medicine, Rotator cuff arthropathy, rotator cuff injuries*

KEYNOTE SPEAKER PRESENTATION

Evidence Based Injury and Illness Prevention in Paralympic Sport

Cheri Blauwet, MD

Dr. Cheri Blauwet is Board Certified in Physical Medicine and Rehabilitation as well as Sports Medicine. She is a graduate of the Stanford University School of Medicine and completed her residency training in PM&R at Spaulding Rehabilitation Hospital/Harvard Medical School. She is a former Paralympic athlete in the sport of wheelchair racing, competing for the United States Team in three Paralympic Games; Sydney ’00, Athens ’04, and Beijing ’08. She is the Chairperson of the International Paralympic Committee’s Medical Committee and serves on the Board of Directors for the United States Anti-Doping Agency (USADA) as well as the Neilsen Foundation Quality of Life Grant Review Board.

POSTER PRESENTATION - 1

Early Intervention Services Provided by Physical and Occupational Therapists for Infants with or at Risk for Cerebral Palsy

Presenter:
Afnan S Gmmash, BSPT, MS[1]

Collaborators:
Susan K. Effgen, PT, PhD, FAPTA[1]

Departmental Affiliations:
[1]Department of Rehabilitation Science, University of Kentucky, Lexington, KY

Abstract Text:

Objective: The purpose of this study is to explore the practices physical therapists (PTs) and occupational therapists (OTs) use currently in early intervention for infants with or at risk for Cerebral Palsy(CP) and to determine if the current practice matches the most recent evidence.

Design: Cross-sectional study.

Participants: A convenience sample of PTs and OTs providing or have provided early intervention services for infants with or at risk for developing CP throughout the US. Materials/Methods: An online, 36 item survey was developed and disseminated using Qualtrics online software. An anonymous survey link was distributed to early intervention providers.

Results: A total of 275 therapists, (29% OTs and 71% PTs) from 37 states completed at least 50% of the survey items. The majority of the providers (57%) reported that infants at risk for CP receive therapy once a week and 58% of them think that these infants needed additional therapy sessions. 90% consider parent education one of the most important goals followed by promoting engagement of the infant in daily routines. However, only 16% of providers always provided parents with evidence-based information related to sleeping, feeding, and responsive parenting. 73% of providers never or rarely used an outcome measure to identify and prioritize parents' goals and only 2% used a formal instrument to ensure enrichment of the home environment.

Conclusions: Findings from this study indicates that therapists do not incorporate sufficient strategies for optimum environment enrichment, comprehensive parental education, and goal oriented interventions.

Key Words: *cerebral palsy, early intervention, physical therapy, occupational therapy*

POSTER PRESENTATION - 2

A Rare Cause of Dorsoradial Wrist Pain: a Case Report

Presenter:
Clay Guynn, DO[1]

Collaborators:
Wade Rankin, DO[2], Kelly Evans-Rankin, MD[2]

Departmental Affiliations:
[1]Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY
[2]Department of Family Medicine, University of Kentucky, Lexington, KY

Abstract Text:

Preiser's disease and Kienbock's disease are rare wrist pathologies that should be in the differential for a patient presenting with dorsoradial wrist pain. The diseases involve avascular necrosis of the scaphoid and lunate bone and can be treated differently: both operatively and non-operatively depending on individual cases. This case presentation will illustrate the presentation, evaluation, and treatment of a patient who presented with wrist pain and was ultimately diagnosed with Preiser and Kienbock disease. The patient's outcome and current status as well as information that the clinician should know when assessing and treating the aforementioned diseases will be discussed. These are important diseases to understand and be aware of because many potential complications can be avoided with earlier diagnosis and intervention, thereby preventing morbidity for the patient.

Key Words: *wrist, pain, dorsoradial*

POSTER PRESENTATION - 3

PCATS: Pediatric Care Across Transitions of Service. Caring for Pediatric Patients with Complex Chronic Conditions

Presenter:
Amy Hiller, DO[1]

Collaborators:
Erika Erlandson, MD[1]

Departmental Affiliations:
[1]Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY

Abstract Text:

The objective of this quality improvement project was to better understand existing communication tools used for pediatric patient transfers between acute care and acute inpatient rehabilitation as well as to understand how communication during handoff process contributed to common complications in pediatric patients with chronic complex conditions. We included 38 pediatric patients, between 4m and 17 years of age, that were transferred from acute care to inpatient rehabilitation hospital. Items related to common hospitalization or readmission for pediatric patients with chronic complex conditions and/or neurologic impairment were tracked and compared between physician and nursing transfer information for completeness, accuracy, and congruence. Comparison between physician and nursing discharge/transfer information revealed incomplete data and discrepancies. Discrepant documentation was found in regard to swallowing evaluation, diet order, presence or absence of tracheostomy, presence of feeding tube, report of vital signs and methods of oxygen delivery. After gathering data and literature review, decision was made to expand into study looking at congruence of documentation of patient information when transferring levels of care. We would like to implement tools to help facilitate timely, concise, accurate, and inclusive information to caregivers, outpatient providers, therapists, and other healthcare providers in children with complex chronic conditions.

