Department of Physical Medicine & Rehabilitation
New Jersey Medical School

KESSLER FOUNDATION RESEARCH CENTER

Department of Physical Medicine and Rehabilitation

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

The 21st Annual Resident, Fellow & Postdoctoral Fellow Research Symposium Abstracts

Wednesday, June 9, 2010
9:30 AM - 5:00 PM

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

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

2010

GRADUATING RESIDENTS

Neeti A. Bathia, MD
Miguel A. Coba, MD
Margaret M. Donlon, MD
Brett A. Gerstman, MD
Richard P. Hoppe, MD
Stephanie K. Liu, MD
Janel Solano, DO
James F. Wyss, MD, MPT

GRADUATING CLINICAL FELLOWS

Gina Benaquista - DeSipio, DO
Jeffrey Chacko, MD
Joseph Mejia, DO
Pinella Holder, DO

GRADUATING POSTDOCTORAL FELLOWS

Sarah R. Dubowsky, PhD
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THE OATH OF HIPPOCRATES

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

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

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

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

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

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

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

THE OSTEOPATHIC OATH

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

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

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

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

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

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

OATH FOR SCIENTISTS

As I embark on my career as a biomedical scientist,

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

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

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

UMDNJ
University of Medicine & Dentistry of New Jersey

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
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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
2009	Steven R. Flanagan, M.D.	New York University School of Medicine
2010	Walter R. Frontera, MD, PhD	University of Puerto Rico School of Medicine

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

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SELECTED TOPICS IN PHYSICAL MEDICINE AND REHABILITATION

With

Guest speaker & recipient of the 2010
UMDNJ-New Jersey Medical School National Teaching Award

Walter R. Frontera, M.D., Ph.D.

Dean of the Faculty of Medicine,
Professor of Physical Medicine and Rehabilitation
& Physiology, University of Puerto Rico (UPR)

June 8, 2010 - 4:00 p.m. – 6:00 p.m.
The Need and Value of Research in PM&R &
International PM&R: An Opportunity for Residents

June 9, 2010 - 10:00 a.m. – 12:00 p.m.
Aging, Muscle and Exercise &
Exercise and the Primary Prevention of Chronic Disease

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Walter R. Frontera, M.D., Ph.D.

Walter R. Frontera, MD, PhD, is the Dean of the Faculty of Medicine and Professor of Physical Medicine and Rehabilitation (PM&R) and Physiology at the University of Puerto Rico (UPR). Dr. Frontera completed his medical studies and a residency in PM&R in 1983 at the University of Puerto Rico and a doctoral degree in applied anatomy and physiology at Boston University in 1986. In 1995 he spent a sabbatical year at the Karolinska Hospital in Stockholm, Sweden in the Department of Clinical Neurophysiology studying the effects of aging on the biochemical and contractile properties of single human muscle fibers. In 1996 he was recruited to Harvard Medical School to establish the Department of PM&R and was appointed the Earle P. and Ida S. Charlton Professor and Chairman of the Department of PM&R at Harvard Medical School and Spaulding Rehabilitation Hospital. He was also the Chief of Service at the Massachusetts General Hospital and the Brigham and Women's Hospital. His main research interest is the study of the mechanisms underlying muscle atrophy and weakness in elderly and the development of rehabilitative interventions for sarcopenia.

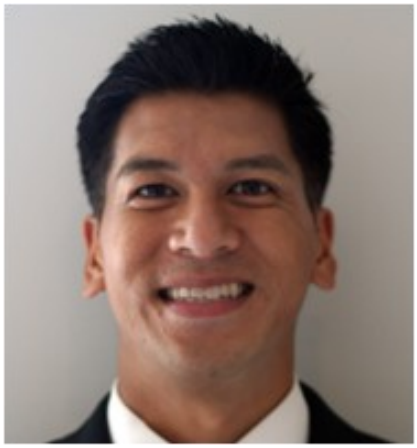
Dr. Frontera has more than 200 scientific publications including more than 75 peer-reviewed articles and 10 edited books. Currently, Dr. Frontera serves as the Editor-in-Chief of *The American Journal of PM&R,* Regional Vice-President of the International Society for PM&R, and President of the International Federation of Sports Medicine. In 2008 he was elected member of the Institute of Medicine of the National Academies (Washington DC, USA) and in 2009 Member-at-large of the National Board of Medical Examiners. Dr. Frontera has presented more than 200 invited lectures in 52 countries and served as a grant reviewer and graduate research examiner for Universities in Canada, South Africa, and Hong Kong. He has received several awards including Best Scientific Research Paper (3 times) presented by the American Academy of PM&R, the Distinguished Academician Award in 2005 presented by the Association of Academic Physiatrists, and the Harvard Foundation Award for his contributions to the field of PM&R. He is an honorary member of the Aragonese-Spanish Society of Sports Medicine, The Spanish Federation of Sports Medicine, the Chilean Society of PM&R, The Dominican Society of PM&R, the Euskalerria Society of Rehabilitation, and the Italian Society of PM&R.

RESIDENTS
2010

Left to right (front)
Janel Solano, DO, Miguel Coba, MD, Stephanie Liu,, MD
Left to right (back)
Neeti Bathia, MD, James Wyss, MD, MPT, Richard Hoppe, MD, Margaret Donlon, MD, Brett Gerstman, MD

CLINICAL FELLOWS
2010

Gina Benaquista-DeSipio, DO
Fellow: Spinal Cord Injury



Jeffrey Chacko, MD
Fellow: Musculoskeletal

Pinella Holder, DO
Fellow: Musculoskeletal

Joseph Mejia, DO
Fellow: Musculoskeletal

POSTDOCTORAL FELLOWS
2010

Nam Kim, PhD; Sarah R. Dubowsky, PhD

Kevin Terry, PhD

UMDNJ-New Jersey Medical School

Department of
Physical Medicine and Rehabilitation

Abstracts Digest

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Department of Physical Medicine & Rehabilitation

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Mentors: *Gerard Malanga MD, Susan V. Garstang MD*

Is there an association between hip abductor and extensor strength and medial leg pain in collegiate cross-country runners: A prospective study.

Neeti A. Bathia, MD
Gerard Malanga, MD, Susan Garstang, MD

Introduction: Exercise-related medial leg pain (ERMLP), or "shin splints," accounts for a large portion of running -related injuries. Several pathophysiologic mechanisms have been proposed for this symptom, including tibial periostitis, muscle and tendon tears at periosteal attachments, subperiosteal evulsions, lower limb compartment syndrome, tibial stress fractures/stress reactions, neurovascular entrapment syndromes, and tendinopathies of the posterior tibialis and anterior tibialis tendons. Prevention of ERMLP via activity modification or pre-training is an option that many have considered, and to that end several studies have looked at various biomechanical, athropometric, and training variables that are associated with the development of ERMLP or one of the pathophysiologic mechanisms listed above. To date, no studies have examined the relationship between hip musculature weakness and the development of ERMLP. The kinetic chain theory suggests that proximal hip and pelvic strength is needed for stabilization of distal segments. From this idea, it is extrapolated that dysfunction of one lower limb joint may manifest itself with pain or dysfunction in distal structures. The purpose of this study is to see whether collegiate cross-country runners who go on to develop ERMLP have pre-existing hip abductor and/or hip extensor strength weakness.

Methods: In this prospective, observational study, a convenience sample of 40 collegiate cross-country runners from 4 local colleges were tested for hip abductor and extensor strength using a hand-held dynamometer at the start of the competitive running season. Other variables shown previously to correlate with ERMLP (weekly mileage, hip external rotation range of motion, hyperpronation) were also measured. Study participants were followed throughout the competitive season to see whether or not they developed ERMLP.

Findings: Multivariate regression models were used to determine if there was a significant difference between subjects who did and did not develop ERMLP with respect to demographics and extrinsic factors affecting ERMLP. There was no significant difference between study groups. T-tests were used to determine if there is an association between hip strength measures in the ERMLP and non-ERMLP groups. No significant difference was seen between groups.

