



10th Annual
Research Day

June 18, 1998

**University of Kentucky
Department of
Physical Medicine & Rehabilitation**

University of Kentucky Department of Physical Medicine & Rehabilitation 10th Annual Research Day Agenda

18 June, 1998

Mining & Minerals Resources Building, Room 102
University of Kentucky

09:15 – 09:25 am	<i>Opening Remarks</i>
09:25 – 09:40 am	Ayman Hadhoud, MD
09:40 – 10:00 am	Robert Taylor, MD, Ph.D.
10:00 – 10:15 am	Courtney Hogendorn, MD
10:15 – 10:35 am	John Ehrich, D.O.
10:35 – 10:50 am	Carmela Osborne, D.O.
10:50 – 11:05 am	Terry Troutt, MD
11:05 – 11:20 am	Sara Salles, MD
11:20 – 11:40 am	Jon Wilson, D.O.
11:40 – 12:00 Noon	Christopher Siodlarz, D.O.
12:00 – 12:30 pm	<i>Lunch Buffet</i>
12:30 – 1:30 pm	“Clinical Investigation: An Approach by Example” William A. Bauman, MD Director, Spinal Cord Damage Research Center Professor, Medicine & Rehabilitation Medicine Mount Sinai School of Medicine, New York, NY Ann M. Spungen, Ed.D. Research Coordinator, Spinal Cord Damage Research Center Professor, Medicine & Rehabilitation Medicine Mount Sinai School of Medicine, New York, NY
1:30 – 2:00 pm	Faculty Poster Presentations: Discussion
2:00 – 2:15 pm	Awards
2:15 pm	Adjournment

Physical Medicine & Rehabilitation Research Day Abstracts 1998

9:25 – 9:40 am

Effect of Soft Tissue Releases on Gait velocity, Cadence and Stride in CP Patients

Presenter: Ayman Hadhoud, M.D.

Collaborators: Susan McDowell, M.D.

Patients with C.P undergo several surgeries either to improve their function, capacity to perform certain tasks or to improve their ambulation abilities. The purpose of this study is to determine the effect of multiple tissue releases on gait velocity, cadence, stride and general quality of their gait, which is of a major concern to the patient and his family as well as the health care provider. Retrospectively, we looked at cerebral palsy patients with spastic diplegia, who underwent soft tissue releases and have had records of pre and post operative gait lab analysis. Very small number of patients have met the criteria, However several other patients have had preoperative gait lab analysis and are scheduled to have the post operative gait analysis in the near future. Those patients will be included in the study to enlarge the size of the study. The temporospatial components Including Velocity, Cadence and Stride will be compared and the conclusion will be done according to the findings. Despite the fact that C.P is an upper motor neurone dysfunction which makes it difficult to expect the outcome of these surgeries, this study may enable the surgeon to relatively expect which temporospatial component will significantly be impacted by the surgery and if any modifications should be done in the future to control the outcome of the surgery.

9:40 – 10:00 am

Back Pain in Idiopathic Scoliosis: Prevalence and Significance

Presenter: Robert F. Taylor, M.D., Ph.D.

Collaborators: B. C. Carney, M.D. and Robert Moore, Ph.D.

A retrospective study of 109 children and adolescents was performed in order to determine the prevalence of back pain associated with the diagnosis of idiopathic scoliosis. Idiopathic scoliosis in this population was seen most often in the age group 11-15 years (78.7%) and 6-10 years (15.7%). Our study found a preponderance of females (84.4%) compared to (15.6%) males with idiopathic scoliosis. The mean age at initial presentation was 12 years and 5 months. At the time of presentation, 35.8% of patients reported a history of back pain. Almost all pain was localized to the lower lumbar region but was variable with respect to type, duration and intensity. The presence of back pain was most often reported in those children between the ages of 11-15 (79.5%) and in those older than 15 (17.9%). The occurrence of back pain in the very young (ages 0-5 years) was zero. Overall, the occurrence of back pain in females with idiopathic scoliosis was much higher than males (43.9%) and only 2 individuals reported some history of injury. Within the female sample, 38 were post-menarchal (41.3%) and of those 19 (50%) had back pain. The proportion of premenarchal females reporting back pain was 37%. There were 3 reported cases (17.6%) of back pain in the boys seen with idiopathic scoliosis and none had a history of back injury. The average Cobb angle was not different between those children with and those without reports of back pain. The direction of the scoliotic curve was not correlated with the presence of back pain (36.7% left curves and 35.4% right curves). There was no predictive value to the presence of back pain as to the need for bracing or surgery. We conclude that a 35.8% prevalence rate of back pain in non-operative idiopathic scoliosis is sufficient enough to warrant offering treatment such as therapeutic exercise, NSAIDs when appropriate, and perhaps behavior modification techniques. *Key Words: Idiopathic Scoliosis, Back Pain, Children*

Physical Medicine & Rehabilitation Research Day Abstracts 1998 (Continued)

10:00 – 10:15 am

Lower Extremity Blood Pressure Measure in the Spinal Cord Injured Population

Presenter: Courtney T. Hogendorn, M.D.

