Research Compendium
Published Research • Posters & Presentations • Active Research
2011 - 2014
Established in 1972 by the Wheaton Franciscan Sisters, the award winning Marianjoy Rehabilitation Hospital is located on a 60 acre wooded campus in Wheaton, Illinois.
Marianjoy Rehabilitation Hospital
Achieving Innovative Solutions through Applied Research

Clinicians and researchers at Marianjoy Rehabilitation Hospital work together to continually refine both the art and science of rehabilitation care for the patients they serve. Located in the western suburbs of Chicago, the physicians and associates of Marianjoy provide highly specialized treatment, quality research, and rehabilitation solutions, which enable adults and children to achieve optimal function following a brain injury, stroke, neuromuscular condition, spinal cord injury, neurological disorder, amputation, or a variety of musculoskeletal conditions.

Patients at Marianjoy work with physicians, therapists, nurses, and other associates to achieve the maximum level of functional independence possible by participating in treatment that leverages the latest technology and evidence-based methods. This quality care is delivered with the compassionate spirit customary at Marianjoy.

In addition to being known for the provision of high-quality care, Marianjoy is also a teaching institution supporting a Physical Medicine and Rehabilitation (PM&R) Residency program, in partnership with the Rosalind Franklin University of Medicine and Science. Clinicians at Marianjoy guide the training and development of the next generation of rehabilitation leaders in collaboration with researchers from renowned hospitals, universities, and professional organizations to advance applied research designed to improve overall patient care and achieve the best possible outcomes.

Marianjoy is a not-for-profit hospital and a member of the Wheaton Franciscan Health System, with facilities located in Wisconsin, Iowa, and Illinois. Sponsored by the Wheaton Franciscan Sisters, Wheaton Franciscan Healthcare owns and operates more than 100 health and shelter service organizations in Colorado, Illinois, Iowa, and Wisconsin. Marianjoy and its programs are accredited by the Joint Commission and the Center for Accreditation for Rehabilitation Facilities.
Dedicated to Compassionate Service and Pursuit of Knowledge

Dr. Noel Rao first came to Marianjoy in 1983 as a member of the Rehabilitation Medical Clinic (now the Marianjoy Medical Group). During his tenure at Marianjoy, he has served as a living example of the caring spirit of Marianjoy during his over thirty years of service.

While at Marianjoy, Dr. Rao has worn many hats, serving as the Vice President of Medical Affairs providing administrative and clinical leadership for the hospital and our various clinics; the Director of the Physical Medicine and Rehabilitation (PM&R) medical residency program supporting the specialty education of up-and-coming PM&R physicians; and an active researcher, who has worked diligently to continue to advance both the art and science of rehabilitation care.

In December of 2014, Dr. Rao formally stepped down from his role as Vice President of Medical Affairs at Marianjoy, and we are honored to dedicate this compendium of clinical research in his name. His steady manner, clinical experience, and general wisdom have been calming influences to countless physician colleagues and clinicians over the years as they have worked together to navigate the ever-changing landscape in which care is delivered.

Dr. Rao isn’t retiring completely. He will be maintaining his clinical practice at Marianjoy and, most importantly, continue to serve as the Director of the Medical Residency Program. Dr. Rao’s contributions to Marianjoy cannot be counted, and his impact as a leader, as well as his legacy as a mentor and researcher, will endure.

Please join us in honoring Dr. Rao for his legacy of caring, compassionate, and dedicated service to the advancement of rehabilitation research, education, Marianjoy, and the patients who have benefited from his knowledge and skill.
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Marianjoy’s three year PM&R training program is fully accredited by the Accreditation Council for Graduate Medical Education, and provides clinical experience, educational opportunities and research activities.
INTRODUCTION

On behalf of the clinicians, researchers, and all associates of Marianjoy Rehabilitation Hospital, we are pleased to share this compendium of research activity conducted at Marianjoy from 2011 to 2014. For more than 30 years, researchers at Marianjoy have been working to advance our understanding of Physical Medicine and Rehabilitation (PM&R).

Designed for the physician reader, this comprehensive report is a reflection of our commitment to delivering the best care possible to patients and families, while measuring functional improvement and results. The purpose of this report is to share our research efforts with the entire PM&R community in order to further advance quality rehabilitative care, improve overall patient satisfaction, and demonstrate optimal treatment outcomes. Many associates at Marianjoy have invested countless hours and contributed their unique skills to identify, develop, and improve rehabilitation treatment protocols. The end result of these efforts is an ever-growing library of peer-reviewed publications and presentations delivered at national and international medical conferences.

The research agenda at Marianjoy is driven by the desire to facilitate advances in PM&R services across the continuum of post-acute care. This is done as a complement to the Wheaton Franciscan Health System values of Respect, Integrity, Development, Excellence, and Stewardship. Physicians, residents, therapists, nurses, and administrators at Marianjoy recognize the value of research and the important role it can play in improving the lives of those who have entrusted us with their care.

It is our greatest hope that you find the content of this research compendium informative and useful as you work toward our common mission of providing the best rehabilitation care possible.

Sincerely,

Kathleen Ruroede, PhD, MEd, RN
Vice President, Quality and Research
Marianjoy Rehabilitation Hospital
The Marianjoy Brain Injury Program is CARF accredited and scores in the 90th percentile for patient satisfaction.
The purpose of the study was to investigate the availability of vision and additional support on anticipatory postural adjustments (APAs) and compensatory postural adjustments (CPAs) and their interaction. Eight healthy adults were exposed to external perturbations induced at the shoulder level while standing with or without holding onto a walker in full vision and while blindfolded. Electrical activity of the trunk and leg muscles and center of pressure (COP) displacement were recorded and quantified within the time intervals typical of APAs and CPAs. The results showed that with full vision, there was no difference in both APAs and CPAs in standing with or without holding onto a walker. With subjects holding onto a walker, CPAs while standing blindfolded were comparable to CPAs with full vision; this was seen in changes in the electrical activity of most of the muscles at the individual muscle, joint, and the muscle group levels as well as in COP displacement. The findings suggest that (1) in conditions where vision is available, vision overrules simultaneously available proprioceptive information from the support, (2) while in conditions where vision is not available, proprioceptive information from the support or support itself could be substituted for vision. It is possible to suggest that using a non-stabilizing support could be a valuable strategy to improve postural control when visual information is not available or is compromised.
Two Stages and Three Components of the Postural Preparation to Action


Previous studies of postural preparation to action/perturbation have primarily focused on anticipatory postural adjustments (APAS), the changes in muscle activation levels resulting in the production of net forces and moments of force. We hypothesized that postural preparation to action consists of two stages: (1) Early postural adjustments (EPAs), seen a few hundred ms prior to an expected external perturbation and (2) APAs seen about 100 ms prior to the perturbation. We also hypothesized that each stage consists of three components, anticipatory synergy adjustments seen as changes in covariation of the magnitude of commands to muscle groups (M-modes), changes in averaged across trials levels of muscle activation, and mechanical effects subjected to external perturbations created by a swinging pendulum while standing in a semi-squatting posture. Electrical activity of twelve trunk and leg muscles and displacements of the center of pressure were recorded and analyzed. Principal component analysis was used to identify four M-modes within the space of muscle activations using indices of integrated muscle activation. This analysis was performed twice, over two phases, 400–700 ms prior to the perturbation and over 200 ms just prior to the perturbation. Similar robust results were obtained using the data from both phases. An index of a multi-M-mode synergy stabilizing the center of pressure displacement was computed using the framework of the uncontrolled manifold hypothesis. The results showed high synergy indices during quiet stance. Each of the two stages started with a drop in the synergy index followed by a change in the averaged across trials activation levels in postural muscles. Overall, the results support our main hypothesis on the two stages and three components of the postural preparation to action/perturbation. This is the first study to document anticipatory synergy adjustments in whole-body tasks.

Preliminary Framework for a Familiar Auditory Sensory Training Task (FAST) Provided During Coma Recovery


Since there remains a need to examine the nature of the neural effect and therapeutic efficacy/effectiveness of sensory stimulation provided to persons in states of seriously impaired consciousness, a passive sensory stimulation intervention, referred to as the Familiar Auditory Sensory Training (FAST) protocol, was developed for examination in an ongoing, double-blind, randomized clinical trial (RCT). The FAST protocol is described in this article according to the preliminary framework, which is a synthesis of knowledge regarding principles of plasticity and capabilities of the human brain to automatically and covertly process sensory input. Feasibility issues considered during the development of the intervention are also described. To enable replication of this intervention, we describe procedures to create the intervention and lessons learned regarding the creation process. The potential effect of the intervention is illustrated using functional brain imaging of nondisabled subjects. This illustration also demonstrates the relevance of the rationale for designing the FAST protocol. To put the intervention within the context of the scientific development process, the article culminates with a description of the study design for the ongoing RCT examining the efficacy of the FAST protocol.
Medical Comorbidities in Disorders of Consciousness Patients and their Association with Functional Outcomes


The objective was to identify, for patients in states of seriously impaired consciousness, comorbid conditions present during inpatient rehabilitation and their association with function at one year. Data was abstracted from a prospective cross-sectional observational study with data collection occurring January 1996 through December 2007. The setting was four inpatient rehabilitation facilities in metropolitan areas. The study sample of 68 participants was abstracted from a database of 157 patients remaining in states of seriously impaired consciousness for at least 28 days. The main outcome measure is one-year cognitive, motor, and total Functional Independence Measure (FIM) score. The most common medical complications during inpatient rehabilitation for the study sample are active seizures (46%), spasticity (57%), urinary tract infections (47%), and hydrocephalus with and without shunt (38%). Presence of ≥ 3 medical complications during inpatient rehabilitation, controlling for injury severity, is significantly (P<.05) associated with poorer total FIM and FIM Motor scores one year after injury. The presence of hydrocephalus with and without shunt (rZ -.20, -.21, -.18; P -.15), active seizures (rZ -.31, -.22, -.42), spasticity (rZ -.38, -.28, -.40), and urinary tract infections (rZ -.25, -.24, -.26) were significantly (p<.10) associated with total FIM, FIM cognitive, and FIM Motor scores, respectively. Reported findings indicate that persons in states of seriously impaired consciousness with higher numbers of medical complications during inpatient rehabilitation are more likely to have lower functional levels one year post-injury. The findings indicate that persons with three medical complications during inpatient rehabilitation are at a higher risk for poorer functional outcomes at one year. It is, therefore, prudent to evaluate these patients for indications of these complications during inpatient rehabilitation.

