Department of Physical Medicine & Rehabilitation
New Jersey Medical School

KESSLER FOUNDATION

Department of Physical Medicine and Rehabilitation

University of Medicine and Dentistry of New Jersey
New Jersey Medical School

The 22nd Annual Resident, Clinical & Postdoctoral Fellow Research Symposium Abstracts

Wednesday, June 1, 2011
9:45 AM - 5:00 PM

Directly Sponsored by Kessler Foundation
1199 Pleasant Valley Way, West Orange, New Jersey 07052

University of Medicine & Dentistry of New Jersey - New Jersey Medical School
Department of Physical Medicine & Rehabilitation
2011

GRADUATING RESIDENTS

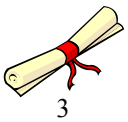
Katherine Bentley, MD
Santiago Campos, MD
Anupama Ganga, MD
Kelly Scollon-Grieve, MD
Benjamin Levy, MD
Bethany Lipa, MD
Amrish Patel, MD, PT

GRADUATING CLINICAL FELLOWS

James Chang, MD
Miguel Coba, MD
Maya Evans, MD
Fernando Gonzalez, MD
Michael Rhee, MD
Janel Solano, DO

GRADUATING POSTDOCTORAL FELLOWS

Elizabeth Galletta, PhD
Denise Krch, PhD
Victoria Leavitt, PhD



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THE OATH OF HIPPOCRATES

I do solemnly swear by that which I hold most sacred:

That I will be loyal to the profession of medicine and just and generous to its members.

That I will lead my life and practice my art in uprightness and honor.

That into whatsoever house I shall enter, it shall be for the good of the sick, holding myself aloof from wrong, from corruption, and from the tempting of others to vice.

That I will exercise my art solely for the care of my patients and will give no drug and perform no operation for a criminal purpose, far less suggest it.

That whatsoever I shall see or hear of the lives of people which is not fitting to be spoken, I will keep inviolably secret.

These things I do promise and in proportion as I am faithful to this my oath, may happiness and good repute be ever mine and the opposite if I shall be forsworn.

THE OSTEOPATHIC OATH

I do hereby affirm my loyalty to the profession I am about to enter.

I will be mindful always of my great responsibility to preserve the health and the life of my patients, to retain their confidence and respect both as a physician and a friend who will guard their secrets with scrupulous honor and fidelity, to perform faithfully my professional duties, to employ only those recognized methods of treatment consistent with good judgment and with my skill and ability, keeping in mind always nature's laws and the body's inherent capacity for recovery.

I will be ever vigilant in aiding in the general welfare of the community, sustaining its laws and institutions, not engaging in those practices which will in any way bring shame or discredit upon myself or my profession.

I will give no drugs for deadly purposes to any person, though it be asked of me.

I will endeavor to work in accord with my colleagues in a spirit of progressive cooperation, and never by word or by act cast imputations upon them or their rightful practices.

I will look with respect and esteem upon all those who have taught me my art. To my college I will be loyal and strive always for its best interests and for the interests of the students who will come after me. I will be ever alert to further the application of basic biologic truths to the healing arts and to develop the principles of osteopathy which were first enunciated by Andrew Taylor Still.

OATH FOR SCIENTISTS

As I embark on my career as a biomedical scientist,

I willingly pledge that
I will represent my scientific profession honorably, that I will conduct my research and my professional life in a manner that is always above reproach, and that I will seek to incorporate the body of ethics and moral principles that constitute scientific integrity into all that I do.

I will strive always
to ensure that the results of my research and other scientific activities ultimately benefit humanity and that they cause no harm.

With this affirmation
I pledge to acknowledge and honor the contributions of scientists who have preceded me, to seek truth and the advancement of knowledge in all my work, and to become a worthy role model deserving of respect by those who follow me.

Department of Physical Medicine and Rehabilitation
National Teaching Award Recipients

Year	Recipient	Affiliation
1988	Justus F. Lehmann, MD	University of Washington
1989	Frederic J. Kottke, MD, PhD	University of Minnesota
1990	Gerald J. Herbison, MD	Thomas Jefferson University
1991	Rene Cailliet, MD	University of Southern California
1992	Barbara J. deLateur, MD, MS	Johns Hopkins University
1993	George H. Kraft, MD	University of Washington
1994	Ernest W. Johnson, MD	Ohio State University
1995	Mehrsheed Sinaki, MD	Mayo Clinic
1996	Diana D. Cardenas, MD	University of Washington
1997	Stanley A. Herring, MD	University of Washington
1998	Daniel Dumitru, MD	University of Texas-San Antonio
1999	James A. Sliwa, DO	Rehabilitation Institute of Chicago/ Northwestern University
2000	Andrew J. Haig, MD	University of Michigan
2001	Lawrence R. Robinson, MD	University of Washington

Department of Physical Medicine and Rehabilitation

National Teaching Award Recipients

Year	Recipient	Affiliation
2002	Kristjan T. Ragnarsson, MD	Mount Sinai School of Medicine of New York University
2003	Elliot J. Roth, MD	Northwestern University
2004	Ross Zafonte, DO	University of Pittsburgh School of Medicine
2005	Teresa L. Massagli, MD	University of Washington
2006	William F. Micheo, MD	University of Puerto Rico School of Medicine
2007	Jacqueline J. Wertsch, MD	Medical College of Wisconsin
2008	John Whyte, MD, PhD	Moss Rehabilitation Research Institute
2009	Steven R. Flanagan, MD	New York University School of Medicine
2010	Walter R. Frontera, MD, PhD	University of Puerto Rico School of Medicine
2011	Michael L. Boninger, MD	University of Pittsburgh School of Medicine

The Department of Physical Medicine and Rehabilitation of the UMDNJ-New Jersey Medical School & the Kessler Foundation

Proudly presents

SELECTED TOPICS IN PHYSICAL MEDICINE AND REHABILITATION

With

Guest Speaker & Recipient of the 2011
UMDNJ-New Jersey Medical School National Teaching Award

Michael L. Boninger, MD

Professor and Chair in the Department of Physical Medicine & Rehabilitation
University of Pittsburgh, School of Medicine
Director of the UPMC Rehabilitation Institute

May 31, 2011 - 4:00 pm – 6:00 pm

- **Repetitive Strain Injuries of the Upper Limb - What Can We Learn from Wheelchair Users**

&

- **Research Case Presentations**

June 1, 2011 - 10:00 am – 12:00 pm

- **Rehabilitation 2032**
- **To Walk or Roll**

This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education (ACCME) through direct sponsorship of Kessler Foundation. Kessler Foundation is accredited by the ACCME to sponsor continuing medical education programs for physicians. Kessler Foundation designates this live activity for a maximum of ***2.0 AMA PRA Category 1 Credit(s)™***. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

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This activity is sponsored by Kessler Foundation and The Baird Fund

MICHAEL L. BONINGER, MD

Dr. Boninger is Professor and Chair in the Department of Physical Medicine & Rehabilitation in the University of Pittsburgh, School of Medicine and Director of the UPMC Rehabilitation Institute. Dr. Boninger is a physician researcher for the Department of Veterans Affairs (VA) and is the Medical Director of the Human Engineering Research Laboratories, a VA Rehabilitation, Research and Development Center of Excellence. Dr. Boninger is a Professor in the Department of Bioengineering and Rehabilitation Science and Technology, and Director of the University of Pittsburgh Model Center on Spinal Cord Injury, a National Institute for Disability and Rehabilitation Research Center of Excellence. Dr. Boninger has an extensive publication record of over 170 published papers spanning 15 years in the area of spinal cord injury and assistive technology. Dr. Boninger also has extensive experience and publications related to teaching research. Dr. Boninger holds four US patents, was inducted in the National Spinal Cord Injury Association Hall of Fame in 2006, and has won numerous awards. Dr. Boninger's students have also won over 45 national awards.

RESIDENTS
2011

left to right

Anupama Ganga, MD, Amrish D. Patel, MD, PT, Kelly Scollon-Grieve, MD, Benjamin Levy, MD, Katherine Bentley, MD, Santiago J. Campos, MD, Bethany Lipa, MD

CLINICAL FELLOWS
2011

Spinal Cord Injury (SCI); Pediatric Rehab (Peds);
Traumatic Brain Injury (TBI)

left to right

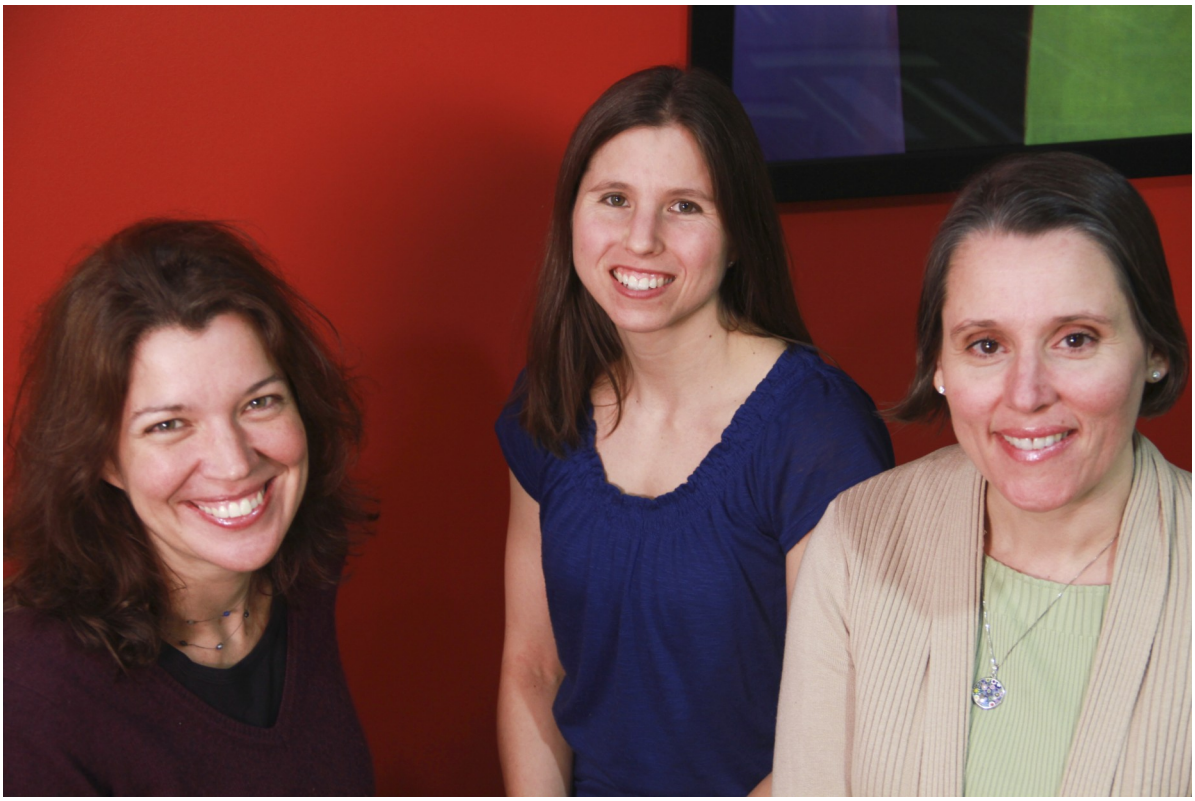
Miguel Coba, MD - SCI; Maya Evans, MD -Peds; Michael Rhee, MD -TBI

CLINICAL FELLOWS
2011
Musculoskeletal/Spine/Sports

left to Right

James Chang, MD; Janel Solano, DO; Fernando Gonzalez, MD

POSTDOCTORAL FELLOWS
2011



left to Right

Victoria Leavitt, PhD, Denise Krch, PhD, Elizabeth Galletta, PhD

UMDNJ-New Jersey Medical School

Department of
Physical Medicine and Rehabilitation

Abstracts Digest

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RESIDENT, CLINICAL & POSTDOCTORAL FELLOW

PRESENTATION ABSTRACTS

UMDNJ - New Jersey Medical School
Department of Physical Medicine & Rehabilitation

RESEARCH ABSTRACTS
Part I

Effect of an Adaptive Rock Climbing Program on Quality of Life for Children with Physical Disabilities

Katherine Bentley MD
JenFu Cheng MD, Amanda Botticello PhD MPH

Introduction: Improving quality of life is an important aspect of social integration for children with cerebral palsy (CP). Research suggests that children with disabilities experience lower quality of life and more social isolation in comparison to their able-bodied peers. Generally, children with disabilities spend more time at home engaging in solitary activities, which may contribute to feelings of diminished competency and self-esteem in academic, athletic, and social pursuits. Engaging in social activities, such as athletic programs, may improve quality of life through improved self-concept. For instance, prior work has shown that athletic identity positively influences quality of life in adult athletes with cerebral palsy. The purpose of this study is to examine the effect of athletic participation on quality of life in children with disabilities.

