UMDNJ
NEW JERSEY MEDICAL SCHOOL
University of Medicine & Dentistry of New Jersey

Department of
Physical Medicine and Rehabilitation

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

The Nineteenth Annul Resident, Fellow & Postdoctoral Fellow Research Symposium Abstracts

Wednesday, June 11, 2008
12:30 PM — 5:15 PM

Kessler Medical Rehabilitation Research and Education Center (KMRREC)
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

2008

GRADUATING RESIDENTS

Andrew Ankamah, MD
Jessica S. Bloomgarden, MD
Richard A. Dentico, MD
Kristina E. Hicks, MD
Roseanna Jackson-Parekh, MD
Ronald Karnaugh, MD
Stacey Miller-Smith, MD
Christopher J. Visco, MD
Brian F. White, DO

GRADUATING CLINICAL FELLOWS

Michal Eisenberg, MD
Kimberly Heckert, MD
Neil Jasey, MD
Jeremiah Nieves, MD
Jonas Sokolof, DO
Jacob Strong, MD

GRADUATING POSTDOCTORAL FELLOWS

Karen Hwang, EdD
Nitin Moholkar, PhD
Margaret Schmitt, PhD
Gerald Voelbel, PhD

PROGRAM DIRECTORS

Anna Barrett, MD
John DeLuca, PhD
Elie Elovic, MD
Susan V. Garstang, MD
Steven Kirshblum, MD
Todd Stitik, MD

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John Bach, MD
John DeLuca, PhD
Eugene Komaroff, PhD
Bruce Gans, MD
John Whyte, MD, 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 judgement 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, M.D.	University of Washington
1989	Frederic J. Kottke, M.D., Ph.D.	University of Minnesota
1990	Gerald J. Herbison, M.D.	Thomas Jefferson University
1991	Rene Cailliet, M.D.	University of Southern California
1992	Barbara J. deLateur, M.D., M.S.	Johns Hopkins University
1993	George H. Kraft, M.D.	University of Washington
1994	Ernest W. Johnson, M.D.	Ohio State University
1995	Mehrsheed Sinaki, M.D.	Mayo Clinic
1996	Diana D. Cardenas, M.D.	University of Washington
1997	Stanley A. Herring, M.D.	University of Washington
1998	Daniel Dumitru, M.D.	University of Texas-San Antonio
1999	James A. Sliwa, D.O.	Rehabilitation Institute of Chicago/ Northwestern University
2000	Andrew J. Haig, M.D.	University of Michigan
2001	Lawrence R. Robinson, M.D.	University of Washington
2002	Kristjan T. Ragnarsson, M.D.	Mount Sinai School of Medicine of New York University
2003	Elliot J. Roth, M.D.	Northwestern University

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Department of Physical Medicine and Rehabilitation

National Teaching Award Recipients

Year	Recipient	Affiliation
2004	Ross Zafonte, D.O.	University of Pittsburgh School of Medicine
2005	Teresa L. Massagli, M.D.	University of Washington
2006	William F. Micheo, M.D.	University of Puerto Rico School of Medicine
2007	Jacqueline J. Wertsch, M.D.	Medical College of Wisconsin
2008	John Whyte, M.D., Ph.D.	Moss Rehabilitation Research Institute

The Department of Physical Medicine and Rehabilitation of the UMDNJ-New Jersey Medical School & Kessler Medical Rehabilitation Research and Education Center (KMRREC)

Proudly presents
SELECTED TOPICS IN
PHYSICAL MEDICINE AND REHABILITATION
With

Guest speaker & recipient of the 2008
UMDNJ-New Jersey Medical School National Teaching Award

John Whyte, M.D., Ph.D.

Professor, Rehabilitation Medicine
Thomas Jefferson University
Director, Moss Rehabilitation Research Institute

June 10, 2008 - 4:30 p.m. – 6:30 p.m.
Drug Treatment to Enhance Cognitive Function &
Models of Rehabilitation Research
&
June 11, 2008 – 9:30 a.m. – 11:30 p.m.
Advances in Research on Disorders of Consciousness &
Disorders of Attention After Traumatic Brain Injury

Kessler Medical Rehabilitation Research and Education Center (KMRREC) is accredited by the ACCME to sponsor continuing medical education for physicians. Each physician should claim only those hours of credit he/she actually spent in the education activity. KMRREC designates this continuing medical education activity for 3 credit hours in Category 1 of the Physician's Recognition Award of the American Medical Association.

It is the policy of Kessler Medical Rehabilitation Research and Education Center (KMRREC) to ensure balance, independence, objectivity, and scientific rigor in all of its educational activities. All faculties participating in continuing medical education programs sponsored by KMRREC are expected to disclose to the program audience any real or apparent conflict(s) of interest related to the content of their presentation(s). Full disclosure of faculty relationships will be made at the program. Kessler Medical Rehabilitation Research and Education Center (KMRREC) is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to sponsor continuing medical education for physicians.

In compliance with the Americans with Disabilities Act of 1990, we will make all reasonable efforts to accommodate persons with disabilities. Please call with your requests.

This activity is supported through an unrestricted educational grant from the Baird Fund.

John Whyte, M.D., Ph.D.

Dr. Whyte is a physiatrist and experimental psychologist specializing in traumatic brain injury rehabilitation. He directs the Moss Rehabilitation Research Institute and is Professor of Rehabilitation Medicine at Thomas Jefferson University in Philadelphia. His research focuses on recovery from prolonged unconsciousness and attention and executive deficits that result from TBI. In addition, he has a longstanding interest in the special methodological challenges presented by rehabilitation research topics, including the definition of rehabilitation treatments and the measurement of treatment effects. His research has been funded by the National Institutes of Health, the National Institute on Disability and Rehabilitation Research, the Department of the Army, and a number of private foundations. He is the past president of the Association of Academic Physiatrists, former chair of the National Center for Medical Rehabilitation Research's Advisory Board, and Principal Investigator and Program Director for the Rehabilitation Medicine Scientist Training Program, a NIH-funded program to train physiatric researchers. He is the 2002 winner of the William Fields Caveness Award, from the Brain Injury Association of America, and a committee member for the Institute of Medicine's 2007 update on Disability in America. He is also the ACRM's 2007 Coulter Lecturer, and 2008 recipient of the Robert L. Moody Prize for Distinguished Initiatives in Brain Injury Research and Rehabilitation.

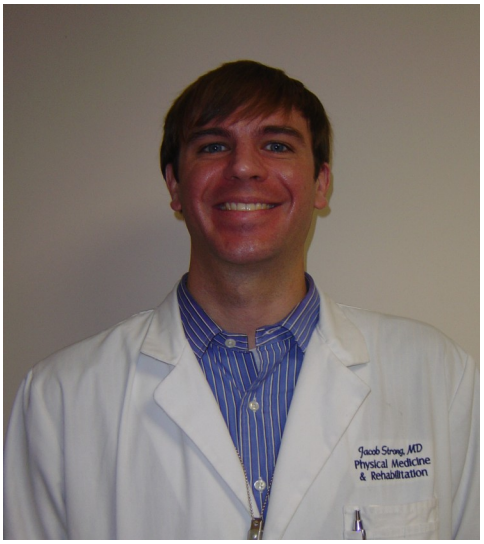
Residents 2008

Bottom Row *(L to R)*: Kristina Hicks, MD; Jessica Bloomgarden, MD; Stacey Miller-Smith, MD; Brian White, DO
Top Row *(L to R)*: Andrew Ankamah, MD; Richard Dentico, MD; Roseanna Jackson-Parekh, MD; Christopher Visco, MD

Ronald Karnaugh, MD

Clinical Fellows 2008

Left to Right: Neil Jasey, MD; Kimberly Heckert, MD; Michal Eisenberg, MD; Jeremiah Nieves, MD



Jonas Sokolof, MD and Jacob Strong, MD

Postdoctoral Fellows 2008

Left to Right: Nam Kim, PhD; Peii (Peggy) Chen, PhD; Kevin Terry, PhD; Gerald Voelbel, PhD; James Sumowski, PhD; Margaret Peggy Schmitt, PhD; Nitin Mohol-kar, PhD; Karen Hwang, EdD (center)

UMDNJ-New Jersey Medical School

Department of
Physical Medicine and Rehabilitation

Abstracts Digest

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PART I

RESIDENT, FELLOW & POSTDOCTORAL FELLOW

PRESENTATION ABSTRACTS

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

RESEARCH ABSTRACTS
Part I

The Effect of Upper Extremity Spasticity Management on Gait Function in the Spastic Hemiplegic Patient

Andrew K. Ankamah, MD
Elie P. Elovic, MD, Gary Galang, MD, Karen Nolan, PhD

Introduction: Spasticity is present in as much as 25 – 40 % of patients with acquired brain injury (ABI), affecting approximately 8 million people in the United States. Chemoneurolysis with botulinum toxin A has been used to treat upper extremity (UE) spasticity in these patients. Prior studies showed improvements in gait and overall function. However, there was lack of objective measures to effectively evaluate actual ambulatory function.
Objective: The purpose of this study was to objectively assess the effect of UE chemoneurolysis with botulinum toxin A on the spastic hemiplegic gait.
Design: Open-label, Pre-Post design.
Methods: The study participants consisted of 3 patients with stroke and traumatic brain injury (TBI) related spastic hemiplegia and 3 age-matched healthy controls. Each patient in the treatment group was evaluated especially the degree of spasticity in the UE muscle groups using the Modified Ashworth Scale. Gait patterns in both the control and the study group were then assessed using the pedobarography, timed six-minute walk test (standard walk test). Parameters assessed included walking speed, and distance during a six-minute walk. The study group received botulinum toxin A injections in the affected UE and was then followed up at 4 weeks post injection. The control group was tested only once thus difference or change scores were not obtained. At the end of the study period, the following analyses were run: pre minus post (change) within the botulinum toxin A group, pre botulinum toxin A versus control, and post-botulinum toxin A and control. Change was assessed for statistical significance in the botulinum toxin A group with the paired Student t-test. Comparisons between botulinum toxin A and control were done with the two-group Student t-test. Given the multiple looks, alpha for the between group comparison was set at 0.025. As a check on the parametric assumptions underlying the t-test, the Wilcoxon signed-ranks test and Wilcoxon rank-sums tests were also performed. These non-parametric tests did not produce any substantive changes on conclusions, thus were not considered further.
Results: The mean (range) age of the healthy control was 46 (24 – 61 years-old), all females. The mean age of the botulinum toxin A group was 39 (21-60), 2 females and 1 male. 2 patients had acquired brain injury due to stroke (1 male, 1 female) and 1 other female with TBI. An average of 330 units of botulinum toxin A was injected in selected UE muscles. The mean (SD) walking distance of the pre-injection patient group was 1030.7 feet (314.16 m). The mean walking distance post-injection was 1152 feet (351.13 m). The mean difference between pre and post injection distance of ambulation during a six-minute walk was 121.33 feet (36.98 m), (p=0.325). The mean distance of the control group was 1490 feet (454.15 m). The mean difference between the control versus pre-injection was 459.33 feet (140.0 m), (p=0.162). The mean difference between the control versus post-injection was 338 feet (103.02m), (p=0.227).
The mean pre-injection and post-injection walking speed 0.87 m/s and 0.97 m/s respectively. The mean difference between the pre and post injection walking speed was noted to be 0.10 m/s. The paired Student t-test showed a p=0.342
Conclusion: The study showed clinical efficacy of botulinum toxin A injection of upper extremity spasticity on gait function in the spastic hemiplegic patient with a mean walking distance difference of 121.33 feet (36.98 m), improvement in six minute walk test post injection compared with pre-injection. There was improvement of 0.10 m/s of walking speed, pre versus post injection. However, this study did not find statistical significance as noted by P-values > 0.05 All else being equal and assuming the observed sample values are excellent estimates of population parameters, there would be an 80% chance of detecting statistical significance in the pre versus post botulinum comparison with at least 14 additional study subjects and alpha = 0.05.

Hypothermia in Patients with Acute Tetraplegia

Jessica Bloomgarden, MD
Steven Kirshblum, MD

Introduction: Normal resting body temperature in adult humans is maintained at a constant 36.5°C-37.5°C (97.7-99.5° F) when exposed to ambient temperatures between 13°C and 60°C. Individuals with spinal cord injuries above the T-6 level, however, have been observed to be "partially poikilothermic," meaning that they are unable to maintain a stable core temperature when exposed to extreme ambient temperatures. Two prior studies have conflicted on whether chronic tetraplegics are hypothermic at normal room temperatures. The goal of this study is to determine if patients with acute tetraplegia have a lower resting body temperature than patients with other diagnoses in an acute rehabilitation facility.

Methods: A prospective analysis of body temperature of inpatients on the spinal cord injury unit at Kessler Institute for Rehabilitation was conducted. Each patient's daily 6:00 AM tympanic membrane temperature was recorded over a period of two weeks. Patients were divided by diagnosis into subgroups: complete tetraplegia, incomplete tetraplegia, paraplegia, or other. Individuals with signs of active infection within 48 hours or with traumatic brain injury were excluded. Patients' anemia status and albumin status were noted, if available. Average body temperatures of the diagnostic groups were compared.

Results: The results are pending.

Conclusion: If present, the clinical correlates of low body temperature in the tetraplegic population are unclear. Mild hypothermia in non-injured individuals is characterized by increased oxygen consumption, hypertension, tachycardia, tachypnea, cold diuresis, hypovolemia, and coagulopathy. As studies on therapeutic hypothermia have shown, low body temperature may have an inhibitory effect on the inflammatory response, perhaps resulting in a decreased ability to fight infection. An increase of 1-2°C in body temperature triggered by infection might be overlooked using established fever criteria in a tetraplegic patient with a baseline low body temperature.