Conclusions: No significant difference was seen in hip strength between those subjects who developed ERMLP and those who did not. The study was limited, however, by a small sample size, questionable validity of the measuring instrument, and its observational design.

Breaking the News:
Discussing Prognosis with Acute Spinal Cord Injured Individuals

Gina Benaquista DeSipio, DO
Steven Kirshblum, MD

Introduction: The prognosis for lower limb recovery and functional ambulation after a severe traumatic spinal cord injury (SCI) is poor. Breaking the news to individuals who have sustained a neurologically complete traumatic spinal cord injury (SCI) regarding the poor prognosis to regain the ability to walk is not an easy task, and there are no definite rules or guidelines regarding how or when to deliver this message. In addition, there is little formal training of clinicians in this area. The goal of this study is to determine when, by whom, and in what setting patients with a neurologically complete traumatic SCI want to hear their prognosis. Additionally, this study seeks to determine how health care professionals, who work with and care for individuals who have sustained a traumatic SCI, feel about discussing their prognosis and in what manner they believe it should be done.

Design: Prospective, internet survey-based study, targeting two groups: individuals who have sustained a neurologically complete traumatic SCI ("Individual") and health care professionals who are involved in the care of spinal cord injured individuals ("Professional").

Methods: Upon IRB approval, participants were recruited from Kessler Institute for Rehabilitation, Rehabilitation Center at Santa Clara Valley Medical Center, and University of Pittsburgh Medical Center Institute for Rehabilitation and Research. Inclusion criteria for the "Individual" questionnaire include history of an ASIA Impairment Scale A traumatic SCI above T10 occurring greater than 3 months prior to completion of the questionnaire, the ability to recall the events of acute care hospitalization pertaining to discussions regarding prognosis after injury, and age 18-80 years. "Professional" questionnaires were completed by health care professionals involved in the care of individuals with SCI, including physiatrists specializing in SCI, general physiatrists, psychologists, neuropsychologists, neurologists, and spine surgeons. Questionnaires were designed and completed anonymously on the internet at www.surveymonkey.com.

Detection Rate of Intravascular Injection in Cervical Transforaminal Epidural Steroid Injections using Fluoroscopy with and without Digital Subtraction Angiography.

Boqing Chen M.D., PhD, Jeffrey Chacko M.D., Todd Stitik M.D., Patrick Foye M.D. Frederick Comrie, M.D., Huey-Jen Lee, M.D.
Department of Physical Medicine and Rehabilitation, UMDNJ-New Jersey Medical School: Newark, NJ

Objective: To evaluate whether digital subtraction angiography (DSA) combined with real-time fluoroscopic imaging improved the detection rate of intravascular injections during cervical transforaminal epidural steroid injections (CTFESIs) in which real-time fluoroscopic imaging alone did not reveal vascular uptake.

Study Design: A prospective interventional study.

Setting: Outpatient procedure suite in academic private office setting. (Outpatient Surgery Center)

Participants: A total of 77 subjects with cervical radicular pain, who had CTFESIs performed between 8/20/09 and 4/10/10.

Summary of Background Data: Cervical transforaminal epidural steroid injections are commonly performed to provide symptomatic relief in patients with cervical radiculopathy. They carry risks however, including brain and spinal cord infarcts possibly secondary to vascular insult. Studies have shown that after proper needle positioning, observed blood in the needle hub and aspiration can predict intravascular injection during CTFESIs and although specific they are not sensitive. Live fluoroscopy with contrast injection may enhance the detection of intravascular uptake during CTFESIs as well. A recent study has shown that by adding DSA technology to real-time fluoroscopic imaging, the detection of vascular uptake nearly doubled. That study, however, was performed with two separate subject groups (one using real time fluoroscopy with contrast alone and one using fluoroscopy with DSA). There have been no prospective studies to date that have evaluated the extent to which DSA in addition to real time fluoroscopy with contrast injection can increase the detection rate of vascular penetration in the same subject group.

Methods: The incidence of intravascular uptake of contrast with fluoroscopy followed by fluoroscopy plus DSA was prospectively observed in 77 subjects treated with cervical transforaminal epidural steroid injections (144 total CTFESIs at one or two cervical levels unilaterally per subject.). Each subject had a clinical diagnosis of cervical radiculopathy. For each subject, the injection level was chosen on the basis of the clinical presentation including history, physical examination, EMG/NCS studies, and imaging studies. Using fluoroscopic guidance, a 25 gauge needle was placed into the epidural space using a transforaminal approach according to the Practice Guidelines of the International Spine Intervention Society. Needle tip location was confirmed with anteroposterior and oblique radiographs. Under real-time fluoroscopy, contrast was injected and the needle tip was repositioned appropriately as needed until no vascular uptake was seen with contrast injection. Then immediately following this, contrast was injected using real-time fluoroscopy with DSA and evidence of vascular uptake was documented. Results were recorded in a prospective manner and differentiated between both venous and arterial uptake after review by a board certified neuroradiolgist.

Results:

Intravascular injection was detected in 34% (49/144) of CTFESIs using fluoroscopy alone. The use of fluoroscopy with DSA detected intravascular injection in 51.4% (74/144) of CTFESIs. Therefore Fluoroscopy with DSA increased intravascular detection by 17.4% (25/144). Furthermore, it was found that intravascular injection was detected in 51.4% (38/74) of CTFESIs using fluoroscopy plus DSA in which live fluoroscopy without DSA was negative for vascular uptake. This was further divided into venous and arterial uptake. After review by a board cerrified neuroradiologist, it was found that 100% (74/74) was venous uptake and 0% (0/74) was arterial uptake.

Discussion:
This is the first study to compare prospectively the use of fluoroscopy with contrast alone and fluoroscopy with DSA for the detection of intravascular uptake in the same patient population. The results of this study clearly show that the use of DSA with fluoroscopy is associated with increased detection rate of intravascular injection during CTFESIs. Even with proper needle positioning within the posterior aspect of the cervical neural foramen, there is risk of intravascular penetration which can lead to serious neurological sequelae, including spinal cord and brain infarction and even death. It has been shown through cadaveric studies that there is great, anatomic variation in vascular anatomy around and within the cervical intervertebral foramina. The ascending and deep cervical arteries can contribute radicular or segmental medullary arteries that traverse the posterior aspect of the cervical inter-vertebral foramen and ultimately communicate with the anterior and posterior spinal arteries. These radicular arteries are vulnerable to cannulation by the spinal needle during CTFESIs and inadvertent cannulation of these radicular arteries can lead to severe neurological sequelae. This is thought to be caused by vasospasm or embolization of particulates steroid during injection.

Conclusions: Even with proper needle positioning within the cervical neural foramen, there is risk of intravascular penetration. Real-time fluoroscopy with contrast alone can miss intravascular uptake as seen in this study. The use of DSA with real-time fluoroscopy improves the detection rate of intravascular injection during CTFESIs. Although our study failed to reveal arterial uptake, DSA has been shown to detect both arterial and venous intravascular penetration that was missed with fluoroscopy alone. This can potentially prevent catastrophic neurologic sequelae and should reinforce the need for fluoroscopy with real-time digital subtraction angiography during CTFESIs.

Keywords: Cervical Transforaminal Epidural Steroid Injection; Digital Subtraction Angiography; Radicular Artery; Complication; Fluoroscopy.

The Prevalence and Effect of Obesity on Rehabilitation after Spinal Cord Injury: A Retrospective Chart Review

Miguel Coba MD, Maya Evans MD, Trevor Dyson-Hudson MD, Amanda Botticello PhD, MPH

Abstract

OBJECTIVE:

This study seeks to examine the prevalence of obesity in Spinal Cord Injury (SCI) patients, as well as the impact of obesity on functional improvements, discharge, and self care for patients in Kessler West from 2005-2010. There will also be analysis of any significant differences in demographics and rehabilitation outcomes between obese and non-obese patients.