Methods: The study sample includes children with CP between the ages of 4-17 who are participants in a 12 week adaptive indoor rock climbing program. Quality of life is measured by either parent or self-report using the PedsQL scale. The PedsQL will be administered at baseline, midway through and at the completion of the program. Self efficacy will be measured at baseline and at the end of the program using the Perceived Physical Ability Scale for Children. A parent questionnaire with other covariate variables will be administered midway through the program.

Findings: Change in quality of life over the course of the program will be assessed using a within-subjects, repeated-measures analysis of variance (ANOVA). Self efficacy, as measured by the Perceived Physical Ability Scale for Children, will be included in the analyses as a covariate with parental reports of medical problems, therapy, educational assessments, and demographic information serving as additional control variables. We hypothesize that participation in a structured, adaptive indoor rock climbing program will improve quality of life over time. We will also use covariate analyses to compare the participants and the outcomes.

Conclusions: Findings from this pilot study will be used to guide future research and to help inform other programmatic activities targeting children with disabilities.

Medial Brachial Cutaneous Nerve Conduction Studies:
A Prospective Pilot Study

Jose S. Campos, MD
Benjamin Levy, MD; Jeffrey Cole, MD; Eric Altschuler, MD

Objective: In this pilot study, we intend to define the best positions of active and reference electrodes for the recording of the medial brachial cutaneous sensory evoked potential in the medial upper arm. We intend to determine the best positions based on the clearest (sharpest negative deflection) and shortest onset latency as well as the greatest evoked amplitude.

Design: Prospective, pilot study

Setting: Tertiary Care Rehabilitation Outpatient Office

Participants: We intend to recruit 20 subjects for this pilot study, with data collected from bilateral upper limbs for a total of 40 nerves studied. Inclusion criteria were healthy adults $\geq$ 18 years of age. Exclusion criteria included history of persistent motor or sensory deficit in upper limbs, history of peripheral neuropathy, (+) CAGE >1, trauma to upper limbs, persistent numbness/tingling in upper limbs by history, rashes or skin lesions around area of study, history of prior brachioplasty, history of cubital tunnel release or surgery in the distribution being studied, implanted electronic device in the area of the region to be stimulated.

Interventions: Using a 4x4 grid array mounted on plastic and strapped along the upper arm at ½ the distance from the medial epicondyle to the junction of the pectoralis major and short head of biceps in axilla, sensory nerve action potentials (SNAPs) of the medial brachial cutaneous nerve were obtained from four recording sites (A, B, C, D) at 2cm intervals across the medial upper arm. With stimulation at the junction of the pectoralis major and short head of biceps in axilla, we recorded three SNAPs per recording site to determine reliability and best recording site.

Main Outcome Measures: Mean data and standard deviations were obtained for onset latency, amplitude, and conduction velocity from each recording site (A-D). Using Cronbach's alpha equation, we measured the internal consistency reliability of SNAPs obtained from each subject.

Results: This study has not been completed to date, with data not available for analysis. We hypothesize that this study will define an efficient and anatomically appropriate set-up that will accurately and reliably study the sensory evoked potential of the medial brachial cutaneous nerve.

Conclusions: This study has not been completed to date, therefore no conclusions can be drawn at this time.

Lumbar Transforaminal Epidural Steroid Injections Through a Reverse Safe Triangle Approach– Technical Consideration

James Chang, MD
Boqing Chen, MD, PhD

Introduction: Reports of paraplegia after lumbar transforaminal epidural steroid injections (1) warrant a re-evaluation of the technical aspects of the procedure itself. Purported mechanism of injury to the arteria radicularis magna as the cause of spinal cord infarction necessitates an adjustment to the procedure such that this artery is protected from injury. Absence of the arteria radicularis magna in the inferior fifth of the pedicular plane in the neural foramen was noted in a retrospective spinal angiogram review. (2) Therefore, needle access in this region would avoid the possibility of arterial injury.

Methods: We reviewed epidurogram images of 50 lumbar epidural injections that were performed through the inferior third of the neural foramen. After squaring off the vertebral endplates, fluoroscopic guidance with an oblique view was used to direct the needle tip to the base of the superior articular process. Once contact was made, the needle was then advanced anterior and medial into the inferior fifth of the neural foramen using a lateral view to avoid intradiscal entry.

Results: 50 transforaminal epidural steroid injections using the reverse safe triangle approach. Contrast dye patterns showed spread in the epidural space and along the exiting nerve root in 33 (66%) cases and along the traversing nerve root in 27 (54%) cases. Using Digital Subtraction Angiography, 7 vascular patterns (14%) were noted. Three cases showed intradiscal entry (6%).

Conclusions: Transforaminal epidural steroid injections using the reverse safe triangle approach are an effective means of delivering medication while avoiding potential

Randomized, Controlled Clinical Trial of Nitrofurazone Impregnated Indwelling Urinary Catheter

Miguel Coba, MD
Jane Mitchell, RN, CM, Susan Sauer, RN Monifa Brooks, MD
Jay Rosenberg, RN Steve Koltenuk, RN

Introduction: The use of indwelling urinary catheters is known to be responsible for an increased risk of urinary tract infections, known as catheter associated urinary tract infections (CAUTI). It is believed that in the acute care setting Foley catheters are responsible for up to 40% of nosocomial infections. Due to the negative impact on patient care, as well as the increased costs, there has been an increased search for ways of preventing CAUTIs. A new antibacterial Foley catheter has been developed in an attempt to control CAUTIs. This catheter contains a broad-spectrum antibacterial compound, nitrofurazone, which is released gradually from its silicone matrix over a period of days into the space between the catheter body and the urethral wall. This study is designed to investigate whether this new urinary catheter impregnated with nitrofurazone is effective in decreasing the risk of CAUTI and asymptomatic bacteriuria in a spinal cord injury patient population when compared to standard latex catheters that are currently in use in an acute inpatient setting.

Methods: Patients in the acute rehabilitation setting who met the inclusion/exclusion criteria of having a cervical level spinal cord injury, a clinical indication for long term foley catheterization, and being off systemic antibiotics were identified and recruited into the study. Once informed consent was obtained, the patients were randomized into either the treatment group or the control group. A baseline UA was obtained to ensure there was no evidence of a current UTI and then the patient's foley was replaced with either the experimental or standard foley catheter. At 2 weeks and at 4 weeks the catheter was changed as per standard institutional protocol and UAs where obtained at those catheter changes. The study period concluded at 4 weeks and the rates of UTIs, as well as, the degree of asymptomatic bacteruria and pyuria at the catheter changes were analyzed.

Results: For this study, UTIs were defined as the presence of bacteruria (>100,000 CFU on culture), pyuria (>25 c/hpf), and symptoms such as fevers, malodorous urine, increased spasticity, urinary calculi formation, or dysreflexia associated with bladder irritation. At this time there are not enough patients to reliably analyze the data for statistical differences between the treatment group and the control group. Preliminary results do show a slightly less propensity to develop UTIs and pyuria with the experimental catheter, but the findings are not statistically significant.

Conclusion: Preliminary results do favor the experimental catheter in decreasing the amount of UTIs when compared to standard catheters, but, unfortunately there is not enough data at this time to definitively make that conclusion. At the completion of this study, the goal is to have enrolled 50 subjects which should provide enough statistical power to accept or reject the hypothesis that the new antibiotic impregnated catheters are useful in decreasing the risk of developing UTIs in SCI patients who require prolonged urinary foley catheterization.

Dysesthesias Following Ethyl Alcohol Nerve Blocks for Treatment of Hypertonia in Children: A retrospective analysis of incidence and risk factors

Maya C. Evans, MD
Martin Diamond, MD

Background/Objective: Hypertonia has been defined as abnormally increased resistance to externally imposed movement about a joint. It can causes pain, deformity and impair mobility and motor performance. For many physicians, especially adult practitioners, the advent of intramuscular botulinum toxin injection has largely replaced the older techniques of perineural phenol or ethyl alcohol injections for hypertonia management. However, because of weight based dosing, most pediatric physiatrist perform a combination of botulinum toxin injection and phenol or ethyl alcohol nerve blocks in their patients.

The main complication is dysesthetic pain occurring within days to weeks after the block of a mixed sensorimotor nerve. Described as burning and continuous, the pain is localized to a small portion of the nerve's sensory territory. The incidence of dysesthesias following phenol blocks has been reported to be between 2-32%. The wide variation in rates may be due to lack of consistent patient follow-up from study to study and dependent on the size of the nerve's sensory territory. Other authors feel that as the clinician gains experience they have a lower rate of dysesthesias, and although never formally studied literature review does not support a correlation between dysesthesias and the concentration or quantity of phenol used. It would stand to reason that ethyl alcohol carries a similar risk of dysesthesia, however very little has been published on it to date.

In order to fully understand the risk of dysesthesia after ethyl alcohol blocks in our patient population and to investigate the role of volume of ethyl alcohol, nerve(s) blocked, history of prior blocks, underlying diagnosis, comorbid seizure disorder and physician experience, we performed a retrospective quality improvement chart review.

Methods: At our hospital during the last 7 years over 960 ethyl alcohol nerve block patient encounters were documented on roughly 480 patients. From this group a random sample of 200 patients was taken. Complete records were available for 157 of the 200 patients. They underwent a total of 305 injection sessions between January 2004 and March 2011.The presence or absence of dysesthesia as identified by physician or nurse report was the primary endpoint. Additional data recorded includes total body dose, dose per kilogram, dose per nerve, location of injections, history of prior injections, ability to communicate, current seizure disorder and physician. Diagnosis and mobility device category were used as proxies for hypertonia severity. All data was analyzed using SAS 9.2 software.

Results/Conclusion: Not available at the time of this publication. They will be presented and discussed at the research symposium.

A Cognitive Model for Translational Treatment of Hypophonia

Elizabeth E. Galletta, PhD
Anna M. Barrett, MD, Anthony Lequerica, PhD

Introduction: Hypophonia, or reduced loudness, is a symptom of dysarthria of speech that greatly affects speech intelligibility. Acquired speech distortion (dysarthria) is a motor cognitive speech disorder/syndrome that involves poor exerted speech effort, and may affect the respiratory system, the articulatory system, the phonatory system, the resonatory system, and the prosodic system. While the causes of hypophonia include degenerative diseases (e.g. idiopathic Parkinson's Disease) and stroke, its classification as an acquired speech distortion is based on symptom presentation (Brookshire, 2007; Adams and Dykstra, 2009). Cortical-subcortical systems are implicated in spastic, hypokinetic, and mixed symptoms (Adams and Jog, 2009). The chronic nature of acquired speech distortion and hypophonia may be responsible for significant personal and social disability greatly affecting quality of life, and millions of dollars of lost work and independence (Hartelius, 2008).

Participants: Four post-stroke participants (two male and two female; mean age = 67) with right hemisphere stroke consented to participate. All of the participants presented with hypophonia and were not currently in speech therapy.

Method: Participants are randomly assigned to two treatment phases after stable baseline performance is established (cf. Hersen and Barlow, 1976): 1) Lee Silverman Voice Treatment (LSVT) (recommended for hypophonia secondary to idiopathic Parkinson's Disease) and 2) Traditional Treatment - training compensatory breathing exercises implemented in a traditional intervention format. All participants receive both types of treatment in this cross-over design.

