Rehabilitation Topics

Abstract 9
Calf Muscle Oxygenation During Exercise in Healthy Adults. Alberto Miranda, MD (VA Greater Los Angeles Healthcare System, Los Angeles, CA); Stephen F. Figoni, Ph.D; Vincenzo Castellano, MD; David Hyams, MD; Todd Nguyen, DO; Amber Tyson, MD; et al. e-mail: allmiranda@med.va.gov.
Disclosure: None.
Objective: To develop an exercise test to detect mismatches between calf muscle tissue metabolism and oxygenation. Design: Cross-sectional, quasi-experimental, repeated measures.
Setting: Large urban tertiary care medical center. Participants: 43 healthy adults, aged 20 to 40 years, any ethnicity or gender. Intervention: While in semirecumbent position on a hospital bed, subjects underwent a testing protocol consisting of 7 test stages of 5 minutes each: rest, 0-W active plantarflexion dorsiflexion, rest, 4-W active plantarflexion, rest, 8-W plantarflexion, and rest. The Stressure pedal ergometer was used for resisted calf muscle exercise. Tissue oxygenhemoglobin saturation (StO2 %) was digitally acquired at the medial calf site in 3- to 4-second intervals by near-infrared spectroscopy (Hitchinson InSpectra Tissue Spectrometer model 325). This technique measures StO2 in skin, subcutaneous tissue, and muscle to a depth of 25 mm.
Main Outcome Measures: In all individuals, 0-W exercise and 0-W active plantarflexion during 4- and 8-W exercise.
Results: Wilcoxon signed-rank tests showed that, compared with previous resting baseline, maximum StO2 during 0-W exercise increased significantly (P<0.006; 6%). Also, minimum StO2 during 4- and 8-W exercise decreased significantly (P=0.00; 9% and 13%, respectively). No exercise intolerance was noted for any subject during the protocol. Conclusions: The mild exercise (0-W active plantarflexion and dorsiflexion) improved muscle oxygenation over resting baseline. This test was also able to detect significant tissue desaturation during nonfatiguing, mild-to-moderate intensity, resistive plantarflexion exercise in healthy adults. The degree and duration of the desaturation may provide an objective test for the assessment of physiologic and functional impairment and functional outcome in patients with peripheral vascular disease and claudication. Key Words: Exercise test; Peripheral vascular diseases; Rehabilitation; Spectroscopy.

Abstract 10
From Space to Clinical Reality: Transcranial Electric Stimulation and Amelioration of Orthostatic Hypotension in Animals Exposed to Simulated Microgravity. Andrei Krassioukov, MD; Tsvirkoun, research grant from British Columbia Neurotrauma Fund; Borovik, research grant from British Columbia Neurotrauma Fund; Griffioen, research grant from British Columbia Neurotrauma Fund; Tsvirkoun, research grant from British Columbia Neurotrauma Fund; Griffioen, research grant from British Columbia Neurotrauma Fund.
Disclosure: Krassioukov, research grant from British Columbia Neurotrauma Fund; Borovik, research grant from British Columbia Neurotrauma Fund; Griffioen, research grant from British Columbia Neurotrauma Fund.
Objective: To determine whether a decrease of descending sympathoexcitatory activity from the supraspinal structures could be responsible for orthostatic hypotension (OH). Design: We examined the effect of transcranial direct electrical stimulation on OFF animals induced by exposure to microgravity using a handler unloading model. Setting: Basic science laboratory. Animals: 20 male Wistar rats were tail suspended with the angle between cage floor and rat’s body of approximately 40°. 10 age-matched Wistar rats were used as control. Intervention: Swan appara-atus was inserted freely in the cage, to consume food and water. NASA originally developed this model as a land-based model to study the effects of space flight as it mimics most of the physiological alterations that occur during prolonged space flight or bedrest. Main Outcome Measures: OH was examined by using an orthostatic challenge test (45° head up test for a period of 5 min). Results: TES was applied during the orthostatic challenge test in experimental group but not in control. Results: The orthostatic challenge test in animals exposed to microgravity caused a significant decrease in arterial blood pressure by 18.4% 2.2%. However, use of TES prominently attenuated microgravity-induced OH. In this group of rats, blood pressure drop during orthostasis comprised only 9.5% ±1.8% (P=0.05) and was not significantly different from corresponding value in cage control group (6.9% ±1.1%). Conclusions: TES sufficiently reduces the change in blood pressure during orthostatic challenge test in animals exposed to microgravity. Future clinical experimental study will be directed on examination of effects of TES on OH in volunteers after prolonged bedrest, in individuals with spinal cord injury, and in asthmatics. Key Words: Experimental animals; Microgravity; Orthostatic hypotension; Rehabilitation.