Three Components of Postural Control Associated with Pushing in Symmetrical and Asymmetrical Stance


A number of occupational and leisure activities that involve pushing are performed in symmetrical or asymmetrical stance. The goal of this study was to investigate early postural adjustments (EPAs), anticipatory postural adjustments (APAs), and compensatory postural adjustments (CPAs) during pushing performed while standing. Ten healthy volunteers stood in symmetrical stance (with feet parallel) or in asymmetrical stance (staggered stance with one foot forward) and were instructed to use both hands to push forward the handle of a pendulum attached to the ceiling. Bilateral EMG activity of the trunk and leg muscles and the center of pressure (COP) displacements in the anterior–posterior (AP) and medial–lateral (ML) directions were recorded and analyzed during EPAs, APAs, and CPAs. The EMG activity and the COP displacement were different between the symmetrical and asymmetrical stance conditions. The COP displacements in the ML direction were significantly larger in staggered stance than in symmetrical stance. In staggered stance, the EPAs and APAs in the thigh muscles of the backward leg were significantly larger, and the CPAs were smaller than in the forward leg. There was no difference in the EMG activity of the trunk muscles between the stance conditions. The study outcome confirmed the existence of the three components of postural control (EPAs, APAs, and CPAs) in pushing. Moreover, standing asymmetrically was associated with asymmetrical patterns of EMG activity in the lower extremities reflecting the stance-related postural control during pushing. The study outcome provides a basis for studying postural control during other daily activities involving pushing.
Anticipatory postural adjustments (APAs) play an important role in the performance of many activities requiring the maintenance of vertical posture. However, little is known about how variation in the available visual information affects generation of APAs. The purpose of this study was to investigate the role of different visual cues on APAs. Ten healthy young subjects were exposed to external perturbations induced at the shoulder level in standing while the level of visual information about the forthcoming perturbation was varied. The external perturbations were provided by an aluminum pendulum attached to the ceiling. The visual conditions were: (1) dynamic cues (full vision and high-frequency strobe light), (2) static cues (low-frequency strobe light) and (3) no cues (eyes open in dark room). Electrical activity of the trunk and leg muscles and center of pressure displacements were recorded and quantified within the time intervals typical for APAs. The results showed that significantly larger APAs were generated in conditions with dynamic visual cues as compared to the conditions with static cues (p<0.05). Finally, no APAs were observed in the condition where there was complete absence of any visual cues. Principal component analysis further revealed different muscle coupling patterns in the full vision and high-frequency strobe light conditions. These findings suggest the importance of using appropriate visual cues in the generation of APAs.

Severe brain injury (BI) is a catastrophic event often evolving into a complex chronic and severely disabling condition making activity participation possible only with sustained caregiving. One aspect of building sustainable caregiving is early provision of information about expected outcomes germane to patients and their caregivers. An analysis was conducted to determine whether two levels of independence with expressing needs and ideas one year after a severe BI could be predicted using variables available early after injury. The authors examined a subsample (n = 79) of participants in an outcome study who received repeated neurobehavioral evaluations with the Disorders of Consciousness Scale (DOCS) and who were assessed one year after injury with the Functional Independence Measures (FIM). Explanatory variables included DOCS measures, patient characteristics, coexisting conditions, and interventions. The outcome is measured with the FIM Expression item. Optimal data analysis was used to construct multivariate classification tree models. The 2nd (p= .004) DOCS visual measure and seizure (p =.004) entered the final model providing 79% accuracy in classifying more or less independence with expressing needs and ideas at one year. The model will correctly identify 78% of future severe BI survivors who will have more independence and 82% of persons who will have less independence. For persons incurring severe BI, it is possible to predict, early after injury, more and less independence with expressing needs and ideas one year after injury. This evidence is one contribution to a larger body of evidence needed to enable early caregiver education about recovery expectations in terms of patient functioning relative to caregiving needs, which in turn will help build sustainable caregiving for this population.
Effects of Intrathecal Opioid Administration on Pituitary Function


The objective is to report a case of panhypopituitarism in a patient receiving long-term intrathecal opioids. This is a case study and review of current medical literature. There is a seven year follow-up time. The patient is one adult male clinic patient with pituitary dysfunction. The theory is that intrathecal opioids may lead to pituitary dysfunction. Intrathecal opioid pain management may produce some generalized effects, as well as pituitary hypofunction, as evidenced by this case. This patient experienced simultaneous suppression of multiple anterior pituitary hormones, which persisted with chronic oral opioid therapy following cessation of an intrathecal opioid pump. All hypothalamic pituitary axes, seem potentially vulnerable to therapy with intrathecal opioids. When patients are receiving these medications, symptoms need to be critically evaluated with appropriate laboratory assessments for suspected pituitary dysfunction. Further studies are required in order to create formal recommendations for routine patient surveillance during intrathecal opioid therapy.

The Effect of Aging on Anticipatory Postural Control


The aim of the study was to investigate the differences in anticipatory postural adjustments (APAs) between young and older adults and its effect on subsequent control of posture. Ten healthy older adults and thirteen healthy young adults were exposed to predictable external perturbations using the pendulum impact paradigm. Electromyographic activity of the trunk and leg muscles, the center of pressure (COP), and center of mass (COM) displacements in the anterior–posterior direction were recorded and analyzed during the anticipatory and compensatory postural adjustments (CPAs) phases of postural control. The effect of aging was seen as delayed leg activity and larger compensatory muscle responses in older adults as compared to young adults. Moreover, in spite of such larger reactive responses, older adults were still more unstable, exhibiting larger COP and COM peak displacements after the perturbation than young adults when exposed to similar postural disturbances. Nonetheless, while APAs are impaired in older adults, the ability to recruit muscles anticipatorily is largely preserved; however, due to their smaller magnitudes and delayed onsets, it is likely that their effectiveness in reducing the magnitude of CPAs is smaller. The outcome of the study lends support toward investigating the ways of improving APAs in people with balance impairments due to aging or neurological disorders.
Psychometric Properties of the Disorders of Consciousness Scale


The objective is to provide evidence for psychometric properties of three of the Disorders of Consciousness Scale (DOCS). This is a prospective, observational cohort. The setting included seven rehabilitation facilities. Participants included 174 patients with severe brain injury. The main outcome measure is DOCS. Initial analyses suggested eliminating six items to maximize psychometrics, resulting in the DOCS-25. The 25 items form a unidimensional hierarchy, rating scale categories are ordered, there are no misfit items, and differential item functioning was not found according to gender, type of brain injury, veteran status, and days from onset. Person separation reliability (.91) indicates that the DOCS-25 is appropriate for individual patient measurement. Items are well targeted to the sample with the difference between mean person and item calibrations less than 1 logit. DOCS-25 Rasch measures result in a 62% gain in relative precision over total raw scores. Internal consistency is very good (Cronbach’s alpha=.86); interrater agreement is excellent (ICC=.90) for both the DOCS-25 and the sensory subscales. The DOCS-25 total measure, but not subscale measures, correlates with the Glasgow Coma Scale (GCS) and the Coma Near-Coma Scales and distinguishes significantly between Vegetative and Minimally Conscious states indicating concurrent validity. The DOCS-25 is psychometrically strong. It has excellent measurement precision and captures a broad range of patient function, which is critical for capturing recovery of consciousness. The sensory subscales are clinically 24 informative but should not be reported as separate measures. The Keyform synthesizes clinical observations to visualize response patterns with potential for informing clinical decision making. Future studies should determine sensitivity to change, examine issues of rater severity, and explore the usefulness of the Keyform in clinical practice.

rTMS Safety for Two Subjects with Disordered Consciousness after Traumatic Brain Injury


The purpose of this letter to the editor was to report safety data for two patients who received repetitive transcranial magnetic stimulation (rTMS) as part of a study providing rTMS to patients with disordered consciousness following traumatic brain injury. This research study was conducted with an FDA investigational device exemption (IDE #G040195), IRB-approved protocol, and informed consent obtained for both patients. Both patients were provided rTMS at 110% of their motor thresholds. Each of 30 rTMS sessions included 300 paired pulse trains. Site of stimulation for Patient #1 was the right dorsolateral prefrontal cortex (DLPFC) and for Patient #2 it was the left DLPFC. During study procedures patient safety was monitored in accordance with a data safety monitoring plan specifying how 15 indicators are monitored for change. Average safety ratings for both patients indicated that mild changes occurred for three of the fifteen monitored indicators. For both patients, structural MRI was unchanged. Patient #2 required resetting of ventriculo-peritoneal (VP) shunt valve pressure after every rTMS session and every MRI scan. Skull x-rays indicated no VP shunt valve movement. EEG showed no evidence of epileptiform discharge for Patient #1, but Patient #2 had an electrographic seizure without clinical accompaniment 40 minutes after the 21st rTMS session. Following the ictal event, Patient #2 was treated with 1000 mg of levetiracetam. rTMS was paused and four additional EEG studies over 1 week were obtained. Since EEG studies indicated no ongoing ictal events or epileptiform discharge and the patient was demonstrating behavioral gains prior to the ictal event, rTMS was restarted cautiously at a lower intensity (less 2%) with 100 fewer trains per session. While the ictal event that Patient #2 experienced was a seizure likely related to rTMS, the ictal event was not typical of rTMS-related seizures that usually occur at site of stimulation either during rTMS or within a few minutes of stopping rTMS. The safety response described in this letter allowed the resumption and successful completion of the study protocol without further seizures. In summary, all changes in monitored indicators, with the exception of the ictal event, were mild and determined to not be attributable to rTMS.
Elevated Intracranial Pressure in the Acute Rehabilitation Setting – A Postoperative Complication from Posterior Fossa Trigeminal Decompressive Surgery


The diagnosis is elevated intracranial pressure (ICP) as a post-operative complication of posterior fossa surgery. This is a case study of a 62-year-old female with history of trigeminal neuralgia who recently underwent microvascular decompression. Post-operatively patient began suffering from more severe, pressure-like headaches worsened by bending over and straining. Associated with these headaches were tinnitus, impaired balance, and blurred vision. During rehabilitation patient developed a cerebral spinal fluid (CSF) leak. Patient was then taken for revision of the left retro-mastoid craniotomy incision with placement of a lumbar drain. Over her post-operative period patient failed multiple clamping trials of the lumbar drain, reporting pressure-like headaches with clamping of the drain. During times the lumbar drain was clamped, slight dilation of the ventricles was seen on follow-up CTs of the head. Patient was subsequently taken for ventriculo-peritoneal (VP) shunt placement, after which the patient’s headache improved greatly. Although the patient did well over a second course of acute inpatient rehabilitation, the Functional Independence measure (FIM) showed a significant setback between the first and second admissions. It was concluded that part of this functional setback was secondary to the development of elevated ICP also known as intracranial hypertension (IH). Symptoms of increased ICP are predominantly headache related. Frequently the headache is increased by bending over or straining. Often reported with these headaches is tinnitus, frequently pulsatile in quality. Other symptoms and signs that suggest a rise in ICP include vomiting and nausea, ocular palsies, altered level of consciousness, and papilledema. In this case the development of IH contributed to a significant setback in function. A prompt diagnosis and initiation of treatment is important to the recovery of function, and therefore physiatrists need to be aware of this serious complication.

