

University of Kentucky
Department of Physical Medicine & Rehabilitation



15th Annual Research Day
June 26th, 2003

Cardinal Hill Rehabilitation Hospital
Center of Learning Rm. CL3-CL4

Physical Medicine and Rehabilitation Research Day 2003

University of Kentucky
Department of Physical Medicine & Rehabilitation
15th Annual Research Day Agenda

Cardinal Hill Rehabilitation Hospital
Center on Learning Rms. CL3 & CL4
June 26th, 2003

08:30 – 09:00 am Continental Breakfast
09:00 – 09:10 am Opening Remarks: Nancy J. Stiles, M.D.

Resident Research Presentations

Plans

09:10 – 09:20 am Fernando Branco, M.D.
09:25 – 09:35 am Melinda Hayes, M.D.
09:40 – 09:50 am Emese Simon, M.D.
09:55 – 10:05 am Paul Harries, M.D.
10:10 – 10:20 am Kathleen Dy, M.D.
10:20 – 10:30 am Gang Li, M.D.

10:35 – 10:45 am BREAK

Projects

10:50 – 11:00 am George Bitting, M.D.
11:05 – 11:15 am Melinda Hayes, M.D.
11:20 – 11:30 am Markus Niederwanger, M.D.
11:35 – 11:45 am Herb Villaflores, M.D.

Student Research Presentations

Projects

11:50 – 12:00 pm Jennifer Hayden, ATC, Amberly Leslie and Sarah Lochow

12:05 – 2:00 pm **LUNCH BUFFET**
Sponsored by Marlene Horn from Pfizer Pharmaceuticals

FEATURE SPEAKER

Pathogenesis of Syringomyelia: Implications for Treatment

1:00 – 2:00 pm Edward H. Oldfield, M.D.
Chief of the Surgical Neurology Branch, National Institute of Neurological
Disease and Stroke, National Institutes of Health

2:15 – 2:30pm BREAK

Poster Presentations and Review

2:30 – 2:40 pm Jennifer Mount

2:45 – 2:55 pm Erica Simpkins, Staff Physical Therapist at
Cardinal Hill Rehabilitation Hospital

3:15 – 3:30 pm Awards and Closing Remarks: Nancy J. Stiles, M.D.
Gerald V. Klim, D.O.

PM&R Feature Speaker

EDWARD H. OLDFIELD, M.D.

Dr. Oldfield received his M.D. from the University of Kentucky Medical School, training in general surgery (1973-75) and neurosurgery (1976-1980) at Vanderbilt University and in neurology (1975-76) at the National Hospital for Nervous Disease, London, England. He is currently Chief of the Surgical Neurology Branch, National Institute of Neurological Disease and Stroke, National Institutes of Health, where he leads a laboratory and clinical research effort in neurosurgery. His interests include brain and pituitary tumors, syringomyelia, the development of new drug delivery techniques for the central nervous system, neural transplantation and regeneration, Von Hippel-Lindau disease, and certain types of vascular disorders of the central nervous system, particularly arteriovenous malformations affecting the spinal cord, dural arteriovenous fistulas, and the pathophysiology and treatment of cerebral vasospasm. In addition to his clinical interests, he has sought to use new information and techniques of basic science to develop new treatment approaches for disorders of the brain and spinal cord. Dr. Oldfield is former chairman of the Editorial Board of the Journal of Neurosurgery. In 1995, he was awarded the Grass Medal from the Society of Neurological Surgeons and in 1999 he received the Farber Award of the American Association of Neurology Surgeons.