Abstract 11
Mechanical Properties Following Repeated Stretch-Activations in Regenerating Murine Extensor Digitorum Longus Muscles. Chad Markert, PhD; Kerry S. McDonald, PhD; Martin K. Childers, DO, PhD; University of Missouri (Columbia, Columbia, MO); e-mail: childersmk@health.missouri.edu.
Disclosure: None.
Objective: To determine the effects of repeated stretch-activations to regenerating extensor digitorum longus (EDL) muscles in 12-week-old mice to test the hypothesis that the extent of stretch-induced force deficit differs between regenerating EDL muscles compared with controls. Design: Open-label cohort study. Setting: Physiology laboratory. Participants: 12-week-old male mice. Intervention: Cardiotoxin, a cobra venom. Main Outcome Measures: Contractile properties of intact hind limb muscles. Results: At baseline, mean specific tensions was 18.7±2.3mN/mm². Intramuscular cardiacotxin (CT) reduced specific tension to 8.9, 15.5, and 15.8±2mN/mm² measured 1, 2, and 3 weeks later (P<0.05). However, differences were not detected in the extent of stretch-induced force deficits of CT-injected and control muscles. Other mechanical properties (stiffness, time to peak force, half relaxation time) did not differ between regenerating and control EDL muscles.
Conclusion: Our findings in 12-week-old mice do not support the hypothesis that the extent of stretch-induced force deficit differs between regenerating EDL muscles compared with controls.
Key Words: Exercise; Muscle damage; Rehabilitation; Skeletal muscle; Stretch.

Abstract 12
Driving Capacity and Multiple Sclerosis: What Factors Make a Difference? Cognitive? Physical? or Both? Maria T. Schattehuber, PhD (Kessler Medical Rehabilitation Research & Education Corp, West Orange, NJ); Cassandra Fleksher, MA; Jocelyn Ang, BA; Eile P. Elove, MD; Richard Nead, CDRS; David Massler, CDRS; et al. e-mail: mschatterhuber@kessler.org.
Disclosure: None.
Objective: To evaluate the relationship between driving, cognitive, and physical measures in persons with multiple sclerosis (MS). Design: Correlational design. All participants were admin-istered a comprehensive cognitive and physical evaluation and a behind the wheel (BTW) driving evaluation. Setting: Medical rehabilitation research facility. Participants: 39 individuals with documented MS, who were active drivers and between the ages of 18 and 56. Interventions: Not applicable. Main Outcome Measures: Cognitive measures included tests that assessed cognitive domains relevant to driving. Physical measures included the Expanded Disability Status Scale (EDSS), lower- and upper-extremity measures, and vision, (acute, depth perception). Driving measures included performance score of the BTW, number of accidents, and number of violations. Results: Correlational analysis examining cognitive driving and physical measures revealed a significant negative relationship between attention (r=0.40, P<0.05) and vigilance (r=0.33, P=0.05) with rehabilitation accidents. Measures of inhibition (r=0.40, P<0.01) and spatial perception (r=0.35, P<0.05) were significantly related to the number of violations. No significant relationships were found between cognitive measures and performance on the BTW. Corroborative analysis examining physical and driving measures, revealed a significant relationship between upper-extremity function (r=0.38, P<0.05) and peripheral vision (r=0.38, P<0.05) with number of accidents. Periperal vision (r=0.34, P<0.05) and visual acuity (right, r=0.38, P<0.05; left, r=0.45, P=0.01) were also related to number of violations. The global measure of function (r=0.56, P<0.01) and lower-extremity function (r=0.40, P<0.05) were significantly related to the BTW. Conclusions: Cognitive and physical measures were significantly related to long-term outcome measures (ie, accidents and violations). Interestingly, the BTW, the most common method for reevaluation of driving capacity, was associated to only physical measures. These preliminary findings suggest that this commonly recommended test for driving evaluation may be less useful in the MS population and may not capture the cognitive demands of driving. Key Words: Automobile driving; Multiple sclerosis; Rehabilitation; Traffic accidents.