METHODOLOGY:

The study proposed is a retrospective study using data collected from an electronic chart review and data complied from SCI patients at Kessler during the the time period of march 2005 to march 2010. The review will include data from all patients with a diagnosis of a spinal cord injury admitted to Kessler West (N≈500) during the acute rehabilitation phase. Data on adult patients (i.e., between ages 18 and 100) will be used. Much of the data will be obtained from an electronic spreadsheet generated from erehabdata.com and the remainder will be retrieved from HMS electronic charts by the primary investigator. The patients will be divided according to body mass index (BMI=weight in kg/height in meters^2) in to the following groups normal weight (BMI<25kg/m^2), overweight (BMI 25-29.9 kg/m^2), moderately obese (BMI 30-39.9 kg/m^2) and severely obese (BMI>=40 kg/m^2). Descriptive data compared between the groups will be age at injury, gender, race/ethnicity, height, weight, martial status, highest level of education obtained, admission ASIA score, and cause of SCI. Rehabilitation outcomes will be assessed by comparing, admission functional independence measure (FIM), discharge FIM, type of bladder management at discharge, and discharge location between groups.

STATISTICAL ANALYSES:

All statistical analysis will be performed in SPSS (version 16.0). Standard univariate methods will be used to document the extent of obesity in the local patient population and to construct a weight group typology for purposes of comparisons. Bivariate analytic techniques will used to compare differences between all individual characteristics and rehabilitation outcomes by weight group. The need for multivariate analysis of the relationship between obesity and functioning outcomes will be assessed. Outcome variables compared between groups will include of bladder management at discharge, FIM efficiency and discharge location.

ANTICIPATED FINDINGS:

Given the high prevalence of obesity in the general US population, we expect to document that a substantial proportion of our patients will be classified as overweight and obese. We also expect to demonstrate that obese patients will have greater impairment than non-obese patients across a range of functioning outcomes. The implications of obesity on rehabilitation for SCI patients will be discussed.

Prevention of Bone Loss in Spinal Cord Patients Using Vibration Page

Resident: **Margaret M. Donlon, MD**
Mentor: *Steven Kirshblum, MD*

Attentional mechanisms contributing to balance constraints during gait: the effects of MS
Authors: Sarah R. Dubowsky, Arvind Ramanujam, James F. Sumowski, Erin L. Nett, Gail F. Forrest

Objective: Gait disturbance is a common symptom of Multiple Sclerosis (MS), and persons with MS require more cerebral resources to perform simple motor tasks relative to healthy controls (HCs). We hypothesize that subjects with MS are less able than HCs to successfully divide adequate attentional resources during the dual-task of walking and talking (counting backwards by 3's), resulting in impaired gait and/or cognitive performance. The goals of the current study are to: 1.) investigate whether gait differences in MS and HC subjects exist; 2.) investigate whether the dual-task of walking and talking exacerbates these differences, and 3.) determine whether walking has a more negative effect on cognition in subjects with MS relative to controls.

Participants: Six subjects (3 MS, 3 HC) gave informed consent to participate in the study. Relapsing-Remitting MS subjects (female, aged 30-55) were recruited based on the following inclusion criteria: no other neurologic disease, no exacerbation of MS within 30 days, no current use of corticosteroid medication, no use of an assistive device for walking, and a Berg Balance Scale (BBS) between 41-56. Age-matched HCs, with no history of neurological disease, a BBS of 41-56, and an Expanded Disability Status Scale (EDSS) of 0.0, were recruited for comparison.

Methods: Subjects completed over ground walking trials to assess their self-selected (SS) walking speed for data collection on a treadmill. A 7-camera Vicon system collected 3D gait data (60Hz) for the following 30-second trials: 1.) walking (W) at SS speed; and 2.) walking and talking (WT) at SS speed. Eight trials were collected for each subject (4 W, 4 WT). Subjects also performed the talking task during quiet stance as a reference point from which to judge the effect of walking on cognition.

Results: During both W and WT trials, the standard deviation for all temporal-spatial outputs between paired-subjects was greater for those with MS. For MS subjects (during W and WT), initial and terminal double stance occurs for a larger percentage, while single stance and the swing phase occurs for a smaller percentage of the gait cycle (%). Kinematically, when comparing conditions (W, WT), there was a minimal increase in knee (0.64±0.66º) and hip flexion (0.86±0.24º) during WT in subjects with MS, while HCs experienced a decrease in these parameters (-0.63±0.46º and -0.63±0.32º, respectively). In comparing paired-subjects, the majority of subjects with MS had greater hip internal rotation (12.01±4.58º) compared to HCs. Cognitively, subjects with MS showed a 9±11% decline in cognitive performance during walking relative to standing, more than double the decline exhibited by healthy controls (4±9%).

Conclusion: The current research informs researchers and therapists about dual-task functioning in more "real life" scenarios in which persons perform multiple tasks such as walking, and simultaneous walking and talking. Large standard deviations in temporal-spatial data observed during treadmill walking suggests an impaired and inconsistent stepping pattern for subjects with MS compared to HC. In addition, there is a trend to show that the dual-task negatively affects cognitive performance for individuals with MS.

Pathological tibiofemoral positioning and cartilage contact in the ACL deficient knee - Pilot Study

Authors: Sarah R. Dubowsky, Jerome Allen, Venkata Gade, Peter J. Barrance

Objective: The primary objective of this study was to computationally quantify *in vivo* joint kinematics and tibial plateau contact area differences in healthy knees between low and high weight-bearing MRI scans.

Participants: Six subjects without orthopaedic knee issues gave informed consent to participate in the MR imaging for this study.

Methods: MRI scans were acquired bilaterally at two levels of weight-bearing: *high weight-bearing* (HWB), during which the patient table was nearly vertical (5º from vertical); and *low weight-bearing* (LWB), during which the patient was recumbent (20º head-up from horizontal). For both scan scenarios, subjects were positioned at 20° of knee flexion. The femoral and tibial bone surfaces, and the medial and lateral cartilage surfaces on each MR image were digitized, and custom software was used to project the digitized points into 3D coordinates. The images were then reconstructed into 3D models. Kinematics positioning of the joint (anterior/posterior and superior/inferior translational displacements and varus/valgus and internal/external rotational displacements) was calculated between tibial and femoral coordinate systems. Contact regions were defined over areas of femoral cartilage that lie within a threshold distance from the tibial cartilage, and the contact centers were calculated as the centroids of all these points. Two-tailed paired t-tests were used to investigate the differences in joint kinematics and tibial plateau contact points between HWB and LWB scans for 12 knees.

Results: Kinematically, there was a significant anterior tibial shift from LWB to HWB ($p<0.005$). The average (±standard deviation) shift for all knees was 2.26 ± 2.19 mm. There was a significant shift in the tibial plateau contact points upon weight-bearing as well. In HWB, there was a significantly more anterior contact point in the lateral compartment ($p=0.018$), with an average anterior shift for all knees of 1.38 ± 1.72 mm. There was also a trend towards a more medial contact point in this compartment ($p=0.075$), with an average medial shift of 1.25 ± 2.21 mm.

Conclusion: This study demonstrated that the addition of weight-bearing causes statistically significant changes in knee joint kinematics and tibial plateau contact areas in subjects with no history of knee pathology. For individuals who have an anterior cruciate ligament (ACL) deficiency marked by elevated antero-posterior and/or rotational laxity, one can assume these differences to be exacerbated. ACL injury is linked to the initiation and progression of osteoarthritis, possibly by changes in the local loading and contact area between joint cartilage surfaces, thus physiological upright MR imaging may be a powerful research tool in quantifying the effectiveness of ACL-reconstruction in reestablishing kinematics and tibial contact areas to pre-injury levels.

Prevalence of Musculoskeletal Pain in Individuals with Developmental Disabilities

Resident: Brett Gerstman
Research Mentor: Donna Lifson

Introduction:

The purpose of this pilot study is to report the prevalence of musculoskeletal pain in a population of individuals with developmental disabilities living in the community. Musculoskeletal disorders and complaints comprise an important public health problem due to high impact on disability. It also has far reaching effects on work absence and disability, and overall health care costs. This topic has been extensively studied in other populations, however, only studied in a very small sub-population of individuals with developmental disabilities. Individuals with developmental disabilities are of interest as they are known to fall victim to health disparities[1] and as a population commonly have risk factors for developing pain. Treating pain in this population is even more difficult as many members have deficits in communication, atypical presentation of pain, and an underlying increased tolerance to pain.