Projected Findings: Post stroke hypophonia treatment efficacy could be greatly enhanced by translationally integrating information about brain-behavior networks mediating self-monitoring.
1. Speech loudness may be critically dependent on monitoring multimodal internal speech representations during communication. We wish to learn if the LSVT/LOUD (the Lee Silverman Voice Treatment program designed for increasing loudness in people with Parkinson's disease, Ramig et al., 2001), supports functional multimodal speech representations by enhancing imagery of internal speech loudness, and the improvement of communication post stroke.
2. Speech rate may be adversely affected by auditory self-monitoring during communication. However, even ballistic speech may be enhanced by training internal speech imagery.
We wish to learn if effects of LSVT training on speech loudness are generalized and have an additional translational effect on speech rate in patients who present with abnormal rate of speech post stroke.

Clinical Applications: Clinical treatments for hypophonia generally focus on top down, verbal strategic methods for modulating respiration (Yorkston et al., 1988) without a specific motor plan that follow a cognitive neuropsychological model. However, if information processing proceeds in stages in motor cognitive disorders (Ochipa et al., 1994) then implicitly enhancing cognitive representational monitoring may actually be more effective than explicit strategic instruction. We propose that successful treatment strategies for hypophonia stimulate changes in bottom-up (stimulus-driven) processing (Luukkainen-Markkula et al., 2009; Jacquin-Courtois et al., 2010).

Facilitation of Electromyographic Spontaneous Activity Following Volitional Contraction of Partially Denervated Muscle

Anupama Ganga, MD
Jeffrey Cole, MD

Introduction: Needle electromyography and evidence of abnormal spontaneous activity are crucial for electrodiagnosis of various neurological and neuromuscular disorders and is helpful in identifying the type of disorder, level of the lesion, severity and time course of the lesion. Denervated muscles produce active denervation potentials secondary to changes in the resting membrane potentials as well as increased sensitivity of the membrane to acetylcholine. Electro diagnosticians very often note occasional spontaneous activity or increased insertional activity on needle electromyography. These findings can be fleeting and hard to reproduce. It is our clinical experience that recording of spontaneous activity may be facilitated following maximal voluntary contraction of the muscle being tested. The purpose of this study was to study the effects of maximal voluntary muscle contraction on the sensitivity of recording electromyographic spontaneous denervation activity in partially denervated muscle.

Hypothesis: Maximal voluntary contraction of the partially denervated muscle increases the sensitivity of recording electromyographic spontaneous denervation activity in partially denervated muscle.

Methods: Patients were recruited from the electrodiagnostic lab at Kessler institute of Rehabilitation at West Orange from the period Jan 2011 to April 2011. Persons scheduled for electrodiagnostic testing underwent electromyographic needle examination as per standard protocol for needle electromyography. If spontaneous activity (i.e., fibrillation potentials, positive sharp waves, etc.) or increased insertional activity were noted, the subject performed a 10-second maximal voluntary contraction of the muscle following which the muscle was reexamined for spontaneous activity. The findings from each testing was recorded and measured quantitatively for the change in number of fibrillation / positive sharp wave potentials and graded as per Denny-Brown Grading of denervation potentials.

Results: To be analyzed.

Pes Anserine Bursitit: Over-Diagnosed In Osteoarthritis Patients?
A Case Series Pilot Study Using Diagnostic Ultrasound

Fernando Gonzalez, MD
Boqing Chen, MD, PhD, Amishi Dharia MS IV, Todd P. Stitik, MD,
Patrick M. Foye, MD, Joel A. DeLisa, MD

Objectives:: Pes anserine bursitis has been described as a common cause for medial knee pain in patients with osteoarthritis. The purpose of our pilot study was to determine the frequency and verify the existence of pes anserine bursitis in these patients.

Design: At an outpatient pain management clinic, diagnostic ultrasound was used to assess for signs of pes anserine bursitis in ten patients with osteoarthritis presenting with medial knee pain.

Results: In all ten patients, the diagnostic ultrasound scanning of the maximal local tender area in the medial aspect of the knee demonstrated increased anechoic signals under the medial tibial collateral ligament and surrounding the medial knee joint line. In three cases, synovium extended below the medial collateral ligament tibial attachment into the medial aspect of the calf. Therefore, the local tender point overlapped the anatomical location of the pes anserine bursa. A localized injection to this area reduced the pain significantly, further reaffirming our diagnosis. Additionally, there was no increased anechoic signal in the area anatomically corresponding to the pes anserine bursa.

Conclusions: In previous clinical literature, pes anserine bursitis is frequently cited as the etiology of medial knee pain. This small pilot study demonstrated that osteoarthritis patients' medial knee pain is due to osteoarthritic changes in the medial compartment of the knee with resultant synovitis under the medial collateral ligament rather than due to pes anserine bursitis. Furthermore, this study indicates that diagnostic ultrasound is a useful tool for imaging the osteoarthritic knees in patients with medial knee pain to avoid over-diagnosing pes anserine bursitis.

The Efficacy of Ultrasound Guidance Compared to Blind Corticosteroid Injection for the Treatment of Carpal Tunnel Syndrome

Kelly Scollon-Grieve, MD

Rex T. Ma, MD, Jonathan S. Kirshner, MD

Objective: To determine if there is a statistically significant benefit to using ultrasound guidance to perform carpal tunnel corticosteroid injections compared to traditional "blind" methods. The specific hypothesis was that ultrasound guided injections lead to a greater decrease in a visual analogue scale (VAS) of overall symptoms than do blind injections at 2,4, and 8 weeks.

Design Randomized, controlled, prospective, single blind study.

Participants: All patients underwent electrodiagnostic testing and 21 enrolled. Inclusion criteria were age 18-90 with one of the following: distal motor latency >4.2 msec, motor amplitude <3.5 mA, antidromic distal sensory latency >3.5 msec, antidromic sensory amplitude <12mA, antidromic median to ulnar distal sensory latency difference > 0.4msec. Exclusion criteria were osteoporosis, prior CTS surgery, allergy to local anesthetic, corticosteroid or ultrasound gel

Interventions: Carpal tunnel injections were performed with 0.50mL (20mg) methylprednisolone and 0.50ml of 1% lidocaine using a 25 Gauge 1.5" needle, using blind or ultrasound guidance. Blind injections were performed just ulnar to the Palmaris longus tendon, inline with the ring finger. Ultrasound guided injections were performed using a long-axis medial-to-lateral approach, as described by Smith et al. 2008

Main Outcome Measures: Visual analogue scale (VAS) and Global Symptom Score (GSS) at 2,4 and 8 weeks

Results: There was a significant decrease in VAS in the ultrasound guided group from baseline to 2 (p=0.023) weeks and 8 weeks (p=0.028). 4 weeks trended toward significance (p=.146). There was a trend toward significance in improvement the weakness measure of the GSS between the 2 groups. There were no adverse reactions reported in either group.

Conclusions: Ultrasound guided carpal tunnel injections are more effective than blind at reducing pain at 2 and 8 weeks, and may improve subjective weakness

Subjective Memory in Multiple Sclerosis is Associated with Initial-Trial Learning Performance

Denise Krch, PhD
James F. *Sumowski, PhD, John DeLuca, PhD, Nancy Chiaravalloti, PhD*

Introduction: Subjective reports of memory functioning provide important insight into how memory problems impact the daily life of individuals with Multiple Sclerosis (MS). However, patients' self-reported memory functioning has been shown to conflict with performance on formal memory tasks. The current study explored the relationships among self-reported memory functioning and objective learning and memory measures.

Methods: The study sample consisted of 16 men and 48 women, aged 47.7 ± 9.3 years with 15.7 ± 2.4 years of education. Mean time since diagnosis was 14.0 ± 9.3 years, and MS course included relapsing-remitting (47), primary progressive (2), secondary progressive (13), and progressive-relapsing (1); the MS course for 1 individual was unknown. Participants completed a self-report memory questionnaire (Memory Functioning Questionnaire, MFQ) and objective measures of learning and memory (California Verbal Learning Test-II, CVLT-II; Open-Trial Selective Reminding Test, OT-SRT; and Prose Memory, PM).

Results: Significant positive correlations were found between self-reported memory functioning and recall performance following initial exposure to material: OT-SRT Trial 1 ($r = .42$, $p = .001$); CVLT-II Trial 1 ($r = .39$, $p = .002$): PM Immediate Recall ($r = .28$, $p = .028$). Subjective memory was unrelated to recall performance on subsequent learning trials, aggregate learning scores, or delayed free recall.

Conclusion: Results suggest that individuals with MS are able to provide accurate and valid subjective assessment of their memory functioning and that subjective memory reports have good clinical utility in memory assessment. Corroboration of self-report on objective testing may depend on comparison to initial-trial recall variables, which appears to most accurately reflect a person's day-to-day experiences.

Abnormal Patterns of Effective Connectivity in Multiple Sclerosis

Victoria Leavitt, PhD
Glen Wylie, PhD, Helen Genova, MD,
John DeLuca, PhD, Nancy Chiravalloti, PhD

Objective: To characterize effective connectivity in the context of an information processing speed task in individuals with multiple sclerosis (MS).

Participants & Methods: 16 individuals with MS and 17 healthy controls (HCs) performed a processing speed task, a modified version of the Symbol Digit Modality Task (mSDMT), during functional magnetic resonance imaging (fMRI) scanning. Granger causality analysis (GCA) was applied to the fMRI data of both groups. GCA allows inferences about the direction of information flow in the brain by assessing correlated activity across spatially remote regions while taking into account a predetermined time lag between regions. 8 seed regions were selected on the basis of a priori data showing areas involved in mSDMT performance of healthy controls. A 2-second time lag was used.

Results: Results of GCA revealed that while the majority of connections between the ROIs were common to both groups the MS group showed differences in connectivity between critical brain regions. Specifically, the MS group had more connections to dorsolateral prefrontal cortices (DLPFC) bilaterally relative to HCs, whereas HCs had more connections to inferior parietal regions relative to MS.

Conclusions: Greater involvement of DLPFC in the MS group is consistent with the literature, and lends further support to the notion that these areas are recruited to maintain performance in the presence of brain pathology.

Medication Self-Administration Following Stroke

Benjamin D. Levy, MD
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Introduction: Stroke survivors have been shown to have significant difficulty in the accurate self-administration of medication. Given the importance of medication adherence to prevent secondary stroke and other medical complications, an education-based rehabilitation program was created at Kessler Institute for Rehabilitation in West Orange, Chester and Saddle Brook, New Jersey. However, given the brain-based nature of stroke survivors' cognitive deficits, we hypothesized that education-based rehabilitation will have little effect on stroke survivors' ability to perform a medication self administration task (Hopkins Medication Schedule). We further hypothesized that poorer performance on the Hopkins Medication Schedule (HMS) may predict discharge to a long-term healthcare facility rather than to home.

Methods: The current study retrospectively evaluated the above via chart review. To be included in the study, subjects must have been greater than 18 years of age and have sustained any type of acute stroke within 6 months of admission to rehabilitation. Excluded from the study were any subjects with aphasia other than mild anomia, psychiatric disorders other than depression, documentation of significant visual disturbance, and other neurological diagnoses such as intracranial malignancy, Alzheimer's Disease or traumatic brain injury. To assess efficacy of the education class, pre-education and post-education HMS scores were compared using a paired samples t-test. Mini-mental status examination (MMSE), admission Functional Independence Measure (FIM), pre-education HMS score and post-education HMS score were analyzed with logistic regression to discern which had an association with discharge disposition.

Findings: A total of 588 patients had been enrolled in the medication education class between 2008 and 2010 with 89 having complete data for analysis. Of these, 19 were excluded from the study due to a diagnosis other than stroke, and 13 were eliminated because of aphasia more significant than mild anomia. Of the remaining 57, twelve were discharged to a subacute facility. All 57 stroke survivors improved on performance of the HMS from a mean score of 4.7895 (out of a possible 11) before education to a mean score of 6 after intervention ($t= -2.891$, $p= 0.005$). The HMS did not have any association with discharge disposition ($p = 0.218$), but lower pre-education HMS performance was associated with discharge to home with home care services as opposed to home without skilled help (OR = 0.83, $p = 0.049$). In contrast, neither MMSE ($p = 0.1722$) nor admission FIM ($p = 0.8965$) were predictive of home care need.

Conclusions: In our sample, stroke survivors overall performed poorly on a standardized medication task. While there was improvement in performance in all subjects, it is unclear as to whether this is due to education or spontaneous recovery of cognitive abilities. Poor performance on admission HMS may predict the need for skilled home care services upon discharge from acute rehabilitation.