Using Oral Corticosteroids in Treating Neck and Back Pain: a Clinical Survey

Richard Dentico, MD
Susan Garstang, MD, Gerard Malanga, MD

Introduction: Pain originating from the cervical and/or lumbar spine is a common presenting complaint in physiatric practice. However, the treatment of this pain is not standardized, and may depend on a variety of factors. Some clinicians routinely use oral corticosteroids to decrease acute pain and inflammation, especially in the setting of suspected disc herniation and/or radiculopathy. Presently there is scant literature (randomized studies, case reports, etc) reviewing the efficacy of such treatment. Said treatment is presently part of the armamentarium for physicians in treating pain due to spinal stenosis, radiculopathy, acute flares of cervicalgia and/or lumbago, and myofascial pain. However, there is a large side effect profile for such therapy, which are not benign. Therefore further investigation into effectiveness is warranted.

Methods: IRB approval was sought prior to initiation of this project. A survey was created using surveymonkey.com, an online program for creating, storing and analyzing survey data, and participants completed the survey through this website. The survey was sent to all members of the New Jersey State PM&R Society, as well as to local faculty members in the Department of PM&R of New Jersey Medical School. The survey was intended to query clinicians as to indications for the use of oral corticosteroids for neck and/or back pain. The survey asked indications for treatment, type and dose of oral steroid prescribed, length of therapy, and objective or subjective methods of effectiveness. The results will be collected and analyzed through surveymonkey.com.

Results: pending at this time.

Conclusion: pending.

Sleep Disruption and Daytime Fatigue after Traumatic Brain Injury

Michal E. Eisenberg, M.D.
Elie P. Elovic, M.D., Anthony Lequerica, Ph.D., Gary Galang, M.D.

Introduction: There is a high prevalence of sleep-related complaints in patients with traumatic brain injury (TBI), yet potentially treatable sleep disorders after TBI are often undiagnosed and untreated. Sleep disturbance and its associated daytime fatigue have shown negative impacts on social functioning and quality of life. Individuals with TBI who report sleep problems show increased anxiety, depression, daytime sleepiness, pain and fatigue. Cognitive dysfunction and impaired self-awareness in the TBI patients limits the utility of subjective, self-reported sleep measures. The high cost and inconvenience of the conventional objective sleep measurement, polysomnography, has limited its use, and therefore, most sleep studies in the TBI literature use self-reported data or hospital staff reports to measure sleep and arousal patterns. Ramelteon (Rozerem) is a neurohormone that functions as a melatonin receptor agonist, approved in 2005 for the treatment of insomnia with sleep onset abnormalities. Ramelteon has minimal affinity for the receptor sites of benzodiazepines, dopamine, opiates, rendering this drug unlikely to cause addiction or cognitive and motor impairments. To date there are no studies investigating the use of ramelteon in TBI patients.
Objective: The current study proposes to examine the effect of ramelteon on sleep/wake patterns and daytime fatigue in TBI patients using both subjective and objective (actigraphy) measures of sleep and daytime performance. The authors hypothesize that: 1) Rozerem (ramelteon) improves sleep quality and reduces daytime fatigue on subjective and objective measures in TBI patients and 2) actigraphy provides a useful objective measure of sleep quality after TBI.
Setting: Brain injury rehabilitation outpatient clinical practice.
Methods: The study is designed as a prospective double-blind crossover investigation of Rozerem versus placebo in patients with a history of moderate to severe brain injury and complaints of difficulty falling or staying asleep or daytime sleepiness. Objective and subjective measures of sleep are tailored to record sleep duration and quality and daytime fatigue. The objective measure is the actigraph, an electronic device worn on the wrist, which measures movement patterns. The actigraph has been shown to measure sleep/wake patterns and evaluate the effectiveness of various treatments for sleep. Subjective measures include a patient sleep log and clinician-administered sleep and fatigue questionnaires.
Results: Data acquisition from the actigraphs can be obtained by uploading the stored actigraph data using manufacturer product software. Data will be screened by calculating descriptive statistics (mean, standard deviation) and by examining the frequency distributions for all continuous variables.
Discussion: Few studies have examined the relationship between sleep and daytime fatigue among individuals with TBI using objective physiological measures. Despite the lack of medical research on ramelteon use in the TBI population, many clinicians rely on this medication as an alternative option to treat sleep disturbance after TBI. This study protocol serves the TBI population's needs for improved clinical sleep evaluation and medical management.

Dysphagia Evaluation, Diagnosis, and Management: A Retrospective Comparison of Rehabilitation and Acute Hospital Care

Kimberly DiCuccio Heckert, M.D.

Eugene Komaroff, Ph.D., Uri S. Adler, M.D., Anna M. Barrett, M.D.

Introduction: Of the 700,000 people per year who suffer stroke, between 29-64% will suffer from dysphagia in the acute phase, and 17% will still show signs of dysphagia at 2-4 months. Accurate identification and tailored management of patients with dysphagia are of utmost importance, due to the need to prevent the complications of dysphagia when present as well as the need to avoid the implications of dietary restriction when such restrictions are unnecessary. The videoflouroscopic swallow study (VFSS) is a universally accepted clinical gold standard for evaluation of dysphagia.

Stroke survivors admitted to post-acute inpatient rehabilitation may or may not have received appropriate prior dysphagia evaluation. The goals of this retrospective study were: 1) to compare the stroke dysphagia assessment pathway at the Kessler Institute for Rehabilitation Saddle Brook Facility (KIRSB), with that employed by referring acute care hospitals, and 2) to compare management recommendations at KIRSB with those of referring acute care hospitals.

Methods: We examined medical records of 226 acute stroke patients admitted to KIRSB from Dec 2006 to May 2007. Twenty-one subjects were excluded (no actual diagnosis of acute stroke, n=17; or medical records unavailable, n=4). We could not find documentation of dysphagia evaluation at KIRSB for thirty-seven patients who were also excluded from data analysis. In the remaining 146 charts, we noted the presence or absence of dysphagia based upon dietary recommendations, documentation, and management strategies prescribed.

Results: Ninety-four patients (64%) evaluated at KIRSB were diagnosed with dysphagia. Of these patients, 86% (n=81) were confirmed by VFSS and 11% (n=10) were not previously diagnosed with dysphagia in acute care (non-negligible number, $p<.0001$). Though there was agreement regarding presence or absence of diagnosis of dysphagia for most subjects (n=124, 85%), prescribed diet differed in 51% (n=75). The KIRSB dysphagia evaluation resulted in a diet downgrade in 12% (n=18) of patients.

Discussion and Conclusions: Dysphagia was common in this post-stroke patient sample. If patient evaluation during acute care were sufficient to establish dysphagia diagnosis, we should see disagreement between acute and KIRSB evaluation only if accounted for by natural recovery. Eleven percent of patients with dysphagia would not have been diagnosed without repeat evaluation. An additional twelve percent of patients required diets for swallowing safety more conservative than those prescribed in acute care. The necessity of repeat dysphagia evaluation as a routine part of acute stroke rehabilitation care has not been completely established. Clinicians treating acute stroke patients in a rehabilitation setting should not consider results of prior dysphagia evaluation to be conclusive. Our results support the need for repeat evaluation upon admission for rehabilitation. Further research addressing dysphagia specific outcomes is necessary to direct the formulation of guidelines for post-stroke dysphagia diagnosis and management in the rehabilitation setting.

Assessment Of Current Pain Management Education In Physical Medicine And Rehabilitation Residency Programs

Kristina Hicks, M.D.
Susan Garstang, M.D.

Introduction: Chronic pain is responsible for 90 million physician visits per year and affects between 30-40% of the population. Yet physicians of multiple specialties report low satisfaction and confidence in treatment of chronic pain and feel they needed more pain education during their residency training. Studies have shown that even short courses in pain management have yielded positive results, including improved use of pain medications and higher patient satisfaction. According to the Accreditation Council for Graduate Medical Education (ACGME), residents in Physical Medicine and Rehabilitation (PM&R) "must have progressive responsibility in diagnosing, assessing and managing" acute and chronic pain. We seek to determine if residents in PM&R are being adequately trained to address pain management issues and what methods are currently being used to educate residents in these issues.

Methods: A survey was created using surveymonkey.com, an online program for creating, storing and analyzing survey data, and participants completed the survey through this website. The survey was sent to the program directors of all U.S. Physical Medicine and Rehabilitation residency programs, as well as to the residents of these programs. The survey was intended to assess what methods are currently being used to teach residents pain management and how well prepared residents feel they are for dealing with pain management issues. The results were collected and analyzed through surveymonkey.com.

Results: Thirty two program directors and eighty residents completed the survey. The largest percentage of residents felt only somewhat satisfied with their training, followed by somewhat dissatisfied. The largest percentage of residents felt they would be only somewhat comfortable treating acute and chronic pain patients upone graduation. Where they felt their training was lacking included spinal injection procedures, nerve blocks, joint and bursal injections, management of implantable devices and complimentary and alternative medicine. Didactics was the most popular method of teaching reported, between 4-6 hours per year, followed by pain management rotations or clinics as part of another rotation and workshops/simulations. Residents reported only occasional exposure to patients with cancer pain, complex regional pain syndrome and implantable devices and relatively frequent exposure to patients with fibromyalgia. They reported very frequent exposure to patients with acute, chronic and neuropathic pain. In terms of procedures, on average residents reported actively performing between 26-50 joint or bursal injections, 1-10 peripheral nerve blocks, 26-50 neurotoxin injections, and 1-10 spinal injection procedures by graduation. Program director responses were fairly similar with some discrepancies. Program directors reported more hours spent in didactics devoted to pain management and felt that most topics were discussed at length (as opposed to briefly, as reported by residents). They also reported more exposure to patients with cancer pain, fibromyalgia, and complex regional pain syndrome.

Conclusions: Residents in PM&R feel they will not be totally comfortable treating acute and chronic pain patients upon graduation. Only half of all responding residents reported having a pain management rotation or clinic as part of their residency training. Incorporating a dedicated pain management rotation or clinic may be helpful in ensuring more adequate training. While residents get the majority of their pain management teaching through didactics, most topics were only touched on briefly. Residents also are not actively performing enough procedures, particularly spinal injections and peripheral nerve blocks. Residency programs need to improve their curriculums to include more extensive training in pain management.

Attachment, Disability, and Romantic Relationships

Karen Hwang, Ed.D.

Mark Johnston, Ph.D, Jeffrey K. Smith, Ph.D

Purpose of study: To examine the relationship between physical disability and attachment in intimate relationships and life satisfaction.

Design: 1-time cross-sectional survey. People with adult onset SCI were compared with people CD in attachment style, physical independence, romantic satisfaction, self-esteem and life satisfaction.

Participants: 50 people with spinal cord injuries SCI acquired after age 16 (mean age = 37.64 SD = 7.15), and 50 people with congenital physical disabilities (CD) (mean age = 36.72 SD = 7.66). Outcome measures: Craig Handicap Assessment & Reporting Technique (CHART) (Whiteneck, et al 1992); Relationship Styles Questionnaire (Bartholomew & Horowitz, 1991); Experiences in Close Relationships Inventory (Brennan, Clark & Shaver, 1998); Dyadic Adjustment Scale (Spanier, 1974); Index of self-esteem (Hudson, 1982); Satisfaction with Life Scale (Pavot & Diener, 1993).

Results: SCI and CD samples did not differ in proportion of secure vs. insecure attachment (chi-square (3df) = 1.426, p = .699). Both groups were similar to mainstream in proportion of secure vs. insecure attachment styles. Both romantic satisfaction and self-esteem were related to attachment security (for romantic adjustment $F(3, 86) = 5.360$, $p = .002$); for self-esteem ($F(3, 98) = 8.126$, $p < .001$) but not to physical independence. Greater physical independence predicted greater life satisfaction ($F(1) = 11.174$, $p = .001$, partial eta squared = .110). Secure attachment predicted greater life satisfaction ($F(3) = 5.694$, $p = .001$, partial eta squared = .160). Both had a combined effect size of .270.

Conclusions: The capacity to love and be loved is just as important as physical independence to life satisfaction for people with spinal cord injuries and congenital physical disabilities.

Cough Augmentation in Duchenne Muscular Dystrophy

Roseanna Jackson-Parekh, MD

John Bach, MD; Eugene Komaroff, MD

Introduction: Respiratory tract infections can lead to pneumonia and respiratory failure in patients with neuromuscular diseases such as Duchenne Muscular Dystrophy (DMD). Cough peak flow (CPF) has been identified as an important predictor of the ability to clear secretions and prevent progression of an upper respiratory tract infection to pneumonia and respiratory failure. Coughing following air stacking to a deep lung volume and coughing with a concomitant abdominal thrust can increase CPF.

Objective: The purpose of this study was to analyze the relative contribution to augmentation of CPF by air stacking, the manual abdominal thrust, and the combination of both for patients with DMD.

Setting: 1. Department of Pediatrics, Yakumo Byoin National Sanatorium, Japan. 2. Department of Physical Medicine and Rehabilitation, University of Medicine and Dentistry of New Jersey (UMDNJ)-the New Jersey Medical School, Newark, N.J.

Methods: CPFs on 61 patients ages 15-36 with DMD were collected using a peak flow meter and examined retrospectively. The following values were analyzed: CPF unassisted, CPF after air stacking to deep lung volumes (CPFair), CPF assisted by abdominal thrust (CPFthrust), and CPF assisted by abdominal thrust immediately after air stacking (aCPF).