Methods:

The study population will consist of the 600-700 active patients who were seen in the Developmental Disabilities Centers at Overlook Hospital from January 1, 2009 – January 1, 2010. Data on sex, age, underlying cause of developmental disability, and incidence of regional musculoskeletal pain (Neck, shoulder, elbow, wrist/hand, low back, hips, knee, or foot/ankle pain) will be obtained through chart review.

Results:

Data will be analyzed comparing the one-year prevalence of musculoskeletal complaints based on sex, age, developmental diagnosis, and regional MSK areas affected. A multivariate logistic regression (ANOVA) analysis will be performed looking for statistically significant trends. Our data will also be compared to recently published studies analyzing the prevalence of musculoskeletal in populations of individuals without developmental disabilities, looking for trends of statistical significance. Results will be presented on research day.

Conclusion:

Once published, this will be the largest study in the literature that addresses the topic of musculoskeletal pain in individuals with developmental disabilities. It will provide useful information about the prevalence of musculoskeletal pain in individuals with developmental disabilities and how age, sex, and underlying diagnosis are related to the prevalence of musculoskeletal pain. Considering that individuals with developmental disabilities are living longer, this pilot study will provide healthcare providers valuable information about what musculoskeletal complaints should be expected in this aging population.

Safe Entry Angle for Cervical Transforaminal Epidural Steroid Injections **Page**

Fellow: **Pinella Holder, DO**

Mentors: *Boqing Chen MD, PhD, Todd P. Stitik, MD*
Patrick M Foye, MD

Reaction time after mild traumatic brain injury: A prospective study

Richard Hoppe, MD
Mentor: Peter Yonclas, MD

Introduction: The ability to drive in the United States is an important aspect of community integration and in many cases essential depending on where one lives or works. Formal driving tests are sometimes utilized for patients with moderate to severe TBI, although one study showed that as many as 60% of TBI sufferers, many of whom were listed as severe, had not received a driving evaluation following the injury. One difficulty is access to a facility which performs road-evaluations with a Certified Driver Rehabilitation Specialist. Some expensive simulators have been developed which, due to size and cost, are not practical for use in a bedside evaluation setting but are very useful for evaluation after discharge from the hospital if there is concern for a patient's ability to drive. Neuropsychological testing has also been heavily studied in various forms to evaluate for cognitive deficits following TBI that may interfere with ability to process information or focus on dual-tasks. Many involve the use of computer reaction time tests, however they utilize a keyboard interface with visual stimuli. To date, no studies have been found in the literature involving a simple computer testing system of reaction time that involved the use of pedals for triggering a response for patients with mild TBI that could be performed at bedside. We feel that such a system would be more useful in an evaluation for driving than traditional testing using keyboard systems. In addition, a simple bedside evaluation may be of benefit in evaluating the patient's individual deficits prior to the time of discharge from the hospital and aid in making recommendations for driving safety.

Design: Prospective, comparison study of subjects to age/gender matched healthy controls, pilot study for proof of concept.

Methods: Participants will be recruited through the emergency department or via trauma team referral at University Hospital in Newark, NJ. Patients with mild TBI will have a documented head injury with GCS score from 13-15, any loss of consciousness less than 30 minutes, AND post-traumatic amnesia less than 24 hours as a result of fall, assault, motor vehicle collision, or pedestrian struck by a motor vehicle. The participants will be drivers at the time of injury, aged 18 or older and English speaking, able to read standard traffic signs. Patients who had been intubated or undergone conscious sedation within 24 hours of testing, had any right leg injuries preventing pedal use, visual deficits preventing ability to see a computer screen or differentiate colors associated with routine driving, a prior brain injury within the last 6 months, or non-drivers are excluded from testing. This initial study will only involve a single test period as part of proof of concept. This study will involve a laptop computer, a pedal trigger system, a computer software stopwatch program and three Microsoft Powerpoint presentations with 1 setup image and 10 test images. The participant will be required to view an image representing a "stop" or "go" situation and will be required to press the appropriate "brake" or "gas" pedal. A standardized Montreal Cognitive Assessment sheet, standardized “trail-making” sheet and data collection sheet will be utilized. MOCA scores and trail-making times will be recorded and compared to standardized "normals" to document potential cognitive deficits. Data collection will include reaction times and pedal pressed for later analysis of mean times and appropriate pedal to go or no-go image displayed in order to evaluate for errors.

Findings/Conclusions: Pending full UMDNJ IRB approval, results to be presented.

Functional Improvement on Hand and Arm Coordination Using Adapted Fits Paradigm with Virtual Rehabilitation **Page**

Fellow: **Nam Kim, PhD**

Mentors: *Gail Forrest, PhD, Peter Barrance, PhD*
Glenn Wylie, DPhil

Does Auricular Acupuncture Improve Tolerance to EMG Testing?:
A Pilot Study

Stephanie Kemper Liu, MD; Trevor Dyson-Hudson, MD;
Jeffrey Cole, MD; Yekyung Kong, MD; MyLan Lam, MD; Jeffrey Zhang, PhD

Background: Needle electromyography (EMG) is an important diagnostic test that evaluates neuromuscular disturbances which cannot be fully assessed by physical examination. The test is uncomfortable for patients, even so intolerable to some that they refuse completion of testing, resulting in incomplete diagnostic information. This could lead to improper or inadequate treatment. Methods such as pre-medication, behavior modification, and relaxation techniques have been studied to improve tolerance to EMG. However, these strategies may be impractical or even contraindicated in certain patients. Auricular acupuncture, a technique that uses small, solid needles in specific points in the ear, may provide a viable analgesic alternative for EMG-induced pain.

Objective: To determine whether auricular acupuncture improves tolerance to EMG testing.

Design: Randomized, prospective, single-blind (participants, electromyographer) and placebo-controlled (invasive sham), with efforts to blind the acupuncturist-evaluator.

Setting: Outpatient clinic.

Subjects: Healthy adult volunteers with no neurologic deficits.

Primary Outcome Measure: Change in pain from baseline as rated on a Numeric Rating Scale (NRS).

Results and Conclusions: Yet to be determined.

A Pilot Study Examining the Role of Microvascular Therapy in the Treatment of Painful Peripheral Neuropathy

Joseph Mejia, DO; Aswin Chandrakantan, MD; Paul Abend, DO; Todd Stitik, MD

Disclosures: None.

Objective: To examine the effectiveness of microvascular therapy (MicroVas®) in treating painful peripheral neuropathy.
Design: Retrospective study.
Setting: Outpatient rehabilitation practice.
Participants: Eighteen patients with painful peripheral neuropathy related to diabetes, peripheral vascular disease, or post-chemotherapy who underwent at least 24 microvascular therapy treatments.
Interventions: All patients were assessed by a board-certified physiatrist and were prescribed microvascular therapy which was administered by the same physical therapist. Treatment sessions were three times per week, 45 minutes each session. At initial evaluation and after 12 and 24 microvascular therapy treatments, patients were asked to rate their improvement/lack of improvement in pain, paresthesias, numbness, proprioception, and strength. All evaluations and follow-up visits were performed by the same physiatrist.
Main Outcome Measures: Subjective improvement/lack of improvement in 5 criteria: pain, paresthesias, numbness, proprioception, and strength.
Results: The use of microvascular therapy as part of a multimodal therapy including medications and exercise resulted in subjective improvement of patient reported pain (78%), paresthesias (67%), numbness (71%), proprioception (75%), and strength (60%). No complications were associated with the use of this modality.
Conclusions: Microvascular therapy is a safe and effective component of a multimodal strategy for improving symptoms in patients with diabetic, peripheral vascular disease-related, and post-chemotherapeutic painful peripheral neuropathies. Further investigation is needed with more objective measures of improvement such as electromyography/nerve conduction studies before and after microvascular therapy. The results of this pilot study should encourage larger, objectively measured, placebo-controlled studies looking at this novel approach in treating painful peripheral neuropathy.