Key Words: *pediatric rehabilitation, inter-professional collaboration, discharge planning*

POSTER PRESENTATION - 4

Neuropathic Pain in High Level Spinal Cord Injury Effectively Controlled by Spinal Cord Stimulator: a Case Study

Presenter:
Prasanth Bobby Katta, DO[1]

Collaborators:
Vittal Nagar, MD[1], Vinod Muniswamy, MD[1], Luis Vascello, MD[2], Sara Salles, DO[1]

Departmental Affiliations:
[1]Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY
[2]Baptist Health Medical Group Pain Management, Lexington, KY

Abstract Text:

Neuropathic pain is common in individuals with spinal cord injury (SCI). To date, studies recommends non-interventional pain management in these patients, with limited literature suggesting use of spinal cord stimulator (SCS) to treat neuropathic pain. The purpose of the study was to investigate the effects of spinal cord stimulator for treatment of neuropathic pain in a patient with SCI. The patient was a 57-year-old male with C4-American-Spinal-Injury-Association (ASIA) classification-C SCI secondary to fall from a truck platform in 2009 resulting in spastic tetraplegia and severe neuropathic pain. An intrathecal baclofen pump was placed in 2012 for spasticity management. Patient complained of right lower extremity chronic neuropathic pain (RLECNP) that persisted since his initial injury. Conservative therapies addressing RLECNP failed including gabapentin, pregabalin, amitriptyline, buprenorphine, a transcutaneous electrical nerve stimulation unit, oxycodone/acetaminophen and intrathecal baclofen pump with baclofen and bupivacaine. The patient found relief with a SCS trial and underwent subsequent implantation in 2014 to control his pain. Ultimately, his RLECNP was well controlled with small gabapentin dose and all opiate medications were discontinued. This case suggests the need to explore use of SCS in the treatment of neuropathic pain. The novel use of SCS to address this pain after failure of non-interventional modalities would greatly improve patient quality of life.

Key Words: *tetraplegia, chronic pain, pain management, interventional*

POSTER PRESENTATION - 5

Dose-response Relationship of Transcutaneous Spinal Direct Current Stimulation in Healthy Humans: a Proof of Concept Study

Presenter:
Elizabeth Powell, MS[1]

Collaborators:
Radha Korupolu[1,2], Philip M Westgate[3], Cheryl Carrico[1], Lakshmi Reddy[1], Lumy Sawaki, MD, PhD[1]

Departmental Affiliations:
[1]Department of Physical Medicine and Rehabilitation, University of Kentucky, Lexington, KY
[2]Department of Physical Medicine and Rehabilitation, University of Texas Health Science Center, Houston, TX
[3]Department of Biostatistics, College of Public Health, University of Kentucky, Lexington, KY

Abstract Text:

Non-invasive transcranial direct current stimulation has been shown to modulate cortical excitability in various studies. Similarly, recent preliminary studies suggest that transcutaneous spinal direct current stimulation (tsDCS) may engender a modulation effect on spinal and cortical neurons. The purpose of this study was to evaluate the dose-response effects of tsDCS in healthy subjects and thereby lay groundwork for expanding treatment options for patients with spinal cord injury (SCI). Nine healthy subjects received each of the following 2 tsDCS conditions: Anodal and cathodal, in random order with at least 1 week washout period between each session. In order to test safety and dose response, various current intensities were used (2, 2.5 and 3 mA) for 20 minutes. The active electrode was placed vertically over T10-T11, and the reference electrode was placed over the left shoulder. To evaluate corticospinal excitability, motor evoked potentials over soleus muscle elicited by transcranial magnetic stimulation were measured. To assess spinal cord excitability, H- and M- wave over soleus muscle to calculate Hmax/ Mmax ratio were measured. Linear regression showed a dose response with cathodal tsDCS on motor evoked potentials measured from the left leg as well as with anodal tsDCS on Hmax/ Mmax ratio measured from the left leg. These findings indicate tsDCS effects are dose-dependent. These effects should be investigated in a larger sample.