Results: Overall mean unassisted CPF were 138 ±70 L/min, CPFthrust were 204±75 L/min, CPFair were 236±68 L/min, and aCPF were 302±78 L/min. The differences between each were statistically significant ($p<0.0001$). Thus, air stacking was significantly more effective than abdominal thrust in increasing CPF but the combination was the most effective. The greatest improvements in CPF were in patients with the weakest coughs.

Conclusion: These data show that the combination of air stacking followed by an abdominal thrust results in a larger increase in CPF compared to air stacking or abdominal thrust alone in patients with DMD. The data also demonstrate that the increases in CPF with manual assistance and air stacking were largest at the lower unassisted CPF baselines (the benefits of manually assisted coughing are greatest for those who are weakest). Patients with DMD should be taught to augment CPF using a combination of air stacking followed by abdominal thrust to prevent respiratory complications associated with low CPF.

A Survey of the Utilization of Guidelines and Practice Trends in the Management of Concussion

Neil N. Jasey, MD
Elie Elovic, MD

Background: Concussion is a common occurrence in sports-related or recreational activity. In general, concussion for all sports in the United States has been estimated at 300,000-500,000 occurrences per year. Incidence varies depending on the nature of the activity, being seen more often in contact sports. In a broader sense, concussion has been reported to affect 50 people per 100,000 annually in the U.S. Despite the ubiquitous nature of concussion, there is no clear consensus on how to evaluate, diagnose or handle these athletes. The extent of clinicians' knowledge of concussion and its management is relatively unknown. One study which targeted pediatricians specifically examined the knowledge and application of the Colorado Medical Society (CMS) guidelines which were adopted by the American Academy of Pediatrics. When given scenarios of athletes suffering from concussion, 7.6% correctly identified a grade I concussion, 56% a grade II concussion and 28% a grade III concussion. In a study investigating treatment, it was reported that when youth athletes were hospitalized for concussion in the Children's Hospital of Alabama, only 30% received the proper discharge instructions. Furthermore, none of the athletes properly advised were in the group identified as severe. The lack of a definition has also made identification, assessment and treatment more difficult. As a result, management paradigms are based on opinion rather than proven science. Additionally, data from a pilot study surveying clinicians suggested that management practices do not correlate with reported knowledge. It is important to reach a consensus in order to provide injured athletes with the most appropriate care.

Design: Two questionnaires were compiled and distributed with the purpose of investigating the extent of athletic trainers' and physicians' knowledge about the basic definition, presentation, treatment and grading of concussion. The four most prevalent sets of guidelines were used as a basis for these questions to insure exposure and to allow analysis for trends in usage. Additionally, the survey sent to the athletic trainers investigated the frequency of concussion, the age of the athletes, and the sports involved. The athletic trainers were also questioned about their referral patterns to physicians and asked to identify the specialty of the physician if possible. The physician surveys were designed to investigate the familiarity of community physicians with the assessment and long term effects of concussion. The respondents were allowed to complete and return the survey at their convenience.

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

Conclusion: This study will most likely conclude that the majority of athletic trainers commonly handle less severe concussion without referring to a physician. It is anticipated that respondents will be unfamiliar with the definition of concussion and that cognitive and post-concussive symptoms will be under recognized and under treated. Thus, treatment of concussion may be inadequate and may place athletes at further risk of injury.

Common Presenting Clinical Issues of Adult Spina Bifida Patients at First Visit to a Spina Bifida Clinic

Stacey Miller-Smith, MD
Bruce M. Gans, MD, Susan Garstang, MD

Introduction: Spina bifida is the most commonly occurring neural tube defect that is compatible with long term survival. Although the incidence has been declining due to folic acid supplementation, there are still approximately 2500 babies with spina bifida born each year in the United States. The broad category of spina bifida includes a wide variety of clinical conditions. The defect may be manifested by an open meningeal sack that contains neural elements, or be completely unrecognized with no external or neurologic deficits noted at birth. In the US, most infants born with a significant neurologic deficit associated with their spina bifida are cared for in multi-disciplinary programs commonly housed in children's hospitals and academic medical centers. In general, these programs are not organized to continue providing care to these patients when they achieve late adolescence or adulthood. The transition from childhood to adulthood presents a unique social and medical challenge for patients with spina bifida. There are few published studies in the literature which describe the unique continuing social, rehabilitative and medical needs of these patients. In addition to their ongoing developmental physical problems, many patients also face discharge from the pediatric care system, and the necessity for finding ongoing care as disabled adults. Few organized programs for adults with spina bifida exist, so many patients experience fragmented and insufficient care and follow-up after their discharge from pediatric centers. In response to the need for an adult service setting, Kessler Institute established an adult program in partnership with the Spina Bifida Association – Tri-state Region.

Objective: The goal of the study is to describe the pattern of primary care, specialty care, social problems and rehabilitative needs of the adult spina bifida patient, at their first visit to a spina bifida program.

Setting: An outpatient adult spina bifida program within a rehabilitation hospital.

Methods: After obtaining IRB approval for this project, a retrospective chart review of all the patients seen in the spina bifida program since onset (3 years prior) was conducted. Information was abstracted from a standardized intake form as well as the initial history and physical in the outpatient record. A standardized data collection form was created to record the information.

Results: Results are still pending at the time this abstract was due. It is anticipated that we will find that the vast majority of patients have been lost to follow-up vis-a-vis their neuromuscular concerns after discharge from their pediatric specialists. It is also expected that we will be able to describe the pattern of social and rehabilitative needs of these patients.

Conclusions: It is expected that we will find that the vast majority of these patients were no longer under the care of practitioners who were comprehensively managing their medical and functional needs. It is also anticipated that we will be able to describe the pattern of social and rehabilitative needs of these patients. It is hoped that characterizing the population in this manner will serve as a stimulus to the development of programs in other locales, and may inform the development of similar programs for other diagnostic categories of patients with childhood onset disabling conditions who need specialized care as adults. Describing the unique needs of these patients should empower other practitioners to better care for these patients.

Initial Electro-Mechanical Response to Rearward Perturbation

Nitin Moholkar, **PhD**
Venkata Gade, MS, Jerome Allen, MS, W. Thomas Edwards, PhD

Introduction: Falls are a major health concern due to the increased morbidity, mortality, and healthcare costs, as well as the decreased quality of life. A sudden rearward perturbation to balance will lead to a fall without a proper response. The nervous system needs to send the proper signal to the muscles, and the musculo-tendon units (MTU) need to respond in an appropriate and timely manner. This mechanical response can be broken down into three components: preset properties of the MTU due to current activation, reflex changes to the MTU, and active changes to the MTU. Prior studies have examined the EMG response of muscles crossing the ankle joint in similar situations but the mechanical effect of the EMG responses has not been adequately investigated.
Objective: To examine the combined EMG and mechanical response to a rearward perturbation and categorize the responses into the three categories (preset, reflex, & active). We hypothesized that it is the active response that provides the bulk of balance recovery.
Methods: Eleven healthy adult subjects gave informed consent and were screened to exclude internal pathologies or medications affecting balance. Subjects stood on a NeuroCom Research Platform. The platform oscillated 12 cm in the anterior-posterior direction at three different frequencies (0.75, 1.0, and 1.25 Hz), with the initial movement in the rearward direction. Each condition was repeated three times with eyes open, for a total of 9 trials per subject. Motion data was collected at 100 Hz using a Vicon motion capture system. Ground Reaction Force (GRF) data was collected through the NeuroCom Research Platform at 200Hz. Motion and GRF data were combined through inverse dynamics to calculate ankle joint moments in the sagittal plane. EMG data from ankle extensor muscles was collected at 1000 Hz. All data was synchronized through the Vicon motion capture system. To determine initial reaction to the platform movement, the initial movement cycles were compared to later cycles, by which point subjects had fully adjusted to the platform motion. Both timing and magnitude of EMG and moment data were examined to separate observed changes into preset mechanical properties of the joint, reflex response, and active response to the perturbation. All results presented are group averages plus/minus standard error of the mean.
Results: *EMG response*: There was a burst starting at 75$\pm$4 ms, 60$\pm$4 ms, and 60$\pm$4 ms after the onset of movement, lasting for 216$\pm$16 ms, 210$\pm$10 ms, and 203$\pm$7 ms for the 0.75, 1.0, and 1.25 Hz trials. This initial burst was followed by asecond, shorter burst. After two to three cycles, the EMG activity became more consistent and coincided with the movement of the platform. A*nkle Moment Response*: The ankle moment increased immediately as the movement started. This was followed by a cycle where the timing of the moment is synchronizing with the platform movement. After two to three cycles, the ankle moment becomes more consistent and timed with the platform movement. *Overall:* The timing of the first two ankle extensor EMG bursts in response to the initial movement of the platform matched well with the timing of small deviations in the ankle moment response, with small time delays, explained by electromechanical delay. By the third cycle of movement, the EMG and extensor moment had settled into their patterns. If preset conditions and reflex activity were sufficient to respond to perturbations, there would not have been a two cycle settling time before reaching a consistent pattern. An active response was necessary to prevent a fall. This study further demonstrates that reflexes alone are insufficient for balance recovery after a perturbation.
Conclusions: Initial preset condition of the ankle extensor muscles combined with reflex activity is not sufficient to maintain balance on a moving platform. Following an initial reflex reaction, further active control is required to match the timing (phase) of the ankle moment and the platform motion and avoid a loss of balance. This study provides new insight for the diagnosis of postural deficits.

Spontaneous activity in persons with motor incomplete spinal cord injury

Jeremiah Nieves, MD
Steven Kirshblum, MD

Introduction: Several studies focusing on intramuscular electromyography (EMG) of muscles below the neurologic level in spinal cord injured (SCI) persons have demonstrated the presence of spontaneous activity (SA) in the form of fibrillation potentials (fibs) and positive sharp waves (PSWs). While these findings are classically seen in lower motor neuron (LMN) injuries, they are not typically associated with upper motor neuron (UMN) injuries, such as those following SCI above the cauda equina. The aforementioned studies postulated several theories to explain the origins of these potentials; however, no one theory has been universally adopted and confusion regarding the matter persists. This confusion is compounded by the finding of neurologic recovery in some of the subjects. Although the majority sustained neurologically complete injuries, some had motor recovery resulting in varying degrees of incompleteness. More interesting still was the decrement seen in the level of SA following motor recovery, leading to the speculation that a relationship existed between these findings.
Although a direct correlation between the completeness of a spinal cord injury and the presence of SA on EMG has not been found, Kirshblum et al studied 25 persons with chronic complete tetraplegia and demonstrated SA in at least 1 muscle in 92% of subjects. A similar study in persons exclusively having sustained a motor incomplete SCI (ASIA C and D) has not yet been undertaken. This type of study would provide a strong foundation upon which comparisons could be made [i.e. the level of SA at baseline in various lower extremity muscles vs. the level of SA following motor recovery in those same muscles]. The results would be useful in particular with respect to interventions proposed to enhance neurologic recovery in humans with SCI, such as body-weight supported treadmill training, given the promising results of this type of intervention in recent animal studies.
Objective: To investigate the presence of SA in selected lower extremity muscles in persons having sustained a motor incomplete SCI (ASIA C and D).
Setting: Outpatient Clinic within a Rehabilitation Hospital
Methods: Nerve conduction studies (NCS) and intramuscular EMG studies were performed in the right lower extremity of subjects with incomplete tetraplegia as follows:
NCS: NCS of the right peroneal and tibial nerves were performed according to accepted technique. Onset latencies (ms) and amplitudes (mV) were recorded and conduction velocities (m/s) were calculated based on standard and measured distances.
EMG: Intramuscular EMG was performed in the right vastus lateralis, biceps femoris (long head), tibialis anterior and medial gastrocnemius, according to accepted technique).
Results: To be discussed.
Conclusions: To be discussed.

Self-Efficacy as a Predictor of Self-Reported Physical, Cognitive and Social Functioning in Persons with Multiple Sclerosis

Margaret M. Schmitt, Ph.D.

Nancy D. Chiaravalloti, Ph.D., John DeLuca, Ph.D.

Introduction: Although the impact of Multiple Sclerosis (MS) can be heterogeneous, research has shown that the disease is associated with impairments in physical, cognitive, emotional, and social functioning. Disease-related factors alone do not completely explain the variability in functional outcomes seen in MS. Research is increasingly focused on the impact of psychosocial factors on outcomes in individuals with MS such as self-efficacy, the belief of an individual in their ability to effectively cope with challenging situations. Self-efficacy has been previously associated with psychosocial adjustment, treatment adherence and depression in MS, but little is known about its relationship with functional outcomes. The present study investigated whether self-efficacy predicts self-reported physical, cognitive, and social functioning in MS when controlling for variability in disease related factors and depression.

Objective: To investigate the ability of self-efficacy to predict self-reported physical, cognitive and social functioning in persons with Multiple Sclerosis (MS) when controlling for variability in impairment due to disease related factors and depression.

Setting: Outpatient medical rehabilitation research organization

Participants: 39 individuals with clinically definite MS, mean age 47.8 years, 77% female, 30 Relapsing-Remitting MS, 8 Secondary Progressive MS, 1 Primary Progressive MS

Main Outcome Measures: SF-36 Health Status Questionnaire (HSQ), Perceived Deficits Questionnaire (PDQ)

Results: All analyses utilized step-wise hierarchical regression analysis. Self-efficacy was a significant predictor of self-reported physical functioning on the Physical Functioning Scale of the HSQ, accounting for a unique 17% of variability in physical functioning after the impact of disease related factors and depression. Self- efficacy was not a significant predictor of self-reported cognitive functioning. However, self-efficacy was a significant predictor of social functioning, accounting for 11% of the variability beyond the contributions of depression and disease related factors.