Poster presented at Association of Academic Physiatrists, Phoenix, AZ

DVT & PE Following Brain Injury during Inpatient Rehabilitation


The purpose of this study was to examine the incidence of risk factors (deep vein thrombosis/pulmonary embolism (DVT/PE) at acute care, BMI, lower limb paralysis, anticoagulation therapy and surgery) for development of a DVT and/or PE for patients following a severe brain injury (BI) while participating at inpatient rehabilitation (IPR) and its impact on rehabilitation outcomes. This was a retrospective study of all patients who were admitted to Marianjoy Rehabilitation Hospital over 24 months (January 2008–December 2009) with a diagnosis of a traumatic brain injury. A 5.7% incidence rate of DVT/PE during IPR was identified with the brain injury population. Risk factors associated with this complication included a DVT/PE at the acute care facility and the presence of lower limb paralysis. The presence of a DVT/PE during IPR did not significantly impact rehabilitation outcomes for length of stay (LOS), overall Functional Independence Measure (FIM) gain, FIM efficiency, or discharge destination.

These results may reflect early identification and treatment of the DVT/PE by the IPR treatment team, thereby minimizing any potential negative impact of this complication.

Poster presented at the Combined Sections Meeting (CSM) of APTA’s Specialty Sections, Chicago, IL.
Unusual Case of CNS Histoplasmosis in a Non High Risk Patient

This case describes a 73-year-old right handed male who presented with stroke like symptoms of sudden onset left sided hemiparesis and facial droop. Prior to admission patient had a history of a 20 pound weight loss without fever. Work-up revealed on CT scan of the brain a right frontal lesion and left-sided lesion with vasogenic edema. MRI was contraindicated due to presence of patient’s defibrillator. Patient was seen by neurosurgery who recommended brain biopsy to rule out metastatic lesions. Upon admission to inpatient rehabilitation patient had dense left-sided hemiplegia, oropharyngeal dysphagia on swallow evaluation, incontinent of bowel and bladder. During patient’s stay his left-sided weakness worsened. CT head was repeated and there was no progression of the lesions. On the same day, pathology report returned which revealed histoplasmosis, initial biopsies were negative times three but were sent out for further review. Patient was placed on Amphotericin B for six weeks as per Infectious Disease’s recommendations. After treatment with intravenous antibiotics patient’s symptoms began to resolve. Patient progressed very well in therapy and patient’s left sided hemiparesis fully recovered with physical, occupational, and speech therapy. Patient was continent of bowel and bladder upon discharge. Patient was upgraded to a regular diet and balance improved as well. Focal infections of the central nervous system (CNS) should be considered in the differential diagnosis; a high index of suspicion is necessary if the patient’s symptoms are not improving. Culture of the cerebral spinal fluid (CSF) or brain biopsy is the gold standard but may be falsely negative; in these cases antigen should be sought out in urine and blood. CNS histoplasmosis is rare in immunocompromised patients but early recognition leads to improved outcomes and delayed diagnosis leads to poor outcomes.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV.

Methylphenidate Induced Thrombocytopenia in a Brain Injured Patient

The diagnosis was impaired activities of daily living, gait and cognition secondary to subarachnoid bleed, status post craniotomy evacuation. This case describes a 63-year-old female with a progressively worsening headache who was found to have a subarachnoid hemorrhage in the right temporal frontal region. Patient underwent burr-hole incision with drainage and coiling of the vessel. After medical stabilization, patient was transferred to an acute inpatient rehabilitation program due to residual cognitive, gait, and balance deficits. Six days into inpatient stay, patient was started on methylphenidate due to persistent decline in attention and concentration. Patient was initiated on 2.5 mg twice a day, and then titrated up to 5 mg twice a day one week later. Incidentally, patient’s platelet count was decreasing. Two days prior to initiation of methylphenidate, patient’s platelet count was 351 k/cu mm. The platelet count immediately began to decrease after just one day, and it progressively dropped to as low as 115 k/cu mm. No other significant medication changes were made throughout that time period. Eventually, the methylphenidate was discontinued. The platelet count began trending up as soon as two days after discontinuation. After successful completion of inpatient rehabilitation, patient was discharged home. Patient’s latest recorded platelet count was 288 k/cu mm, which was approximately two months later. Methylphenidate has a well-known positive effect on attention, concentration and processing speed, and is commonly used for rehabilitation in stroke or brain injury patients. There have been five reported cases of thrombocytopenia and thrombocytopenic purpura in patients on methylphenidate. We believe this is the first reported case in a brain injured patient. Although thrombocytopenia is a very rare side effect of methylphenidate, it should not be overlooked. Clinicians should be aware of possible side effects and should consider routine monitoring of complete blood counts, especially in traumatic brain injury (TBI) or stroke patients, who are at increased risk for intracranial hemorrhage.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV; and, (2012, November) at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Atlanta, GA.
Terson’s Syndrome with Blindness in a Patient with Subarachnoid Hemorrhage

This case describes a 65-year-old male who was found unresponsive at home. Patient was taken to an outside hospital and diagnosed with a large subarachnoid hemorrhage. Patient underwent coiling for ruptured anterior communicating artery aneurysm and placement of an external ventricular drain (EVD) due to hydrocephalus. The drain was revised a total of three times. Due to persistent hydrocephalus, a ventriculoperitoneal (VP) shunt was placed. Patient’s hospital course was complicated by right lower extremity deep vein thrombosis (DVT). Inferior vena cava (IVC) filter was placed. Patient developed respiratory failure, required ventilator support and underwent tracheostomy and G-tube placement for enteral feeding. Patient was also noted to have persistent fevers and on isolation precautions for multi-drug resistant organisms (MDRO) urinary tract infection (UTI). Patient was stabilized and admitted to acute inpatient rehab. Upon admission, patient was found to be confused, disoriented, and a poor historian. Patient’s rehab course was significant due to a complaint of left eye pain and decreased vision. Initial exam showed abrasions in the cornea of the left eye. Patient continued to complain of decreased vision and pain with documented limited acuity, decreased ocular motility when tracking with the left eye, impaired convergence, and left eye being able to detect light only. Fundoscopic exam demonstrated evidence of blood in the vitreous. Patient was sent for ophthalmologic exam, diagnosed with Terson’s syndrome and underwent emergent vitrectomy. Post-op the patient had marked improvement in visual acuity, perception, and relief of pain. Terson’s syndrome refers to an intraocular hemorrhage occurs secondary to an intracranial hemorrhage or elevated intracranial pressures. It is postulated that the increased intracranial pressure impairs venous drainage of the posterior compartment of the eyes and results in vitreous hypertension and retinal or vitreous hemorrhage. Approximately 13% of patients with subarachnoid hemorrhages experience a vitreous bleed. It is necessary to thoroughly assess the patient’s vision in the rehab setting.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV; and, (2012, November) at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Atlanta, GA.

Unusual Presentation of Brain Tumor: Foot Drop

This patient is an 81-year-old right handed white female who presented with right foot drop for three months. Patient’s symptoms were insidious in onset and slowly progressive, associated with chronic lower back pain with shooting pain radiating down patient’s right lower extremity. MRI revealed severe L4-L5 lumbar spinal stenosis and patient was diagnosed with L5 radiculopathy. EMG, nerve conduction studies were not done and patient was treated conservatively and was given ankle-foot orthosis (AFO). Patient’s symptoms progressed with further weakness in patient’s right lower extremity and had a CT scan of the head which revealed a left parietal mass consistent with meningioma with moderate amount of edema in the left parietal white matter. Patient underwent craniotomy with resection of the mass. Postoperatively patient was transferred to begin acute inpatient rehabilitation. Patient was transferred to acute inpatient rehabilitation and despite tumor resection, distal leg weakness did not return. EMG of the right lower extremity showed no findings of radiculopathy. Early diagnosis and localization of neurologic weakness as early decompression is imperative, whether it be a peripheral lesion such as radiculopathy or central nervous system (CNS) lesion such as a brain tumor. Delay in diagnosis can result in permanent neurologic deficits. This case is an example of how careful physical exam, utilization of differential diagnosis, and use of EMG can help rule out L5 radiculopathy, as MRI is useful in diagnosis, but can be too sensitive. MRI diagnosed spinal stenosis is very common in the elderly. Central causes, although rare, need to be considered in the differential diagnosis of foot drop. This case confirms that good results can be achieved when correctable central causes of foot drop are recognized; unfortunately in this case the symptoms are permanent.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV; and, (2012, November) at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Atlanta, GA.
Status Epilepticus, Anomic Aphasia and Cranial Nerve Deficits Following Acute Traumatic Cerebellar Injury


The patient is a 15-year-old female with status epilepticus, anomic aphasia, and cranial nerve deficits following acute traumatic injury of the cerebellum. Patient has past medical history (PMHx) of Attention Deficit Hyperactivity Disorder (ADHD) and no known history of seizures who presented in status epilepticus following a traumatic blow to the back of the head by an errantly thrown ball from a softball teammate. Patient did not lose consciousness or report any neurologic deficits and continued to play the duration of the game without impairment. Hours later, patient became dysarthric, obtunded, and unresponsive. Patient then began to seize with tonic clonic activity and was emergently intubated for Glasgow Coma Scale (GCS) of 3. Patient was experiencing generalized convulsive status epilepticus refractory to first and second line pharmacologic agents (Lorazepam, Dilantin). Keppra and Propofol were additionally given with eventual cessation of seizure activity after an hour of status epilepticus. CT and MRI imaging revealed no acute findings or gross abnormalities. EEG revealed sharp wave forms in bilateral fronto-temporal regions. Patient was extubated on day two and remained seizure free, but was aphasic, dysarthric, and ataxic. In addition, patient also had cranial nerve VI and VII deficits. Fortunately, patient enjoyed a rapid recovery from the symptoms. This is the first reported case of status epilepticus, anomic aphasia and cranial nerve deficits following acute traumatic cerebellar injury. The case was also unusual due to delay in onset of symptoms and persistently normal radiologic studies. The conclusion is that delayed onset of symptoms can occur without intracranial findings. Current recommendations against imaging and hospitalization for mild traumatic brain injury (TBI) must be tempered with caution. Speech assessment should be considered after any traumatic brain injury to detect deficits despite location of injury.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV; and, (2012, November) at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Atlanta, GA.