Presentation

Pathogenesis of Syringomyelia: Implications for Treatment

The pathophysiology underlying the development and origin of syringomyelia have been controversial, to some extent because of limited physiological information. Recent investigations using anatomic and cine MRI combined with intraoperative ultrasound (IOUS) in patients with syringomyelia associated with a Chiari I malformation of the cerebellar tonsils suggest that syringomyelia may result from occlusion of the subarachnoid space (SAS) at the foramen magnum by limiting the free pulsatile movement of CSF between the cranial and spinal SAS, partial entrapment of the CSF in the spinal SAS, and excess pulsatile pressure waves in the spinal SAS. To investigate this further, we performed a clinical protocol in which clinical assessment, anatomic and cine MRI, preoperative pressures measured simultaneously from the syrinx and the cervical and lumbar SAS at rest and with Valsalva and Queckenstedt maneuvers, intraoperative pressure measurements from the same sites (and a cerebral ventricle for the intraoperative component of the study) combined with IOUS monitoring of the spinal cord, syrinx, and tonsils, and postoperative MRI and pressure testing similar to the preoperative testing was performed. The pressure waves in the syrinx and SAS at the various sites were recorded digitally and the cine MRI and IOUS were related to the cardiac cycle (EKG) so that the physiological and anatomic changes that occur over the course of the cardiac cycle could be related and compared. The results, which confirm the hypothesis of the study, and their clinical significance will be presented and discussed in relation to other existing theories and in relation to other types of syringomyelia.

Physical Medicine and Rehabilitation Research Day 2003

PM&R Resident Presentations (Plans)

Comparison of Oral Sildenafil and Penile Injections in the Treatment of Erectile Dysfunction in Patients with Spinal Cord Injury

Presenter: Fernando Branco, M.D.

Departmental Affiliations: University of Missouri, University of Kentucky

Sexual dysfunction is common among people with chronic illness and disability. It may occur in up to 75% of men after traumatic Spinal Cord Injury (SCI) (Stone, 1987). Erectile Dysfunction (ED) is a common complication of spinal cord injury. These patients have been the subjects of several studies due to mostly intact cognition and young age of injury. Erectile dysfunction is defined as the persistent inability to attain or maintain penile erection sufficient for sexual intercourse. Different therapeutic approaches have been used that included Sildenafil and Penile Injections. Studies have been done to evaluate the efficacy of both methods. None, to my knowledge, has compared them. **Objective:** This study will compare oral Sildenafil (Viagra) with Caverject (Penile Injections). Subjects will be tested with both methods and a direct comparison will be made. **Hypothesis:** It will be tested if Viagra has better, the same or worse results than Penile Injections for the treatment of Erectile Dysfunction in Spinal Cord Injury patients. Viagra is more effective for psychogenic erectile dysfunction, while penile injections will have better results with neurogenic dysfunction.

Key Words: *Erectile Dysfunction, Spinal Cord Injury, Viagra, Caverject*

Exploring Sleep Quality in People with Fibromyalgia: Review and Follow-Up (Plan).

Presenter: Melinda Hayes, M.D.

Collaborators: John F. Wilson, Ph.D.

Departmental Affiliations: Physical Medicine and Rehabilitation, Behavioral Science

Problem: Fibromyalgia is diagnosed by at least three months of widespread pain with reproducible tender points bilaterally above and below the waist. The chronic pain syndrome is characterized by morning stiffness, fatigue, and sleep disturbances, as well as variable other symptoms. Chronic pain initiates a vicious cycle resulting in difficulty initiating and maintaining sleep, and non-restorative sleep in turn exacerbates chronic pain symptoms. The purpose of this study is to review an existing database of people with fibromyalgia, focusing on aspects of sleep, and to design and execute a follow-up study four years after the original collection of data. **Hypothesis:** On a four-year follow-up study, people with fibromyalgia who report fewer sleep disturbances will have stable or improved pain symptoms compared with people who endorse more sleep disturbances. **Aim:** To determine the correlation between sleep quality and pain quality in a group of people with fibromyalgia at baseline and at follow-up four years after the initial study. **Methods:** In 1999, data was collected from 50 people who met the diagnostic criteria for fibromyalgia. This database will be used as the baseline. The subjects will be re-contacted to repeat selected questions regarding sleep and pain symptoms as well as to answer questions to gauge sleep hygiene and techniques used to facilitate sleep. Data will be analyzed to determine associations and statistical significance. **Relevance:** Exploring the ways in which people with fibromyalgia achieve restorative sleep will give clinicians clues to helping people with chronic pain stabilize or improve their symptoms

Key Words: *Fibromyalgia, Sleep, Chronic pain syndromes*

Physical Medicine and Rehabilitation Research Day 2003

PM&R Resident Presentations (Plans)

The Efficacy and Safety of Exelon in Patients with Traumatic Brain Injury (TBI) with Persistent Cognitive Deficits

Presenter: Emese Simon, M.D.