Conclusions: Self-efficacy plays a significant role in individual adjustment to MS across multiple areas of functional outcome, beyond that which is accounted for by disease related factors and depressive symptomatology. Thus, improvements in self-efficacy may influence the impact of biological disease progression on functional outcomes. This is an important finding in a progressive condition with no known cure.

Musculoskeletal Complaints in Traumatic Brain Injury Associated Spasticity - Review of a 7-Year Experience

Jonas Sokolof, D.O.,
Todd P. Stitik, M.D., Lisa Schoenherr, BA, Patrick M. Foye, MD, Peter P. Yonclas, MD, Jong Kim, M.D., Ph.D., Namish Baxi MSIII

Objective: Spasticity is a common complication of TBI and may have a significant effect on the incidence of musculoskeletal pain. Although pain in the TBI population is well recognized, there has been very little research published investigating the epidemiology, incidence and etiology of these complaints in this population to date. The objective of this retrospective chart review is to provide quantitative data on the association between spasticity and musculoskeletal complaints in traumatic brain injury patients.

Design: retrospective chart review of all patients who have been treated in the University Hospital Acquired Brian Injury Clinic over a seven-year period.

Setting: University Hospital Acquired Brian Injury Clinic.

Participants: all patients seen within the University Hospital Acquired Brian Injury Clinic over a seven-year period.

Interventions: chart review with a particular focus on musculoskeletal complaints and spasticity complaints, with the formation of a patient database.

Main Outcome Measures: The main outcome measure is the completion of a database including basic patient epidemiology data (e.g., severity of brain injury, duration since injury, etc.), location of musculoskeletal complaint, clinical diagnosis, details regarding spasticity, analysis of muscle weakness, and description of treatments prescribed. .

Results: pending completion of study.

Conclusions: pending completion of study.

EMG-Guided Botox® Injections for Patients with Spastic Dysphonia-Review of a 7 Year Experience

Jacob Strong M.D.
Todd P. Stitik M.D., Lisa Schoenherr B.A., CCRC, Jong H. Kim M.D., PhD, Naimish Baxi MSIII

Background: Spastic dysphonia is a focal dystonia of unclear exact etiology that involves involuntary vocal cord movement towards the midline (adductor type-85%) and/or away from midline (abductor type-15%) during phonation. This spasticity disorder results in significant difficulties with phonation and has been linked to secondary psychological manifestations including increased stress, anxiety, and depression. While primary behavioral treatment is not effective and surgical intervention has been associated with high recurrence rates and potential morbidity, botulinum toxin injection is recognized as an effective treatment by the American Academy of Neurology, the American Academy of Otolaryngology-Head and Neck Surgery and the National Institutes of Health. Although Botox® has been used since 1988 to treat laryngeal dystonia patients, there are still some major unanswered questions in need of further investigation.

In addition, data is needed for the rationale design of additional research. This is of importance in light of the conclusion from a recent Cochrane systematic review that "Due to the lack of published randomized controlled trials, there is a pressing need for funding and implementation of multi-centre randomized controlled trials to assess the effectiveness of botulinum toxin for spasmodic dysphonia." A retrospective review is being conducted involving spastic dysphonia patients from their clinical practice, who have been receiving EMG-guided laryngeal Botox® injections over the last five years, in order to help answer the above questions and serve as pilot data for a potential multicenter study.

Methods: The results from 14 spastic dysphonia patients who received EMG-guided Botox® injections into their laryngeal musculature were compiled for presentation last year. This year's study represents a continuation of last year's study. The results from additional patients with spastic dysphonia who have since received injections and the results from patients in the original analysis who have received additional injections since that time will also be analyzed. This new data will be analyzed both separately and combined with the data from last year in order to more fully answer the questions posed below.

- Is there an optimal muscle selection? If so, what is it?
- Are better results (i.e. longer duration effect) seen with unilateral versus bilateral injection?
- Does dose seem to correlate with effect duration?
- Are there any particular needle EMG abnormalities that are predictive of effect duration?
- Does patient age correlate with effect duration?
- Does patient gender correlate with effect duration?

Results: The additional data referenced above is in the process of collection and analysis

Conclusion: The conclusions will be presented based upon this additional data referenced above.

Walking Poles: An Alternative Assistive Device

Christopher J. Visco, MD
Joseph Rempson, MD, Brian F. White, DO, Bonnie Nezlick, PT, Ginean Wolfe, PT/DPT,
Jennifer Turcl, MPT

Background: Walking poles are used by many healthy individuals to improve the base of support and increase balance when hiking on uneven terrain. Walking poles are beginning to see resurgence in popularity as an exercise device. A walking 'stick' has been used by cultures for centuries, and more recently has been replaced by the cane. Patients in a general physiatry outpatient clinic have tried poles as an assistive device under the supervision of therapists and had varied results. A patient with a dramatic improvement in balance continued to use the poles as her primary assistive device. This patient and others were the impetus for researching this topic further.

Objectives: To evaluate the utility of walking poles as an assistive device in patients with varied diagnoses. To investigate the limiting factors of their use and examine which patient populations they may work well in. To determine if and when poles should be offered as an alternative assistive device.

Methods: A cross-sectional analysis was performed on subjects who had attended therapy and trialed poles as part of their treatment plan in the prior year. Health related quality of life was assessed using a short form survey. Therapists who had patients trial poles from three distinct physical therapy gyms were surveyed using a brief questionnaire.

Results/Conclusion: results are pending at this time.

Functional Near Infrared Spectroscopy (fNIRS) Reveals Cortical Recruitment of the Prefrontal Lobe in Traumatic Brain Injury During Working Memory

Gerald Voelbel, Ph.D.
J. Lengenfelder, G. Wylie, R. Barbour, Y. Pei, A. Smith, J DeLuca, Ph.D.

Objective: The objective of this study was to investigate whether persons with a severe traumatic brain injury (TBI) recruited additional cortical resources in prefrontal lobes during working memory compared to healthy adults.

Participants and Methods: Seven right-handed adults with TBI and 7 healthy adults without any history of neurological disease or psychiatric disorders were included (HC). All participants were between the ages of 21 and 55 years old. A 30 fNIRS source/ detector optode array was placed on the foreheads. The fNIRS scan started with a 5 minute baseline period, followed by the auditory presentation of the N-Back test. The N-Back consisted of three randomly presented trials of the 0-, 1-, 2-, and 3- back tests. In the N-Back test, the 0-back condition was a baseline condition, and the 1-, 2-, and 3- Back conditions place increasing demands on working memory systems. The participants tapped the table with their right hand to respond to the target letters.

Results: Compared to the HC group, the TBI group revealed significantly greater levels of oxygenated hemoglobin in the right ventral lateral prefrontal cortex when 0-Back (baseline) was subtracted from the 1-, 2-, and 3-Back tests. In addition, the TBI group revealed increased activation of the contralateral prefrontal cortex compared to the HC group when the 1-Back was subtracted from the 2-Back.

Conclusions: This provides preliminary evidence that persons with persons with TBI recruit additional cortical resources of the prefrontal lobe during a working memory task compared to healthy adults. These results replicate prior fMRI research, but are the first to be demonstrated in fNIRS TBI research.

Pedobarographic Evaluation of Patients with Anterior Knee Pain

Brian F. White, DO
Karen Nolan, PhD, Chris Visco, MD, Elie P. Elovic, MD

Introduction: Anterior knee pain is a very common clinical complaint representing a constellation of clinical issues commonly lumped together under the umbrella term patellofemoral pain syndrome (PFS). Pain in this region is potentially of a multi-factorial etiology and there have been many mechanisms proposed as causal including the inappropriate summation of forces across the knee joint medializing the knee joint into a valgus position as well as lateralizing the extensor mechanism through the patella. These forces are likely to include osseous, muscular, and neuromuscular factors involving all aspects of the lower extremities as well as more global factors such as trunk motion. In closed chain kinetics the final common pathway for all of these forces is transmission of force to the ground through the foot. By examining the functional summation of forces through the foot to the ground during mid-stance as measured by pedobarographic pressures, it may be possible to identify a motion pattern unique to patients with anterior knee pain. Identification of such a motion pattern may allow for early identification of patients at risk for development of anterior knee pain, and possibly the development of novel treatment measures.
Objectives: The purpose of this study is to determine if subjects with anterior knee pain have a common loading pattern of their foot in mid-stance which differs from that of asymptomatic subjects.
Methods: This is a prospective, observational cohort study with participants recruited by convenience sampling. Twenty five asymptomatic controls with no history of knee pain during the previous 12 months and 25 patients with anterior knee pain of greater than 3 months duration are to be enrolled. Study participants are between 25 and 45 years of age, have a BMI < 30, no history of knee surgery, a clinical knee exam without noted ligamentous laxity, meniscal injury, bursitis, or effusion, and general good health. Each participant is instructed in the study procedure and informed consent obtained. Following this, a study information questionnaire is filled out and a clinical knee exam performed by one of the study authors (White or Visco). Participants then perform 3 trials of a 50 foot walk test with foot pressure data collected using the pedar-x-expert system which uses a thin elastic sensor shoe insert placed inside their shoe under their foot. Pressure data are collected at 50Hz and analyzed using pedar-x- expert software. For each subject, the foot strike data at is summated for all three trials to create a composite foot strike for both the left and right foot at mid-stance.
Results: For purposes of this study, the composite foot pressure map at mid-stance is divided into quadrants. Longitudinally, four regions are created corresponding to: the toes, forefoot / metatarsal heads, mid-foot, and hind-foot. In the medial to lateral dimension, three columns are created: medial, middle, and lateral. Peak pressures in the quadrant corresponding to the medial column of the metatarsal heads is used to compare asymptomatic controls to the patient group. Additionally, the medial and middle columns in the mid-foot region are compared to determine the size of the contact area at the mid-foot longitudinal arch. This study is still in the data collection phase at press time for this abstract.
Conclusions: No conclusions are available at this time as data collection continues.

PART II

R-1Research Review Abstracts

PART II
PGY-2 RESEARCH ABSTRACTS

Anthropometric and Biomechanical Factors Associated with Tibial Stress Fractures and Exercise-Related Medial Leg Pain in Active Populations: A Review of the Literature

Neeti Bathia, MD
Todd Stitik, MD

Objective: Medial leg pain in active populations has been described in the literature since the 1960s with the original term "shin splints." Several different diagnoses and pathophysiologic mechanisms have been proposed regarding the etiology of this condition. Studies in both military and athletic populations have attempted to elucidate whether an association exists between various anthropometric and biomechanical factors and conditions which cause medial leg pain, such as tibial stress fractures. The purpose of this review is to clarify which of these factors were and were not found to be associated with generalized medial leg pain or with a diagnosis that presents as medial leg pain (e.g. tibial stress fracture) from repetitive stress.

Methods: The review was done via MEDLINE using several search strings including combinations of the following diagnoses "shin splints," "medial tibial stress syndrome," "tibial stress fractures," "posterior tibialis tendinitits/tendinopathy" and the following population groups "runners," "military," and "athletes." The titles and abstracts of these studies were reviewed. Studies were included if they dealt with the following: i. active population; ii. medial leg pain from repetitive stress or a diagnosis which causes medial leg pain from repetitive stress; and iii. biomechanical/anthropometric factors. Studies that looked at overuse injuries or all stress fractures without specifically associating risk factors for injury with medial leg pain or tibial stress fractures were excluded. In addition, citations from articles returned in the original search which were relevant were also examined and included for review if they fit the inclusion criteria.

Results: A total of 42 studies were included for review. The studies dealt with one of three populations (runners, military, or athletes) and with one of two diagnoses (exercise related medial leg pain or tibial stress fracture). Static anthropometric variables that were evaluated included hip, knee, and ankle range of motion; knee alignment; heel alignment; foot type; amount of pronation; tibial width, cross-sectional area and moment of inertia; leg length discrepancy; quadriceps and plantar flexor strength; and hamstring and calf flexibility. Dynamic variables including ground reaction forces, loading rates, and hip, knee and foot kinematics.

Conclusions: Of the static anthropometric variables studied, only tibial width, cross-sectional area, and moment of inertia were consistently shown to correlate with TSFs in the military population. Additional studies are required to determine whether static pronation measures and amount of hip external rotation correlate with TSFs or exercise related leg pain. Several dynamic biomechanical factors assessed during running gait analysis are associated with development of TSFs and medial leg pain.