Cryptic Hemorrhage Complicated by Epidural Hematoma: A Case Report


This case describes a previously healthy 51-year-old female with acute onset headache, neck pain and nausea/vomiting who presented to ER with acute headache, diplopia, and weakness. Patient was intubated for airway protection after becoming more somnolent and lethargic. Work-up including cerebral angiography showing no evidence of aneurysm was consistent with diagnosis of cryptic hemorrhage. Cryptic hemorrhage is a condition caused by clinically latent vascular lesions, some of which were angiographically occult, that result in either apoplectic cerebral hemorrhage or signs of a growing mass lesion. These lesions are pathologically diverse, consisting of arteriovenous malformations (AVMs), venous hamartoma, and cavernous angiomas. Patient required external ventricular drainage. After extubation patient was transferred to the ward. Patient was able to begin therapies but was noted to have severe gait imbalance. Patient subsequently began to experience low back pain and began to experience urinary retention requiring intermittent catheterization. Patient was further evaluated with lumbar spine MRI and pelvic ultrasound, which showed epidural hematoma at L2-L3 level. Upon admission to rehabilitation hospital, patient was in need of min/mod assistance for bed mobility, transfers, had gait ataxia and continued diplopia. During the rehab course patient continued with severe low back pain and urinary retention. Patient underwent bladder scans with post-void residuals greater than 250ml requiring intermittent catheterizations. Prior to discharge pt. had resolution in both urinary retention and low back pain. Initial FIM Score: 70. After two weeks of intensive therapy, including speech/OT/PT the patient continued to improve with regard to mobility and gait dysfunction with discharge Functional Independence Measure (FIM) score of 111. This is a unique case of patient with cryptic cerebral hemorrhage with extension to lumbar area, not reported in rehabilitation literature and it is important to raise awareness to physiatrists.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV; and, (2012, November) at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Atlanta, GA.
Postural Tachycardia Syndrome After Concussion: Case Report


This case describes a 29-year-old female with no significant medical history who suffered a concussion after falling in February 2011. Since then, patient has experienced intermittent dizziness, cognitive deficits, limb fatigue, and imbalance. A full neurologic workup was inconclusive. Although the symptoms did not completely subside, they did decrease in frequency and intensity. Patient found ongoing speech therapy helpful for her cognitive deficits. Unfortunately, patient had a relapse in February 2012 and started having progressive tachycardia when upright, fatigue with exertion, increased cognitive deficits, dizziness and episodes where patient’s legs would give out, causing a fall. After an extensive workup by endocrinology, cardiology, rheumatology and neurology, it was ultimately determined that patient developed postural orthostatic tachycardia syndrome after a concussion. Patient was advised to drink fluids rich in electrolytes, increase salt intake and was put on a beta-blocker and fludrocortisone. Patient was also admitted for acute inpatient rehabilitation. Physical and occupational therapy focused on orthostatic tolerance; speech therapy worked on her cognitive deficits. This comprehensive treatment plan helped patient almost fully recover in just 2-3 weeks. It is not uncommon for traumatic brain injury patients to present with autonomic dysfunction. This case illustrates one of a few known cases of postural orthostatic tachycardia syndrome as a long-term complication of traumatic brain injury. Recognition of this dysautonomia is imperative to providing appropriate therapy for a successful recovery. This case report provides an overview of this rare syndrome and how to manage it from a rehabilitation perspective. Postural orthostatic tachycardia syndrome may be a complication of traumatic brain injury. Early recognition of this syndrome and implementation of known therapies can result in a quick recovery from this debilitating disorder.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Atlanta, GA.

Ataxia in a Fourteen Year Old Football Player Due to Acute Cerebellitis


This case describes a 14-year-old male with a history of presumed streptococcal pharyngitis two weeks prior to presenting symptoms of severe headaches, dizziness, light headedness, nausea, vomiting, ataxia, and slurred speech, which began while playing in a high school football game. The diagnoses include post viral cerebellar ataxia, acute cerebellar ataxia, and acute cerebellitis. Patient had no history of head trauma or loss of consciousness during the football game. Patient was admitted emergently to the hospital. CT scan of the brain was normal. Lumbar puncture was negative for changes consistent with acute bacterial or fungal infection. Patient was seen by an infectious disease physician who concluded that patient’s symptoms were the result of post-viral cerebellar ataxia secondary to an Epstein-Barr virus infection during his recent bout of pharyngitis. Patient was treated with IV fluids and Zofran. Patient continued to have difficulties with balance and moderate dysarthria. Patient was admitted to acute inpatient rehabilitation where patient received speech, physical, and occupational therapies. After fourteen days of comprehensive interdisciplinary rehabilitation, patient’s ataxia, dysarthria, and balance were much improved. The differential diagnosis for acute ataxia is not broad but includes trauma, hemorrhage, tumor, autoimmune disease and infection. Infectious and non-infectious causes of cerebellar ataxia rarely result in significant long term sequelae. Post viral cerebellar ataxia, also known as acute cerebellar ataxia, is characterized by sudden, uncoordinated muscle movement due to cerebellar injury. Physiatrists should be aware of this rare infectious disease since these patients experience significant impairment, respond to treatment and tend to have a good outcome.

Poster presented at Association of Academic Physiatrists, New Orleans, LA.
Usher Syndrome: A Case Report on the Effects of the Most Prevalent Cause of Hereditary Deaf-Blindness on the Acute Rehabilitation Process


This case describes a 27-year-old Hispanic male with history of Usher Syndrome I (USH I), Attention Deficit Hyperactivity Disorder (ADHD), and newly diagnosed HIV, presented with altered mental status and impaired mobility. Brain MRI findings were consistent with acute disseminating encephalomyelitis (ADEM). Patient was treated with IV steroids and plasmapheresis at the acute care hospital. Rehabilitation was complicated by clinical symptomology of Usher’s Syndrome, specifically patient’s inborn sensorineural hearing impairment and progressive retinitis pigmentosa. Patient’s progressively worsening retinitis pigmentosa allowed for only 15 to 20 degrees of tunnel vision. Patient had a limited attention span due to ADHD impeded communication via sign language through a narrow visual field, resulting in a 66% accuracy rate for single step cues. Through skilled interventions the patient showed tangible functional gains. On admission the motor Functional Independence Measure (FIM) score was 27, improving to 40 just two weeks later with a goal of discharge to home under family supervision. Cognitive FIM score on admission was 10, with a score of 11 after two weeks. Obstacles for the patient’s rehabilitation included inability to localize in space, narrow field of vision, lack of attention, and initiation, all requiring maximum redirection and cues. The patient benefited from strict routine daily therapy in a low stimulatory environment to limit distractions. Therapies were centered around gross motor exercises with basic object and color recognition, aided by the use of prism glasses. Providing multiple choice answers during cognitive exercises was also beneficial.

Usher Syndrome comprises a collection of autosomal recessive disorders characterized by varying degrees of a dual sensory impairment of the audio-vestibular and visual systems. USH I, the most severe form, presents with congenital audio-vestibular impairment and retinitis pigmentosa. This is the first case, to our knowledge, of Usher’s syndrome with ADHD, HIV, and ADEM. Through the integration of adaptive therapy strategies patient was able achieve functional gains.

Poster presented at Association of Academic Physiatrists, New Orleans, LA.

Hypertensive Emergency Causing Reversible Posterior Leukoencephalopathy Syndrome


The case diagnosis is reversible posterior leukoencephalopathy syndrome as a cause for a new onset seizure and visual disturbance in an 89-year-old male. Patient has a past medical history of hypertension, atrial fibrillation, congestive heart failure, and chronic kidney disease, who presented to the emergency department post MVA with noted confusion, multiple seizures, and cortical blindness and subsequently found to have malignant hypertension. Initial CT imaging showed ventricles mildly increased in size with periventricular ischemic change however follow-up MRI showed only chronic small vessel ischemic changes. Within days of blood pressure treatment, patient’s cortical blindness resolved, as had confusion and headache. Patient was started on Keppra and has not had any additional seizures.

Reversible posterior leukoencephalopathy syndrome is characterized by seizure, visual disturbance, confusion, and headache. Its incidence is unknown, although it’s thought to affect females more than males, and spans all age groups. Treatment remains targeting the causative disruption: primarily, hypertension, eclampsia, and immunosuppressive therapies. Neuroimaging typically shows symmetrical white matter edema in the posterior cerebral hemispheres which often resolves in days to weeks with proper treatment. The conclusion is that reversible posterior leukoencephalopathy syndrome is a condition of unknown frequency which should be considered in patients with new onset seizure, confusion, headache, and visual changes.

Poster presented at Association of Academic Physiatrists, New Orleans, LA.
Acute Rehabilitation of Patient with Severe Orthostatic Hypotension and Syncopal Episodes due to Vascular Cavernoma of Pontomedullary Junction


This case describes a 46-year-old female with history of vascular cavernoma at the pontomedullary junction complicated by severe autonomic orthostatic hypotension with associated syncopal episodes. Patient was a healthy female prior to diagnosis. Initial presentation to acute care hospital was a two month history of dizziness, headaches and progressive dysphagia. Patient underwent resection of the vascular malformation followed by complications of autonomic orthostatic hypotension with syncopal episodes, severe sub-glottic narrowing with vocal cord paralysis resulting in tracheotomy placement, percutaneous endoscopic gastrostomy (PEG) placement for severe dysphagia, weakness in all extremities, and cranial nerve involvement of V, IX, X and XII. Orthostatic hypotension was diagnosed to be central in origin from her brain stem lesion. Patient was admitted to acute rehabilitation hospital. Patient’s orthostatic hypotension was a significant obstacle in the acute rehabilitation process. Pharmacological management included fludrocortisone, pyridostigmine and midodrine. Equipment provided included compression venous stockings, abdominal binder, and a reclining wheelchair for effective positional orthostatic management. Attempts to de-cannulate her tracheotomy tube were unsuccessful due to sub-glottic narrowing and oxygen de-saturations. Due to vocal cord paralysis, a Dynavox speech generating device was used to supplement the communication deficit. Therapeutic interventions included frequent rest periods and titration of patient’s schedule to accommodate orthostatic blood pressure changes. After 21 days of rehabilitation, patient’s functional status improved from moderate assistance to standby assistance level in mobility and self-care skills which enabled patient to successfully return home. This case illustrates a patient with severe orthostatic hypotension and associated syncopal episodes that were successfully managed using multiple pharmacologic and therapeutic modalities. Team communication was essential in providing an interdisciplinary approach and providing for a successful rehabilitation outcome.