Collaborators: Gerald Klim, D.O.

Objective: This is a 12-week, prospective, randomized, double blind, placebo-controlled, multi-center study of the safety and efficacy of Exelon 3 to 6 mg/day in patients with TBI with persistent cognitive deficits. Approximately 150 patients will equally be randomized to receive Exelon or placebo. **Method:** Patients will be individuals living in the community who are 18-50 years old and have history of previously documented head injury. (A documented history of previous head trauma will be required). Inclusion criteria will therefore be: age 18-50 years old, male or female, documented history of previous head trauma, at least 12 months post brain injury with current persistent cognitive deficit. Patients with diagnosis of active, uncontrolled peptic ulcer, current unstable pulmonary or cardiovascular condition, large intraparenchymal hemorrhage, history of major brain surgery, penetrating brain injury, previous exposure to Exelon or other cholinesterase inhibitors will be excluded. There will be pre-study assessment of cognitive and memory status as well as baseline laboratory studies with a complete history and physical, as well as neurological examination. At four, eight and twelve weeks, patients' cognitive status, as well as their physical parameters, will be re-evaluated. Safety and tolerability assessment will consist of monitoring and recording adverse events, monitoring hematology, chemistry and urinalysis with periodic measurement of vital signs and EKG, as well as physical and neurological examination. **Relevance:** The study will be followed by one primary efficacy assessment consisting of measured cognitive improvement on either CANTAB RVIP subtest or on HVLT at screening. Final conclusion regarding the safety and efficacy of Exelon will be drawn based on the summary and analysis of the study results.

Key Words: *Traumatic brain injury, Persistent cognitive deficit, Exelon*

The H Reflex and F Wave as Objective Measures of Spinal Cord Stimulation

Presenter: D. Paul Harries, M.D.

Collaborator: R. Nickerson, M.D.

Problem: Spinal cord stimulation (SCS) is increasingly being used to treat refractory neuropathic pain. SCS is felt to work in a multifactorial fashion with some descending and some ascending input on pain pathways. SCS requires implantation of a percutaneous spinal epidural lead with four electrodes at its tip and a subcutaneous pulse generator. Correct placement of a lead can take several hours while the area of stimulation is mapped. The patient is awake for the entire procedure and their concentration tends to fluctuate, reducing the likelihood of optimal electrode placement. There is currently no neurophysiological measure of SCS to assist in lead placement. We aim to indirectly measure the descending activity in the spinal cord using the H-reflex and F-wave. Small studies performed in the 1970s and 1980s demonstrated that the H-reflex and F-wave are affected by SCS. These studies have not been repeated with more effective modern day SCS equipment. **Purpose:** To determine whether the H-reflex and F-wave can be used as clinical measures of the effectiveness of SCS. **Methods:** Twenty consecutive patients due to undergo SCS implant for chronic neuropathic pain will have preoperative H-reflex and F-wave studies performed. The studies will be repeated in the postoperative period with SCS turned on and off. Pain scores will be recorded prior to each study. The effect of SCS upon latency and amplitude will be calculated. **Relevance:** Development of a reliable neurophysiological measure of spinal cord stimulation may aid in SCS lead placement. Additional benefits may include assisting in the optimal selection of electrical stimulation parameters and obtaining a better understanding of how SCS works.

Key Words: *Spinal cord stimulation, H-Reflex, F-Wave*

Physical Medicine and Rehabilitation Research Day 2003

PM&R Resident Presentations (Plans)

Quality of Life Assessment of Non-ambulatory Lower Limb Amputees Versus that of Ambulatory Lower Limb Amputees and of the General Non-Amputee Population

Presenter: Kathleen C. Dy, M.D.