Pronator Syndrome: A Comprehensive Review

Miguel A. Coba, MD
Mylan Lam, MD, Jeffrey Cole, MD

Introduction and Background: The most common peripheral mononeuropathy is entrapment of the median nerve as it courses through the carpal tunnel. However, when a patient presents with numbness of the first three and a half digits, or other symptoms suggestive of median nerve entrapment at the wrist, compression of this nerve at other sites should be in the differential. Pronator Syndrome refers to a rare entrapment of the median nerve at the elbow or proximal forearm. Classically, this syndrome implies entrapment of the median nerve as it passes under the pronator teres; however, the term has become synonymous with entrapment of the median nerve along any of the sites of entrapment at the elbow or proximal forearm.
Methods: The review was done using PubMed by searching the database for articles with the keyword "pronator syndrome." The search revealed 107 articles that were narrowed down to 51 English articles.
Results: Pronator syndrome is a peripheral neuropathy caused by compression of the median nerve at the elbow. The four main sites of compression are: as the nerve passes through the ligament of Struthers in the medial distal arm, under the thickened aponeurosis that extends from the biceps tendon to the flexor forearm mass known as the lacertus fibrosus, the pronator teres muscle belly, or under the thickened or fibrous portion of the flexor digitorum superficialis. Depending on the exact site of entrapment, the clinical presentation may vary slightly, but in all cases there is hyperesthesia and/or paresthesia of the hand in the median nerve distribution, weakness of median enervated muscles distal to the site of entrapment (never involving the pronator teres itself), and pain and tenderness at the elbow. Pronator syndrome is less common than carpal tunnel syndrome, but the exact prevalence of pronator syndrome is not known. Some sources do site it as the 3rd most common peripheral nerve entrapment syndrome of the arm, following median nerve neuropathy at the wrist and ulnar nerve neuropathy at the elbow. Diagnosis is made clinically with a corresponding history, risk factors, and exam findings. Electrodiagnostics are often used to confirm the diagnosis. Treatment has varied from activity modification, the use of soft orthotics, neuropathic pain medication, to surgical release of the median nerve.
Conclusion: A comprehensive review of the literature on pronator syndrome reveal that despite the general acceptance of this syndrome as a median nerve entrapment syndrome there is relatively few clinical investigations, which is in part due to the fact that it is considered a somewhat rare entrapment syndrome. However, the reality is that there are essentially no good clinical studies into the prevalence of this disease entity. Though the basic pathology is well understood, and the clinical presentation and diagnosis is agreed upon there is no consensus on treatment for pronator syndrome. Since the literature on this topic is scarce and mostly limited to case studies and small outcome studies there is a need for further investigation of the true prevalence and best treatment of pronator syndrome.

Long-Term Prognosis and Functional Outcome in Patients with Critical Illness Polyneuropathy

Margie Donlon, MPH, MD
Peter Yonclas, MD

Objective: Critical illness polyneuropathy (CIP), an axonal sensorimotor polyneuropathy, is a frequent cause of weakness in intensive care unit (ICU) patients. It is a diagnosis that is becoming increasingly common because of improved survival from severe illnesses such as sepsis, and therefore more likely to be encountered in acute rehabilitation settings. Its pathophysiology, risk factors and means of diagnosis have been written about extensively in the acute care literature. However, less is known about the long-term outcome of these patients and their rehabilitative course. A better understanding of the functional deficits and rehabilitation needs of CIP survivors might be achieved through a review of the available literature. This information in turn, could assist rehabilitation professionals in creating realistic rehabilitative goals for these patients and facilitate a meeting of their needs throughout their course of recovery.

Design: A review of the literature was completed through PubMed and OVID, using the search terms "critical illness polyneuropathy" combined with "long-term outcome" or "prognosis" or "function." The search was limited to adults and English language. The PubMed search revealed 177 articles that were narrowed down to 14 rehabilitation-relevant articles. The search in OVID revealed 32 articles, of which a total of 9 were relevant to a rehabilitation setting. From the combined results, 9 primary articles and 2 case reports were selected for this literature review.

Results: The literature suggests that the long-term outcome for survivors of CIP is varied, prolonged and often incomplete. A complete recovery is reported in 50% of the patients who survive. Among those whose recovery is incomplete, remaining deficits include distal>proximal motor weakness, painful hyperesthesia, foot drop, reduced proprioception, ADL impairments, and paraparesis or tetraplegia in severe cases. Neurophysiologic abnormalities have been found to be present up to 5 years after ICU discharge. Quality of life for CIP survivors was invariably reported as reduced. Studies are limited by poorly defined outcome measures, small study populations and follow-up times that were too short to definitively depict the long-term outcome in CIP.

Conclusion: Survivors of CIP are ideal patients for acute rehabilitation programs because this setting would allow them to maximize their functional potential by providing intensive physical and occupational therapies while maintaining close medical monitoring. Their likelihood of achieving rehabilitation goals is positive, given that complete recovery and return-to-home is possible in many cases. The fact that functional deficits can persist up to several years in some survivors suggest that certain patients may require longer courses of therapy. A better understanding of the process of recovery from CIP and the degree to which rehabilitative therapies can affect its course would be beneficial. Additional studies with clearly defined outcome measures, larger study populations, and longer follow-up times are necessary.
that has been associated with phantom limb pain.steps in the cascade of events leading to arthritic changes in the joint. They may prove to be the most promising new agents available, since their goal is to halt the progression of OA.

Carotid Cavernous Fistula

Brett Gerstman MD
Yekyung Kong, MD

Introduction: Carotid cavernous sinus fistulas (CCFs) are spontaneous or acquired connections between the carotid arterial system and the venous cavernous sinus. These lesions are typically classified by the anatomic origin of the arteries supplying the fistula, as either direct or dural. Direct CCFs are characterized by a direct connection between the intracavernous segment of the internal carotid artery and the cavernous sinus while dural CCFs are characterized by a communication between the cavernous sinus and one or more meningeal branches of the internal carotid artery, external carotid artery, or both.

Findings: Direct carotid-cavernous sinus fistulae represent 70-90% of all CCFs and are most commonly associated with trauma, especially in the setting of basilar skull fracture. Most of the lesions occur in young adults probably reflecting the larger risk of head trauma, however up to 20% of all direct CCFs may occur spontaneously as a result of a cavernous internal carotid artery aneurysm rupture or weakened ICA vessel wall. Dural carotid-cavernous sinus fistulae usually have low rates of arterial blood compared to direct CCFs and almost always produce symptoms and signs spontaneously, without any antecedent trauma or manipulation. They most frequently occur in middle aged or elderly women. The pathogenesis is controversial, although atherosclerosis, hypertension, and pregnancy are thought to be contributing factors. Irrespective of the etiology or location of the CCF, shunting of blood between a high flow arterial system and low-flow venous system produces increased vascular pressure and resistance in the venous system causing vascular congestion in the regions that are normally drained by the cavernous sinus, such as the orbits. This congestion accounts for the clinical symptoms and possible adverse sequelae of the CCF. Patients typically present with complaints including a new onset of eye redness, diminished vision, bulging eye, retro-orbital headache, and pulsatile tinnitus. Common physical findings include proptosis, pulsating exophthalmos, ocular bruit, conjunctival chemosis, elevated intraocular pressure and ophthalmoparesis. These symptoms and physical findings are typically more dramatic in the setting of a direct CCF as they have higher flow rates due to the direct connection between the ICA and the cavernous sinus. Arriving at a diagnosis of direct CCF, especially in post-traumatic cases is relatively easy from the history and clinical presentation. However, the same may not be true in case of the spontaneous variety. Spontaneous CCFs may be mistaken for chronic conjunctivitis, orbital pseudotumor, orbital cellulites or thyroid disease. Once suspected, immediate involvement of both neuroradiolgy and neurosurgery consultants is advised. Neuroimaging often provides clues to the diagnosis of CCF, but angiography is the definitive test for diagnosis as well as for guiding treatment. Direct fistulas are usually immediately repaired endovascularly. Dural fistulas may first be treated conservatively with carotid compression therapy prior to endovascular repair. Once a fistula is closed most symptoms and signs usually begin to improve within hours to days however it may take months for ocular symptoms of congestion to subside. Common chronic disabilities caused by CCF include visual loss, neurological deficits caused by cerebral ischemia or hemorrhage, or even death in rare cases. Chronic disability from CCF is more likely with a delay in treatment from the onset of first symptoms; therefore, early diagnosis and treatment is imperative.

Review of Novel Non-Pharmacologic Treatments for Phantom Limb Pain Syndromes

Richard Hoppe, MD
Shailesh S. Parikh, M.D., M.S.

Introduction: Phantom limb pain is a condition first described in the amputated limb by Ambrose Pare, a French surgeon, in the mid-1500s. It is an often debilitating sequelae of amputations that has been reported in up to 80% of all amputees. Phantom pain syndromes involve three types of pain including residual limb pain, phantom limb sensation and true phantom limb pain. The etiology and pathophysiological mechanisms of phantom pain are not clear-ly defined. However, both peripheral and central neural mechanisms have been de -scribed, along with superimposed psycho-logical mechanisms. Yet despite having a long history of research there have been few treatments thus far that have proven efficacious. Many of the treatments have focused on oral analgesics and other drug types including anti-depressants and anticonvulsants which have been used for neuropathic pain. There are, however, several other treatments that have been attempted in recent years to reduce the ef-fect of phantom limb pain through non-pharmacologic methods.

Findings: Novel treatments involve various mechanisms along the neuraxis, from the re-sidual limb itself to the cortex. In the residual limb it has long been theorized that there is peripheral nerve sprouting which can lead to neuroma formation and nociceptive receptors undergoing a phenotypic switch resulting in abnormal signal transmission. Some research-ers have been trialing Botox for improvement in use of prosthetic limbs and suspected inter-ruption of transmission of nociceptive transmitters. Other researchers have focused on ob-servations that weather can often exacerbate the perception of phantom limb pain with a be-lief that electromagnetic waves may be influencing the abnormal signal transmission in the residual limb. These trials make use of a Faraday cage principle with a metal mesh that can be worn within a residual limb liner. There have been limited studies regarding these mate-rials but results have been promising and this method is less-invasive than other treatment modalities. Finally, there are two foci of research in the brain, one being cortical remapping and the other being transcallosal cross-referencing. The former deals with findings that a void in the signals from the amputated limb result in remapping in the somatosensory cortex from areas that are nearby and are still active in transmitting signals. The latter observation notes that use of a mirror box and observation of the intact limb with a mirror reflection rep-resenting the amputated limb has been shown in limited research to help relieve phantom limb pain through yet unclear mechanisms. It has been hypothesized that use of mirror-box therapy can help prevent this cortical remapping that has been associated with phantom limb pain.

Conclusion: This review has giving a brief description of suspected etiology and physio-logical changes involved in phantom limb pain syndromes as well as novel attempts at treat-ment of this serious condition.

Modafinil for Excessive Daytime Sleepiness in Acute Inpatient Stroke Rehabilitation

Stephanie Kemper, MD
Susan Garstang, MD

Objective: Excessive Daytime Sleepiness (EDS) in otherwise medically stable stroke patients prevents participation in acute inpatient rehabilitation programs. Various stimulant medications including dextroamphetamine and methylphenidate have been used to promote wakefulness and therefore improve acute rehabilitation participation. However, modafinil has gained favor as a non-stimulant wakefulness promoting agent which is considered to be safer and have fewer side effects than stimulant medications. The purpose of this paper was to review the literature to assess the prevalence of the problem of EDS in stroke patients, and to determine whether sufficient evidence supports the use of modafinil in this population.

Methods: PubMed was searched from 1966 to April 2008 using combinations of the following keywords: stroke, excessive sleepiness, excessive daytime sleepiness, hypersomnolence, sleep-disordered breathing, sleep apnea, prevalence, acute rehabilitation, modafinil. Websites for Cephalon and the Food and Drug Administration were also consulted, as was modafinil's package insert.

Results: This search did not retrieve a citation for the prevalence of EDS in stroke and could not estimate the number of acute rehabilitation stroke patients unable to stay awake for the minimum 3 hours of daily therapy, though the prevalence of sleep-disordered breathing and sleep-wake disorders that may contribute to EDS is high among stroke patients. Although there are no randomized controlled trials of modafinil in stroke patients, extensive trials including over 3,000 human subjects demonstrate the drug's general safety and efficacy. The literature contains a small number of case reports, a case series, and a retrospective observational study of modafinil given to stroke patients.

Conclusions: The few reports of modafinil for EDS given to stroke patients suggest a role for modafinil in stroke recovery. However, because stroke patients demonstrate a high prevalence of sleep-disordered breathing (SDB), which can impede functional recovery and significantly increase mortality, it is recommended that stroke inpatients be screened for SDB before beginning modafinil for EDS symptoms. By interfering with the CYP metabolism of other drugs, modafinil treatment may complicate anticoagulation and antihypertensive regimens. Formal study of modafinil in stroke patients could determine the drug's safety and efficacy profile in this specific population, as well as define whether drug response differs with brain lesion site and type.

Viscosupplementation in Osteoarthritis of the Hip

Janel Solano, DO
Peter Yonclas, MD

Introduction and background: Viscosupplementation has been a widely accepted option in the approach to nonsurgical treatment of osteoarthritis of the knee. The application of viscosupplementation for treatment of osteoarthritis of the hip has been less studied. One of the primary reasons identified is that the hip joint is less accessible than the knee requiring skilled use of either fluoroscopic or ultrasound guidance.

Methods: PubMed, Ovid and Cochrane databases were searched using the search items "hip, viscosupplementation, injection, Hyalgan, hyaluronate, and Synvisc". A total of 27 articles were selected as relevant for this review.

Results: The articles reviewed include fourteen prospective clinical trials, two randomized control trials, four reviews two of which were systematic reviews, and 2 case studies. There were no meta-analyses. Studies primarily evaluated safety and efficacy of treatment. Other topics included low versus high molecular weight supplements, comparison of Kellgran grade on x-ray and relation to outcome, presence of joint effusion on outcomes, use of NSAIDs and delay of surgery. There were two methods of localizing the injection that were used; fluoroscopy and sonography. Overall the treatment appeared to be safe with no adverse effects except local pain at injection site that resolved without incident. One case study of septic arthritis of the hip and intrapelvic abscess following repeated corticosteroid and viscosupplementation was presented. The studies varied by outcome measures, number and type of injections and length of follow up. Overall results suggested that viscosupplementation may be of benefit, particularly in mild to moderate stages of osteoarthritis, for improving pain and function. There was no consensus on number of injections for optimal benefit as each study had own protocol of 1,2 or 3 injections. The one randomized double blind control study comparing steroid, viscosupplementation and saline injection failed to show a significant difference between groups.