Abstract 13
Effects of Electrotactile Vestibular Substitution: Pilot Study. Yuri Danilov (Wicab Inc, Middleton, WI); Mitchell Tyler; Paul Bach-y-Rita; F. Owen Black, e-mail: y.danilov@wicab.com.
Disclosure: Danilov, Wicab, Inc. employee; Tyler, Wicab, Inc. employee; Bach-y-Rita, Wicab, Inc. employee; Black, Legacy Clinical Research and Technology Center, employee.
Objective: To estimate the efficiency of a sensory substitution as an approach to rehabilitation of bilateral vestibular loss (BVL) patients using a novel noninvasive tongue electrotactile vestibular substitution system (TEVSS) based on functional biologic feedback. Design: Pilot study. Setting: Rehabilitation; Technological MEMS access. 351 P=0.05 with number of tongue display unit, transferring biological feedback of signal from the helmet (position of the head in inertial space) as an dynamic electrotactile stimulation. Participants: 15 subjects with severe to profound ototoxic BVL symptoms were selected. Intervention: A set of physical tasks in various sitting and standing conditions was presented. Training was designed as a set of 3-10 repetitions of sessions. Main Outcome Measures: Ability to perform the stance with closed eyes, standing on a soft base, to walk on uneven or unstable surfaces. A statistically significant decrease of head sway. Improvement in computerized dynamic posturography (CDP) test sensory organization test (SOT) revealed both subjective improvement reports. Results: Acquisition of normal or near to normal postural sway occurred within 3 to 5 days of training. All BVL subjects demonstrated objective improvements during the acquisition. Retention of improved postural stability and transfer to a more stable gait occurred in all subjects and persisted for several days after training. Some, but not all, subjects reported improvement of oscilloska, timitus, sleep, cognitive functions, and fine motor control. Conclusions: Our preliminary results suggest that BVL subjects experience a significant improvement of their balance, posture control, and gait stability following training with TEVSS system. To our knowledge, the acquisition, retention, and transfer of postural stability using inertial electrotactile inputs is an area that requires further research. Key Words: Balance; Rehabilitation; Tongue; Vestibular.

Abstract 14
Step Ergometry for Training and Back Rehabilitation. Raul Marian, L.T.C(P), MC, FS (Walter Reed Army Medical Center, Washington, DC); Tamara Marin Cyhan, RN, BSN; Audrey Chang, Ph.D; Phil Dinauer, MD, e-mail: raul.marian@navamed.army.mil.
Disclosure: None.
Objective: To evaluate which of 2 different step-stairing techniques poses a larger aerobic challenge and to assess if magnetic resonance imaging (MRI) is a valid tool for the evaluation of aerobic muscle use during stair-stairing exercise. Design: Randomized, single-blind, 2-period crossover design. Setting: Tertiary U.S. military medical center. Participants: 24 active duty military beneficiaries, 18 years or older. Intervention: Subjects were assigned to 1 of 2 stair climbing techniques (short stair short steps, ERECT vs. 80% of stair height; arms-supported [LEAN]). Main Outcome Measures: Rate of perceived exertion (RPE), maximum

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