Keywords: rehabilitation, peripheral neuropathy, microvascular therapy, pain

Athletic Experience, Demographics and Injury Experience in Skiers and Snowboarders with Spinal Cord Injury

Janel Solano, D.O.
Jeremiah Nieves, M.D.

Introduction: Participation in sports for people with disabilities continues to grow in popularity. However with participation in sports, there is always an inherent risk of injury. Currently there is limited literature available on the injuries among disabled skiers and snowboarders. The studies published directly comparing sports participation of both able-bodied and disabled individuals suggest that athletes with disabilities do not have a significantly greater overall risk of injury than their able bodied counterparts. However, the functional consequence of injury may be significantly greater than what may occur for an able-bodied person. Many of previous studies have employed a 'cross disability' design, and to date there have been no studies describing the athletic and injury experience occurring specifically in skiers in the spinal cord injury (SCI) population.
Objective: The goal of this study is to describe the demographics and injury experience in skiers and snowboarders with spinal cord injury**.** The information obtained may assist in the planning of future studies on development of injury prevention programs.
Design: Retrospective observational study
Participants Athletes 18 and older of all skill levels in adaptive alpine skiing and snowboarding with physical disability due to spinal cord injury.
Methods: An electronic survey was developed and distributed using software available at www.surveymonkey.com. Program directors and regional coordinators were contacted at multiple adaptive ski programs across the country and asked to distribute the electronic link to their athletes via email, as well as posting a recruitment flyer at their facility. Demographic information including sex, age, and diagnosis was collected. The second portion of the survey included obtaining information on experience level, skill level prior to injury, current skill level, and equipment use. Lastly, information on injury related data for both acute injuries and chronic injuries including time to return to participation, medical treatment sought, diagnostics and treatment rendered was obtained.
Findings/Conclusions: Pending completion of data collection.

Utilization of Sports Injury Prevention Programs by Athletic Trainers in the State of New Jersey

Investigators: James F. Wyss MD, PT; Gerard A. Malanga MD; Susan Garstang MD; Michael Prybicien ATC

Background: Sports injury prevention is a growing field of sports medicine. The amount of evidence based literature that supports the use of sports injury prevention programs in high school and college athletics has grown substantially. Unfortunately, further review of the literature fails to indicate whether these injury prevention programs are being implemented at high school or college athletic programs.

Objective: Our primary objective was to determine if sports injury prevention programs are under utilized in high school and college athletic programs in the state of New Jersey. We also attempted to identify the types of programs being implemented and the potential barriers to implementing these programs.

Design: We distributed an email-based survey to athletic trainers in the state of New Jersey, with the help of the Athletic Trainers Society of New Jersey (ATSNJ). We then analyzed the data gathered via descriptive statistics.

Results: Our response rate was 16.8% (164/975 potential respondents). 50.3% of the respondents indicated that they utilized injury prevention programs. The most commonly utilized programs were rotator cuff injury, ankle injury and ACL injury prevention programs (57.3, 53.7 and 53.7% respectively). 49.7% of the respondents indicated that they didn't utilize injury prevention programs, although the majority of this group (86.4%) believed these programs would be helpful to their athletes. The primary barrier identified to implementing these programs was lack of time (44.7%) and the secondary barrier was limited staff (17.1%).

PART II

R-1Research Review Abstracts

PART II
PGY-2 RESEARCH ABSTRACTS

Median Nerve Stimulation in the Treatment of Comatose States: A Systematic Literature Review

SuAnn Chen, MD
Jonathan Fellus, MD

Introduction: In the last 20 years, there has been growing use of median nerve transcutaneous electrical stimulation to aid in the treatment of comatose patients. This has become a method of central nervous system stimulation by increasing cerebral blood flow, increasing dopamine levels and stimulating the reticular activating system in the brainstem. The efficacy of this modality is still unclear and the proper technique in using this method is still to be discerned and clarified.

Primary objective: To review the literature regarding the effectiveness in the use of transcutaneous median nerve stimulation as an intervention to promote arousal from comatose states.

Methods: A systematic electronic literature search of multiple databases (PubMed, REHABDATA, CINAHL, Ovid Medline, PsycINFO, Google Books) was conducted. A total of 15 relevant articles were found ranging from 1994 – 2006 in comatose patients treated either with transcutaneous median nerve stimulation or control sham treatments. The data from each article was reviewed and analyzed.

Results: In total of all the studies that were reviewed, there were 64 subjects tested. However, the cause of comatose states varied, with the majority being traumatic brain injury, but other etiologies including hypoxic encephalopathy, hemorrhagic stroke, or aneurysm rupture. Also, the date from initial injury when median nerve stimulation was started was different in each study, with the majority being early on in the acute brain injury course, usually within the first two weeks of coma. In these cases, median nerve stimulation often allowed for statistically significant earlier emergence from comatose states compared to control groups. The majority of the studies used median nerve stimulation only on the right arm, but it was not consistent throughout and the settings for the stimulators were varied across the board.

Conclusions: Due to small sample sizes and differences in inclusion criteria, there have not yet been sufficient studies with statistical significance to be able to affirm that transcutaneous median nerve stimulation should always be used for the treatment of comatose states to promote arousal. However, there have not been any adverse effects noted and there was always a general trend toward improvement, suggesting that this may be one modality worth trying. Larger, more robust studies are needed to further demonstrate the positive effect.

Myofascial Low Back Pain: a Review

Eduardo J. Cruz, MD Gerard Malanga, MD

Introduction: Myofascial syndrome is a common non articular local musculoskeletal pain syndrome caused by myofascial trigger points located at muscle, fascia or tendinous insertions. It affects up to 95% of people with chronic pain disorders. This syndrome is characterized by the presence of trigger points which are hyperirritable tender spots in palpable tense bands of skeletal muscles. Simmon's integrated hypothesis proposes that a sequence of events including an "energy crisis" of the muscle fibers will cause sustained sarcomere contracture. We will explore new evidence supporting Simmon's hypothesis as well as new views regarding diagnosis and management.

Methods: A literature review was performed and articles were selected based on their relevance to the topic.

Findings: New techniques to diagnose myofascial trigger points include magnetic resonance imaging and ultrasound which can diagnose trigger points based on viscoelastic properties and high resistance arterial flow by doppler images. Current treatment options include botox, dry needling, local anesthetic injections, manual therapy and pharmacology.

Conclusion: Simmon's hypothesis is the most accepted regarding the pathofisiology of TrPs. Injection methods are the most effective treatment in inactivating TrPs. Besides manual palpation, new trends in diagnosis of TrPs such as ultrasound, magnetic resonance elastography and doppler images have demonstrated promising results.

Amanda Farag, MD

Introduction and Background

Knowledge of disabling conditions and attitudes towards the disability community has a profound impact on the care of patients with disabilities, both in rehabilitation medicine as well as primary care and surgical specialties. Presently, there are 54 million people living with disabilities in the United States, twenty-five percent of the total U.S. population. The second goal of the Surgeon General *Call to Action to Improve the Health and Wellness of Persons with Disabilities* (2005) is that "Health care providers have the knowledge and tools to screen, diagnose and treat the whole person with a disability with dignity."[10] Many medical schools and residency training programs, both in rehabilitation medicine and other specialties, have requirements to provide training for physician residents in knowledge about and sensitivity towards patients with disabling conditions. The current review aims to identify and summarize those studies pertaining to the attitudes of physicians towards disability.

Methods

A literature search was completed on Pubmed utilizing many terms including the following: "knowledge," "attitude," "disability/handicapped", "physician," and "resident/housestaff." From the relevant articles found, their bibliographies were reviewed for further relevant articles.