Poster presented at Association of Academic Physiatrists, New Orleans, LA.

Isolated Food Drop: The Effects of a Left Fronto-Parietal Stage II Ependymoma on the Acute Rehabilitation Process


This case describes a 55-year-old male with a past medical history of significant asthma and gout who developed an isolated acute onset right foot drop and was found to have a left fronto-parietal stage II ependymoma. Patient was noted to be a healthy male prior to diagnosis of an isolated right foot drop. Patient presented to an acute care hospital approximately one month after onset with brain MRI demonstrating a 3.4 x 3.7 x 4.5 left fronto-parietal necrotic mass with local mass-effect. Patient underwent a left fronto-parietal craniotomy with pathology significant for ependymoma stage II. At admission to the rehabilitation hospital patient was noted to have a right foot drop with patient being stand-by assist for all activities of daily living reaching goals of modified-independence prior to discharge. Through skilled intervention and application of polymer ankle-foot orthosis (P-AFO) for management of right foot drop patient was able to achieve rehabilitative goals. On admission patient’s motor Functional Independence Measure (FIM) score was 42, improving to a motor FIM score of 72 at discharge only after 14 days of acute inpatient rehabilitation. Obstacles for patient’s rehabilitation included visual inattention, impaired proprioception, and right foot drop. Patient benefited from skilled intervention and right P-AFO to achieve goals set forth by therapist. This case illustrates a rare presentation of an isolated foot drop caused by a central lesion with etiology yielding stage II ependymoma. More commonly recognized causes of isolated foot drop are L4-L5 radiculopathy or a peripheral peroneal neuropathy. Intracranial cause of isolated unilateral foot drop is very rare. Tumor resection, an aggressive therapeutic skilled comprehensive rehabilitation program, as well as application of AFOs can result in dramatic recovery and aid patient to achieve functional goals.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, National Harbor, MD.
BRAIN INJURY
ACTIVE RESEARCH PROJECTS

Predictors to Deep Vein Thrombosis following a Traumatic Brain Injury during Inpatient Rehabilitation

Rao, N.; Sayyad, A.; Fetter, T.; McQuillan, C; Eppenstein, P.

The complication of a deep vein thrombosis (DVT) can be life-threatening for patients in rehabilitation; however, it is a preventable and treatable condition. The incidence of DVT following a traumatic brain injury (TBI) has ranges from 7.8% to 39%. Individuals following a TBI are at risk to develop a DVT because of concomitant risk factors of trauma to the extremities and prolonged periods of immobilization. Often times the medical team is reluctant to start thromboprophylaxis to prevent a DVT with individuals who have experienced a TBI because of the increased risk of the extension of the intracranial bleeding sustained during traumatic brain injury. Several risk factors for the development of a DVT with individuals following an acquired brain injury who were participating with inpatient rehabilitation have been identified and they included the following: over 40 years of age, history of DVT at acute care, obesity, gross varicose veins, immobility, hormone replacement therapy, surgery, and paralysis of a lower limb. The purpose of this study is to identify the incidence, predictive variables, and potential impact a DVT may have upon patients admitted to inpatient rehabilitation following a TBI. Currently in the literature there is limited information available comparing the rehabilitation outcomes with individuals following a TBI who developed a DVT versus those who did not while participating with inpatient rehabilitation. The information derived from this study will be used to develop an evidenced based clinical guideline to focus on appropriate medical intervention to either prevent DVT or promote earlier identification of DVT for patients at Marianjoy. This study is a retrospective medical chart review. The main study objective is to identify the incidence, predictive variables, and potential impact a DVT may have upon patients admitted to inpatient rehabilitation following a TBI.
The only CARF accredited pain program in Illinois.
Scapular Winging After Chiropractic Treatment: A Case Report


This case describes a 32-year-old female with medial scapular winging and pain in the left shoulder, neck, and anterior chest. Pain started two days after patient received chiropractic adjustment of the thoracic and cervical spine with high velocity and low amplitude manipulation. Pain progressively worsened and began radiating from the shoulder to the neck. Pain improved temporarily with hot showers, massages and trigger point injections to the left trapezius muscle but worsened with any activities involving shoulder motions, deep breathing, and neck side bending towards the affected side. MRI of cervical and thoracic spine showed left rhomboid atrophy, increased bone marrow signaling along the lateral aspect of the scapula consistent with contusion and mild bulging disks in C4-7 with no evidence of nerve impingement. Bone scan, CT scan, and x-rays were all within normal limits. On examination, patient is a well-developed athletic female, reflexes were symmetric and normal in all extremities with no evidence of focal sensation loss to light touch or pin prick. Patient had 8/10 pain with left cervical side bending. Roos, Adson, and Spurling tests were negative. EMG showed denervation of the left serratus anterior muscle with some reinervation which explains the medial scapular winging and resulting scapular motion dysfunction. Mechanism of injury was likely due to injuries to long thoracic nerve and dorsal scapular nerve which occurred during manipulation. Patient underwent physical therapy. Scapular traction exercises, stretching, and strengthening improved patient’s pain and strength was regained. Long thoracic nerve injury should be considered a cause of shoulder pain and a risk of manipulative treatment. A thorough examination of scapular strength is essential in evaluating shoulder pain.

Poster presented at Association of Academic Physiatrists, Phoenix, AZ.
An Interdisciplinary Pain Management Approach for the Treatment of Four Extremity CRPS


This case describes a 26-year-old female with no medical history who sustained crush injury to the bilateral feet at work in a warehouse in April 2009. The diagnosis is Complex Regional Pain Syndrome (CRPS). A 550-pound palette dropped onto and pinned patient's feet. X-rays showed no fractures; MRI was negative. Several weeks later, patient experienced bilateral lower extremity burning pain and severe allodynia; bone scan showed CRPS. Patient sought treatment from multiple pain specialists. Past treatments of minimal efficacy included: series of nerve blocks, trial of lumbar spinal cord stimulator, and ketamine infusion. Patient received multiple courses of physical therapy, opiate/neuropathic pharmacotherapy, and modalities including contrast baths, desensitization and mirror therapy. In November 2009, pain progressed to bilateral upper extremities and back, with onset of ankle edema and debilitating pain causing mobility and balance dysfunction. Patient suffered severe allodynia with blowing air exposure and sensitivity to clothing. Patient was subsequently admitted to an outpatient, interdisciplinary pain management program for physical therapy, psychotherapy, and modalities to improve physical symptoms, coping, and daily function. In the program, medications were optimized, and patient received intense physical therapy, modalities, individual and group psychotherapy, and daily coping educational sessions. On admission, patient scored Beck Depression Index (BDI) of moderate and Beck Anxiety Index (BAI) of mild. By discharge, BDI was mild and BAI was moderate. Average pain score on admission was 9/10. By discharge, pain score was 7/10. Patient's walking increased by 54%, fast walking increased by 71%, and lifting increased by 100%. CRPS of the four extremities is an infrequent, yet disabling condition in physical, psychological, and social aspects of life. Patients treated with an integrated treatment program may improve symptomatology, alter disease perception, and improve function.

Poster presented at Association of Academic Physiatrists, Phoenix, AZ.

Effects of Various Opioids on Pupillary Diameter in Chronic Pain Patients


The objective of this study is to compare the effects of different opioids and duration of treatment on pupil diameter. To qualify for the study, subjects must be chronic pain patients who have been taking opioids longer than one year. Duration of the opioid usage was divided into four equal length groups. Patients' best visual acuity was checked with Snellen Eye chart. Subjects with less than 20/40 visual acuity and with known eye pathology or history of eye surgery were excluded from the study. Thirty-one subjects were enrolled who upon presentation were on various opioids. Subjects were asked to rate their visual analog scale level and the amount of relief that they were getting from opioids. Eye exam was performed including cornea, iris, lens, and fundus. Pupil diameters were measured with pupil gauge (mm) in an ambient light controlled environment. The study setting is an outpatient chronic pain clinic. Participants included 31 chronic pain patients between ages 28 and 64. 64.5% of subjects were female (n = 20) and 35.5% were male (n = 11). Mean pupil size for hydrocodone group was OD:4.00mm, OS:4.14mm; for oxycodone group, OD:3.00mm, OS:3.00mm; morphine sulfate group, OD:3.20, OS:3.20mm; fentanyl group was OD:2.20mm, OS:2.20mm; propoxyphene OD:4.80mm, OS:4.80mm. A significant difference in pupil diameter was found between hydrocodone usage and fentanyl usage (p < 0.01) as well as between hydrocodone and morphine sulfate. However, there was no significant difference when comparing hydrocodone and propoxyphene or when comparing fentanyl and morphine sulfate. There was no significant difference in measured pupil diameter when comparing groups of treatment duration or diameter between schedule II and schedule III opioid usage. There was no significant association between measured pupil diameter and length of opioid usage. This is the first study comparing the effects of various opioids on pupil diameter in the chronic pain population.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Orlando, FL.
Central Pain Syndrome in a Woman with Thoracic Intradural Intramedullary Ependymoma: A Case Report


This case describes a 56-year-old female with a thoracic ependymoma. Patient presented with right arm numbness and weakness. MRI suggested an expanding cystic lesion at level T2 and patient underwent cystic drainage with a T2-T3 laminectomy. An ependymoma was identified and resected. Postoperatively, patient was admitted as T6 ASIA D into a spinal cord program at an acute inpatient rehabilitation hospital in order to improve function. At admission, patient was at minimal assistance for activities of daily living. Patient received comprehensive treatment and made significant gains; however, sensation did not change and patient had no pain. Subsequently, patient underwent further radiation treatments and developed pain. The pain was 9/10 in severity, localized to the back and knees, worse with movement, and associated with spinal fluid collection. Subsequently, patient underwent T1-T4 laminectomy and C5-C6, T1-T10 posterior spinal instrumentation. Patient’s hospital and rehabilitation course was significant for uncontrolled pain even though patient had treatment with methadone, tramadol, acetaminophen, and gabapentin. Furthermore, patient had balance dysfunction and became severely depressed. Despite a well-demarcated ependymoma and improvements with microsurgical techniques, patients need pain management to restore function. Intramedullary ependymomas typically occur in the cervical region; however, a thoracic ependymoma tends to have a higher morbidity. Patient had the presence of an intradural neoplasm with a syrinx that suggested a noninfiltrative lesion, a good prognosis, and may have benefited from a pain program. Although many people do not develop central pain syndrome following ependymoma resection, in order to optimize functional outcomes for those that do, a comprehensive approach to pain will help maximize recovery.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Orlando, FL.