Conclusion: Based on available studies, it appears viscosupplementation of the hip is generally a safe option in conservative management of hip osteoarthritis however cannot be recommended as standard therapy for other populations. Further research should include randomized blinded control trials as only two studies to date have been performed to date. Also needed is an evaluation of ideal number and schedule for dosing of injections.

Pharmacotherapy for Osteoarthritis

James F. Wyss, MD, MPT
Todd P. Stitik, MD

Objective: To conduct an evidence-based review of currently available oral and topical pharmacologic agents utilized in the treatment of osteoarthritis (OA) pain and to assess novel therapies that may play a role in the future management of OA pain and the underlying disease process.

Design: A computer-aided search of several databases was conducted, including PubMed (2000 to present) which served as the primary database for our evidenced-based review. Searches were conducted using the following key word phrases: "pharmacotherapy for osteoarthritis", "acetaminophen and osteoarthritis", "NSAIDs and osteoarthritis", "oral anti-inflammatory medications and osteoarthritis", "COX-2 inhibitors and osteoarthritis", "celecoxib and osteoarthritis", "tramadol and osteoarthritis", "opioids and osteoarthritis", "topical analgesics and osteoarthritis", "topical NSAIDs and osteoarthritis", and "novel therapies and osteoarthritis".

Results: Acetaminophen remains an inexpensive and well-tolerated medication (few side effects, toxicities or drug-drug interactions) that provides modest pain relief for those with OA and as a result, should be considered a first line analgesic in OA. NSAIDs have been proven to be somewhat more efficacious than acetaminophen, but they remain a second-line oral analgesic agent for the treatment of OA due to a greater number of side effects, toxicities and drug-drug interactions (e.g. gastro-intestinal, cardiovascular and renal side effects). In regards to COX-2 inhibitors, only celecoxib remains an option in the U.S. for patients with significant gastro-intestinal bleeding risks, those taking anti-platelet medications and those currently being anticoagulated with Coumadin. Tramadol is considered if the patient fails to respond adequately to the previously discussed oral agents and has proven to be safe and efficacious for the treatment of OA. Opioid analgesics remain the final option for the treatment of moderate to severe OA that is refractory to prior treatment due to issues of dependence and abuse. Additional agents to consider include topical analgesics (e.g. capsaicin cream, topical salicylates, topical NSAIDs topical lidocaine patch) and they may be used as adjunctive therapy or if the patient has been unable to tolerate oral agents. In regards to novel therapies for OA, the future offers hope and the most intriguing agents being investigated are disease modifying OA drugs (DMOADs), which target various steps in the cascade of events leading to arthritic changes in the joint. They may prove to be the most promising new agents available, since their goal is to halt the progression of OA.

Conclusion: Acetaminophen remains the most appropriate first-line oral analgesic for the treatment of OA. NSAIDs remain a second-line oral analgesic agent for the treatment of OA due to a greater number of side effects, toxicities and drug-drug interactions. Tramadol is considered if the patient fails the previously discussed oral agents; opioid analgesics remain the final option due to issues of dependence and topical analgesics may be considered as adjunctive therapy.

PART III

Listing of Poster Displays

64 yo male with isolated left biceps tendonopathy, and remote history of left shoulder surgery

Steve M. Aydin, D.O.
Rex T. Ma, M.D.

Title: 64 yo male with isolated left biceps tendonopathy, and remote history of left shoulder surgery.
Setting: Musculoskeletal Outpatient clinic
Patient: 64 year old male
Case Description: 64 yo male present with left shoulder pain, with remote history of shoulder arthroscopy, rotator cuff debridement, subacromial debridement, distal clavicle resection, and open biceps tenodesis. Original injury occurred in 2006, after lifting a bucket over his head followed by his shoulder giving out. Three months prior to presentation, he went to pick up a bag and felt a pain in the arm and shoulder. He complains that the pain is in the arm whenever he goes to pick something up with the left arm. At rest the pain is 0 out of 10, and can reach 8 out of 10 on activities. On physical exam he has full active and passive range of motion at the shoulder, elbow, and neck. Spurling's test was negative, and no atrophy was noted in the left upper limb. All muscle testing for the bilateral arms were 5 out of 5, excluding left forearm supination 5 out of 5 with give way secondary to pain. Provocative testing of the left shoulder was negative. On palpation there was tenderness noted in the mid arm, along the biceps muscle. X-ray showed post-surgical changes of the AC joint with proximal humeral cortical cyst. MRI showed area of signal void of proximal diaphysis of the humerus, a cyst noted in the superior proximal humerus, limited evolution of the labrum, lack of the origin of the biceps tendon at the labrum, and supraspinatus tendonosis.
Assessment/Results: Left biceps tendonopathy at the proximal biceps muscle and tenodesis site. Patient was sent for.
Discussion: Biceps tendonopathy is often susceptible due to overuse injuries, especially in overuse activities. It can often be confused with rotator cuff tendonopathy, and is rarely seen in isolation. However, it does not appear that the patient has a coupled impingement syndrome or rotator cuff tendonopathy, due to the tenodesis of the biceps tendon to the proximal humerus.
Conclusions: Biceps tendonopathy after tenodesis can present as an isolated biceps tendonopathy. It is important to obtain a comprehensive medical and surgical history to help assist in making a diagnosis.
Key Words: Biceps, tenodesis, tendonopathy, shoulder pain

Does monocular patching induce spatial neglect? Evidence from healthy adults.

Peggy Chen, PhD
Lillian Erdahl, MD, Anna M. Barrett, MD

Introduction: Posner and Rafal suggested (1987) that eye patching might be used in rehabilitation of patients with spatial neglect. By occluding vision from the ipsilesional eye, orienting and attention may improve in the neglected or contralesional visual field if, based on Sprague (1966), a collicular-cortical system mediates bias. Although monocular patching may improve contralesional bias, it may also worsen or produce abnormal performance (e.g., Barrett & Burkholder, 2006, Barrett et al., 2001; Walker et al., 1996). A major obstacle to examining results over studies is that patients diagnosed with spatial neglect may demonstrate dysfunction of perceptual-attentional "where," motor-intentional "aiming," or other brain-behavior systems. We investigated the effect of monocular patching on healthy spatial cognition.

Objective: We hypothesized that monocular patching might induce contralateral orienting (collicular-cortical effect), ipsilateral orienting (tactile cuing effect), or might decrease accuracy nonspecifically. We additionally hypothesized that "where" but not "aiming" bias would be altered by an eye patch.

Setting: Participants performed line bisections on a video apparatus in the Stroke Rehabilitation Research Laboratory.

Methods: Sixteen neurologically healthy right-handed individuals, between the ages of 18 and 40 (mean age 28.1 yr, eight female), used a laser pointer to mark the perceived midpoint of a line on a video apparatus that provided natural and left-right reversed visual feedback of performance. Each participant performed a total of 224 trials, in 28 trial blocks of 8 trials per block. Participants either did not wear a patch or wore a conventional patch, a visual-occlusion-only patch, or tactile patch not occluding vision on one eye. Bisecting errors were measured, which were deviants from the true center of the line. Rightward errors were coded positive and leftward negative. Using the mean error values in the natural and reversed conditions, we algebraically fractionated "where" and "aiming" bias.

Results: We did find that right visual occlusion induced "where," but not "aiming" rightward spatial bias. The induced bias, however, was ipsilateral (i.e., right eye patching induces rightward orienting). No effect of left eye patching was found.

Conclusions: Our results suggest that monocular patching may produce spatial bias in healthy controls. This bias may be based on visual occlusion, rather than tactile cuing, and may be supported by asymmetry in posterior "where" perceptual-attentional processing.

Bromocriptine: Current use in Rehabilitation Medicine

Michal E. Eisenberg
Joan P. Alverzo, Anna M. Barrett

Introduction: The dopaminergic agonist bromocriptine may benefit patients in the treatment of aphasia, spatial neglect, and attention, but may also adversely affect spatial neglect. Thus, its utility is dependent on overall functional effects. We retrospectively reviewed use and tolerance of bromocriptine in an acute inpatient rehabilitation hospital, using medical records to identify prescription patterns and applications of bromocriptine.

Methods: We identified patients with traumatic, hypoxic or vascular brain injury who were prescribed bromocriptine during hospitalization from the six -month period of December 2005 to May 2006. We reviewed length of stay, age, dose, duration and rationale for use, as well as admission and discharge functional independence measure (FIM).

Results: Sixteen patients received bromocriptine from a total of 707 stroke and 402 brain injury cases. Eight patients received bromocriptine for aphasia and eight for attention and initiation. In the attention-initiation group, improved communication was noted in one case. In the aphasia group, two patients demonstrated improved alertness and another patient showed decreased perseveration, attributed to bromocriptine. Two patients were identified as having spatial neglect, with no notation of adverse or beneficial effects of bromocriptine on these symptoms. Upon discharge, all but three patients were prescribed bromocriptine, without a documented plan for discontinuation.

Conclusion: Bromocriptine may be in current use, albeit infrequently, for aphasia and deficient attention and initiation. A documented post-discharge treatment plan for patients taking bromocriptine may reduce the rate of unnecessary long-term usage and attendant complications. Future prospective investigations are needed to further develop its role in routine neurorehabilitation.

Botulinum Toxin Injection for Spastic Muscles with no Volitional Contraction: A Case Report of Aberrant Innervation

Michal E. Eisenberg
Elie P. Elovic

Introduction: Botulinum toxin has been used to reduce muscle over-activity for many years. Antagonist muscle firing can result in increased tone and/or co-contraction, which impair movement. Judicious selection of muscles and dosages to inject is crucial to maximize functional improvement by blocking pathological activity and minimizing weakening functional muscles. There is some controversy regarding the ideal methodology for muscle localization as well as the ultimate mechanism for neuronal recovery after toxin treatment.

Case Report: WG is a 59-year-old male who presented to clinic 9 months after sustaining an MVA related TBI and SCI. He recovered to community level ambulation, but had limitations of hand function due to spasticity related stiffness. Oral and therapeutic options were unable to address these issues, prompting his referral for evaluation for chemodenervation. Electromyography (EMG) demonstrated relatively intact volitional flexor digitorum profundus muscles, but the bilateral flexor digitorum superficialis (FDS) muscles demonstrated co-contraction and minimal volitional function.

Intervention: A total of 100 units of botulinum toxin type A (Botox®) were injected to the bilateral FDS muscles, divided equally to the right and left muscles, utilizing EMG guidance.

Results: EMG guided chemodenervation resulted in a significant reduction in subjective stiffness and improved ability for volitional flexion and extension bilaterally.

Conclusion: This case demonstrates the potential for abnormal regeneration of muscular innervation and motor recovery, given that the FDS muscle showed spastic co-contraction but no normal volitional contraction for active flexion. WG's unusual muscle activation pattern further highlights the crucial role of properly selecting muscles for botulinum toxin injection to maximize functional recovery. While there are various ways of localizing muscles, precision of toxin injection is enhanced with EMG guidance as demonstrated with WG.

Double Direction Trigger Finger

Maya Evans, MD
Patrick Foye, MD

Case Report:

A 64 year-old right-handed male with CAD, HTN and DMII was seen at an outpatient physiatrist office for pain, swelling, and locking in flexion of his left 4th digit. Examination showed tenderness at the left 4th digit proximal phalanx, and MCP and IP joints. ROM was significantly decreased in extension at those joints. The patient was diagnosed with stenosing tenosynovitis or trigger finger. A local injection with 40mg of Depo-Medrol and 1ml of 1% lidocaine to the peritendinous region of the A1 pulley site was performed.

Three weeks later the patient had a 20% improvement in pain and ROM, but he reported locking in both flexion and extension. Repeat physical examination was unchanged with the exception of palpable clicking with flexion and extension at the MCP joint. A similar corticosteroid injection was performed, however the peritendinous region distal to the A1 pulley was targeted.

At his third visit two weeks later, the patient reported a 75% improvement in pain and ROM. On examination he continued to have palpable clicking in flexion and extension, but his ROM was within normal limits and he no tenderness to palpation.

Stenosing tenosynovitis is a common condition. For unknown reasons the A1 pulley, which anchors the flexor tendon just proximal to the MTP joint constricts, pinching the tendon and leading to the formation of a nodule. Triggering classically occurs with extension as the extensor muscles are weaker than the flexors. In this case the patient had a “double direction trigger finger” which may have been caused by a second nodule distal to the A1 pulley or a single nodule, which extended the length of the pulley. This hypothesis is supported by the patient’s response to the second injection distal to the pulley. The case offers a possible treatment plan for other patients with a “double direction trigger finger”.

Normal Cervical Paraspinal Muscle EMG after Anterior Cervical Discectomy and Fusion: A Case Report

Kristina E. Hicks, M.D.
Patrick M. Foye, M.D.

Setting: Outpatient physiatric academic practice.

Patients: Patients with a history of anterior cervical discectomy and fusion (ACDF), referred for electrodiagnostic testing (EMG).

Case Descriptions: We present five patients who were referred for EMG at various times after ACDF.