Key Words: *Neuromodulation, spinal cord, transvertebral spinal direct current stimulation*

POSTER PRESENTATION - 6

Chemotherapy-induced Peripheral Polyneuropathy: Monochromatic Infrared Light Energy Therapy Improves Symptoms and Mobility-related Function

Presenter:
Andrew Savoie, DO[1]

Collaborators:
Sara Salles, DO[1]

Departmental Affiliations:
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Abstract Text:

Case Description: 69-year-old male presented with history of stage IIA rectal adenocarcinoma status post neoadjuvant capecitabine and radiation therapy followed by surgical resection and then postoperative oxaliplatin and capecitabine. He was treated conservatively but continued to experience paresthesias in a stocking-glove distribution of the lower extremities. We referred him to physical therapy for monochromatic infrared light energy therapy (Anodyne) and generalized mobility therapies. Patient underwent thirteen physical therapy (PT) sessions with Anodyne therapy to his bilateral feet during twelve. After three sessions he reported subjective improvement in pain and numbness. His functional progress was measured with Single Leg Stance times (right leg 5s to 23s, left leg 6s to 25s) and 5 time sit to stand (22s with upper extremity assist to 12s with no upper extremity assist). **Discussion:** Chemotherapy-induced peripheral neuropathy due to oxaliplatin has been described in two distinct patterns while capecitabine has been shown to induce milder, intermittent cases of peripheral neuropathy. Use of Anodyne therapy is approved for use in temporarily increasing circulation and reducing pain. In this case, Anodyne therapy used in conjunction with PT improved function and symptoms of chronic pain and paresthesias due to chemotherapy-induced peripheral neuropathy. **Conclusions:** Monochromatic infrared light therapy is an available therapy modality that may improve symptoms of chemotherapy-induced peripheral neuropathy and paresthesias.

Key Words: *paresthesia, chronic pain, peripheral neuropathy, anodyne*

POSTER PRESENTATION - 7

Non-invasive Brain Stimulation Paired with Robot-assisted Gait Training after Spinal Cord Injury

Presenter:
Lumy Sawaki, MD, PhD[1]

Collaborators:
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Abstract Text:

Locomotor training with a robot-assisted gait orthosis (LT-RGO) and transcranial direct current stimulation (tDCS; a form of non-invasive brain stimulation) are interventions that can significantly enhance outcomes of rehabilitation after spinal cord injury (SCI). No studies have investigated whether combining these interventions significantly enhances lower extremity movement function more than training alone in spinal cord injury. The objective of this study was to determine whether active tDCS paired with LT-RGO improves lower extremity movement function more than sham tDCS paired with LT-RGO, for subjects with motor incomplete SCI. Fifteen adults with SCI received 36 sessions of either active or sham tDCS (20 minutes) preceding LT-RGO. Outcome measures included manual muscle testing (MMT; primary outcome measure); 6-Minute Walk Test (6MinWT); 10-Meter Walk Test (10MWT); Timed Up and Go Test (TUG); Berg Balance Scale (BBS); and Spinal Cord Independence Measure-III (SCIM-III). RESULTS: MMT showed significant improvements after active tDCS paired with LT-RGO, with the most pronounced improvement in the right lower extremity. 10MWT, 6MinWT, and BBS showed improvement for both groups. TUG and SCIM-III showed improvement only for the sham tDCS group. These results suggest that pairing tDCS with LT-RGO can improve lower extremity movement function more than LT-RGO alone. Future research with a larger sample size is recommended to determine longer-term effects on movement function, including activities of daily living.

Key Words: *Neuroplasticity, motor function, treadmill training*

POSTER PRESENTATION - 8

The Power of Play: Enhancing the Occupational Performance of Handwriting

Presenter:
Kara Wade OTS[1], Camille Skubik-Peplaski, PhD, OTR/L, BCP, FAOTA[1]

Collaborators:
Sarah Anderson, OTS1, Elizabeth Mueller, OTS[1], Bobbie Smith, OTS[1], Jennifer Hight, OTD, OTR[1]

Departmental Affiliations:
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Abstract Text:

Development of fine motor proficiency and sensory regulation are integral aspects of occupational performance. The aims of this study were to compare the difference in handwriting after receiving either Handwriting Without Tears™ (HWT) or occupation-based interventions for children with coordination deficits. A 3-week intervention with pre/post testing and 8-week follow-up was conducted with 10 children ages 5-9 at two different clinics. All children completed similar warmups and the same number of interventions. Outcome assessments for all the children were The Print Tool, Test of Visual Motor Skills and Test of Visual Perceptual Skills. The participants demonstrated increased visual motor, visual perceptual skills, sensory integration and prehension. The occupational therapy students providing the interventions in this study improved their therapeutic use of self, clinical reasoning, and confidence. Occupation-based interventions contributed to improved visual motor skills and the handwriting interventions led to increased visual perceptual skills. Both interventions were beneficial for the children to improve motor skills and occupational performance. Occupational therapy students reported being better able to critically think, clinically reason, and prepare for their future.