Collaborator: David R. Gater, M.D., Ph.D.

The reliability of lower extremity blood pressure measurements in the spinal cord injured (SCI) population has not been studied. This is important as the interest in the study of the effects of exercise in the SCI population grows. A commonly used method for controlled exercise regimen is the upper extremity crank ergometer. As has been previously demonstrated, upper extremity blood pressure measurement in or around the time of exercise with this method results in false readings. The reliability of lower extremity blood pressure measurement has been demonstrated in able-bodied population, however it has not been studied in the SCI population. We propose to study the reliability of comparing lower extremity versus upper extremity blood measurements in SCI patients. We plan to measure blood pressures in all patients that are admitted to a SCI rehabilitation facility. Measurements are to be taken by the investigator with mercury sphygmomanometer, aneroid sphygmomanometer and automatic sphygmomanometer in patients who have been at rest in a seated position. Measurements are to be taken in both arms and both legs using all three methods. We will also record pertinent medical information from the chart. Our goal will be to demonstrate that lower extremity blood pressure measurements in the SCI population are reliable. *Key Words: Blood Pressure, Spinal Cord Injury, Measurement*

10:15 – 10:35 am

The Role of Nutrition in the Functional Outcome and Length of Stay of Geriatric Patients With Hip Fractures on a General Rehabilitation Unit

Presenter: Jon J. Ehrich, D.O.

Collaborators: William J. Lester, M.D.

This retrospective study is to determine the association between the nutritional status of inpatients with hip fractures and their overall discharge level of mobility as well as the total number of days needed to achieve this goal. The outcome measures were based on FIM scores by a physical therapist in the areas of ambulation, bed mobility, and transfers. Baseline labs upon admission included both serum albumin and total protein. Body weights were recorded at day 1 and prior to the last day. The population consisted of 123 randomly selected patients and each chart was reviewed to collect data. A malnutrition score was derived by the summation of the abnormal parameters for each patient. Criteria for nutritional status were then categorized to prognosticate the effect of nutrition on functional outcome, which is often related to LOS in the rehab hospital. *Key Words: Nutrition, Hip Fractures, Mobility, Rehab LOS*

Physical Medicine & Rehabilitation Research Day Abstracts 1998 (Continued)

10:35 – 10:50 am

Does Educational Intervention Affect Patient Compliance and Outcome in Acute Low Back Pain?

Presenter: Carmela Osborne, M.D.

Collaborator: David Musick, Ph.D.

The purpose of this project is to determine if educational intervention will affect the outcome in acute low back pain patients receiving physical therapy. The patient population will be patients who experience acute low back pain not relieved by first line therapy (medications, rest) who are referred for physical therapy. Our patient population will include work-related injury as well as other acute low back pain. Exclusionary criteria will include previous history of back pain requiring treatment, chronic back pain and patients with surgical diagnoses. The intervention will be at the first physical therapy visit. Patients will be randomized to receive the educational intervention in the form of a booklet or pamphlet which will be explained by the therapist. Patients who do not receive the educational intervention will proceed with therapy. All patients may also undergo psychological analysis for indicators of chronic pain behavior. Intervention success will be assessed by follow-up survey and will be geared toward return to function rather than exclusively toward pain relief. *Key Words: Education, Acute Low Back Pain, Function*

10:50 – 11:05 am

A Double Blind, Placebo Controlled, Parallel Group, Randomized Study Evaluating The Effect of Regrenex (Becaplermin) Gel Versus Placebo Gel In The Treatment of Full-Thickness, Pressure Ulcers

Presenter: Terry L. Troutt, M.D.

Collaborators: David R. Gater, Jr., MD, Ph.D., Richard Salcido, M.D., James Donofrio, Ph.D., and Mary Margaret Smith, R.N.