Brain Lesion Mapping Reveals Subtypes of Spatial Neglect

Bethany Lipa, MD

Peii Chen, PhD, Shah Priyank, MS, Anne Foundas,MD, Anna Barrett, MD

Objective: To determine if there is an association between brain lesion location after stroke and specific subtypes of spatial neglect. The specific hypothesis was that strokes involving the temporo-parietal cortical areas (i.e., posterior lesion) lead to a "where" perceptual-attentional (PA) subtype of neglect, while lesions involving the frontal subcortical areas (i.e., anterior lesion) lead to an "aiming" motor-intentional or -exploratory (ME) subtype of neglect.

Design: Hypothesis-driven group study

Setting: Three freestanding inpatient rehabilitation facilities.

Participants: All patients underwent screening for spatial neglect prior to enrollment and had brain imaging performed during their acute care admission.

Inclusion criteria are as follows: ability to give informed consent, post-stroke with right-brain cortical injury and spatial neglect, ≥ five days post-event at enrollment, ≤ fourteen days of stroke rehab admission upon study entry. Exclusion criteria were significant brain disorders other than stroke, pregnancy, history of inner ear/vestibular disorders, and taking current dopaminergic medication.

Interventions: Brain imaging of twelve patients were obtained from the acute care hospitals. Lesions were manually drawn onto normally aligned brain templates using MRIcro for comparison by two examiners who were innocent to patient history or behavioral data. An independent neurologist specialized in stroke images confirmed the accuracy of all the lesion-mapped brain images. Patients completed the Catherine Bergego Scale (4 CBS-PA items and 6 CBS-ME items) and the Behavioral Inattention Test (BIT; 5 PA-related items) to assess presence and severity of left-sided neglect. They also performed a computerized line bisection that separate PA and ME-related spatial errors.

Results: Controlling for lesion size, we included six of the twelve patients to the analysis. We found that patients with lesions involving posterior regions (n=4) had poorer PA than ME errors, comparing to patients with anterior but without posterior lesions (n=2). Brain lesion maps will be overlapped to present the results.

Conclusions: Brain imaging at the acute stage after stroke can reveal subtypes of spatial neglect manifested in the relatively subacute phase.

Physical Medicine and Rehabilitation Resident education on Outpatient Physical Therapy Prescription Writing

Amrish Patel, MD

Jeremiah Nieves, MD

Background: All Physical Medicine and Rehabilitation (PM&R) physicians encounter patients in their outpatient clinics for which often therapy is prescribed. Other physicians and patients also refer to PM&R physicians as the "physical therapy doctors" and as such this should be a knowledge base that PM&R residents should excel at. Writing a patient centered physical therapy prescription is a fundamental skill every PM&R physician should have. Residency training would be a time where teaching these skills will make a large difference for not only practice of PM&R but also the patient. This survey is to determine if residents receive lecture style or "on the job" training in writing physical therapy prescriptions and to assess if residents feel they are able to write patient focused prescriptions. Our objective is to ascertain if most training occurs via lecture based training or during clinical duties and if residents feel adequately trained in writing prescriptions for most musculoskeletal diagnoses encountered in outpatient settings.

Methods: After obtaining IRB approval through Kessler , an email-based survey and consent forms were emailed to the chief residents of PM&R residency programs, with the help of the AAPM&R that has a list serve of current chief residents at programs across the country. Emails reminders to have subjects enroll in the study were sent once every 10 days. The survey included questions to determine if residents feel confident writing patient specific physical therapy prescriptions and if they feel they receive adequate and what type of training they receive during residency. We also attempted to identify if residents know if patients are receiving therapy they prescribe and what if any resource they turn to for evidence based therapy. The survey was created, data was collected and rough analyzing was done using free software available at www.surveymonkey.com. The sites security measures include McAfee Secure and VeriSign Secured. The primary investigator and co-investigator were the only two investigators with direct access to this protected site. The survey was available online until May 20th, 2011.

Results: Data is still being collected to date.

Conclusion: Conclusions will be available upon completion of data collection and data analysis.

Traumatic Subarachnoid Hemorrhage in Complicated Mild Traumatic Brain Injury: A Prognostic Indicator?

Michael Rhee, MD
Peter Yonclas, MD, Neil Jasey, MD, Ziad Sifri, MD

Introduction: Emerging evidence suggests the presence of subarachnoid hemorrhage (SAH) is a negative prognostic indicator in traumatic brain injury (TBI) overall. However, it is unclear whether this holds true for a specific subset of TBI, specifically complicated mild TBI (defined as GCS 13-15 with bleeding, bruising and/or swelling on day-of-injury head CT). This study was undertaken to evaluate whether the presence of subarachnoid hemorrhage is a negative prognostic factor in complicated mild TBI.

Design: Retrospective chart review

Methods: The charts of all complicated mild TBI patients age >17 from 2008-2009 in the UMDNJ-Newark trauma registry were reviewed. Patients were excluded if the injury was a penetrating TBI or if concurrent injuries were deemed to overly influence outcome. Data collected included basic demographic information, past medical history, all CT head reports, concurrent injuries, hospital course and Glasgow Outcome Scale (GOS) score. The primary analysis entailed assessing for correlation between SAH and GOS. Secondary analyses involved evaluating for correlation between other variables (to be determined) and the GOS.

Results: The results of the study are not yet available.

Conclusion: It is hypothesized that this study will show that SAH is a negative prognostic factor in complicated mild TBI.

.Hydrodissection: A Novel Technique in the Treatment of Carpal Tunnel Syndrome

Janel Solano DO
Todd P. Stitik MD, Evan Grant MS III

Objective: To describe the relatively new technique of ultrasound-guided hydrodissection and its application in treatment of carpal tunnel syndrome.

Setting: Outpatient musculoskeletal practice in an academic medical center.

Background: Ultrasound guidance is becoming increasingly incorporated as a tool in outpatient musculoskeletal practices both for diagnostic purposes as well as for needle guidance during injection procedures. Use of ultrasound for needle guidance helps to minimize risk and allows for precise placement of an injectate via direct visualization of the target structures. Hydrodissection can be defined as the injection of fluid as a method for separating tissue planes. The technique of hydrodissection for carpal tunnel injections aids in the mobilization of the median nerve away from the flexor tendons and undersurface of the flexor retinaculum. The body of literature on hydrodissection in the peripheral nervous system is extremely limited. What has been described has included use of small volumes of saline and/or lidocaine. The authors in that particular study combined hydrodissection with needle fenestration of the transverse carpal ligament. In a second article, hydrodissection was described in the setting of carpal tunnel syndrome in scleroderma patients. Here, even smaller volumes were utilized; 3 ml of 1% lidocaine.

Injection Technique: We describe the technique used in which larger volumes, totaling a 20 cc mixture of 1% lidocaine plus normal saline were used to assist in the mechanical dissection of the median nerve circumferentially within the carpal tunnel, including both above and below the median nerve. This was followed by the instillation of methylprednisolone. One of two ultrasound-guided approaches was used; ulnar long axis approach and palmar short axis approach.

As part of routine clinical care, written/signed informed consent was obtained after the potential benefits and side effects of the procedure were explained to the patient, and after opportunity for questions was provided. In addition to typical procedure-related side effects, specific possible side effects from the procedure were explained including injury to the median and/or ulnar nerves/branches, injury to the median and/or ulnar vessels/branches, skin depigmentation/subcutaneous atrophy from corticosteroid, and injury of the flexor tendons.

The overlying skin was prepped with chlorhexidine, which was allowed to dry. Visualization of the carpal tunnel region anatomy was performed with a high frequency linear ultrasound probe sterilized with a PDI wipe, and then sterile ultrasound gel was applied. Under direct ultrasound visualization the carpal tunnel in the region of the median nerve was injected using one of the following approaches; ulnar transverse superficial to the ulnar nerve and artery or palmar transverse short axis. The skin and underlying soft tissue was anesthetized with approximately 1 cc of 1% preservative free Lidocaine using a 25 gauge 2 inch spinal needle attached to extension tubing. The median nerve was visualized and the following solution was then injected under direct ultrasound visualization after a syringe exchange was performed: 15 ml of normal saline and 5 cc of 1% preservative free lidocaine with approximately ½ above and ½ below the median nerve for hydrodissection followed by ½ mL of 1% Lidocaine and ½ mL of 80 mg/mL Depo-Medrol after another syringe exchange was performed.

Discussion: case illustrations and technical considerations to be discussed.

Conclusions: future studies anticipated include formal retrospective analysis.

PART II

R-1Research Review Abstracts

PART II

PGY-2 RESEARCH ABSTRACTS

Evaluation and Management of Osteoporosis in Children with Severe Neuromuscular Disorders

Melissa Fleming, MD
Michael Armento, MD

Introduction: Osteoporosis is a progressive deterioration of bone architecture which results in bone fragility and susceptibility to fractures. There are a variety of factors affecting bone homeostasis, including weight-bearing activity, nutrition (especially calcium and vitamin D intake), and numerous hormones. Osteoporosis is most often associated with the elderly, and the evaluation and management of osteoporosis in adults is well-defined. However, defining and treating osteoporosis in the pediatric population remains ambiguous. What is clear is that children with severe neuromuscular disorders are at increased risk for bone fractures due to diminished bone mineral density (BMD), a significant cause of potentially preventable morbidity. This literature review aims to examine how low BMD is evaluated and managed in children with severe neuromuscular disorders.

Methods: Relevant articles were selected from a computer-based literature review

Results: Evaluation of children with neuromuscular disorders for low bone density should include an assessment of fracture history, bone pain, serum analyses (including levels of vitamin D, calcium, and bone turnover markers such as alkaline phosphatase and N-telopeptides) and imaging studies. Quantitative computed tomography (QCT) to measure BMD by Z-score is more useful in the pediatric population than dual-energy X-ray absorptiometry (DXA) because it is not influenced by skeletal size. Measuring BMD in the long bones of the leg, particularly the distal femur, is more useful than in the lumbar spine in the pediatric population, as it better correlates to fracture risk.

A Z-score below -2.0 and/or the presence of pathological bone fractures is abnormal and further action should be taken. Mechanical intervention to promote bone formation is an appropriate initial step. In one study, targeting physical therapy to weight bearing activity 2 to 3 hours per week over 8 months in children with spastic CP was shown to significantly improve BMD as measured by DXA, whereas the control group lost BMD in that time period. A standing program alone (i.e. passive standing with external support) does not increase BMD in long bones and is therefore unlikely to prevent lower extremity fractures. Interestingly, “active” standing on a vibrating platform did improve tibial BMD in one study.

Hypovitaminosis D is very prevalent in children with moderate to severe neuromuscular disease; one study found insufficient levels in 61% of disabled patients at baseline. While widely considered to be safe, it’s not clear how effective calcium and vitamin D supplementation are at increasing BMD as they have not been shown to alter levels of bone turnover markers. Although recommended daily allowances have been determined for the general population by age, it is thought that these doses would not result in serum levels high enough to achieve skeletal benefits, suggesting that there should be different recommendations for special populations.

Treatment with bisphosphonate therapy has been shown to significantly increase bone mineral density, decrease bone pain, and prevent new fractures. There do not appear to be adverse effects of bisphosphonate on growth in the short term, although this remains a theoretical risk. Delayed fracture healing has been observed, and caution should be used in patients who will be undergoing orthopedic surgeries. One controversial case study demonstrated induction of osteopetrosis with very high doses of bisphosphonates, highlighting the need for optimizing the dosing regimen for such treatment in children.

Conclusions: Bone mineral density is reduced in children with severe neuromuscular disorders, resulting in risk for non-traumatic fractures. Evaluation should ideally include QCT of the distal femur to determine fracture risk. Initial treatment should increase weight-bearing activities and optimize calcium and Vitamin D intake. Bisphosphonates should be considered.

Benefits of Animal-Assisted Therapy in the Inpatient Setting: A Review

Christine Greiss DO
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Study Design: A comprehensive literature review

Objectives: To review and critically evaluate the past literature focusing on the potential benefits of animal-assisted therapy in various inpatient settings, as it relates to physiatrists. The goal of this review is to closely observe and note the significant psychological, physical, and emotional benefits that animal therapy may provide in the inpatient setting, as well as to try to pinpoint a specific category of inpatients that appear to gain the most benefit from pet therapy, in hopes of improving their quality of care. Medical databases were searched for studies noting the benefits of animal assisted therapy, as well as specific benefits in the inpatient setting.