Assessment/Results: In each case, needle EMG of the cervical paraspinal muscles was normal, thus making it less likely that the patients' symptoms were caused by any cervical radiculopathy. Meanwhile, in each case, EMG and nerve studies within the upper limbs were abnormal, leading to a diagnosis of brachial plexopathy in one case, ulnar neuropathy in four cases, and apparent median neuropathy at the wrist in one case. In each patient, the electrodiagnostic conclusion essentially fit well with the patient's presenting symptoms and physical exam findings. In each case, the normal cervical paraspinal EMG was a crucial portion of the testing. We believe this case series is the first to explicitly address the issue of normal cervical paraspinals after ACDF.

Discussion (relevance): During needle electromyography (EMG), cervical paraspinal muscle abnormalities are often considered a hallmark finding in electrodiagnosis of cervical radiculopathy. However, such abnormalities have also been reported merely as a result of spinal surgery, thus decreasing the utility of paraspinal EMG testing in postoperative patients. However, newer, anterior approaches to cervical spine surgeries potentially spare the paraspinals from surgery-induced EMG abnormalities.

Conclusions: Our results have important implications for any electromyographer evaluating upper limb symptoms in a patient status post ACDF. Electromyographers should not erroneously assume that the post-operative status automatically causes paraspinals to be abnormal. Such flawed assumptions might mislead electromyographers into skipping paraspinal EMG testing. Conversely, our results emphasize the importance of including needle EMG study of the cervical paraspinals, even in patients status post ACDF.

Access, Coordination, and Quality of Health and Rehabilitative Services for Community-Living Persons with Disability: Preliminary Development of Measures for SCI

Karen Hwang, Ed.D

Mark Johnston, Ph.D, David Tulsky, Ph.D., Ken Wood, Ph.D., Trevor Dyson-Hudson, MD, Eugene Komaroff, Ph.D.

Objectives: (1) to solicit qualitative data from individuals with disabilities regarding their health care services and whether extant instruments adequately assess their care quality issues; and (2) to develop a standardized, validated survey that addresses the concerns of people with disabilities with regard to access and quality of their health care services.

Design: Participatory action research.

Setting: Outpatient rehabilitation facility.

Patients or Other Participants: 15-20 adults with physical and neurological disabilities (e.g. spinal cord injury [SCI], multiple sclerosis [MS] and stroke) living in the community.

Intervention(s): n/a.

Main Outcome Measure(s): Community Assessment of Health Care Plans, or CAHPS.

Results (expected): A qualitative data report and a preliminary instrument appropriate for persons with disabilities (modified CAHPS) will be drafted.

Conclusion(s): information from consumers with disabilities themselves will result in an assessment measure that reflects their concerns more accurately.

Neuralgic Amyotrophy in a Young Male After Excessive Video Game Play

Arik Mizrachi M.D.
Todd Stitik M.D.

Setting: Outpatient Musculoskeletal Office.

Patient: A 38-yr-old male with right shoulder, forearm pain and accompanying weakness.

Case Description: Patient presented with a 3 month history of pain and weakness. Patient claims prior to onset of pain and weakness he played video games for 10 hours a day for seven days. Patient had never played with such frequency nor had any history of pain or weakness on the right side. Patient awoke one morning after playing video games the week prior with severe pain in the right shoulder and forearm. Within the next week severe weakness of the right shoulder girdle musculature appeared. The pain has mildly subsided but the profound weakness remained for a duration of three months. Pain was described as constant, dull, moderate intensity, over the anterior shoulder and right posterior forearm. Patient claims intermittent numbness in the same region. Pain has not responded to ice/heat, anti-inflammatories, or anti-spasmodics. Patient claims no exacerbating or alleviating factors. Past medical history, allergies, social, family history, review of systems were all unremarkable. Physical examination revealed: right biceps atrophy, decreased shoulder ROM in all but IR and ER, positive drop arm test and empty can maneuver, tender AC joint and subacromial palpation, positive O'Brien's test and "scarf" sign on the right, 3/5 strength in right shoulder abductors and elbow flexors. Patient presented with unremarkable cervical spine x-rays as well as unremarkable right shoulder x-rays. EMG/NCS impression was one of right sided brachial plexopathy, with signs of denervation of musculature in the right upper limb suggesting that the pathology was in the upper trunk. Electromyography demonstrated significant loss of motor recruitment, however no full loss of voluntary activity to suggest a complete lesion. These findings were consistent with a diagnosis of neuralgic amyotrophy. MRI of the right shoulder was significant only for moderate subacromial-subdeltoid bursitis without evidence of atrophy or edematous changes to the shoulder. Based on physical examination, clinical history, EMG/NCS, lack of radiological evidence for other diagnoses it was felt that the patient's symptoms were due to neuralgic amyotrophy.

Discussion: Neuralgic amytrophy, a.k.a. Parsonage-Turner syndrome, brachial plexitis, idiopathic brachial plexopathy, and brachial amyotrophy is a rare disorder of unknown etiology. Often it encompasses a history of acute onset of excruciating unilateral shoulder pain, followed by flaccid paralysis and/or atrophy of the right shoulder girdle musculature. Numbness may or may not be present in the shoulder region. Patient may present with a history of recent surgery, illness, trauma, immunization or other stressor to the immune system. The younger-middle aged male tends to be afflicted with this syndrome. Less than ¼ of persons affected have long-term disability. A few of the differential diagnoses includes cervical radiculopathy, rotator cuff tear, and thoracic outlet syndrome. Diagnosis is via clinical history and physical examination, radiological studies, and EMG/Nerve conduction studies. Treatment is largely supportive (with more than ¾ recovering function within 2 years) and usually consists of relative rest, analgesia, physical and occupational therapy.

Viscosupplementation of the Knee: Time Course for Onset Duration and Pain Relief

Arik Mizrachi M.D.
Todd Stitik M.D.

Objective: The goals of the review were to first briefly summarize the overall literature on viscosupplementation, determine which studies looked at time course duration and summarize the results from these studies.

Background: In the United States today, there are currently tens of millions of individuals who are afflicted with arthritis. Osteoarthritis of the knee is the most prevalent form of arthritis. Arthritis in the form of osteoarthritis is one of the top three forms of disability in individuals living currently in the United States. Viscosupplementation, also referred to as biosupplementation, is the intraarticular injection of HA into the synovial fluid. Viscosupplementation is recommended for those people who fit the previous criteria as well as for those who have had non-successful treatment with other non-invasive methods, i.e. physical therapy, oral pain medications, etc. Numerous studies have investigated the efficacy and safety of viscosupplementation. In addition to relieving pain, the majority of published studies have found Ha's to have an excellent overall safety profile. Viscosupplementation as a treatment of knee osteoarthritis is recommended via the American College Of Rheumatology. The exact mechanisms) of action and time course duration are not known with certainty at this point in time. Although the exact timing of pain relief and the duration of effect of viscosupplementation are not established with certainty, literature is accumulating.

Methods: A literature search was done, including PUBMED and MEDLINE databases. The search covered articles from the past three decades. As Viscosupplementation was first proposed in the late 1970's, articles pertaining to this topic were found from the 1980s until present day. The articles that were included for subsequent analysis met the following criteria: published in English, involved human subjects with knee OA and examined both the onset and duration of pain relief. Results: Although 53 total papers were initially reviewed, only 15 actually contained to both the onset and duration of pain relief. Pain relief was generally quantified using pain scales, such as the VAS or WOMAC. The timing of pain relief ranged from as early as 1 week onset post injection
with up to a duration of 14 months post injection. Numerous trials showed pain relief in between the broad range of 1-24 weeks. Although most studies found a concomitant increase in quality of life and increase in activity
level this was not analyzed further as the goal of the paper was to review the timing of pain relief.

Conclusions: The conclusions are based on literature search done including papers regarding viscosupplementation of osteoarthritis of the knee. Pain relief for patients who responded to HAs was found to be as early as 1 week
and as late as 4 weeks post injection. Duration of pain relief for those responders was found to be from a minimum of three months to a maximum of 14 months. The average onset of pain relief and duration of pain relief was 3.63 weeks and 7.07 months, respectively.

Transitions Between Dynamic Movement Patterns Reduce Effort and Increase Stability

Nitin Moholkar, PhD
Venkata Gade,MS, David Tung, MD, W. Thomas Edwards, PhD

Objective: The "Coordination Dynamics of Posture and Gait" session, ACRM 2006 demonstrated transitions in gait response reduce effort and improve coordination. The objective was to determine, if transitions between dynamic movement patterns occur in response to platform moving at fixed frequency.

Design: Movement response on platform oscillating anterior/posterior at constant frequencies.

Setting: Balance rehabilitation research laboratory.

Participants: Thirteen healthy individuals with no balance disorder.

Interventions: Six constant frequency oscillation trials, ranging 0.1-1.25Hz, 6cm peak amplitude. Each trial repeated three times; both with eyes open and eyes closed conditions.

Main Outcome Measures: Movement response described in terms of: phase relationship between COP and COM, magnitude of COP and COM excursion.

Results: Movement response showed COP and COM in-phase for slower translation frequencies and out-of-phase for higher translation frequencies. Approximately 15% trials started with response involving more effort showed transition to response involving less effort. The decrease in magnitude of COP excursion indicates transition results in more efficient movement response involving less effort.

Conclusions: Balance disorders are serious complications following TBI and Stroke.
These findings provide insight on efficient response patterns providing effective measures to design rehabilitation and train patients to improve balance and arrest falls.

Asymmetries in Weight Bearing Measures in Healthy Individuals

Nitin Moholkar, PhD
Venkata Gade, MS, David Tung, MD, W. Thomas Edwards, PhD

Objective: Therapy for stroke rehabilitation sometimes involves the recovery of weight bearing on the paretic leg to restore symmetric balance. The objective was to determine the degree of weight bearing asymmetry in healthy control subjects, who are often used for comparisons in rehabilitation research.

Design: Subjects tested on an oscillating platform.

Setting: Balance rehabilitation research laboratory.

Participants: 12 healthy individuals with no balance disorder.

Intervention(s): 3 oscillation trials at 1.25 Hz with 6cm peak amplitude with eyes open.

Main Outcome Measure(s): Vertical ground reaction force under each foot. Asymmetry index, assessing degree of uneven weight distribution on the feet.

Results: More than a third of the trials (39%) showed an uneven weight distribution (asymmetry index < -0.1) between the feet. Some subjects averaged nearly 100 Newtons more weight on one side than the other. This would lead to under- or over-estimation of joint forces and moments, and therefore incorrect baseline values for comparison with injured populations.

Conclusion(s): While not as asymmetric as stroke patients, healthy controls demonstrate a reasonable amount of asymmetry in weight bearing. This finding appears important to consider for interpretation of rehabilitation weight bearing activities.

Power Required to Maintain Balance on a Moving Platform

Nitin Moholkar, PhD
Venkata Gade, MS Jerome Allen, MS, David Tung, MD, W. Thomas Edwards, PhD

Introduction: The measure of Center of pressure (COP) has been conventionally used to describe posture and balance and give a measure of effort. Movement response to a platform translating sinusoidally in the anterior posterior direction can be used to understand balance. Prior studies have demonstrated that maintaining balance on a translating platform involves choosing a balance strategy depending on the frequency of platform translation. It is believed that at all frequencies; subjects tend to select strategies that minimize the motion of the head and the upper body. Does the selection of strategy also reduce the effort required to maintain balance?

Objective: To quantify the effort in maintaining balance on a moving platform using the power spectrum analysis for COP movement in anterior posterior direction.

Methods: Fifteen healthy adult individuals participated in the study. A NeuroCom Research Balance Platform consisting of two independent AMTI force plates provided the anterior-posterior translations and gathered the ground reaction forces. Subjects stood on the platform with their feet shoulder width apart with one foot on each forceplate. Motion data along with the forceplate information was collected using a six camera Vicon system. The platform translated sinusoidally with fixed frequencies (0.1, 0.25, 0.5, 0.75, 1.0, and 1.25 Hz) with a peak to peak amplitude of 6 cm. Each translation frequency was repeated three times with both eyes open and closed conditions. Subjects were protected from falling in the event of loosing balance using a safety harness system.
The effort required for maintaining balance during a trial was quantified by the average power calculated from the power spectrum of the COP movement. Power spectrum was calculated from the Fast Fourier transform of zero-mean COP trajectory. The average power of a signal in time series by definition is $P_{ave}(t) = 1/T \int |x(t)|^2 dt$ (1). The integral of power spectral density across all frequencies is proportional to the average power of the signal. $P_{freq}(f) \alpha P_{ave}(t)$ (2).We confirmed that the integral of power spectrum was scaled properly to match the calculated average power. The integral of power spectrum across all frequencies was divided by the constant of proportionality, calculated from equation-1, to obtain the average power for COP movement. The average power was calculated for each platform frequency and averaged across all the subjects to quantify the effort required to maintain balance.

Results: Several trends were observed with respect to the frequency of oscillation and eyes open or closed condition. At each frequency, subjects tend to select a strategy that minimize the motion of the head and the upper body and that reduces effort, power. Across all frequencies, the average power calculated from the power spectrum of COP, $P_{ave}(t)$, shows an increase in its value at increased translation frequency. In general, all the subjects showed a higher average power, $P_{ave}(t)$, in eyes closed conditions when compared to the same frequency eyes open trial. Two subjects showed more average power for eyes open when compared to eyes closed trials.

Conclusions: This study, for the first time demonstrates the effort required to maintain balance on an oscillating platform. These results suggest that under different dynamic conditions there are postural control strategies that enhance stability and reduce effort. It is hoped that new diagnostic and treatment techniques can be derived from these studies and applied in rehabilitation using whole body oscillations and other balance therapies.