Problem: A 1991 market survey estimated the cost of decubitus ulcerations (DU) treatment and hospital stay to be near \$6 billion/year. The cost per decubitus ranged from \$2,000-\$40,000. Current treatments include alginates, foams, gauze, hydrocolloids, hydrogels, transparent films, wound fillers, wound pouches, and surgery. The purpose of this study is to identify Platelet Derived Growth Factor (PDGF) as an effective treatment method for DU. **Hypothesis:** PDGF (Regrenex) when applied topically in a gel base to decubitus ulcerations will result in healing of the ulcer. **Methods:** A multicenter double blind, placebo controlled parallel group randomized study will apply a PDGF gel based coating to stage III or IV DU every morning. This will be followed by an evening normal saline dressing change. This group will be compared to a control group given a placebo gel base applied utilizing the same protocol. Each week the length, width, and depth of the DU will be recorded along with Jeltrate volume mold measurements. The area of the DU will be measured using acetate tracings and planimetry. All data will be recorded for a total of 16 weeks or until wound healing occurs. **Results:** Sixty patients were screened but only one met inclusion criteria. For this patient the DU size changed from 6.0cm L x 4.0cm W x 0.8cm D to 5.5cm L x 3.5cm W x 0.5cm D. **Relevance:** For this patient, there was a clinical improvement of the DU size. The statistical significance of this improvement remains to be determined in the full-scale clinical trial. *Key Words: Decubitus Ulcerations, Platelet Derived Growth Factor, Treatment*

Physical Medicine & Rehabilitation Research Day Abstracts 1998 (Continued)

11:05 – 11:20 am

An Open-Label Study to Assess the Long-Term Safety of Zanaflex (Tizanidine HCL) in Patients Treated With 28 to 36 mg/day

Presenter: Sara S. Salles, D.O.

Collaborators: Susan McDowell, M.D., David R. Gater, Jr., MD, Ph.D., Randall Kindler, P.A.

Problem: Spasticity is a common development in patients with UMN lesions such as spinal cord injury or multiple sclerosis. Multiple medications have been developed for the treatment of spasticity. Since the 1980's, Zanaflex (Tizanidine) has most recently been FDA approved as an antispasmodic medication for the use in the above patients. **Hypothesis:** Patients will be able to tolerate 28-36 mg/day without any adverse side effects. **Aim:** Post marketing study to demonstrate the safety and effectiveness of higher doses (28-36 mg/day) of Zanaflex, specifically to monitor the drop in blood pressure with changes in position (orthostatic hypotension). **Methods:** Spinal cord injury and multiple sclerosis patients with at least three months of spasticity to be included in a multicenter, open-label, prospective randomized study with a concomitant comparison group. The patients are to be titrated on increasing doses of Zanaflex (28-36 mg/day) with scheduled follow-up to include vital sign monitoring, spasm/clonus chart review and visual analog scale review. **Relevance:** To determine the maximal dosing of Zanaflex without adverse effects allowing optimal control thus decreasing the potential for medical complications related to uncontrolled spasticity. *Key Words: Zanaflex, Spasticity, Orthostatic Hypotension*

11:20 – 11:40 am

Functional Independence with Bladder Management in Tetraplegia: a Retrospective Study

Presenter: Jon J. Wilson, D.O.

Collaborators: David R. Gater, M.D., Ph.D.

Problem: Literature suggests that many tetraplegic patients are independent with bladder management and that those at or below a C6 level are able to perform self-catheterization. **Hypothesis:** Although C6 tetraplegics have been reported to self-catheterize their bladders, the majority of tetraplegics at this level remain dependent for bladder management. **Aim:** The purpose of this retrospective study was to evaluate the independence level of tetraplegic patients at least six months following injury in regards to bladder management. **Methods:** Sixty-one charts from a free-standing rehabilitation hospital's spinal cord unit were reviewed to determine the relationship between neurologic level, American Spinal Injury Association (ASIA) score, upper extremity motor score (determined from bilateral wrist extensor, finger flexor, and finger abductor strength on a 0-5/5 scale), method of bladder management, and Functional Independence Measure (FIM) score. **Results:** The majority of C6 and C7 tetraplegic patients are dependent with bladder management. Those who were modified independent (FIM=6) with self-catheterization had a bilateral upper extremity motor score of at least 12. **Relevance:** The majority of tetraplegic patients with ASIA A or B impairments were dependent with bladder management. The most common form of bladder management in this population was intermittent catheterization followed by indwelling foley catheter. *Key Words: Tetraplegia; Spinal Cord Injuries; Bladder Management; Functional Independence Measure*

Physical Medicine & Rehabilitation Research Day Abstracts 1998 (Continued)

11:40 – 12:00 Noon

Shoulder Strengthening for Impingement Prophylaxis in Paraplegia

Presenter: Christopher J. Siodlarz, D.O.

Collaborators: David R. Gater, Jr., MD, Ph.D., John A. Nyland, Ed.D., Denise A. Gater, M.S.