Summary and Background Data: Animal-assisted Therapy (AAT) is also known as Pet therapy (PT). It is a goal-directed intervention in which an animal, usually a canine, is incorporated into the treatment process. AAT is delivered or directed by a professional health or human service provider who demonstrates skill and expertise regarding the clinical applications of human -animal interactions. Although its potential psychological and emotional benefits are obvious to many, statistically significant outcomes of pet therapy in the inpatient setting have yet to be standardized. This may be due to the fact that pet therapy can be offered to a variety of patients with different diagnoses in the inpatient and outpatient setting with each program customized to the patient, their illness and impairment, and their prior perception of animals.

Methods: A comprehensive review of the bibliographies was performed. Studies that focused on PT in any inpatient setting were included. Studies focusing on PT in the outpatient setting, as well as those studies performed in long term care facilities, were excluded. In addition, studies that revealed the potential harm of animal assisted therapy in the inpatient setting were excluded. Amongst the studies performed in the inpatient setting, the various benefits were subcategorized into psychological, physical, and emotional.

Results: Pets provide motivational, educational and recreational interactions that enhance a patient's quality of life. PT in the literature purportedly offers a vast array of benefits ranging from improving mood to cardiovascular stability. In the inpatient setting, this type of therapy provides inpatients with mental stimulation, psychological stability, and physical benefits. Some studies have noted a decline in patient's blood pressures, as well as improved confidence and mood during their stay. Other studies reveal decreases in the pain scales of patients receiving pet therapy during their hospitalization.

Conclusion: Physical benefits can be seen in the inpatient setting and these include cardiovascular, neurological, psychological, as well as musculoskeletal improvement. Pets have also been used in the inpatient setting as memory aids in patients suffering from dementia and stroke.

Platelet-Rich Plasma in the Treatment of Non-insertional Achilles Tendinopathy: A Systemic Review

Jay B Jani MD
Nigel Shenoy MD

Introduction: Achilles tendinopathy is characterized by the clinical triad of pain, limitation in activities and focal swelling, associated with degenerative change in the tendon. Often wrongly mentioned as 'Achilles tendonitis', the histological findings include disorganized collagen and abnormal neo vascularisation and complete absence of inflammatory cells. There are different treatment modalities recommended in the treatment of Non-insertional Achilles Tendinopathy with varying success, but there is particular enthusiasm in use of Platelet Rich Plasma(PRP) in recent times.

Results: Gaweda et al described smaller study including 14 patients aged 24-52 years.All these patients had tried different modalities of treatment without success. Objective assessment upon enrollment was done using American Orthopaedic Foot and Ankle Society (AOFAS) scale for the hind foot and the Victorian Institute of Sport Assessment –Achilles (VISA-A) scale. Under US guidance 3 ml of PRP was injected into the hypoechogenic areas of tendon. Physical and imaging evaluations were done at 6 weeks, 3, 16, 18 months after the injections. After treatment, statistical significant improvement in AOFAS and VISA-A scale was noticed at all the observation point. Also the US of the tendon showed improvement in the form of resolution of hypoechogenic foci and reduction in tendon thickness. Authors concluded that growth factors in PRP have regenerative capabilities and recommended its use in treatment of chronic midportion Achilles tendinopathy.Inspired by animal studies, laboratory studies and small clinical trials, De vos et al described one of the first double blind block randomized placebo controlled trials. They randomized 54 patients aged between 18-70 years with clinical diagnosis of mid portion Achilles tendinopathy in PRP group (n=27) and placebo group (n=27). Both the groups received standard 'eccentric exercise program'. Outcome measures included Victorian Institute of sports assessment –Achilles (VISA-A) questionnaire. Secondary outcome measures were subjective patient satisfaction, return to sports and adherence of the eccentric exercise. Patients were assessed for these measures at baseline and at 6, 12 and 24 weeks. At the end of 24 weeks period the authors did not notice statistically significant improvement in primary or secondary outcome measures. In another double blind block randomized placebo controlled clinical trial, authors evaluated tendon structure and neovascularisation, measured with ultrasongraphic technique and colour Doppler respectively. This study was a part and extension of the previously described study where tendon structure and vascularity was assessed at baseline and at 6,12 and 24 weeks. Contrarily to the popular belief, the result showed no significant difference in change in tendon structure and vascularity. Authors commented that one of the reasons why animal and laboratory studies showed positive effects on tendon structure may be they used either healthy tendons or traumatically induced lesions, which may not be a good experimental model for Non-insertional Achilles tendinopathy. Also, length of time the PRP remained at the site of injection varies in vivo and in vitro, and in vivo the PRP may have diffused rapidly from the site of lesion. Though highly unlikely, eccentric exercise may adversely affect regenerative properties of PRP .In conclusion, the authors do not recommend use of PRP in treatment of Non-insetional Achilles tendinopathy.

Conclusions: We acknowledge the widespread interest in PRP in treatment of Non-insertional Achilles tendinopathy. Ease of preparation, cost effectiveness compared to recombinant growth factors and lack of side effects make it more appealing treatment option. Literature is replete with in vitro and animal studies showing beneficial effect of PRP in tendon healing. However there is a vacuum of randomized controlled clinical trial showing its beneficial effect in treatment of Non-insertional Achilles tendinopathy.

The Role of Singing as a Rehabilitation Intervention

Joslyn John, MD
Gautam Malhotra, MD

Introduction: While there is ample research on the effects of music therapy, there is only a limited amount of studies done on the intervention of singing. The objective of this paper is to comprehensively review and analyze existing research regarding singing as a medical intervention, and to consider its potential role as an adjunctive therapy in various patient populations in rehabilitative medicine.

Methods: A comprehensive literature review was done on singing therapy on PubMed. The bibliographies of these papers were then reviewed. Articles focused on melodic intonation therapy (a distinct therapy for aphasia), therapy for professional singers, and medical issues pertaining to the voice were discarded.

Results: Singing as an intervention was shown in the general population to significantly increase IgA, and have a positive effect on mood, energy, general well-being, stress reduction, lung capacity, and posture. It was also shown to increase FVC (although a statistical significance wasn't reached). In the asthmatic population, improvements of pulmonary function were not statistically significant; however it was found the intervention helped health awareness, communication, and compliance among an indigenous people. For patients with COPD, singing classes significantly improved quality of life and anxiety levels as per surveys, although pulmonary function assessments in each study were varied, some studies showed significant improvements in expiratory function. Singing therapy also showed some improvement (not statistically significant) in expiratory function in multiple sclerosis patients. A pilot study done on Parkinson's patients revealed significant changes in maximum phonation time, functional residual capacity, maximal inspiratory pressure, maximal expiratory pressure, and quality of voice. A nonsignificant improvement in coping was found in chronic pain patients after enrolling in singing classes. A pilot study was also done on chronic snorers, which suggested singing could reduce the time of snoring.

Conclusion: More studies are needed to establish objective statistically significant improvements for pulmonary function, quality of life, stress reduction, and improvements in phonation with singing as an intervention in rehabilitation settings. The intervention of singing could be a cost-effective, enjoyable adjunctive modality for recreation or speech therapists to employ during rehabilitation. The enjoyment associated with singing itself may reveal an inherently high level of compliance with this intervention among patients.

.Ketamine: A Possible Solution for Complex Regional Pain Syndrome:

A Literature Review

Jong Kim, MD
Todd Stitik, MD

Introduction and Background: Complex regional pain syndrome (CRPS) has been a somewhat controversial topic. It has been used for patients with complex regional pain syndrome (CRPS) whose pain is refractory to conventional pain management techniques. As one of the mechanisms of CRPS appears to be related to NMDA receptors, ketamine, an NMDA receptor antagonist, has provided some insight into a possible solution for CRPS. Although there have been some promising results from initial clinical trials as well as from anecdotal reports, ketamine also has been associated with serious side effects which limit safe use of the medication. The current literature review aims to provide useful information to clinicians considering the administration of ketamine for the patients with intractable signs and symptoms of CRPS.

Methods: A literature search was performed using PubMed, Medline, and OVID and articles were selected based on their clinical relevance and methodology.

Findings: **Route of administration*: There are several ways of delivering medication in general including the IV, IM, oral, subcutaneous, nasal, rectal, topical, and epidural routes. The most common route of ketamine administration in the research articles was intravenous. **Type / Dosage of IV ketamine*: S(+) enantiomer of ketamine is known to have a more favorable cardiovascular profile with a possible neuroprotective potential over racemic ketamine. Ketamine infusion with higher dose (200mg/4hr) provided greater pain relief than lower dose (100mg/4hr). High dose and long-term ketamine infusion, however, may be associated with a worse side effect profile and neurotoxicity based on animal data. **Topical application*: Higher dose with prolonged use of ketamine cream may have benefit with minimal side effects. **Evidence based effectiveness of ketamine*: Only two randomized and double blinded studies with IV ketamine were available at the time of the literature review. Each article claimed to demonstrate effectiveness of IV ketamine. However, others have noted that complete blinding during the clinical trials was difficult to maintain given the apparent side effects including psychomimetic effects of ketamine. No study showed improvement in function in spite of significant pain relief. At the end of a 12 week follow up in a study, statistical differences in pain relief between groups in the study vanished. To extend duration of effectiveness, it was suggested that the ketamine should be combined with other pain interventions and that booster treatments with ketamine should be given. **Side effects*: Nausea, headache, fatigue, dysphoria, blurry vision, hallucinations, delusions, and erratic behavior were listed. Anesthetic high dose of ketamine administration, which is not yet an approved treatment in the U.S., may have significant risks secondary to immobilization, the need for parenteral nutrition, endotracheal intubation/mechanical ventilation, and nosocomial infection. The concomitant use of midazolam or clonidine was used to control the hallucinogenic and/or dysphoric effects of ketamine.

Conclusion and Future Directions: Since CRPS is often a very challenging chronic pain syndrome, ketamine, is being considered as a management strategy despite its unfavorable side effect profile. Evidence has accumulated that appears to favor the use of sub-anesthetic IV doses of ketamine over anesthetic doses. Double blinded randomized clinical trials in the near feature with greater number of subjects may shed further light on the appropriate use of ketamine including optimal dosage, route of administration, and ultimately, development of proper therapeutic protocols.

Alternatives to Corticosteroid for Interventional Sacroiliac Joint Injections

Shounuck I. Patel, DO
Todd P. Stitik, MD

Introduction: Radiographic and histological evidence has validated the complexity of the sacroiliac joint, as well as the existence of sacroiliac joint pathology. Growing use of diagnostic and therapeutic intervention has demonstrated the sacroiliac joint as a viable pain generator in a faction of patients with low back pain. Historically, corticosteroid has been the standard for therapeutic injection in this region. This review aims to identify the various alternatives to steroid for interventional treatment of sacroiliac joint pain, and the current gaps in the research.

Methods: A literature review was completed using online database and articles were chosen based on relevance to sacroiliac joint interventions.

Findings: Aside from corticosteroid injection, interventions described in the literature include radiofrequency neurotomy, phenol ablation, cryotherapy, prolotherapy, injection of DMARDs, and botulinum toxin. Each alternative aims to treat different proposed aspects of sacroiliac joint pathology. Reports describing radiofrequency neurotomy seem to be most abundant amongst alternative treatments, far overshadowing the cryoanalgesic and phenol means of ablation. Though there is some literature on dextrose prolotherapy, there are no articles on the use of platelet rich plasma in this region. Finally, injection of DMARDs and botulinum toxin each have limited report of use for the sacroiliac joint.

Conclusion: Though even the research supporting corticosteroid injection to the sacroiliac joint is imperfect, alternative interventions are a largely unexplored territory. It is critical to note that case studies remain the predominant type of literature regardless of intervention type. Since the sacroiliac joint has been demonstrated to be so complex in anatomy and physiology, it will prove fruitful in the future to explore its many possible pain generators and their respective treatments.