Findings

There were 50 articles that were originally found but only 11 met the criteria and were reviewed. Many articles were found that reviewed attitudes in nurses, medical students and other health care professionals, however, few articles were found that specifically studied or reviewed resident physician attitudes towards the individuals with disabilities or the impact of disability education on resident attitudes towards this population. The Attitude Towards Disabled Persons Scale (ATDP) was used in many studies to assess subjects' attitudes since it is the best known and most widely utilized tool in assessing attitudes towards people with physical disabilities. In one study of medical and dental students as well as physicians of varying specialties, females had significantly more positive attitudes as well as whites when compared to Asians (but no difference when compared to African-Americans and Hispanics). In this study, type of contact with the disabled had no significant impact but those with increased frequency of contact with disabled patients had significantly higher mean attitude scores.[9] In a study reviewing the impact of pediatric residency rotations where residents had greater exposure to children with disabilities, it was found that exposure to handicapping conditions significantly improves some positive attitude measures.[2,4] Another study found that physicians need more education about disability issues and have limitations in their knowledge as well as profound communication gaps and require cultural sensitivity training.[7] A recent educational program has been implemented in a rehabilitation residency in which people with disabilities teach residents about challenges of daily living and this has been shown to improve resident understanding and appreciation for patients. Some physician editorials and commentaries were found in major medical journals that discussed the need for further study in this area.[11]

Conclusions

While many studies and reviews have been done on the knowledge and attitudes of medical students and health care professionals towards the disabled community, there is a paucity of information regarding physician attitudes. This is surprising as physicians of all specialties regularly provide care for this large subset of patients. The few attitude survey studies in physicians show primarily neutral or positive attitudes among physicians with small subsets of negative attitudes. Increasing exposure to the disabled community, both during specialized rotations and opportunities for these people to become lay-teachers to physicians in training has been shown to have a positive impact on attitudes and understanding in subjective post-exposure questioning. Many medical schools have included cultural competency modules into their curriculum, but there should be further work to include physician competency education among residency training programs of all specialties.

Feasibility of Ultrasound-Guided SI Joint Injections

Debra Ibrahim, DO

Introduction*:* Sacroiliac joint pain has become a more recognized significant generator of low back pain. Etiologies of SI joint pain include inflammatory rheumatic diseases, mechanical injury, and pregnancy. Conservative treatment includes anti-inflammatory medications, relative rest, manual manipulation, and physical therapy with modalities including deep heat, myofascial release, and muscle balancing. Injections into the SI joint are both diagnostic and therapeutic. The SI joint is a diarthrodial joint with a small volume capacity demanding precision of needle placement into the SI joint before injection of corticosteroid or lidocaine. Ultrasound guided injections in pain medicine as a whole is not as widely used due to several reasons including relative poor image quality, technical requirements, time demand, and the use and acceptance of MRI-, CT- and fluoroscopy- guidance as the gold standard. Several recent studies have focused on the feasibility and accuracy of Ultrasound-guided SI joint injections.

Methods: A computer-based search of medical databases was performed using the keywords: *sacroillitis, ultrasound guided SI joint injections*, and *sacroiliac joint*. A review of the literature on accuracy of SI joint injection using ultrasound guidance was then performed.

Findings: Studies have shown that image guidance is superior to blind injections. Intraarticular accuracy rates vary from study to study, from as low to 40% up to 97%, with most studies showing improvement in accuracy rate with experience.

Conclusion: Ultrasound guided SI joint injections have increased intra-articular accuracy with experience. The feasibility of ultrasound usage for this injection is promising in offering patients adequate pain relief at a lower healthcare cost, while also decreasing radiation exposure to the both the patient and healthcare professional. Radiation exposure becomes of particular concern in younger patients and also in pregnant women in whom SI joint pain is a common development. There are other studies that show a significant decrease in SI joint pain with peri-articular injections as well, implying that precise accuracy intra-articularly is not necessarily vital in providing pain relief to the patient. This is even further promising that ultrasound guidance for SI joint injections may be sufficient, even if only peri-articular positioning is obtained.

Krzyzek

Altered Adrenal Function after Spinal Cord Injury: A Review

Anthony Lee, MD

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

Spinal cord injury is a serious condition that can cause impairments in function. However, in addition to its effects on overall gross motor performance, it also affects organ systems and physiology. One such example is alteration of adrenal function after spinal cord injury. Research on the effects of spinal cord injury on endocrine systems has been ongoing for several decades. Early studies showed increased eosinophil i a. decreased ** y c not] of cortisol metabolites, loss of positional regulation of aldosterone excretion, and deciea ed response to the applied stressors of insulin-induced hypoglycemia and orthostat c hypotension; all of which are associated with adrenal impairment. More recent studies on subjeets with chronic spinal cord
injury have directly tested the function of the hypothalamic a itary-adrenal axis by administering corticotropin releasing hormone ((RH) and adrenoeorticotropic hormone (ACTH). These studies showed a relatively high pievalence of adrenal impairment in chronic spinal cord injury and a decreased ability to mount an adrenal stress response with low cortisol levels despite normal ACTH levels. With respect to acute spinal cord injury, several recent case reports described the development of adrenal insufficiency after administration of high dose steroids for treatment of acute spinal coat injr*r■ lug ihermore, it can be argued that additional factors related to the care of patient l'ter acute final c ,r ll inury, such as critical illness-related corticosteroid insufficiency and iiL(V erse effect, o Im ed i c,Ltions, compound the risk of adrenal impairment. Finally, studies in animal models have shown preservation of adrenal compensatory responses even after elimination of endocrine signaling, and also a side-specific increase in hypothalamic activit' after unilateral adrenalectomy. Both findings suggest a neurologic connection hetn'een tli : central lervntn system and the adrenal glands, and provides a pathophn si,,Iu iL, 1,,r impaired adrenal it uietion after spinal cord injury. While it may not be the 1110„k. commoiil; .>>sociated condit1 *i, it is important to recognize that alterations in adrenal function can occur in both acute and chronic spinal cord injury. Early diagnosis and treatment can have a dramatic impact on a clinical course and limit complications.

Tendinous Injuries in Athletes Using Anabolic-Adrenergic Steroids

Kirk Lercher, MD

Introduction: Anabolic-androgenic steroids (AAS) have been abused by athletes to gain a competitive advantage by increasing muscular development and strength. Its use among athletes in the United States is believed to date back to the 1950s and became increasingly prevalent in Olympic and professional sports in the 1970s and 80s leading to the governing bodies of professional sports leagues enacting bans on such performance enhancing drugs (PEDs). AAS use has persisted since that time despite such sanctions imposed by athletic organizations and growing awareness of the adverse effects to various organ systems. Perhaps most troublesome is the trend of using AAS to achieve either success in athletics or improve bodily appearance in non-athletes and adolescent populations. This has an unknown long-term public health outcome. Recent reviews have estimated *that* between 1-3 million people in the United States have used AAS; reports have estimated a lifetime prevalence of AAS use for adolescent males of 4-6% and for females of 1.5-3%. Awareness of adverse effects of AAS on various organ systems, especially in the large quantities used by many athletes, remains poorly understood and predominantly anecdotal, especially when it comes to adverse effects on the musculoskeletal system. Based on a series of case reports and selected animal studies, it is believed that athletes who abuse AAS are at an increased risk of musculotendinous injuries and possible tendon rupture. In this review we looked at the current literature to determine the current understanding of the relationship between AAS and musculotendinous injury and what further research remains to be done.

Methods: A literature search was performed using PubMed and Medline; articles were selected based on their relevance in answering the current clinical question.

Findings: A series of case reports were found that documented subjects who had a history of AAS use and had tendon ruptures occurring in various body regions including bilateral quadriceps, triceps, and pectoralis major tendons. Additionally a case report was found that documented Achilles tendon ruptures in the setting of supplementation with the testosterone prohormone androstenediol. The limitation of all case reports remains that causality cannot be attributed and clinical trials in humans is unethical. Two animal studies were found that analyzed the effect of AAS on tendons via inhibitory effects on matrix metallopeptidase 2 activity, leading to alterations in the biomechanical properties of collagen within the tendons. This suggests a decrease in tendon structural integrity in the face of increased demand by AAS using athletes. However, a prior study on human tendons failed to show ultrastructural collagen changes. There was a recent retrospective survey-based study utilizing retired NFL players who admitted to AAS use in the past and their subsequent musculoskeletal injuries; however, this study failed to show a correlation between AAS and tendon injuries.