Promoting Language and Communication with the iPad: A Case Study


Despite documented benefits of Augmentative and Alternative Communication (AAC) in outpatient settings, its use within acute rehabilitation is rare. This study presents outcomes of the use of an iPad as an AAC system for an individual with aphasia and apraxia in an acute rehabilitation hospital. Objective /subjective measures and implications for future research are reported. This case study emphasizes the benefits and importance of incorporating the use of an AAC system at the onset of rehabilitation not only to compensate for skills lost, but also to promote recovery. This case study also emphasizes the role of smart devices in rehabilitation for increased functional communication. Though only one case, the results are promising for further research to investigate the incorporation of multimodal communication systems and smart devices at the acute phase of rehabilitation.

Poster presented at American Speech Language Hearing Association San Diego, CA.
L5 to S1 Tarlov Cyst Found Incidentally in Presence of Progressively Worsening Right Foot Pain: A Case Report


This case describes a 32-year-old male involved in a motor vehicle accident 15 years ago sustaining multiple traumas who presented with chronic, intractable right foot pain. The pain was located along the dorsum of the right foot with a pins-and-needles sensation. During the past 1.5 years, the frequency of right foot pain increased from once a month to being constantly present. Percutaneous spinal cord stimulator was implanted to alleviate patient’s right foot pain, but patient was unable to tolerate its usage. MRI of lumbar spine revealed a 1.3 x 1.9 x 5.0-centimeter cystic mass in the spinal canal at the L5 to S1 vertebral levels representing an intrasacral meningocele or Tarlov cyst. Pertinent physical examination findings consisted of no Achilles tendon reflex on the right; decreased sensation to light touch, vibration, and pinprick distal to right patella; absent sensation to light touch, vibration, and pinprick distal to right ankle; and 0/5 strength with right ankle dorsiflexors and plantar flexors. Cystic mass at the L5 to S1 vertebral levels could be impinging on the right-sided L5 and S1 nerve roots, leading to neuropathic pain in the patient’s right foot. Patient had already seen two neurosurgeons regarding the cystic mass and was told that operating to remove the cystic mass would be highly risky. Tarlov cysts are cerebrospinal fluid-filled sacs located in the spinal canal, usually in the S1 to S4 region, and can be distinguished from other meningeal cysts by their nerve fiber-filled walls. 15 % to 30% of Tarlov cysts are symptomatic with the most common symptoms being pain and sexual and bladder dysfunction. Tarlov cysts can enlarge over time, leading to increasingly frequent and intractable pain, especially in the lower extremities.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV

Cerebral Symptoms Associated with a Dorsal Sacral Meningocele in a Woman with Marfan’s Syndrome: A Case Report


This case describes a 52-year-old female with diagnosis of ductal ectasia, Marfan syndrome, and pain. The patient has a history of Marfan syndrome and spondylolisthesis. Patient underwent L5-S1 spinal fusion, presented with persistent lumbosacral pain radiating down the left leg, numbness in the lower limbs upon sitting, and dizziness when pressing on a fluid collection in patient’s back. Post-operative complication included a dural leak. Patient’s symptoms improved with rest and medications; however, they (including dizziness) were exacerbated when applying pressure to the lower back. MRI and myelogram suggested a stable dural ectasia at level T12 and a 4 X 4 cm dorsal sacral meningocele. Patient’s decreased mobility, neuropathic pain, depression, left valgus deformity, failed back syndrome, and radiculopathy were followed. Physical therapy improved patient’s range of motion and decreased patient’s overall pain. Patient continued to have success with a home exercise program and patient’s depression was managed well with medication. Dural ectasias can be found in many people with Marfan syndrome, but not all dural sac abnormalities, including anterior meningocele, cause pain. This is a report of a dorsal sacral meningocele found in a patient with Marfan syndrome who experienced cerebral symptoms upon manipulation of the sac. Consultation from a neurosurgeon suggested that patient’s abnormality was not an indication for surgery. In patients with cerebral symptoms, consider the presence of a posterior meningocele. Here, a meningocele in a patient with Marfan syndrome was causing patient’s dizziness, headaches and syncope after manipulation. A dorsal sacral meningocele may cause cerebral problems along with the pattern of orthopedic, ocular, and cardiovascular signs when present in a patient with Marfan syndrome.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV.
Chronic Exertional Compartment Syndrome Masked by Lumbosacral Radiculopathic Pain: A Case Report


This case describes a 68-year-old female status post L4-to-L5 laminectomy and fusion 20 years ago who presented with recurrent low back pain. Patient developed low back pain two-three years ago with radiation of the pain down the left lower extremity to the foot. The pain was stabbing in character and exacerbated by ambulation. MRI of lumbar spine revealed findings consistent with lumbosacral radiculopathy. During patient’s participation in a chronic pain management program, the pain in the back and left thigh was significantly reduced. However, patient continued to experience pain that was burning in character along the lateral aspect of the left lower extremity from the knee down to the foot. Physical examination revealed 4/5 strength with left extensor hallucis longus, decreased light touch sensation in the first digital cleft of left foot, and tense left lateral leg compartment. Paresthesias were elicited on dorsum of left foot with compression of left lateral leg compartment. Ultrasound of the area around the left fibular head revealed no evidence of common peroneal nerve compression. Patient also experienced tingling in the left lower extremity that increased after five minutes of weight bearing activity and subsided after 45 minutes of rest. Intracompartmental pressures were measured and found to be elevated at 33 mmHg in left anterior and 25 mmHg in left lateral leg compartments. Patient was diagnosed as having left anterior and lateral exertional compartment syndrome with recommendations for anterior and lateral compartment release. Chronic exertional compartment syndrome (CECS) should be suspected in any patient who presents with chronic anterolateral leg pain that worsens with prolonged use and resolves with activity cessation.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV.

Effects of Intrathecal Opiate Administration on Pituitary Function: A Case Report


This case describes a 40-year-old chronic pain patient who presented with gynecomastia and fatigue. Patient’s history was significant for a fall from a height of 35 feet in 1984 resulting in fracture of the pelvis, several vertebrae, right ankle, and calcaneous. Patient endured nine separate surgical procedures in order to make the ankle more functional, but suffered constant pain. After attempting various oral analgesics and opiates, it was decided patient would benefit from an intra-abdominal morphine pump in 1995. In 2002, initial lab results indicated decreased luteinizing hormone, follicular stimulating hormone, total testosterone, and free testosterone. Intramuscular testosterone replacement was initiated every two weeks for his hypogonadism. Patient underwent a left unilateral mastectomy with benign pathology. A normal thyroid stimulating hormone level and decreased thyroxine level were obtained. Levothyroxine was started for secondary hypothyroidism. Patient’s insulin-like growth factor one level was low normal. Daily growth hormone replacement injections were initiated. Based on subnormal peak and stimulated rise in cortisol levels on an adrenocorticotropic hormone stimulation test, the patient was diagnosed with adrenal insufficiency. Patient was started on hydrocortisone twice daily. Despite gradual lowering of the intrathecal morphine pump dose and eventual discontinuation in 2007, the patient’s chronic fatigue persisted along with low levels of hormones and cortisol levels. Intrathecal opiate pain management may produce some generalized effects, as well as pituitary hypofunction. Chronic intrathecal opiate use can result in pituitary dysfunction.Physiatrists should be aware of these potential side effects and symptoms need to be critically evaluated with appropriate laboratory assessments. Further studies are required in order to create formal recommendations for routine patient surveillance during intrathecal opiate therapy.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Atlanta, GA.
**Effects of Manual Tracings of Acupuncture Meridians for Improvement of Sense of Well Being & Health**


The objective of this study was to investigate the effects of tracing acupuncture meridians by hand on the improvement of the flow of energy (Qi) resulting in improvements in sense of well-being, stress, fatigue level and activities of daily living (ADLs). This was a prospective, randomized clinical study with thirty-one subjects. Employees of this hospital volunteered for this study. Sixteen subjects were randomized for control group and 15 for experimental group. Participants in the experimental (acupuncture meridian tracing group) received tracing over the 14 acupuncture meridians in the direction of the flow of energy. The control group received range of motion exercises for upper and lower extremities. A self-assessment questionnaire using a 10-point visual analog scale for the four attributes of sense of well-being, stress, fatigue, and activities of daily living (ADLs) was used to assess the participant’s response to meridian tracings and range of motion exercises. The mean gain for sense of well-being in experimental group was three points (P=.000). The exercise group gained 1.4 points (P=.001). The mean gain for stress level improved 3.8 (P=.000) and the control group mean gain for stress level was 1.5 (P=.001). The mean gain for fatigue level in experimental group was 3.47(P=.000). Control group mean gain 1.6 (P=.001). Mean gain for ADLs for experimental group was 2.3 (P=.001). Mean gain of ADLs for control 1.9 (P=.509). Subjects in both groups made gains in all four measures. However, the acupuncture meridian tracing group showed two times more improvement in all attributes.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Atlanta, GA.