The Effect of Stretching on Running Speed: A Review of the Literature

Sara Salim, MD
Nigel Shenoy, MD

Introduction: Stretching exercises are widely used as a technique to prepare for intense physical activity, with the belief that they will decrease risk of injury and may enhance athletic performance. However, in the last 10 years an increasing amount of literature suggests that stretching may actually decrease athletic performance. On a physiologic level, if stretching increases flexibility of muscle, this may decrease recoil and storage of potential energy, and thus lead to decreased power and speed of movements.
Stretching may be static, performed while the body is at rest with the end position held, or dynamic, performed with active muscle movement and momentum. Measures of athletic performance include strength, endurance, agility and speed. The aim of this review is to examine the published evidence on the effects of stretching exercises on running speed.

Methods: A literature search using the PubMed and Ovid Medline databases was performed with the search terms: stretching, running, and sprinting. All articles related to lower limb stretching and running speed were reviewed. A total of 18 articles were relevant to the subject.

Findings: Of the 18 articles reviewed, 12 suggested that stretching was detrimental, 3 reported no effect, 1 suggested it was beneficial and 2 had equivocal results. Seven articles compared the effects of dynamic stretches to static stretch, and of these, 3 reported dynamic stretches were beneficial to running speed, 2 reported that they were detrimental and 3 reported no change. Out of the total articles reviewed, one evaluated endurance, as distance was measured over one hour; the remainder evaluated sprint time.
One study focused only on adolescents. One article evaluated the influence of baseline flexibility and found a significant correlation, whereby individuals with comparatively high baseline flexibility had a negative effect of stretching on sprint performance, while those with lower flexibility did not.

Conclusions: The majority of literature suggests that stretching has a detrimental effect on running speed. The results for dynamic stretching compared to static stretching are contradictory, and there is insufficient evidence to make a conclusion. There is some evidence to suggest that comparatively high baseline flexibility plays a part in the negative effect of stretching on running speed, however more research needs to be done on this.

A Systematic Literature Review of Antibiotic Resistance in Spinal Cord Injury and Disorders

Jackie Tran, MD
Carol Gill, MD

Introduction: Many bacteria have joined ranks with the first penicillin-resistant bacterium, discovered in 1947, to gradually defeat modern antibiotics. Antibiotic resistance is in fact a growing public health crisis, contributed by unnecessary and inappropriate antibiotic use. The Center for Disease Control and Prevention (CDC) launched the *Get Smart for Healthcare* campaign in 2010 to address this crisis, by optimizing antibiotic use in inpatient healthcare. Patients with spinal cord injury and disorders (SCI&D) are notably affected by this campaign; these individuals have increased risk of exposure to and acquisition of antibiotic-resistant organisms from inherent neurogenic dysfunctions and prolonged hospitalization. There is, however, little data to guide effective antibiotic use in this specific population.

Methods: A systematic electronic literature search of multiple databases (PubMed, CINAHL and Ovid MEDLINE) was conducted using the following keywords in the abstract: "antibiotic," "resistan*," and "spinal cord injuries." The search was limited to human subjects and the English language. Primary results were reviewed and citation tracking was used as an additional search strategy.

Results: Literature review confirms that the prevalence rate of infections is greater for SCI&D patients than the general rehabilitation population. The annual incidence of urinary tract infection (UTI) is observed to be as high as 20% in SCI patients. Aggregate studies suggest that the genitourinary system is a prime breeding ground for infection because bacteriuria is nearly universal and uropathogens can spread to wounds and the bloodstream. Antibiotic resistance also poses a significant problem for the SCI&D population, especially for the subgroup that relies on urinary catherization. Gram-positive cocci are most likely to be multidrug-resistant. One study further observed that resistance to one antibiotic may facilitate development of multidrug resistance.

Conclusion: The SCI&D population is uniquely susceptible to infection with antibiotic-resistant organisms because of various anatomic, physiologic and psychosocial characteristics. For this reason, greater attention needs to be paid to SCI&D patients as the CDC continues its national campaign to improve antibiotic use. Further research is also needed to examine factors (e.g., bladder management methods and treatment choice) that may contribute to the development of antibiotic resistance.w

Injectable Stem Cells as a Treatment Option for Cartilage Repair: A Review

Ian W. Wendel, DO
Gerard A. Malanga, MD

Introduction: Joint pain, caused by degeneration and defects of cartilage from various etiologies including osteoarthritis and trauma, is a problem that currently plagues millions of people worldwide. Although there are a wide variety of treatment options available for cartilage damage from conservative to surgical approaches, these treatments have varying levels of risks and benefits associated. With this in mind, there has been a push in the medical community to develop new treatments for this disabling problem. One area that is currently being investigated is the evolving realm of regenerative medicine, including platelet augmentation, recombinant growth factor amplication and stem cell therapy, as there is potential for adult tissue, including cartilage, to regenerate.

Methods: A literature review was performed on research articles specific to this topic.

Findings: After reviewing the current medical literature, injectable mesenchymal stem cells (MSCs) appear to be a viable treatment option for cartilage repair. Numerous papers have investigated the different types of MSCs, growth factors to stimulate MSC growth, and cell delivery vehicles for use to regenerate cartilage.

Conclusions: The ability to repair cartilage using minimally invasive injections of MSCs to a site of cartilage damage appears to be a promising area of medicine however there are some problems that exist with the current procedure.

PART III

Listing of
Meeting Presentations and Posters

The Affect of Pediatric Adaptive Rock Climbing on Quality of Life

Katherine Bentley, MD

JenFu Cheng, MD, Amanda Botticello, PhD, MPH

Improving quality of life is an important aspect of social integration for children with cerebral palsy (CP). Research suggests that children with disabilities experience lower quality of life and more social isolation[i] in comparison to their able-bodied peers. Generally, children with disabilities spend more time at home engaging in solitary activities, which may contribute to feelings of diminished competency and self-esteem in academic, athletic, and social pursuits. Engaging in social activities, such as athletic programs, may improve quality of life through improved self-concept. For instance, prior work has shown that athletic identity positively influences quality of life in adult athletes with cerebral palsy.[ii] The purpose of this study is to examine the effect of athletic participation on quality of life in children with disabilities. We hypothesize that participation in a structured, adaptive indoor rock climbing program will improve quality of life over time. The study sample includes children with CP between the ages of 4-17 who are participants in a 12 week adaptive indoor rock climbing program. Quality of life is measured by either parent or self-report using the the PedsQL scale.[i] The PedsQL will be administered prior to beginning the program, at baseline, midway through and at the completion of the program. Change in quality of life over the course of the program will be assessed using a within-subjects, repeated-measures analysis of variance (ANOVA). Self efficacy, as measured by the Perceived Physical Ability Scale for Children[iv], will be included in the analyses as a covariate with parental reports of medical problems, therapy, educational assessments, and demographic information serving as additional control variables. We expect to observe a significant positive relationship between program participation and health related quality of life over time among children with CP that will inform other programmatic activities targeting children with disabilities.

Nutcracker Syndrome Presenting with Bilateral Hip and Low Back Pain: A Case Report

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Susan V. Garstang, MD

Patient: A 51-year-old male with a history of HIV and Hepatitis C presenting with chronic bilateral low back pain during the past 2-3 years.

Case Description: The patient presented for follow-up complaining of bilateral lateral hip and lower back pain (L>R) that had been getting progressively worse during the past year. He described a constant, sharp pain along superior, posterior aspects of bilateral hips and flank regions. The pain increased to an intensity of 10/10 at its worst. Symptoms were exacerbated by forward flexion and prolonged sitting. He reported no improvement with multiple prior pain medications and multiple courses of physical therapy. On examination, he was noted to have mild lumbosacral facet tenderness with exacerbation of symptoms upon side-bending to the right. Neurologic testing revealed normal strength, sensation, and reflexes bilaterally. No costovertebral angle tenderness was elicited upon palpation.

Setting: Secondary care PM&R outpatient clinic.

Results: A CT of the abdomen and pelvis revealed narrowing of the left renal vein between the superior mesenteric artery and abdominal aorta, consistent with a clinical diagnosis of Nutcracker syndrome. The patient was referred to Vascular surgery, with further work-up to be completed.

Discussion: Nutcracker Syndrome is a rare condition consisting of compression of the left renal vein between the superior mesenteric artery and abdominal aorta. This condition frequently presents with hematuria, proteinuria, and debilitating left flank pain.

Conclusions: Patients complaining of chronic low back pain refractory to standard medical management may have unusual etiologies contributing to their symptoms.

KEYWORDS: Flank pain, Low back pain, Renal veins

Pancoust Tumor Presenting as T2 Radiculopathy

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Patients or Programs: 69 year old male veteran with decreased sensation at T2 dermatome, axillary pain and unintentional ten pound weight loss.

Program Description: The veteran presented with persistent burning right axillary and anterior chest wall pain which began after a fall three months ago. Cardiac evaluation was unremarkable. Some dysesthesias also present in the axilla radiated to the medial elbow. Symptoms were relieved with placing the right hand on his head. Other than some myofascial taut bands in the periscapular muscles, physical exam only revealed consistently decreased light touch and pinprick sensation in the T2 dermatomal distribution (i.e. axilla) Imaging was ordered to rule out an anatomical cause for thoracic radiculopathy. Chest x-ray demonstrated right apical scarring and thoracic MRI revealed an ill-defined mass in the right upper lobe posteriorly between the first and second ribs. Pulmonary and cardiothoracic surgical consulting services ordered detailed chest CT with contrast which revealed ill-defined mass in the posterior aspect of the apex of the right with abnormal signal changes in the right second rib posteriorly due to the invasion of the tumor tissue, but no involvement of the brachial plexus.

Setting: Physical Medicine & Rehabilitation Outpatient clinic in Veterans Administration Hospital System.

Results: CT guided biopsy revealed a poorly differentiated squamous cell carcinoma of the right lung with bony involvement. The patient is undergoing chemotherapy and radiation.

Dalfampridine: Is the Seizure Risk Greater Than Previously Thought?

Amanda Farag, MD

Case Description: A 50 year-old female with secondary progressive multiple sclerosis was simu taneously started on dalfampridine ten milligrams twice a day to help improve her ambulation and donepezil five milligrams daily for her worsening cognition. One hour after her eighth dose of dalfampridine, the patient developed recurrent seizure activity. She had no personal or family hi tory of seizures. Her only other medications were glatiramer and Baclofen, which had remained unchanged for over ten years. An EEG did not show seizure activity. MRI showed atrophy, small vessel ischemic disease and symmetric ventriculomegaly but was otherwise normal. The dalfa pridine was immediately discontinued and she had no further seizure activity.

Discussion: Dalfampridine is a recently FDA approved potassium *channel* blocker *indicated* to improve walking in patients with multiple sclerosis. It is contraindicated in patients with history of seizure due to increased incidence of seizures observed in clinical studies. In those clinical trials, seizures were reported after nine to fourteen weeks duration. There were no reports of seizures being seen after such short treatment duration. It is possible that the patient's increasing disease activity may have contributed to her seizure risk, but she had no prior seizure until *being* started *on these new* medications. This *suggests that the seizure* risk associated with this new medication may be present after shorter treatment durations than has been previously described. Alternitavely, it is possible that donepezil may have lowered the patient's seizure threshold thereby potentiating the epileptogenic effect of dalfampridine.

Conclusion: While shown to have potential benefit to improve ambulation in multiple sclerosis patients and thereby being a potentially valuable tool for physiatrists caring for multiple sclerosis patients, it must be used cautiously and not introduced at the same time as other medications that could potentially reduce seizures threshold.

Catching The Cluneal Nerve: A Case Report on Diagnostic Cluneal Nerve Block

Anupama Ganga, MD
Jeffrey L Cole, MD

Case Diagnosis: Superior Cluneal Nerve Neuritis

Case Description: 48 year old woman with a diagnosis of "failed back syndrome" presented to our clinic with symptoms of aching chronic low back and left lower extremity pain. Clinically, she was found to have Quadratus lumborum and lumbar paraspinal muscle spasms as well as Superior Cluneal nerve irritation possibly due to scar tissue. The Quadratus lumborum and paraspinal spasms were successfully treated with botulinum toxin injections. For her residual pain, a diagnostic superior cluneal nerve block was performed.. She reported vague relief of pain sensation but did not find significant relief. The diagnostic injection was repeated a week later and the patient reported complete relief of her pain. The fluoroscopic images of the two injection procedures were compared and it was found that there was only a 2-3mm change in the positioning of the needle.