Conclusion: Clinical research on this subject remains limited and further understanding of the link between AAS and musculotendinous injuries would be beneficial to further educate athlete patients, devise treatment plans, and promote therapy regimens that could help prevent such injuries in the future.

Effectiveness of Pilates and Yoga for the Treatment of Low Back Pain, A Literature Review

Christine Pfisterer, Carol McMara-Gill

Introduction: Low back pain is one of the most common complaints at physicians' offices. Millions of dollars are spent to treat this ailment, and it is the most common cause of disability in middle aged persons. Despite the pervasiveness of this problem, many patients continue to experience back pain even when receiving appropriate treatment. Their pain often becomes a chronic problem, lasting for at least 6 months, and as they continue to deal with this ailment many look to alternative and complementary medicine for treatment options. Yoga and Pilates are two techniques that have been used to treat low back pain, and their benefits can help many different groups of people. With the increased popularity of yoga and Pilates, studies have been performed to prove their effectiveness, and demonstrate feasibility of turning these practices into medical treatment programs.

Methods: An electronic search of PubMed, OVID, Medline, and CINAHL was done. The terms Pilates and low back pain, as well as yoga and low back pain, were searched to find relevant articles. Articles were excluded if they did not address the potential effectiveness or ineffectiveness of these programs to help patients with low back pain.

Findings: Pilates helps to improve core strengthening, and has been shown to be effective in the elderly as well as the young. Yoga has been shown to be effective in pregnant patients, patients with low income, as well as others. These exercise programs can be used to treat a wide variety of patient, and can be adapted to meet each patient's needs.

Conclusion: When patients fail to respond to other modalities or treatment for low back pain, Pilates or yoga can be used as an effective method to treat low back pain.

Roque

Limb Activation Therapy in the Rehabilitation of Left Spatial Neglect

Mark A. Sison, MD *Anna M Barrett, MD*

Introduction

Among impairments following a right hemisphere stroke, left spatial neglect is a significant disabling deficit and is one of the single best predictors of poor functional recovery. Given the poor prognosis of patients with left spatial neglect, there is a dire need for effective strategies to alleviate this condition. As such, over the past several decades, many rehabilitation techniques have been presented to reduce left spatial neglect. One technique found to have some success in reducing neglect is Limb Activation Therapy. This technique is based on activating a poorly attended body schema by making voluntary initiated contralesional limb movements in the left side of space. In this review, Limb Activation is described, explained in terms of its theoretical bases and evaluated in terms of experimental findings and practical implications for neglect remediation.

Methods

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

Findings

Limb activation therapy was developed from observation that left spatial neglect could be reduced if tasks are performed using the left hand in left space. In clinical practice, the patient is required to initiate movements with his/her left paretic limb in left hemispace.

The underlying mechanism(s) for the limb activation effect on neglect are not established. It is not clear whether the facilitatory effect of limb activation is due to a direct relationship between motor programming and elective attention, or a perceptual-motor cueing effect. However, it appears that neither the "recruitment" nor the "cueing" hypothesis is adequate to explain the improvement of left visual neglect after left hand activation in left hemispace.

It has been shown in several studies that left limb movements in left hemispace shorten hospital stay, improve body image, and increase scores in formal testing, functional, and visual task performance measures in patients with neglect. Several studies have likewise shown that limb activation produces significant gains in several ADL areas. Furthermore, long-term effects have been reported in some studies. The functional effectiveness of limb activation still remains to be demonstrated in RCTs.

Conclusion and Future Directions

Altogether, the studies reviewed show promising results; however, more studies are needed to determine the optimal conditions for promoting generalized training. As such, there is now compelling evidence to encourage further randomized controlled trials or well designed single case studies using meaningful activity levels over longer follow-up periods. Further research is needed to investigate treatment efficacy against functional criteria and refining intervention procedures in keeping with the advances in brain activation research.

Alon Terry

Abstract for R1 **review paper**

NEED TITLE

Study Design: Review of the literature

Background/Objectives: Shoulder pain from rotator cuff pathology is a very common cause of morbidity in the spinal cord injury population. Manual wheelchair propulsion, transfers, raised ischial pressure reliefs, and frequent overhead reaching leads to significantly increased demand on the upper extremity when compared to able-bodied individuals. This review will discuss the current knowledge regarding epidemiology, pathomechanics, and prevention/treatment of rotator cuff tendonopathy in the spinal cord injury population.

Methods: Review of the literature using PubMed/MEDLINE and bibliographies of selected articles.

Results: Rotator cuff tendonopathy/tears is by far the most common etiology of shoulder pain in individuals with spinal cord injury. Incidence of rotator cuff pathology is significantly increased when compared to age matched able-bodied individuals. Factors that increase the risk of shoulder pain included tetraplegia, complete injury, female sex, age, increased time since injury, and BMI. Shoulder impingement is the likely cause of overuse rotator cuff tendonopathy. Spinal cord injured population is at increased risk of impingement because of manual wheelchair propulsion, thoracic kyphosis, poor flexibility, and imbalances of scapular stabilizers and rotator cuff muscles. While there have not been many studies focused on prevention and treatment of rotator cuff tendonopathy in the SCI population, people do seem to benefit from exercise programs focused on scapular stabilization and improving shoulder range of motion.

Conclusion: Many studies have been conducted that investigate the epidemiology of shoulder pain in spinal cord injured individuals. While etiology is likely multifactorial, more studies are needed to illustrate how the pathomechanics differ in this population compared to able-bodied individuals. This will help shape how clinicians view both prevention and treatment of shoulder pain in spinal cord in-

PART III

Listing of
Meeting Presentations and Posters

A Typical Left Upper Quadrant and Thoracic Pain Syndrome from a Sequestered Thoracic Disc Masquerading as a possible Meningioma: A Care Report **Page**
Neeti Bathia, MD

Title: “Influenza vaccine shoulder”-vaccination-related traumatic injury to the infraspinatus: a case report.

Authors: Bathia, N. Stitik T

Case Report BS reported 3 weeks of right shoulder pain beginning during an intramuscular (IM) influenza vaccination into the deltoid region. She noted more pain than usual during the vaccination and stabbing, 9/10 right shoulder pain with internal/external rotation and adduction afterwards. She denied any instability, clicking/popping, neurologic symptoms in the arm/hand, or any new repetitive activity. On exam, active internal/external rotation, resisted external rotation both with the shoulder adducted and abducted to 90° and shoulder impingement maneuvers were painful. Reflexes, strength, sensation and AC joint provocative maneuvers were normal. Traumatic infraspinatus and/or teres minor tendon injury was suspected as the cause of her pain.

Results: She received little benefit from oral anti-inflammatory medication, a diagnostic subacromial lidocaine injection and 6 P.T. sessions. T2 weighted shoulder MRI showed infraspinatus tendinosis without frank tear. She is scheduled to undergo ultrasound-guided diagnostic lidocaine injection of the infraspinatus tendon sheath.

Conclusions: The deltoid muscle is a common site of IM injections. As per prior case reports, the greatest risk of injury is to the axillary nerve, subdeltoid bursa, and circumflex humeral artery. Despite prior studies examining skinfold thickness over the deltoid to estimate correct needle length for such injections and anatomic studies to determine structures at risk and the optimal site of needle placement, a study of both general practitioners and nurses questioning deltoid IM injection techniques showed a lack of understanding of deltoid region anatomy and, in general practitioners, a lack formal training in administering IM injections. In this case, improper injection proximally into the deltoid muscle resulted in infraspinatus tendon injury, which has not been reported in the literature previously.

Iatrogenic infraspinatus tendon injury during IM injection of the deltoid is a rare complication. Knowledge of shoulder anatomy and correct injection techniques is important for health care workers who administer IM injections.