Problem: Up to 70% of the Spinal Cord Injured population experiences shoulder pain post-injury. Impingement syndrome is the most common diagnosis. The primary consequences of chronic shoulder pain for the paraplegic is the loss of Independence, i.e. mobility and activities of daily living and an increased need for medical care and hospitalizations. Many studies have recommended the development of prevention and treatment programs for pain syndromes, but to date, few studies have been reported in the literature. **Hypothesis:** The purpose of this study is to provide a structured 12 week progressive resistance scapular stabilization program to yield improvements in strength, range of motion, pain, endurance and to decrease the incidence of shoulder injury. **Methods:** Twenty subjects will be recruited for this randomized controlled prospective study who have spinal cord injuries between T7-L5 complete or incomplete and are at least six months post-injury. We will employ the Wheelchair User's Shoulder Pain Index (WUSPI), standard goniometry techniques for range of motion testing, isokinetic strength testing and fatigue studies using a Cybex II Isokinetic dynamometer with dual channel recorder and a Biodex Upper Extremity Chair. The following statistical analysis will be performed: modified 2x2 factorial experimental design; two-tailed, two sample t-test and statistical significance will be determined at 0.05 level. **Relevance:** If such a program is employed on a national scale, it could significantly reduce the social and financial costs attributed to upper extremity overuse injuries. *Key Words: Rotator Cuff Impingement, Scapular Stabilization, Exercise, Paraplegia*

Physical Medicine & Rehabilitation Research Day Abstracts 1998 (Continued)

Faculty Poster Presentations 1:30 – 2:00 pm

Aerobic Exercise Intervention on CAD Risk Profiles in Spinal Cord Injured Adults

Presenter: David R. Gater, Jr., MD, Ph.D.

Collaborators: J.W. Yates, Ph.D. and Jody Clasey, Ph.D.

Problem: Heart disease is the second leading cause of death in Spinal Cord Injury (SCI), accounting for approximately 22% of all deaths. Coronary Artery Disease (CAD) risks are significantly greater in persons with SCI, largely because of their neuromuscular paralysis and its subsequent impact on activity levels, lipid profiles, glucose tolerance and obesity. The purpose of this pilot investigation is to improve CAD risk profiles, aerobic fitness, and functional independence in persons with chronic spinal cord injury (SCI) through exercise intervention. **Hypothesis:** Despite the disruption in autonomic and central nervous control associated with low cervical and high thoracic spinal cord injury, aerobic exercise of appropriate intensity, duration and frequency will significantly improve CAD risk factors, aerobic fitness and functional abilities. **Aim:** The primary objective of this pilot investigation is to quantify the intensity of aerobic exercise required in cervical and high thoracic SCI to yield significant improvements in CAD risk profiles, aerobic capacity, and functional abilities. **Methods:** SCI persons will be prospectively randomized to a High exercise intensity level 30 minutes/day, 3 days/week for 10 weeks and CAD risk profiles (lipids, glucose tolerance, body fat) as well as functional mobility will be compared (Pre- and Post) to a non-exercising Control group. Afterwards, the Control group will undergo 10-weeks of training, 30 minutes/day 3X weekly at a significantly Lower exercise intensity to compare outcomes with the High intensity group. **Relevance:** Determining appropriate exercise dose parameters including intensity, duration, frequency and exercise progression is essential to the successful exercise prescription and subsequent implementation of exercise protocols in SCI centers across the country. *Key Words: Spinal Cord Injury, Aerobic Exercise, Lipids, Glucose Tolerance*

Control of Posture and Movement Using Electrical Stimulation in Spinal Cord Injured Adults

Presenter: James J. Abbas, Ph.D.

Collaborators: JoAnne Riess, M.S., Susan McDowell, M.D.

Problem: While advances in medical care and assistive technology have improved the outlook for individuals with thoracic level spinal cord injury, functional capabilities are still limited by motor impairments. Several research groups have investigated the use of functional neuromuscular stimulation (FNS) to restore standing function to individuals with thoracic level spinal cord injury. Due to several limitations, however, these efforts have not yet led to widespread clinical use of electrical stimulation systems. This research address one of these limitations: users of existing FNS systems are limited in their ability to perform functions while standing. **Hypothesis:** Our approach to addressing this problem involves a two-stage hypothesis: 1) that adaptive control algorithms can improve the quality of postural control provided by the electrical stimulation system; and 2) that improved postural control does indeed result in enhanced ability to perform functions while standing. **Methods:** We have developed adaptive algorithms to automatically customize stimulation parameters for a particular individual, thus providing an efficient method for 'fitting' the stimulation system to the user. This approach has been evaluated in computer simulation studies using mathematical models and in experiments on human subjects. **Results:** Both the simulation studies and the experimental studies have indicated that the adaptive control system can provide improved control of posture and movement. Future work will focus on determining if the improvements in control will result in an enhanced ability to perform functions while standing. *Key Words: Spinal Cord Injury, Functional Neuromuscular Stimulation, Standing, Adaptive Control.*

Physical Medicine & Rehabilitation Research Day Abstracts 1998 (Continued)

Temperature Effects on Surface Pressure-Induced Changes in Rat Skin Perfusion: Implications in Pressure Ulcer Development

Presenter: James C. Donofrio, Ph.D.