Discussion: Superior Cluneal nerve neuritis is a missed diagnosis in patients who present with chronic low back pain. Scar tissue is known to cause irritation of the nerve causing symptoms of gluteal pain and referred pain to the limb. As the superior cluneal nerve is a small nerve it is important to isolate it prior to performing the nerve block. This case report describes the superior cluneal nerve's anatomy, the block procedure, and the challenge in making the diagnosis due to normal anatomical variations as well as the nerve's isolation within a fascial reflection.

Conclussion: Cluneal nerve blocks' efficacy can be affected by the most minimal positioning changes when attempting a diagnostic block. When clinical suspicion of Cluneal nerve neuritis is present, the absence of a good response to a fluoroscopic guided block should not discourage additional attempts using slight changes in needle location.

Chronic Pelvic Pain Secondary to Lumbar Spinal Pathology: A Literature Review

Anupama Ganga, MD
Jeffrey L. Cole, MD

Introduction: Chronic pelvic pain and sensory aberrations are usually attributed to various organic and functional disorders of the structures in the pelvic cavity and pelvic floor. When structural or specific pelvic pathology for the pain symptoms are not explainable, the symptoms get categorized as functional disorders with unclear etiologies.

Aim: To conduct a literature review of lumbar spinal pathology and its association with chronic pelvic pain.

Methods:: A literature review for the years up to March 2009 was performed using the MELINE database of the United States National Library of Medicine. Further relevant articles were viewed from the bibliographies of the articles found through the MEDLINE search. A review of the Cochrane database was also done.

Results: Two case series were identified describing lumbosacral pathology as a possible cause of chronic pelvic pain. However, multiple animal model studies discussed neurogenically mediated process at the lumbosacral region as a pathophysiological mechanism for chronic pelvic pain and related syndromes. The mechanisms are explained by various mechanisms such as expansion of pain projection fibers and receptive field in the WDR spinal lamina, antidromic axonal reflex via dichotomizing afferent neurons, dorsal root reflex causing viscero-somatic convergence in the spinal cord or via a sympathetic reflex.

Conclusions: Many animal model studies describe chronic pelvic pain secondary to neurogenically mediated process at the lumbosacral region. Although human case reports have been described, these are very limited.

Key Words: Chronic Pelvic Pain Syndrome, Lumbar Spine, Suprapubic pain, Lumbar Radiculopathy

Benefits of Animal-Assisted Therapy in the Inpatient Setting: A Review

Christine Greiss DO

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Study Design: A comprehensive literature review

Objectives: To review and critically evaluate the past literature focusing on the potential benefits of animal-assisted therapy in various inpatient settings, as it relates to physiatrists. The goal of this review is to closely observe and note the significant psychological, physical, and emotional benefits that animal therapy may provide in the inpatient setting, as well as to try to pinpoint a specific category of inpatients that appear to gain the most benefit from pet therapy, in hopes of improving their quality of care. Medical databases were searched for studies noting the benefits of animal assisted therapy, as well as specific benefits in the inpatient setting.

Summary and Background Data: Animal-assisted Therapy (AAT) is also known as Pet therapy (PT). It is a goal-directed intervention in which an animal, usually a canine, is incorporated into the treatment process. AAT is delivered or directed by a professional health or human service provider who demonstrates skill and expertise regarding the clinical applications of human-animal interactions. Although its potential psychological and emotional benefits are obvious to many, statistically significant outcomes of pet therapy in the inpatient setting have yet to be standardized. This may be due to the fact that pet therapy can be offered to a variety of patients with different diagnoses in the inpatient and outpatient setting with each program customized to the patient, their illness and impairment, and their prior perception of animals.

Methods: A comprehensive review of the bibliographies was performed. Studies that focused on PT in any inpatient setting were included. Studies focusing on PT in the outpatient setting, as well as those studies performed in long term care facilities, were excluded. In addition, studies that revealed the potential harm of animal assisted therapy in the inpatient setting were excluded. Amongst the studies performed in the inpatient setting, the various benefits were subcategorized into psychological, physical, and emotional.

Results: Pets provide motivational, educational and recreational interactions that enhance a patient's quality of life. PT in the literature purportedly offers a vast array of benefits ranging from improving mood to cardiovascular stability. In the inpatient setting, this type of therapy provides inpatients with mental stimulation, psychological stability, and physical benefits. Some studies have noted a decline in patient's blood pressures, as well as improved confidence and mood during their stay. Other studies reveal decreases in the pain scales of patients receiving pet therapy during their hospitalization.

Conclusion: Physical benefits can be seen in the inpatient setting and these include cardiovascular, neurological, psychological, as well as musculoskeletal improvement. Pets have also been used in the inpatient setting as memory aids in patients suffering from dementia and stroke.

Central Fatigue: Cognitive, Mood and Behavior, Psychiatric Diagnoses

Victoria M. Leavitt, PhD
John DeLuca, PhD

Abstract

Despite its popular clinical use as a descriptor of certain symptomatology, fatigue is not a unitary construct. Describing central fatigue as distinct from peripheral fatigue represents one way of understanding the underlying neural and behavioral concomitants of fatigue. The present review describes and defines the concept of central fatigue, followed by a discussion of the behavioral and neuroimaging studies that attempt its assessment and measurement. A brief description of how fatigue can be differentiated from psychiatric symptoms and from sleepiness is also provided. Promising directions for future research will be outlined in the final portion of this review.

Does Memory Retraining in Multiple Sclerosis Increase White Matter Tract Integrity in the Brain?

Victoria Leavitt, PhD
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Objective: To determine the effects of cognitive remediation on white matter integrity within a specific set of neural subsystems known to be involved in learning and memory.

Methods: Individuals with MS with documented impairment in new learning and memory were randomly assigned to either a treatment group or a placebo control group. The treatment group was enrolled in a 5-week memory retraining protocol (10 treatments, 2 times per week) that consisted of learning and practicing imagery and contextual strategies for encoding story material. Diffusion tensor imaging (DTI) and behavioral data were collected at two timepoints (baseline, session 1, and 5 weeks later, session 2) from a treatment group (N= 5) and a control group (N= 5) that were matched for age, education, and time since diagnosis. Mean fractional anisotropy (FA) for each subject was derived from tract-based spatial statistics (TBSS) conducted in FSL. A voxelwise 2-way ANOVA was conducted with factors of group (treatment vs. nontreatment) and time (session 1 vs. session 2); the dependent variable was FA.

Results: There was a significant group x time interaction, with the treatment group showing increased FA after memory retraining in two primary brain regions: the body of the corpus collosum and the inferior longitudinal fasciculus, an area implicated in visual memory processing. No significant change in FA was shown by the non-treatment group.

Conclusions: These preliminary results suggest that employing visualization as a rehabilitative strategy has a beneficial effect on the integrity of white matter tracts associated with visual memory in individuals with MS.

.**The Relative Contributions of Processing Speed and Cognitive Load to Working Memory Accuracy in Multiple Sclerosis**

Victoria M. Leavitt, PhD
Jean Lengenfelder, PhD, Nancy B. Moore, MA
Nancy D. Chiaravalloti, PhD, John DeLuca, PhD

Abstract

Cognitive symptoms of multiple sclerosis (MS) include processing speed deficits and working memory impairment. The precise manner in which these deficits interact in individuals with MS remains to be explicated. We hypothesized that providing more time on a complex working memory task would result in performance benefits for individuals with MS relative to healthy controls. Fifty-three individuals with clinically definite MS and 36 matched healthy controls performed a computerized task that systematically manipulated cognitive load. The interval between stimuli presentations was manipulated to provide increasing processing time. The results confirmed that individuals with MS who have processing speed deficits significantly improve in performance accuracy when given additional time to process the information in working memory. Implications of these findings for developing appropriate cognitive rehabilitation interventions are discussed.

Warmer Outdoor Temperature is Associated with Worse Cognitive Status in Multiple Sclerosis.

Victoria Leavitt, PhD
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Objective: This is the first study to test the hypothesis that individuals with MS perform worse on cognitive tasks when temperatures are warmer.

Background: Warmer seasons are associated with a higher incidence of exacerbations and increased T2 lesion activity in persons with MS. However, the impact of temperature on cognitive status in MS patients has not yet been examined.

Design/Methods: Forty persons with MS and 40 matched healthy controls were enrolled throughout the calendar year; temperature was recorded for the day of participation. Neuropsychological tests measured cognitive status (processing speed, learning/memory). MS patients underwent high-resolution MRIs of the brain to measure brain atrophy, which was controlled for in subsequent analyses. Partial correlations between daily temperature and cognitive status were calculated separately for MS patients and healthy persons, controlling for age, education, and gender.

Results: A strong association was found between temperature and cognitive status in MS patients ($r_p = -.46$, $p = .006$), with worse cognitive performance on warmer days. Healthy controls showed no association between cognitive status and temperature ($r_p = .00$, $p > .9$), indicating that the relationship between temperature and cognition is specific to MS disease.

Conclusions: MS patients demonstrated worse cognition on warmer days, consistent with the link between heat and MS lesion activity in previous research. These findings have implications for clinical treatment, as fluctuations in cognitive status may herald otherwise quiescent exacerbations. Also, patient awareness of heat-related cognitive decline may guide life decisions, and researchers must consider the cognitive impact of temperature when planning clinical trials.

Leftward walking deviation after right-hemisphere stroke: A Case Report

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Peii Chen PhD, Naureen Zaidi, Cristin McKenna MD, PhD and Anna M. Barrett, MD

Case Description: The patient presented with complaints of intermittent headache and acute onset disorientation and dizziness. She subsequently developed left facial droop, hemiplegia, and neglect. Imaging revealed an acute right middle cerebral artery territory infarction and a large thrombus within the right internal carotid artery. Upon transfer to acute rehabilitation she was alert, dysarthric, had left spatial neglect, poor sitting balance and ADL dysfunction. During her stay, motor function improved and upon discharge was she was ambulating with modified independence. A *leftward* bias was observed on line bisection performance. On forward walking task performed in a neutral visual stimulation environment with eyes opened, a *leftward* walking deviation was noted. When blindfolded, she did not consistently deviate. Contrary to her performance, she reported veering rightward during the test.

Assessment/Results: Spatial neglect significantly affected the functional recovery of our patient. Both line bisection and a forward walking task with eyes opened revealed leftward deviation.

Discussion: Patients with neglect have been shown to demonstrate abnormal deviation in walking. Interacting with and navigating through the environment requires spatial updating of body position in visual surroundings. Spatial updating may be asymmetrical in spatial neglect. Prior literature suggests that patients with spatial neglect rely mainly on representation of the destination located in far space versus perceptual information. Our patient revealed that walking deviation is primarily perceptual rather than representational since blindfolding did not cause deviation in forward walking. If walking deviation depended first upon representation, the patient would deviate similarly regardless of blindfolding status.

Conclusion: Spatial neglect is a disabling disorder often under-diagnosed clinically. Walking deviation is a potential deficit that should be recognized. This case suggests that patients with spatial neglect may rely on perceptual information rather than representation of a destination when navigating their environment.

Key words: Gait; Hemispatial neglect; Stroke.

Not Just Orthostasis: Adrenal Failure During Spinal Cord Injury Rehabilitation

Anthony Lee, MD
Barbara T Benevento, MD

Description: A 41-year-old male was involved in a motorcycle collision that resulted in a traumatic spinal cord injury (SCI) consistent with a C4 American Spinal Injury Association (ASIA) Impairment Scale (AIS) A injury. He underwent spinal surgery, however intravenous steroids were not administered. The acute hospital course was significant for refractory hypotension and hyponatremia, treated with vasopressors, fluid restriction, and sodium tablets. He was weaned off the vasopressors, but continued to have a borderline blood pressure and remained hyponatremic. Ultimately, he was transferred to a spinal cord injury unit at an acute inpatient rehabilitation hospital. There, he continued to have episodes of hypotension, and remained on fluid restriction and sodium tablets for persistent hyponatremia as low as 126 mmol/L. Demeclocyline was started for suspected Syndrome of Inappropriate Anti-Diuretic Hormone secretion (SIADH); however, the hypotension and hyponatremia continued. Further evaluation included thyroid function tests and urine studies, which were all normal. Serum cortisol testing was low at 0.6 micrograms/dL, and follow up cosyntropin stimulation testing only elevated serum cortisol to 7.3 micrograms/dT,. Serum adrenocorticotropic hormone was borderline low at 10 pg/mL. He was started on oral hydrocortisone replacement, which dramatically improved his blood pressure and hyponatremia. Serum sodium levels remained within normal limits even after discontinuing fluid restriction, sodium chloride tablets, and demeclocycline.