Collaborator: Mei Melvin Hu, M.D., Ph.D

Departmental Affiliations: Dept of PM&R, University of Kentucky
Cardinal Hill Rehabilitation Hospital, Amputee Program

Objective: The number of lower extremity amputations has been rising slowly throughout the years. Successful outcomes for amputations have been measured by prosthetic use and the ability to ambulate. The objective of this study is to determine the quality of life among patients who have successfully regained the function of ambulation with the use of a lower limb prosthesis as compared to the quality of life among lower limb amputees who are non-ambulatory. **Design:** A cross-sectional study, mailed questionnaire. **Methods:** A questionnaire (SF-36) will be mailed to each subject and responses will be included in the study. Follow-up phone calls will be made for subjects who failed to respond by mail. Amputees will be selected from a list of amputee patients who were seen and evaluated at Cardinal Hill Rehabilitation Hospital. A healthy spouse or family member who is not an amputee will be given the same questionnaire to serve as control. Main outcome measures include statistical analysis of available responses to the SF-36 questionnaire. This scale assesses eight health concepts, including limitations in physical and social activities because of health or emotional problems, pain, vitality, general mental health and general health perceptions. Scoring will be based on the SF-36 Scoring Manual. These data will provide information as to whether patients should be strongly considered for, and encouraged to, use lower limb prostheses after amputation.

Key Words: *Lower limb amputation, quality of life, prosthesis, SF-36*

Recovery of Cardiovascular Control After Spinal Cord Injury

Presenter: Gang Li, M.D.

Collaborators: Joyce Evans, MS, James Abbas, PhD, Charles Knapp, PhD, Robert Taylor, MD, PhD, Susan McDowell, MD, David Gater, MD, David Randall, PhD, David Brown, PhD, Robert Nickerson, MD

Problem: The effects of spinal cord injury (SCI) are loss of not only motor function due to damage to the somatic nervous system, but also many other physiological processes as a result of damage to the autonomic nervous system, such as cardiovascular (CV) regulation due to damage to neurons innervating the heart and the systemic vasculature. Impairment of CV system (Orthostatic intolerance, etc.) limits the patient's participation in in-patient rehab, extends the initial in-patient stay, has profound impact on patient's health, quality of life and opportunities of employment. There are very little data available regarding several key issues in CV control that could be used to develop improved rehab therapies. The effects of SCI on the regulatory processes that control the heart and the vasculature are poorly understood, especially regarding the effects of level of injury and the adaptive processes that occur in the months following injury. **Aim:** To characterize the changes in CV control that occur in the months following SCI, to provide insight into the mechanisms responsible for CV regulation in SCI and provide important baseline data for future assessment of experimental treatment options. **Methods:** Twenty-four subjects (age of 18-35) with C/T SCI of 1-2 week duration without contraindication for head-up tilt/monitoring devices attachment will be in the study. Several hemodynamic (BP/CO/SV/EF) and hormonal (epinephrine/PRA/PPP) measurements, while the subject undergoes head-up tilt using a standard tilt table, will be collected and analyzed, using three factor ANOVA. A control group of eight able-bodied individuals will be in the study as well.

Key Words: *Spinal cord injury, tilt table, cardiovascular regulation, orthostatic intolerance*

Physical Medicine and Rehabilitation Research Day 2003

PM&R Resident Presentations (Projects)

Ambulatory Status of Patients With Arthrogyrosis Following Lower Extremity Surgery

Presenter: George A. Bitting, M.D., Dr. Vish Talwalkar

Twenty nine patients with Arthrogyrosis multiplex congenita who were seen at the Lexington, KY Shriners hospital from January, 1980 through December, 2001 were reviewed. Fifteen patients were found to have had lower extremity surgery. Ambulatory status of these patients were evaluated (patients could ambulate household distances or greater). Results showed 67% of these patients were ambulatory. Patients with hip procedures, 72% were ambulatory on follow-up evaluation. Patients with club foot procedures on follow-up were 57% ambulatory. This was a retrospective follow-up study using the Hoffer Bullock method and Gillette Functional Assessment Questionnaire.

Key Words: *Arthrogyrosis multiplex congenital, Hoffer Bullock method, Gillette Functional Assessment*

X-Linked Hypophosphatemic Rickets in Children: Gender-Associated Response of Calcitriol and Phosphate Supplementation on Linear Growth

Presenter: Melinda Hayes, M.D.

Collaborator: Richard J. Mier, M.D.