Demonstration of Postural Coordination and Learning Effect on an Oscillating Platform

Nitin Moholkar, PhD
Venkata Gade, MS, David Tung, MD, Jerome Allen, MS,W. Thomas Edwards, PhD

Introduction: The posture control system regulates the interactions between the upper and lower body segments to maintain a stable posture. Previous studies investigating the movement response using sinusoidal displacements over a range of frequencies reported that the ratio of the head to hip horizontal displacement was mostly consistent and independent of both visual feedback and translation frequency (0.2 and 0.6 Hz). For their test conditions, they also found no benefit from the experience of repeated trials.

Objective: To examine the relationship of head to hip displacement over a wider range of platform translation frequencies and to determine if there is training effect with repeated exposures.

Methods: Fifteen healthy individuals (6 females and 9 males) participated in the study. All subjects were screened for balance disorders and musculoskeletal injuries and informed consent was obtained. Motion data was collected using VICON 460 motion analysis system. A NeuroCom research platform provided anterior-posterior translations and measured the ground reaction forces. The participants were asked to stand on the platform for trials at six fixed frequency platform oscillations; 0.1, 0.25, 0.5, 0.75, 1.0 and 1.25 Hz. Each trial was repeated with eyes open (EO) and eyes closed (EC). Participants were exposed to each translation frequency three times for both the EO and EC conditions to investigate learning effect. Subjects were protected from falling by an overhead safety harness system. The displacement of segments was expressed in terms of the standard deviation (SD) of the marker displacement in the sagittal plane. The effort required to maintain balance during a trial was quantified by the average power of COP movement. For analysis, the frequency of platform perturbation was classified as low frequency (0.1, 0.25 and 0.5 Hz) and high frequency (0.75, 1.0 and 1.25 Hz).

Results: The relationship of head to hip displacement was found to be dependent on the visual condition and the frequency of translation. With an increase in translation frequency, the head and hip displacement decreased. The peak-to-peak displacements of head and hip were always more with EC when compared to EO trials. For high frequency EC trials, head displacements were largest suggesting the need for visual feedback. The amplitude of displacements of the head and hip decreased with repeated exposure to the platform translations, particularly at frequencies > 0.75 Hz. The amplitude of head and hip displacements decreased with each repetition. For low frequency, the amplitude decrease between the 1^{st} and 2^{nd} repetition was significant ($p<0.1$), but the decrease between the 2^{nd} and 3^{rd} repetition was not significant ($p>0.1$). For high frequency the decrease was significant between the 1^{st} & 2^{nd} and 2^{nd} & 3^{rd} repetitions. The average power demonstrated a significant decrease between the three trials at platform frequencies greater than 0.75 Hz. The effect was not found at the two lowest frequencies.

Conclusions: The coordination between the head and hip was altered and optimized to cope with the external disturbance. The relationship between head and hip displacement and their coordination depends on both the visual feedback and translation frequency. With visual feedback and increased translation frequency, the head and hip movement decreases. Considering the power required for balance both the EO and EC conditions showed a decrease with each exposure. In conclusion, it is hoped that treatment techniques can be refined considering the learning effect seen in the current study.

Identification of Postural Control Strategies that Enhance Stability

Nitin Moholkar
W. Thomas Edwards, Venkata Gade, David Tung, Senthil Nakappan

Introduction: The risk of falling and fall-related injuries increases following TBI or stroke. Abrupt and unexpected changes of a support surface while standing are not well tolerated if postural control has been compromised. A sinusoidally moving platform, although challenging balance, provides a more predictable disturbance and is more easily managed than an impulsive perturbation. Such consistent mechanical motions can be used to examine balance by monitoring responses that propagate from the feet up through the legs and upper body. Healthy subjects use two general strategies in response to such stimuli for moderate platform motions. These are the ankle strategy in which rotations occur at the ankle with little rotation at the other joints and the hip strategy in which the upper body is stabilized by combined ankle and hip rotations to reduce head motion. Postural control studies using an oscillating platform show subjects respond differently as the frequency of oscillation increases.

Objective: To determine to what extent subjects increase stability by selecting different balance strategies.

Methods: Fifteen healthy adult subjects participated, all in good health with no history of balance disorders or falls. A NeuroCom Research Balance Platform system provided anterior-posterior oscillations, monitored the platform position, and gathered ground reaction forces. Subjects were exposed to sinusoidal translations with a 6-cm amplitude. A Vicon system gathered motion data. The motion data measurements provided segment positions and joint angles. Data were collected both for fixed frequencies of platform oscillation (0.1, 0.25, 0.5, 0.75, 1.0, and 1.25 Hz) and a frequency sweep 0-1.25-0 Hz. Each condition was repeated three times, both for eyes-open (EO) and eyes-closed (EC). Subjects rested between trials. Subjects were protected from falling by a safety harness system. The positions of the center-of-mass, center-of-pressure, and the position of the platform were compared.

Results: The response for the six test frequencies and the frequency sweep trials demonstrated different patterns-of-motion as frequency increased. At all frequencies, subjects tended to select postural control strategies that minimize their motion and remain as steady as possible. At lower frequencies (0.10 and 0.25 Hz), all subjects moved in phase with the platform. As frequency increased the motion of the head and upper body decreased. At all frequencies during the sweep, the COM was observed to be in-phase with the platform. At the highest frequency, subjects tended to lean forward as hip motion increased. At frequencies above 0.75 Hz, all subjects displayed increased rotation at the hip that reduced head and upper body motion. Subjects appeared to select different postural control strategies to accomplish this. Seventy-five percent of subjects demonstrated a transition from the lower frequency response to the high frequency response in a single fixed-frequency trial. The choice of the pattern of motion was used to reduce effort and lower torque at the ankle, as demonstrated by smaller excursions of the COP. The choice of the second strategy reduced effort (smaller COP excursions) and improved stability (with less motion of the COM).

Conclusions: The subjects were able to tune the response of the ankle, knee, and hip to reduce the motion of the head and the upper body. Subjects report that in this way they feel more stable and require less effort. This is consistent with earlier studies. At the higher frequencies, above 0.75 Hz, subjects transitioned between balance strategies to minimize the head and upper body motion. The results of the present study demonstrate that under different dynamic conditions there are postural control strategies available that enhance stability and reduce effort.
Our results extend earlier findings by directly comparing the motion of the COP to the COM. For the first time, this "tuning" effect can explain the change in amplitude and phase of the motion patterns with frequency

Hypoesthetic volar forearm patch in the setting of ulnar lesion but intact medial antebrachial cutaneous nerve

Joshua Reimer, MD
Eric Altschuler, MD, PhD

Case Report:

A thirty-two year old male presented regarding left arm weakness following a gunshot that entered his armpit, exiting his lateral shoulder. Chief complaints were inability to raise his left arm and wrist, and numbness in the forearm and hand. Left arm strength testing revealed profound weakness in all ulnar innervated muscles, and radial muscles distal to the triceps. There was decreased sensation in the left palmar and dorsal ulnar cutaneous regions. Sensation was intact over the median, medial and lateral antebrachial cutaneous (M/LAC) distributions, shoulder and upper arm.

Nerve conduction studies confirmed the presence of two distinct peripheral nerve injuries. The MAC sensory nerve action potential (SNAP) was intact, but the ulnar SNAP and motor response were absent. This lesion was likely caused upon bullet entry into the axilla. Subsequently, the bullet likely struck the radial nerve in the spiral groove prior to exiting anteriorly. Hyposthesia over the posterior cutanous nerve of the forearm, a radial branch distal to the spiral groove is consistent with this observation. Of particular note, the patient identified a portion of the medial forearm, extending 5cm proximal from the wrist crease in which he had decreased sensation. Proximal to this intact patch, the medial forearm had preserved sensation. The unaffected medial cord with injured ulnar nerve enables us to appreciate a patch of hypoesthesia that may reflect the subtlety of sensory innervation of this area. This region may represent an autonomous sensory area innervated by the deep cutaneous sensory branch of the ulnar nerve, having either failed to anastomose with the MAC or extending beyond the most distal branches of the MAC. It could also be considered that the palmar
cutaneous branch of the ulnar nerve is supplying autonomous sensation to this area, sprouting twigs as it tracks along the ulnar artery.

Coccydynia (Coccyx Pain) due to Dynamic Instability of the Tailbone: A Case Report

Michael Rhee, M.D.
Patrick M. Foye, M.D.; David Tung, M.D.

Setting: Outpatient, academic physiatric practice.
Patient: A 53-year-old female with coccydynia (coccyx pain), worse with sitting.
Case Description: The patient presented for physiatric pain management consultation for coccydynia. Previous work-up elsewhere focused on imaging studies (including MRI) of the lumbosacral spine, ironically lacking any images that included the symptomatic tailbone.
Assesment/Results: Upon consultation, the physiatrist ordered sacrococcygeal radiographs, specifically including coned-down lateral views of the coccyx in three positions: supine, standing, and seated. The supine and standing coccygeal radiographs appeared essentially within normal limits. However, the radiographs obtained with the patient seated (the position which reproduced her concordant pain) demonstrated a blatantly obvious posterior dislocation of the coccyx relative to the sacrum. In fact, in the seated position, approximately 75% of the coccygeal depth (in the anterior-posterior dimension) had dislocated posterior to the posterior aspect of the distal sacrum. Thus, while seated, most of the coccyx had actually dislocated to a position behind the sacrum, rather than remaining inferior to the sacrum. These "stress" views documented pathology that would have been missed by traditional coccygeal imaging studies. The dynamic instability visualized from these studies corroborated her concordant symptoms.
Discussion: The etiology of coccydynia is sometimes elusive. Objective findings, when demonstrated, can have significant medicolegal implications. Objective findings can also help reassure patients that their tailbone pain is not "all in their head," as some patients have been told by their doctors. Such abnormalities can form a basis for discussing with the patient an individualized approach to the various treatment options for coccydynia.
Conclusions: Diagnostic workup for coccydynia should often include adding coned-down lateral radiographs with the patient in the seated position. These seated views are particularly helpful in cases where more traditional radiographs have failed to document pathology that explains the patient's symptoms.

Functional Near Infrared Spectroscopy Study of the PASAT in Healthy Adults.

G.T. Voelbel
J. Lengenfelder, G. Wylie, R. Barbour, Y. Pei, A. Smith, J. DeLuca.

Objective: To investigate the pattern of cerebral activation in the frontal lobes of healthy adults with functional Near Infrared Spectroscopy (fNIRS), during the PASAT with overt vocalizations.

Participants and Methods: Participants were 9 right-handed, healthy adults (6 females) between the ages of 20 and 51 without any history of neurological disease or psychiatric disorders. Participants were seated comfortably and 30 fNIRS source/ detector optodes were placed on their foreheads. The fNIRS scan started with a 5 minute baseline period, followed by the control task which consisted of the vocalization of randomly presented numbers every 3 seconds. The Paced Auditory Serial Addition Task (PASAT) was administered with a single digit number presented verbally every three seconds on the first series of single digit numbers and every two seconds on the second series of numbers. The participants vocalized the sum of the last two digits presented.

Results: Across the 9 participants there was elevated oxyhemoglobin (OxyHb) detected in the right prefrontal cortex (PFC) during both the 3-second and the 2-second PASAT when controlling for the auditory monitoring and vocalization task.

Conclusions: This is the first known fNIRS study investigating the pattern of activation during the PASAT task. Unlike fMRI studies, which typically use a modified version of the PASAT, this study used the version of the PASAT typically used clinically, and demonstrates activation of the right frontal cortex.

Hill-Sach Deformity after Shoulder Dislocation

Brian White, DO
Peter Yonclas, MD

History:
A 15 yo right handed male baseball player presents with a one month history of right anterior shoulder pain which began following an impact injury from running into a fence while playing baseball. At time of initial impact, he had mild pain which subsequently evolved later in the game while pitching. At time of presentation he notes sharp pain in the anterior aspect of the right shoulder exacerbated by shoulder abduction, extension, batting practice, and pitching. He denies any sensation of shoulder instability and reports relief of pain with rest. He denies any workup or evaluation by other physician prior to initial exam, and also denies prior shoulder or upper extremity problems or injuries. He is in the 10^{th} grade and plays Varsity level baseball and hockey. Past medical, surgical, and family history are unremarkable.

Physical Exam:
Inspection: mild hollowing of the right infraspinatous fossa.
Palpation: tenderness at the proximal right biceps tendon and anterior labrum.
ROM: right shoulder with full shoulder flexion and extension. Mild deficit of right shoulder internal rotation compared to the left.
External rotation: Left 120^0, right 140^0. Internal rotation: Left 45^0, right 30^0.
Motor, sensory exam, and DTR's all normal.
Special tests: Hawkins, Neer, and empty can test all negative.
O'Briens test is positive and Anterior slide test equivocally positive.

Differential Diagnosis:
1. Anterior Labral tear
2. Labral Cyst
3. Rotator cuff injury
4. Focal Biceps tendinopathy

Transient anterior shoulder dislocation

Tests and Results:
X-ray: Performed at office visit revealed open growth plates and no obvious pathology.

MRI: Performed 2 days post-evaluation with gadolinium:

1. Mild tendinosis of the distal supraspinatus tendon without evidence for rotator cuff tear;
2. Hill-Sachs deformity of the humeral head with subjacent marrow edema suggesting a subacute anterior dislocation;
3. Heterogeneous signal in the region of the anterior-inferior labrum without definite MR evidence for a detached labral tear.

Final / Working Diagnosis:
Hill-Sach deformity likely secondary to subacute anterior dislocation from impact with fence.