Collaborators: Suryachandra Patel, MD, Charles F. Knapp, Ph.D., Richard Salcido, MD

The effect of varying local skin temperature on surface pressure-induced changes in skin perfusion and deformation were determined in hairless fuzzy rats (13.5 ± 3 months, 474 ± 25 grams). Skin surface pressure was applied by a computer-controlled plunger with corresponding skin deformation measured by a linear variable differential transformer while a laser Doppler flowmeter measured skin perfusion at different surface temperatures. In Protocol I, skin surface perfusion was measured without heating (control, $T=28^{\circ}$ C) and with heating ($T=36^{\circ}$ C) for control (probe just touching skin, 3.7 mmHg) and two different skin surface pressures, 18 mmHg and 73 mmHg. Heating caused perfusion to increase at control and 18 mmHg pressure, but not at 73 mmHg. In Protocol II, skin perfusion was measured with and without heating as in Protocol I, but this time skin surface pressure was increased from 3.7 to 62 mmHg in increments of 3.7 mmHg. For unheated skin, perfusion increased as the skin surface pressure increased from 3.66 to 18 mmHg, but further increases in surface pressure caused a decrease in perfusion until zero perfusion was reached for pressures over 55 mmHg. Heating increased skin perfusion for skin pressures from 3.7 to 18 mmHg, but not for pressures greater than 18 mmHg. After the release of surface pressure, the reactive hyperemia peak of perfusion increased with heating. In Protocol III, where skin deformation (creep and relaxation) was measured during the application of 3.7 and 18 mmHg, heating caused the tissue to be stiffer, allowing less deformation. It was found that for surface pressure below 18 mmHg increasing skin temperature significantly increased skin perfusion and tissue stiffness. The clinical significance of these findings may have relevance in evaluating temperature and pressure effects on skin blood flow and deformation and the efficacy of using temperature as a therapeutic modality in the treatment of pressure ulcers. *Key Words: Temperature Effects, Skin Perfusion, Surface Pressure, Ischemia/Reperfusion, Pressure Ulcer, decubitus, Rat Model*

Effect of a Single Bout of Exercise on 4-h and 24-h Growth Hormone (GH) Release in Young and Older Subjects

Presenter: J. L. Clasey

Collaborators: J. Y. Weltman, R. Nass, S. S. Pezzoli, A. Weltman, M. O. Thorner, M. L. Hartman (University of Virginia, Charlottesville VA)

Exercise is a powerful acute stimulus of GH release but the effect of a single exercise bout on 24-h GH release is unknown. To study the effect of a single (30 min) exercise bout on 4-h and 24 h GH release we studied 9 younger (4 men, 5 women; 24.3 ± 0.8 (SE) yr) and 10 older (5 men, 5 women; 69.2 ± 2.5 yr) subjects. Serum GH was measured every 10-min for 24h in an enhanced sensitivity chemiluminescence assay on two occasions [1 control admission (C Admit) and 1 exercise admission (E Admit)]. During the E Admit subjects performed a single treadmill bout (0800h - 0830h) at 80% of VO_2 Peak. Standardized meals were served at 0900, 1300 and 1800h during each admission. Integrated GH concentrations (IGHC) were calculated using Cluster (V6.01). 24h IGHC and 4h (0800-1200h) IGHC were determined and are presented below (mean \pm SE):

Subjects	4h IGHC (ug L x min)		24h IGHC (ug L x min)	
	C Admit	E Admit	C Admit	E Admit
Younger	187 + 88	359 + 89	2204 + 341	2538 +331
Older	145 + 45	337 + 123	1538 + 330	1518 + 323

2 X 2 ANOVA with repeated measures by admission type revealed: 1) E Admit resulted in similar increases in 4h IGHC independent of age ($p = 0.02$); 2) E Admit 24h IGHC was not significantly different than C Admit 24h IGHC, but 24h IGHC tended to be lower in older subjects ($p=0.06$). We conclude that a single exercise bout increases GH release acutely but does not increase the amount of gH released over 24h. *Key Words: Growth Hormone, Exercise, Elderly*