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Kelly L. Scollon-Grieve, MD, Gerard Malanga, MD

Warfarin-Induced Hepatotoxicity in an Ashkenazi Jewish Female Following Total Knee Arthroplasty

Benjamin D. Levy, MD, Neil Jasey, MD

Setting: Inpatient rehabilitation institute

Patient: A 78 year-old Ashkenazi Jewish female admitted for rehabilitation of left total knee arthroplasty.

Case Description: Upon admission to rehabilitation, the patient complained of nausea since her surgery and described non-bilious non-bloody vomiting while in acute care. She denied fevers, chills, skin color change, recent unintended weight loss, or similar symptoms prior to her surgery. The patient had no history of cholelithiasis, pancreatitis or cancer. Physical exam revealed normoactive bowel sounds, and a soft nontender abdomen without hepatosplenomegaly. Sclerae were anicteric and the patient was not jaundiced. On initial laboratory testing, the patient was noted to have elevated alkaline phosphatase (AP), gamma-glutamyl transpeptidase (GGTP), and alanine aminotransferase (ALT). A gastroenterology consult was obtained. Subsequent workup was negative for viral hepatic disease or hepatobiliary obstruction. The patient was taken off her proton pump inhibitor and acetaminophen, but her AP, GGTP and ALT continued to rise. Warfarin was then discontinued and switched to low-molecular-weight heparin. The cessation of warfarin resulted in the rapid normalization of the patient's laboratory values.

Discussion: Warfarin-induced hepatotoxicity is a rare yet important complication of oral anticoagulation. It is characterized by an increase in LFTs with continued administration of warfarin that rapidly resolves following its discontinuation. Warfarin-induced hepatotoxicity may manifest with jaundice and elevated transaminases, or may present with increases in alkaline phosphatase and GGTP. Workup must exclude other hepatotoxic medications, viral hepatitis, and hepatobiliary pathology prior to considering warfarin as the primary etiology. To our knowledge, there has never been a case reported of warfarin-induced hepatotoxicity in an Ashkenazi Jewish patient. This population has a high frequency of warfarin resistence conveyed by an allele of CYP2C9. It is unknown whether this allele may also predispose patients to warfarin-induced hepatotoxicity

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Long-term outcome in patients with critical illness polyneuropathy and myopathy

Margaret M Donlon, MD, MPH

Background: Critical illness polyneuropathy (CIP) and critical illness myopathy (CIM) are frequent causes of weakness in the intensive care unit. These diagnoses are becoming increasingly common because of improved survival from sepsis, and therefore more likely to be encountered in rehabilitation settings. The pathophysiology for CIP/CIM has been written about extensively in the acute care literature but less is known about long-term outcome. A literature review was therefore undertaken in order to establish what is known about the course of recovery in CIP/CIM and to illuminate areas that need further research.

Methods: 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 revealed 209 articles that were narrowed down to 23 rehabilitation-relevant articles. From this group, thirteen primary articles, two case reports and one review article were selected.

Findings: Mortality among patients with CIP/CIM is as high as 50% by 1 year. Of those who survive, the majority have some degree of improvement. The long term prognosis ranges from complete recovery within months to persistent weakness and disability after several years. Recovery time in CIP is somewhat dependent on the severity of neuropathy and distance over which axonal regeneration must occur. Compression neuropathies are a cause of permanent seqeulae in patients with CIP. CIM may have a better long-term prognosis than CIP.

Conclusions: The overall quality of the majority of studies was poor to fair. Many of the studies used non-statistical analysis and less than half were prospective. Outcome measures were often limited to manual muscle strength or ability to ambulate, which do not necessarily correlate with function. Future studies should include several validated functional measures and involve multiple follow-up points, so that an accurate trajectory of recovery can be delineated.

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Title: Atypical left upper quadrant and thoracic pain syndrome from a sequestered thoracic disc masquerading as a possible meningioma: A case study.

Authors: Bathia N, Stitik T

Case Report: A 52 year old woman with a history of peptic ulcer disease and irritable bowel syndrome presented with 11 months of abdominal knife like pain in the left upper quadrant radiating around her ribs to her thoracic spine and rostrally along her left thorax and into her left arm. Abdominal imaging, upper endoscopy and colonoscopy were normal. Examination revealed normal strength and sensation. She had vague tenderness to palpation in the left upper abdominal quadrant, left lower ribs, and posterior left lower thorax without organomegaly or associated skin lesions. The initial differential diagnosis included thoracic radiculopathy, spinal mass, myelopathy, cervical syrinx, rib cage disorder, and atypical abdominal wall syndrome.

Gadolinium enhanced MRI of the T-spine revealed a 1.5 x 0.8 cm mildly enhancing extradural mass along the posterior margin of T12. Differential diagnosis included calcified meningioma, lymphoma, plasmocytoma, and sequestered disc. Follow-up CT scan confirmed disc herniation. Of note, C-spine MRI showed multi-level disc herniations from C3-4 through C6-7 with flattening of the ventral margin of the spinal cord and severe left C6-7 foraminal stenosis. She underwent surgical excision of the thoracic mass. Surgical pathology was consistent with an osteophyte-disc complex.

Conclusions: Thoracic disc herniation comprises only 1% of spinal disc herniations (Alberico 1986). Other case reports describe localized back pain with occasional lower limb neurologic symptoms (Bose 2003, Partheni 2005, Neugroschl 1999, Morizane 1999). The differential diagnosis of an extradural spinal mass is broad, including epidural abscess or hematoma, synovial or epidermoid cysts, neurofibroma, Schwannoma, meningioma, and lipoma. MRI and CT can be helpful in distinguishing between these different pathologies, although histologic diagnosis is still generally necessary. In this case, a sequestered thoracic disc contributed to atypical left upper quadrant and thoracic pain, and should be part of the differential diagnosis for patients presenting with atypical abdominal and neuropathic pain.

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PRESENTATION TYPE: Case Report
PRIMARY TRACK: Brain Injury
TITLE: Post-anoxic facial myoclonus triggered by speaking but not singing: a case report

Patients or Programs (Case Reports Only): A 28 year old male collapsed while singing during a church event. After fifteen minutes of resuscitation, he regained a pulse but had already suffered from severe anoxic brain injury. He was later diagnosed with cardio-myopathy and a defbrillator was implanted.

Initially in a vegetative state, he progressively regained consciousness during inpatient re-habilitation and began to verbalize. However, as he regained his ability to communicate, he also developed severe post-anoxic myoclonus in his facial muscles which was triggered by speaking and made intelligible communication with the patient nearly impossible.

Program Description (Case Reports Only): Several different medications failed to control the facial myoclonus. Levetiracetam had the most notable improvement, but only at higher doses which also induced somnolence. As the patient's level of consciousness improved and his attempts at verbal communication increased, the language-induced myoclonus be-came a frustrating barrier to achieving meaningful interaction with the patient.

Setting (Required for Abstracts and Case Reports): Inpatient brain injury unit at an acute rehabilitation facility

Results (Required for Abstracts and Case Reports - Include Assesments for Case Re-ports.): During evening rounds, the patient was observed to be singing church hymns with his wife. While singing, the patient did not exhibit any facial myoclonus, allowing him to ennunciate clearly. However, the myoclonus re-appeared when he attempted to respond to questions.

Discussion (Case Reports Only): Post-anoxic myoclonus is often poorly controlled with medications. While spoken language is known to trigger facial myoclonus, this is the first reported case where its suppression was induced by singing. These findings suggest that that different neural pathways are activated during facial myoclonus. The cognitive proc-ess underlying vocal expression appears to trigger myoclonus more than singing, which is considered to be a more "automatic" function of the brain.

Conclusions (Required for Abstracts and Case Reports): Post-anoxic facial myoclonus can be induced by speaking in brain-injured patients and is difficult to control with medica-tions. Automatic functions of the brain, such as singing or counting, may not trigger myo-clonus to the same extent. These strategies should be used in speech therapy with these patients, and may allow for improved communication with them.

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