Discussion: This is the first reported case of adrenal insufficiency after SCI diagnosed in a rehabilitation setting. Previous studies have shown physiologic adrenal impairment in chronic SCI, and previous case reports described its diagnosis after SCI in the acute care hospital and in association with intravenous steroid administration.

Conclusions: Adrenal impairment may be subtle and difficult to recognize in patients with SCI. Proper diagnosis and treatment limits interruptions and complications in the rehabilitation process.

Heterotopic Ossification of the Coccyx as a post-Operative Complication of Coccygectomy

Kirk Lercher, MD
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Case Description: Coccygectomy (removal of the coccyx) is a surgical procedure used to treat coccydynia (tailbone pain). This surgery has many potential post-operative complications including infection, pelvic prolapse, lengthy recovery process, persistent pain, etc. Literature review failed to demonstrate any reported cases of development of heterotopic ossification (ectopic bone) as a post-operative complication of coccygectomy. We present a 36 year-old male patient who fractured his coccyx when he fell from a dirt bike. An orthopedic surgeon performed a partial coccygectomy approximately 2 months after the initial injury. Following the surgery, unfortunately the pain in his tailbone region persisted, especially when sitting, though his pain while standing had decreased. He subsequently was treated by multiple specialists including physical therapists, chiropractors and a pain management physician who performed 3 coccyx steroid injections. Despite these interventions his coccydynia persisted for over five years before presenting for evaluation at our physiatric musculoskeletal practice at an academic medical center. Coned-down sacrum/coccyx x-rays were done, revealing heterotopic ossification distal to and posterior to the remaining coccygeal segment (Cl). Review of his pre-operative and post-operative images confirmed that the heterotopic ossification was a post-operative occurrence. Review of post-operative MRI and CT scans confirmed heterotopic ossification, which had been unappreciated at the time those images had been done and read. He was subsequently treated with ganglion Impar nerve block and steroid injection.

Discussion: Heterotopic ossification of the coccyx has not been previously reported as a post-operative complication of coccygectomy in the treatment of coccydynia. However, this patient's history, physical exam and radiographic findings confirm the development of Heerotopic ossification of the coccyx following partial coccygectomy.

Conclusions: Heterotopic ossification is a newly-reported post-operative complication of coccygectomy.

Symptomatic Quadriceps Herniation after Traumatic Laceration: A Case Report

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Gautam Malhtra, MD

Introduction: Ten years prior to presentation, two taxis collided causing a street sign to land on the veteran while he was seated at an outdoor cafe. A large laceration of his left lateral thigh required skin grafting from the contra lateral thigh for closure of the laceration. On presentation, he reported numbness and pain in his lateral thigh since the injury previously attributed to "nerve injury." He also reporting a feeling of "a lot of movement" and a noticeable a bulge in his left lateral thigh when walking and shifting weight to his left leg.

Setting: Outpatient Veteran's Hospital Physical Medicine and Rehabilitation Clinic

Results: Veteran had an MRI (picture presentation on poster) showing a defect within the lateral aspect of the mid left thigh subcutaneous fat that measured approximately 6.4 cm in greatest diameter. The quadriceps musculature appeared to be herniating through the subcutaneous fat and was thought to be the source of his lateral thigh pain. Surgical evaluation was requested and was recommended to continue conservative management.

Discussion: Quadriceps herniations are not common. They have been reported as a complication at an anterolateral perforator flap donor site[1]. In sports related injuries the cause of herniation is not clear. Although usually associated with a sudden forceful kick, it may also be associated with a weakened or previously injured quadriceps fascia. The hernia is usually small and can normally be felt anteriorly with quadriceps contraction. Cases have been described also in patients that have sustained electrical burns. Typically, the fascial defect does not heal, but usually is not surgically corrected. Wearing a neoprene sleeve can provide some relief of discomfort: Significant symptoms could require surgical repair. A rare complication of a muscle herniation would be entrapment of the muscle in the defect, causing a compromise in blood flow to the muscle. This would cause severe pain and requires immediate medical treatment.

Conclusions: This is the only reported case of large symptomatic quadriceps herniation after traumatic laceration. Non surgical management with physical therapy did help to resolve his lateral thigh pain. Physiatrists should be aware of this to obviate unnecessary procedures and reassure the patient at time of presentation.

Seizure Activity As the Cause of Unresponsiveness In a Teraplegic Patient with Stable Vital Signs

Christine Pfisterer, DO
Carol Gill, MD

Case Diagnosis: Nonconvulsive Status Epilepticus

Case Description The patient was a 70 year old male with history of chronic C7 tetraplegia, sacral decubitus, diastolic heart dysfunction, and CHF, who was admitted to the hospital for bacteremia. After his condition stabilized, ,he underwent a myocutaneous skin flap for a chronic stage IV decubitus ulcer. His hospital stay was prolonged, as he was placed on 6 weeks of bedrest to protect the flap. One evening, the patient was found to be unresponsive, despite having stable vital signs. He was transferred to the ICU for evaluation, and returned to his cognitive baseline a few hours later. A CT of the brain was negative for infarct or acute bleed. He was found to have QT prolongation, so medications were changed, and no further neurologic workup was done. He was transferred back to the SCI floor, and a few weeks later, had another unresponsive episode with stable vitals. During each of these episodes, the patient was found lying unresponsive in bed, motionless, without evidence of seizure or other inciting factor. After this second episode, when all other work-up was negative, a full neurologic work-up was done, including a MRI of the brain and an EEG. The MRI was consistent with diffuse atrophy, and the EEG revealed seizure activity, although the patient never had any visible seizures. The patient was started on antiseizure medications, and at time of discharge, he did not have any further episodes of unresponsiveness. Prior to these episodes, there was no overt evidence of dementia, but after undergoing a full neuropsychological evaluation when his condition stabilized, he was found to have significant dementia. No reversible causes of dementia were identified, and it was felt that his dementia, which he had become very good at compensating for, was due to age, and not any other outside factors.Seizure activity has been described in patients with dementia; however, the seizures are most often complex partial in nature. Nonconvulsive status epilepticus (NOSE) is another condition that has been described; it is characterized by at least 30 minutes of behavioral or cognitive changes in a patient from baseline with EEG evidence of seizures. There is debate regarding the diagnosis and morbidity of this condition, but it has often been described in patients with severe dementia. This patient did not have a documented history of dementia prior to these events, and he did not exhibit any overt seizure activity. If not for the EEG findings, he would not have been started on antiepileptics, and his unresponsive episodes would likely have continued.

Conclusions: Although rare, physicians should be aware of the possibility of seizure activity and underlying dementia as a cause of unresponsiveness in patients with stable vitals.

Puddle Slip Injury Resulting in a Complete Proximal Avulsion of the Semimembranosus Tendon in a **Non-Athletes** A **Case Report**

Christine Roque-Dang, MD

Todd P. Stitik, MD

Case Description: The patient had complained of severe right hip region and lower limb pain after she slipped on a puddle of water. She stated that her right knee was flexed, her ankle was dorsiflexed, and she recalled hearing a "pop" while slipping. She complained of "burning" posterior and medial thigh pain with radiation to the posterior ankle and noted resolution of her initial right hip pain. On physical examination, she had an antalgic gait, ecchymoses were visualized over the posterior thigh, and she had decreased sensation to light touch in the distribution' of the sciatic nerve.

Assessment/Results: Musculoskeletal ultrasound examination revealed architectural distortion of the biceps femoris and semimembranosus muscles with surrounding edema. A subsequent MRI showed complete avulsion tear of the semimembranosus tendon from the ischial tuberosity. At subsequent follow ups, the patient's sciatica resolved as local edema subsided. An orthopedic surgery consult was obtained arid, at 1 month post-injury, the patient underwent a right proximal hamstrings tendon repair with good outcome.

Discussion: Complete proximal origin avulsions of the hamstring tendons are rare and usually result from injuries with a flexed hip and extended knee. Most of these injuries occur in young athletes and several cases involve water skiers. In non-athletes, there is no consensus regarding conservative versus operative management. Few cases exist where concomitant temporary sciatica is described.

Conclusion: Reported is an unusual case with an atypical presentation of a complete proximal hamstring tendon avulsion in a non-athlete and necessitating surgical repair for improved function

The Effect of Stretching on Running Speed: A Review of the Literature

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Nigel Shenoy, MD

Introduction: Stretching exercises are widely used as a technique to prepare for intense physical activity, with the belief that they will decrease risk of injury and may enhance athletic performance. However, in the last 10 years an increasing amount of literature suggests that stretching may actually decrease athletic performance. On a physiologic level, if stretching increases flexibility of muscle, this may decrease recoil and storage of potential energy, and thus lead to decreased power and speed of movements.
Stretching may be static, performed while the body is at rest with the end position held, or dynamic, performed with active muscle movement and momentum. Measures of athletic performance include strength, endurance, agility and speed. The aim of this review is to examine the published evidence on the effects of stretching exercises on running speed.

Methods: A literature search using the PubMed and Ovid Medline databases was performed with the search terms: stretching, running, and sprinting. All articles related to lower extremity stretching and running speed were reviewed. A total of 18 articles were relevant to the subject.

Findings: Of the 18 articles reviewed, 12 suggested that stretching was detrimental, 3 reported no effect, 1 suggested it was beneficial and 2 had equivocal results. Seven articles compared the effects of dynamic stretches to static stretch, and of these, 3 reported dynamic stretches were beneficial to running speed, 2 reported that they were detrimental and 3 reported no change. Out of the total articles reviewed, one evaluated endurance, as distance was measured over one hour; the remainder evaluated sprint time.
One study focused only on adolescents. One article evaluated the influence of baseline flexibility and found a significant correlation, whereby individuals with comparatively high baseline flexibility had a negative effect of stretching on sprint performance, while those with lower flexibility did not.

Conclusions: The majority of literature suggests that stretching has a detrimental effect on running speed. The results for dynamic stretching compared to static stretching are contradictory, and there is insufficient evidence to make a conclusion. There is some evidence to suggest that comparatively high baseline flexibility plays a part in the negative effect of stretching on running speed, however more research needs to be done on this.

Limb Activation Therapy In the Rehabilitation of Left Spatial Neglect

Mark A Sison, MD, PT

Objective: Among the impairments following a right hemisphere stroke, left spatial neglect is one of the best predictors of poor functional recovery. One technique found to have some success in reducing neglect is Limb Activation Therapy. In this review, Limb Activation Therapy and its history is described. Its clinical benefits, possible underlying mechanisms and practical implications are also evaluated.

Design: A systematic literature search was performed using the Cochrane Database of Systematic Reviews and PubMed. The following keywords were used for this review: *stroke, cerebrovascular accident, left spatial neglect, and limb activation therapy.* Citation tracking of all primary studies, reference lists from review articles, and books identified in the searches provided an additional search strategy.

Results: Limb Activation Therapy was developed from observation that left spatial neglect could be reduce if tasks are performed using the left hand in left space. In clinical practice, the patient is required to initiate movements with his/her left paretic limb in left hemispace. It is not clear whether the facilitatory effect of limb activation is due to a direct relationship between motor programming and elective attention, or a perceptual-motor cueing effect. It has been shown in several studies that Limb Activation Therapy can shorten hospital stay, improve body image, and increase scores in formal testing and task performance measures in patients with neglect. Multiple studies have likewise shown that Limb Activation Therapy produces significant gains in several ADL areas. Furthermore, long-term effects have been reported in some studies.

Conclusions: Altogether, majority of the studies reviewed show that Limb Activation Therapy is beneficial in the treatment of neglect; however, more randomized controlled trials over longer follow-up periods are needed to determine the optimal conditions for promoting generalized training. Further research is needed to investigate treatment efficacy against functional criteria while keeping with the advances in brain activation research.

NOTES