**True Acquired Macroglossia From Hypocobalaminemia: A Case Report**


This case describes a 72-year-old male patient with true acquired macroglossia from hypocobalaminemia. Patient presented with new left-sided weakness and dysarthria confirmed by CT and MRI as an acute frontoparietal infarct. Patient was transferred to acute rehabilitation where repeat swallow studies demonstrated moderate-severe dysphagia. Patient was subsequently placed on a mechanical soft diet with nectar thick liquids. Weeks later, patient exhibited increasing difficulty with mastication and swallowing accompanied by profuse drooling. Physical exam findings were consistent with overt macroglossia. No congenital anomalies, neoplasms, trauma, or infections were detected. Laboratory workup were all negative. Medications were reviewed and noncontributory. Amyloid biopsy was ordered, yet not obtained as the patient began to deteriorate due to dehydration, malnutrition and respiratory distress. Intravenous fluids and oxygen were initiated along with antihistamine and steroids. Patient was stabilized; however, his macroglossia was unchanged. Homocysteine and MMA levels were then obtained with elevated results. Patient’s omeprazole was discontinued and intramuscular cyanocobalamin was administered with dramatic regression of the tongue to normal size, consistency, and function. Patient was then able to respire, initiate bolus formation, and swallow without risk of aspiration. Repeat swallow study revealed minimal dysphagia and his diet was upgraded.

Vitamin B12 deficiency is most commonly seen in the elderly secondary to gastric achlorhydia resulting in malabsorption. This is the first reported case of macroglossia induced by hypocobalaminemia. Case was also unusual due to chronic proton-pump inhibitor use, normal Vitamin B12 level, and no clinical features of macrocytic deficiency. With pronounced macroglossia, feeding and respiratory difficulties may ensue; thus, the cause must be rapidly identified and treated. Symptoms of subclinical deficiency are subtle, often overlooked and associated with an increased morbidity if undetected.

Poster presented at Association of Academic Physiatrists, New Orleans, LA.
Treatment of a Patient with Functional Movement Disorder with an Interdisciplinary Pain Management Program


This case describes a 50-year-old female who presented with acute gait difficulties, balance dysfunction, dizziness, extreme fatigue, difficulty using her right hand and arm, and chronic pain located in the neck, shoulders, and back after lifting several boxes weighing approximately 60 pounds. Patient was seen by numerous physicians and underwent a series of tests and examinations; illnesses such as Parkinson’s disease and multiple sclerosis were ruled out. Patient underwent acupuncture, prolotherapy, physical therapy, and many sessions with a chiropractor without any relief. As a result of the symptoms patient experienced a total of twenty sudden, controlled falls. After one year, patient was diagnosed with Functional Movement Disorder and was subsequently admitted to a comprehensive pain management rehabilitation program for 21 days. Following targeted physical therapy, nursing education, and cognitive therapy with a psychologist, symptoms greatly improved; patient only had one fall during the stay, chronic pain improved and energy level increased. Most importantly, patient was able to apply the pain coping strategies that were learned, resulting in an improved quality of life. Functional movement disorders are believed to result from psychological and psychiatric causes rather than a primary neurologic pathology. This disorder can be very difficult to diagnose, as well as treat. Physiatrists should be aware of functional movement disorders because the condition is often under-diagnosed. Through comprehensive interdisciplinary pain management programs, significant gains can be made through cognitive behavioral therapy and many of the pain management techniques can be applied to these patients and will improve outcomes if they are treated early in the course.

Poster presented at Association of Academic Physiatrists, New Orleans, LA.

Managing Chronic Pain in a Cerebral Palsy Patient: A Case Report


This case describes a 23-year-old female with spastic diplegic cerebral palsy and a Gross Motor Functional Classification System (GMFCS) Level 2 who presented to Marianjoy Pain Management Program. Patient’s pain started in 2004 with left knee pain and swelling. Multiple medications, therapeutic ultrasound, TENS unit, and a thorough workup were unable to alleviate pain. Botox injections, nerve blocks, and steroid injections actually made pain worse. In 2008 patient was diagnosed with complex regional pain syndrome. By 2010 the pain seemed to localize to the left side. Patient suffered daily throbbing and tingling pain in left lower back with radiation up the back, down the left arm, into the left side of the head, and down the left leg into the toes. Pain could be so severe at times patient would experience dizziness and disorientation. Patient started a 21-day Outpatient Pain Management Program consisting of group and individual physical therapy, psychology, education, discussion, and biofeedback. Patient’s initial pain scale was 5/10 involving the entire left side of the body. Through the pain management program patient learned coping mechanisms such as exercises, stretching, sacroiliac corrections, kinesio tape, and pacing, which brought daily baseline pain down to a 2/10. Patient had one episode of pain flare-up during participation in a program in which patient was able to handle pain more functionally through coping mechanisms. Patient’s score on the University of Alabama pain behavior scale went from a 5/10 to a 2.5/10. Interdisciplinary pain management programs utilizing biofeedback, individual and group psychology, education, and individual and group exercise results in better patient satisfaction. Adults with cerebral palsy who experience chronic pain would benefit from participation in an interdisciplinary pain management program rather than through pharmacological treatment alone.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, National Harbor, MD.
A Rare Case of Multiple Cervical & Thoracic Tarlov Cysts Presenting as Thoracic Outlet Syndrome


This case describes a 56-year-old female presenting with symptoms of thoracic outlet syndrome from cervical perineural cysts. Prior medical history is significant for lumbar L4-L5 fusion due to a fall onto an outstretched arm. This trauma resulted in a right wrist Colles’ fracture. Patient was deemed nonsurgical by orthopedics and treated with splinting. After the splint was removed, patient complained of pain radiating down the arm into the hand with a burning pins and needles sensation. Patient complained of weakness in the upper arm and hand resulting in difficulty carrying bags and paperwork. Two EMG studies resulted in negative findings. Patient was seen at the outpatient chronic pain clinic. On exam patient was found to have biceps and triceps weakness, as well as hand intrinsic weakness. Patient also had sensory deficits in the thenar region. Patient had cervical MRI without contrast displaying large perineural cysts bilaterally at T1-T2, C7-T1, and on the right C6-C7 nerve root. Patient is actively being followed in the outpatient clinic with active physical therapy focusing on neural retraining.

There are very few case reports describing symptomatic perineural cysts, particularly cervical cysts, thus making our case of thoracic outlet syndrome presenting with perineural cysts very uncommon and worth recognizing. Patients after a fall and repair may present with different manifestations of pain. While thoracic outlet syndrome should be considered after ruling out the most likely diagnosis, it is important to complete a proper work-up to rule out other diagnoses.

Poster presented at Association of Academic Physiatrists, Nashville, TN.

Residual Lower Extremity Pain and Sensory Deficits in a Patient with a Thoracic Cavernoma Status Post Hemorrhage, Approach to Pain Management and Rehabilitation: Case Report


This case describes the management of chronic neuropathic pain secondary to thoracic cavernoma status post hemorrhage. Patient is a 60-year-old male with a T11-T12 cavernoma with hemorrhage and subsequent paralysis, pain and sensory deficits from the waist down. No intervention was done and the cavernoma regressed. Although patient regained some function and strength with acute rehabilitation, patient continued to experience pain and numbness in his lower extremities along with lower back pain and fatigue. These deficits were refractory to a variety of medications and therapeutic modalities. Patient participated in a five-week comprehensive pain management program to learn strategies to better manage pain and improve overall function. Patient ultimately made gains in five of seven key functional items on the Marianjoy Pain Functional Assessment Tool. Pain can be seen in over 60% patients with spinal cord injury. The interdisciplinary approach to pain management allows for the trial of novel therapeutic techniques while daily follow up allows for assessment of their effectiveness. Incorporating nursing education and psychology to address the cognitive and behavioral issues is essential to the patient’s success. This case study illustrates how effective an interdisciplinary pain management approach can be in helping patients restore function in the face of chronic pain. In addition to showcasing the unique therapies utilized with our patient, this case study highlights the critical importance of addressing the psychological aspects of chronic pain management as well.

Poster presented at Association of Academic Physiatrists, Nashville, TN.
The Use of Customized Abdominal Brace to Improve Functional Limitations after Removal of Abdominal Tissue after Necrotizing Fasciitis Infection: A Case Report


This case describes a patient with functional impairment following abdominal muscle removal as a consequence of necrotizing fasciitis infection following motor vehicle accident. The patient is a 49-year-old female who was involved in a motor vehicle accident suffering facial, clavicle, and sternal fractures, small bowel and mesenteric injury with complete transection of small bowel, lumbar spine compression fracture, and anterior abdominal wall fascia and muscle disruption. After undergoing numerous surgeries for repair, the patient developed extensive necrotizing fasciitis requiring complete removal of anterior abdominal wall tissue and subsequent abdominal wall reconstruction with mesh and skin grafting over bowel. Patient was stabilized and transferred to long term acute care facility, discharged home; and underwent abdominal wall reconstruction with tissue traction and received an abdominal binder for support. Patient failed multiple modalities for pain relief from subsequent to injuries. Patient was admitted to 21-day outpatient pain program undergoing six-seven hours per day of nursing education, physical therapy, physiatry, psychology, biofeedback, and case management to manage chronic pain, improve functional impairments and limitations due to abdominal deformities, and poor support of the abdominal binder. A custom abdominal brace was provided with left lateral abdominal support flap, dual lumbar support uprights, inferior and superior padded support bars to improve lumbar and abdominal support. Initial functional assessment with abdominal binder showed significant patient improvements from admission to completion of the 21-day program. There have been a few reports on functional limitations following debridement status post necrotizing fasciitis infection, mostly involving the extremities, however, this is the first such case in an outpatient rehabilitation setting involving the trunk and core musculature showing functional improvement with a custom fit abdominal brace providing support in the weakened areas.

Poster presented at Association of Academic Physiatrists, Nashville, TN.

Successful Treatment of Flagyl Induced Peripheral Neuropathy with an Interdisciplinary Pain Management Program


This case describes a 46 year-old female patient with flagyl-induced neuropathy. Patient has had peripheral neuropathy in the lower extremities with allodynia since 2005. Patient tried acupuncture, chiropractic care, massage, medication, physical therapy, aquatic therapy, TENS, infrared light, and sensory integration. However, patient continued to have flare ups that were debilitating to functionality, affecting family and social life; and reverted back to opioid therapy. Patient’s pain is thought to be centralized. Patient has had chronic pain in lower extremities for eight years with failure of various therapeutic modalities; therefore patient was enrolled in a 21-day comprehensive pain management program that included physical therapy, psychology, biofeedback, and pain education. Initially, patient was found to have autonomic dysfunction to stress response in that patient’s pain level became 10/10, patient became pale, nauseous, and had body temperature differences in the lower verses upper extremities. Eventually patient learned how to manage this response with the combination of Butrans and tools acquired through the pain program. Some of the techniques that patient learned included neuromobilization, breathing, lower extremity desensitization, and guided imagery. An objective tool used for pain program patients is the Marianjoy Pain Functional Assessment Tool measuring physical activity capacity, visual analog scale, and assessment of pain behavior. Patient improved in each area. This is a patient with chronic centralized pain of seven years duration that made significant functional and social gains in level of functioning after participating in an intensive 21-day pain management program.