Problem: X-linked hypophosphatemia (XLH) is the syndrome of hereditary vitamin D-resistant rickets characterized by short stature, leg bowing, and long bone changes. The current standard-of-care for children is calcitriol [1,25(OH)₂D₃] and phosphate supplementation, a regimen repeatedly shown to positively affect linear growth. Although the degree of serum phosphate depression is comparable in boys and girls, severity of clinical symptoms generally has been thought to be less severe in girls than in boys. Limited studies have shown improvement in height disproportionately greater in girls than in boys in response to medical management. **Hypothesis:** In children with XLH treated with calcitriol and phosphate supplementation, statistical significance exists between height-for-age z-scores of girls versus boys. **Methods:** The clinical records of 20 children (10 boys, 10 girls) diagnosed with XLH who were treated and followed for at least 36 months were examined retrospectively. Patients were divided by gender, age-matched for onset of treatment. Data collected included age at onset of treatment, duration of treatment (to date), height-for-age z-score at onset of treatment, current height-for-age z-score, type(s) of treatment, and complications of treatment. **Relevance:** Reproducible evidence that gender affects linear growth in response to medical treatment for XLH may guide future diagnosis and treatment strategies.

Key Words: *X-linked hypophosphatemia, Rickets, Calcitriol, Phosphate*

Physical Medicine and Rehabilitation Research Day 2003

PM&R Resident Presentations (Projects)

Physiologic Bowlegs and Weight: Is There a Relationship?

Presenter: Markus Niederwanger

Collaborator: Richard Mier

Departmental Affiliation: Shriners Hospital for Children, Lexington, KY

Background: Physiologic bowing is a consequence of normal growth and development in children. It resolves spontaneously and has a favorable natural history. Thus far, no risk factors associated with physiologic bowlegs have been reported in the literature. Blount's disease (infantile tibia vara) can be difficult to differentiate from physiologic bowing. Obesity is known to be a risk factor for Blount's disease. **Purpose:** To evaluate if there is a relationship between physiologic bowlegs and weight. **Materials/Methods:** Retrospective review of all cases diagnosed with "physiologic bowlegs" or "genu varum" at the Shriners Hospital Lexington from 1995 to 2000. Inclusion criteria were age six months to three years and exclusion of non-physiologic bowing. Charts were evaluated for weight, stature, age, sex and duration of follow-up. Z-score values were obtained from published CDC Growth Charts. Z-score values were calculated for weight-for-stature, weight-for-age, and stature-for-age. Paired t-test and ANOVA methods were used for statistical analysis. **Results:** Eighty-six cases were in the database. Seventy-five met the inclusion criteria. Eight cases were excluded because weight or stature was not recorded and three cases were excluded due to the diagnosis of non-physiologic bowlegs during the follow-up period. (One case was diagnosed with X-linked-hypophosphatemia and two with Blount's disease on follow-up). Forty-five were male, 30 female, mean age 19 months (6 to 35 months), mean height 81.7 cm (68 to 105 cm). Forty-seven had follow-up and 28 were without follow-up. Z-scores for weight-for-stature and for weight-for-age were significantly increased compared to the reference pediatric population ($p < 0.0001$). Z-score for stature-for-age was not significantly different ($p = 0.63$). **Conclusion:** Children with physiologic bowlegs in this study showed significant overweight. **Discussion:** There are no risk factors reported for physiologic bowing in the literature. This study suggests an association between overweight and physiologic bowing. Three cases originally diagnosed with physiologic bowlegs were later diagnosed with non-physiologic bowing.

Key Words: *Physiologic bowlegs, weight*

Pre-op vs. Post-op Outcomes of Selective Dorsal Rhizotomy

Presenter: Herbert Villaflores

Objective: Selective Dorsal Rhizotomy (SDR) is one of the definitive ways to manage increased tone in the lower extremities secondary to spasticity. **Methods and Measures:** A study of 26 pediatric patients with cerebral palsy was performed to determine the effects of SDR. Pre-operative data was compared to post-operative data using the following outcome measures: 1) Tone (via the Modified Ashworth Score – M.A.S.); 2) Active and Passive Range of Motion; 3) Gross Motor Function Measure (GMFM); and 4) Gait analysis with two-dimensional and three-dimensional methods. **Results:** The study suggested that SDR was beneficial in the majority of the outcomes measured. SDR was found to demonstrate decreased tone with increases in active and passive range of motion. GMFM was found to be improved for each dimensional score leading to an overall improvement in the total GMFM score. For gait, SDR was inconclusive when comparing pre-operative to post-operative data.