Key Words: *Occupational Therapy, Handwriting, Fine Motor Skills*

POSTER PRESENTATION - 9

Recovery of Hand Function in Spinal Cord Injury Patients augmented by BCI-driven Afferent Nerve Stimulation

Presenter:
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Collaborators:
C. Schildt[1], E. Powell[2], Y. Rajamanickam[1], S. Salles[2], L. Sawaki[2], S. Sunderam[1]

Departmental Affiliations:
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Abstract Text:

Individuals with cervical spinal cord injury (SCI) can retain sensory and motor function in the upper limbs, albeit with severe impairment. Development of efficient rehabilitation techniques is necessary to help patients regain their independence. Peripheral nerve stimulation (PNS) applied to sensory fibers prior to motor therapy is known to augment rehabilitation. A brain-computer interface (BCI) was developed to trigger PNS in real time based on motor intent-related electroencephalogram (EEG) features. Nine of the participants received both closed loop (CL) and open loop (OL) motor interventions. Transcranial magnetic stimulation (TMS)-evoked cortical motor map volume (MMV) and maximum hand grip force were assessed relative to participant reported dominant (DH) and non-dominant hands (NDH). A Wilcoxon's sign rank test was performed to determine if median group ratio values were significantly different. Participants who received explicit CL interventions (n=10) with had mean MGF outcomes ratios of 1.73 ± 0.29 (DH) (p=0.0195) and 1.99 ± 0.38 (NHD). Participants who had motor maps present (n=9) had mean outcome ratios of 1.63 ± 0.21 (DH) (p=0.0195) and 0.87± 0.09 (NDH). For matched samples (n=9), the mean MGF ratios were 1.663 ± 0.32 (CL DH), 1.06 ± 0.07 (OL DH), 2.01 ± 0.47 (CL NDH) (p=0.0195), 1.08 ± 0.19 (OL NDH). Mean MMV ratios were 1.54 ± 0.22 (CL DH) (p = 0.047), 1.10 ± 0.11 (OL DH), 0.94 ± 0.08 (CL NDH), 0.88 ± 0.14 (OL NDH). These results suggest that BCI-driven protocols with fine control of PNS timing could accelerate rehabilitation of patients with SCI.

Key Words: *Neuroplasticity, motor function, somatosensory stimulation, peripheral nerve stimulation*

POSTER PRESENTATION - 10

An Atypical Cause of Lateral Shoulder Pain

Presenter:
Wesley Troyer, DO[1]

Collaborators:
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Departmental Affiliations:
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Abstract Text:

44-year-old, right-hand dominant male with past medical history significant for diabetes, presented to the sports medicine clinic with a three to four month history of waxing and waning left shoulder pain without any eliciting event. He complained of intermittent, dull, achy, lateral shoulder pain at rest and reported that it would occasionally wake him up at night. He stated that at times he would be pain free but that weightlifting and overhead activity made the pain worse. He had noticed significant weakness with any elbow flexion activities while weightlifting. The patient reported some improvement in pain over two to three weeks since stopping all overhead weightlifting. He denied numbness, tingling, skin changes, injury, or constitutional symptoms. However, he had noted numbness and tingling of his fingers to his primary care physician shortly prior to consult. Radiographs taken at initial appointment showed focal sclerosis of the humeral head. Further evaluation with magnetic resonance imaging showed humeral head avascular necrosis (AVN) and capsular thickening of the axillary recess causing impingement of the axillary nerve. He was prescribed conservative management with diclofenac and allowed to continue activity while refraining from overhead lifting of heavy weights and pain resolved. This is an interesting case of lateral shoulder pain with a rare cause that presents similarly to many other common diagnoses made in sports medicine. This patient was negative for risk factors that would lead a clinician to suspect AVN.

Key Words: *Osteonecrosis of the humeral head, avascular necrosis*

NOTES