Key Words: *Selected Dorsal Rhizotomy, Tone, Spasticity*

Physical Medicine and Rehabilitation Research Day 2003

Student Presentations (Projects)

Physical Therapy Outcomes of Post-Rotator Cuff Surgery Patients: A Prospective Study

Presenters: Jennifer Hayden, ATC, Amberly Leslie and Sarah Lochow

Collaborators: Tim Uhl, PhD, PT, ATC and Janice Kuperstein, PT, MSED

Objective: To examine the functional and financial outcomes of post-operative rotator cuff surgical outcomes of patients as it relates to physical therapy intervention. **Methods and Measures:** Eight patients (four men and four women) with an average age of 44.9 who had a repair of the rotator cuff between 2001 and 2002 were followed for nine months post-operatively. Each subject filled out a general information sheet prior to surgery, Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire and the Rand-36. The DASH and Rand-36 were filled out pre-operatively and post-operatively at one, three, six and nine months. The subject's physical therapist provided information regarding services rendered and number of visits. **Results:** The DASH scores decreased by an average of 12 points between the post-operative time periods of one to three months, three to six months and six to nine months, indicating improvement in function. The Rand-36 measures of physical functioning, role limitations due to physical health and pain improved by an average of 14, 37 and 18, respectively, between the third and sixth month post-operatively, which represented the greatest amount of change. From a cost-effectiveness perspective, an average increase of 1.92 in the DASH score between one to three months post-operatively was seen for every \$100 spent on physical therapy services. **Conclusions:** Functional outcomes and pain were improved post-operative rotator cuff surgery. Due to the limitations of this study, a conclusion cannot be made regarding the nature of these improvements in respect to physical therapy. From the results, it is reasonable to state that the physical therapists discharged the patients at an appropriate time when the significant change in function occurred.

Key Words: *Rotator cuff surgery, physical therapy, DASH, Rand-36, cost effectiveness*

Physical Medicine and Rehabilitation Research Day 2003

POSTERS

Is the Functional Independence Measure the Best Indicator of Functional Independence in the Traumatic Brain Injury Population: A Review of the Literature

Presenter: Erica Simpkins, Staff Physical Therapist at Cardinal Hill Rehabilitation Hospital

Key Words: *Functional Outcomes, Traumatic Brain Injury, Functional Independence Measure*

The Effects of Therapeutic Massage on Resting Muscle Tone in Individuals with Multiple Sclerosis: A Pilot Study

Presenter: Jennifer Mount

Collaborators: Ashley Adams, Tiffany Zimmerer

Departmental Affiliations: Third year Physical Therapy students at the University of Kentucky

Background and Purpose: The intent of the study was to examine the effects of therapeutic massage on resting muscle tone in individuals with Multiple Sclerosis (MS). Our hypothesis was that there would be a gradual decrease in muscle tone as determined by objective measurements by the Myotonometer™. MS is an autoimmune disease characterized by destruction of myelin in the brain and spinal cord. One of the most debilitating aspects of MS is spasticity, defined as “a velocity-dependent increase in muscle tone.” The Myotonometer offers an objective measure of muscle tone. **Subjects and Methods:** Individuals with MS completed a personal spasticity questionnaire to determine location of greatest spasticity. The Experimental Group (n=5) received therapeutic massage two times a week for three weeks. A pre- and post-massage reading of muscle tone was taken. **Results:** Repeated measures ANOVA was used to analyze the data followed by post-hoc analysis. Preliminary analysis showed no interaction between factors. The only statistically significant difference was found between pre- and post-massage measurements of muscle tone in the right biceps femoris with a p-value of 0.0097 (significance at $p \leq 0.05$). **Discussion and Conclusion:** Our findings do not support our hypothesis for using therapeutic massage to reduce muscle tone in individuals with MS. However, subjective reports indicated an increase in ease of performing daily tasks. Due to the lack of statistical support, we cannot advocate the use of therapeutic massage as a primary intervention for decreasing resting muscle tone in individuals with MS until further studies are completed.

Key Words: *Spasticity, MS, massage, Myotonometer*

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