Poster presented at Association of Academic Physiatrists, Nashville, TN.
Dr. Jeffrey Oken assumed the leadership role of Vice President of Medical Affairs in 2015.
Healthcare Policy & Organization Practice
PUBLISHED RESEARCH

Improving Long-Term Outcomes after Discharge from ICU: Report from a Stakeholders’ Conference


Millions of patients are discharged from intensive care units annually. These intensive care survivors and their families frequently report a wide range of impairments in their health status which may last for months and years after hospital discharge. A two day Society of Critical Care Medicine conference was held to improve the long-term outcomes after critical illness for patients and their families. Thirty-one invited stakeholders participated, representing key professional organizations and groups, which are involved in the care of intensive care survivors after hospital discharge. Invited experts and Society of Critical Care Medicine members presented a summary of existing data regarding the potential long-term physical, cognitive and mental health problems after intensive care and the results from studies of postintensive care unit interventions to address these problems. Stakeholders provided reactions, perspectives, concerns and strategies aimed at improving care and mitigating these long-term health problems. Three major themes emerged from the conference to improve outcomes for survivors and families: (1) raising awareness and education, (2) understanding and addressing barriers to practice, and (3) identifying research gaps and resources. Post-intensive care syndrome was the recommended term to describe new or worsening problems in physical, cognitive, or mental health status arising after a critical illness and persisting beyond acute care hospitalization.
Charting a Course for Value Innovation: Applying Blue Ocean Strategy in a Post-Acute Setting


Today, health care leaders and providers are being asked to plan for a future which promises to be fundamentally different than what they’ve known in the past. This will require a new paradigm for creating a system focused on the delivery of innovative medical services built upon a patient-centered foundation of quality outcomes and value. Understanding the nature of health care value is a critical first step in charting this new course for health care strategy and planning leaders. Some (Porter, 2010) have sought to define health care value as the outcomes achieved per dollar spent. Put simply then, the health care value equation is a function of quality improvement and cost reduction.

Journey to Discharge


Case study reviews actions taken to improve overall communication and patient understanding of the inpatient rehabilitation process, and to establish appropriate expectations for the patient stay. The study reviews an organization-wide initiative to improve overall patient experience through a consistent approach to communication regarding the patient stay. The success of the initiative demonstrates the capacity and power the rehabilitation team has to innovate and change practices to affect patient satisfaction and improve patient transitions across the continuum of post-acute care. The flexible nature of the process describes helps to ensure patients continue to understand how they will be navigating the complex transitions of care which occur in the post-acute care setting, as well as be satisfied with the excellent service provided by the clinical, therapy, and ancillary support services associates of Marianjoy.

Expanded Role of Hospital Librarian in the Changing Healthcare Environment: A Case Study


The healthcare industry and the libraries operating within it are going through constant change. Librarians need to capitalize on the flexibility created by change and creatively expand the library’s role beyond traditional library services. This may be a golden opportunity to step back, take a fresh look at our roles, and make some hard decisions about our future directions and roles. This case study illustrates how a small hospital library faced these challenges and survived by transitioning from a product-based approach to an experience-based approach and by creatively expanding the library’s role.
Exploring the Scope of Post-intensive Care Syndrome Therapy and Care: Engagement of Non-Critical Care Providers and Survivors in a Second Stakeholders Meeting


Increasing numbers of survivors of critical illness are at risk for physical, cognitive, and/or mental health impairments that may persist for months or years after hospital discharge. The purpose of this study was to develop strategies and resources required for raising awareness and education; understand and address barriers to clinical practice; and identify research gaps and resources; ultimately, aiming to improve patient and family outcomes. This collaboration was done with non-critical care providers and survivors during the 2012 Society of Critical Care Medicine post-intensive care syndrome stakeholder conference. They used the post-intensive care syndrome framework encompassing these multidimensional morbidities, developed at the 2010 Society of Critical Care Medicine conference on improving long-term outcomes after critical illness for survivors and their families. Representatives from 21 professional associations and health systems were involved in the provision of both the critical care and rehabilitation of ICU survivors in the United States. Summaries were presented reviewing the impact of morbidities and the experience of survivors and their families. Future steps were identified regarding the recognition prevention and treatment of post-intensive care syndrome. Additional strategies were recommended for optimizing institutional capacity to support and partner with survivors and families, as well as understanding and addressing barriers to practice. There was recognition of the need for systematic and frequent assessment for post-intensive care syndrome across the continuum of care, including explicit “functional reconciliation” (assessing gaps between a patient’s pre-ICU and current functional ability at all intra- and inter-institutional transitions of care). Future post-intensive care syndrome research topic areas were identified across the continuum of recovery, including characterization of at-risk patients (recognizing risk factors, mechanisms of injury, and optimal screening instruments); prevention and treatment interventions; and outcome research for patients and families. Raising awareness of post-intensive care syndrome for the public and both critical care and non-critical care clinicians will inform a more coordinated approach to treatment and support during recovery after critical illness. Continued conceptual development and engagement with additional stakeholders is required.

Information Connections: Linking Libraries and Communities


Information Connections is a Web site for parents of children with developmental disabilities and chronic diseases. It is a collaborative effort led by Nalini Mahajan, Marianjoy Medical Library Director, and Webmaster, Mary Keen, MD, Director of the Marianjoy Pediatric Program, with input from the Pediatric Team and parents of children affected by developmental disabilities. The project began with a simple idea of assisting parents and caregivers to obtain reliable and updated health information at the point of need for making informed health care decisions. The goal was to develop a better understanding of the health information needs of the parents of children with developmental disabilities and chronic conditions, and build a dedicated Web site to provide up-to-date and reliable information with a focus on autism, cerebral palsy (CP), Attention Deficit Hyperactivity Disorder (ADHD), Down syndrome, and traumatic brain injury (TBI). Information Connections seeks to simplify access to the most relevant health resources while alleviating the problems of information overload, duplication, and currency. The Web site is available to parents, clinicians, and anyone looking for up to date and reliable information on the Internet. It is freely available at http://www.informationconnections.org.
Driving for Adults with Acquired Physical Disabilities


The purpose of this paper is to document and give context to consensus statements for drivers with physical disabilities, and specifically chronic obstructive pulmonary disease, by expert clinicians in driver rehabilitation and researchers in the area of driver assessment. A brief introduction to the profession of driver rehabilitation sets the context for how individuals with physically based impairments have facilitated the development of the specialty area.

An Initiative to Improve Patient Discharge Satisfaction


The purpose of the article was to provide patients with knowledge needed to make a smoother transition from inpatient rehabilitation to the community or another level of care. The Journey to Discharge concept developed from efforts to clearly communicate the stages a patient travels through on the path to discharge from inpatient rehabilitation.

The creation and implementation of this concept led to marked improvement in patient satisfaction scores as measured by Press Ganey Associates. Specifically, measures of discharge-specific questions increased from the 39th percentile in fiscal year (FY) 2009 to the 84th percentile in FY 2011 and gains were maintained through FY 2012 and into 2014. The Journey to Discharge guides Marianjoy Rehabilitation Hospital associates in helping patients understand expectations for their inpatient rehabilitation stay. This patient-centered initiative demonstrates an innovate approach to better understanding of the rehabilitation process and to easing the patient’s transition across the continuum of care. The concept includes a post discharge follow-up component designed to ensure patients are following instructions, thereby potentially lowering the incidence of readmission following discharge. Optimizing patient discharge preparation can lead to improvement in satisfaction scores and has the potential to lower the incidence of readmissions.

Incidence and Risk Factors for Newly Diagnosed Deep Venous Thrombosis and Pulmonary Embolus in Inpatient Rehabilitation Patients

Nemeth, D., Rao, N. (2011, April)

The purpose of this study was to find the incidence and risk factors for thromboemboli in patients undergoing inpatient rehabilitation. Forty-three patients were identified with a thromboembolism from a 120 bed hospital. Data was collected over 30 months from 7,036 admissions and analyzed retrospectively. Twenty-four of these patients were diagnosed and treated for a deep vein thrombosis (DVT) in the rehabilitation hospital. Nineteen patients were transferred to an acute care hospital for management of their DVT (9) or pulmonary embolism (PE) (10). Patients were assessed for multiple risk factors including: Recent surgery (last three months), recent fractures (last three months), hypercoagulability, immobility, BMI, and contraindications to anticoagulation. Forty-three patients developed DVT/PE’s (0.61%). Of the patients who developed a thrombosis, 48.9% recently underwent surgery (25.6% orthopedic surgery), 38.1% sustained a recent fracture, 48.9% had a hypercoagulable state (41.9% cancer), 65.2% were able to ambulate less than 150 feet, 39.5% had a BMI greater than 30, and 41.9% had a contraindication to anticoagulation. 79.1% had at least two of the six risk factors identified. 16.3% were sub-therapeutic or not on appropriate anticoagulation. This study shows that the incidence of thrombosis was low in the inpatient rehab setting despite having a higher risk for DVT/PE due to immobility, high risk surgeries, and contraindications to anticoagulation. This suggests that aggressive anticoagulation and intense therapy reduced the incidence. This study has prompted future research to consider alternative methods to prevent thromboemboli in patients with a contraindication to anticoagulation.

Poster presented at Association of Academic Physiatrists, Phoenix, AZ; and (2011, November) at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Orlando, FL.
Anticoagulation Management: Outcome of Implementing the Program at an Inpatient Rehabilitation Hospital


Anticoagulants are recognized as high risk medications as they are the leading cause of adverse drug events (ADEs) and medication errors resulting in patient harm. This prompted the Joint Commission to develop a National Patient Safety Goal (NPSG) 3E, which outlines measures to reduce the likelihood of patient harm associated with the use of anticoagulation therapy. In response to this patient safety goal, pharmacy developed a warfarin management protocol. This poster describes the implementation and outcomes of the oral anticoagulation management program in a 120 bed inpatient teaching hospital. A multidisciplinary task force was formed to oversee the initiative, led by a physician, clinical pharmacy manager, and pharmacy director; and included representatives from nursing, education, quality, risk management and information technology. Following gap analysis, a consensus decision was made to create an evidence-based warfarin protocol that included dosing indication, patient sensitivity, drug interaction information, lab monitoring and handling of sub/supra therapeutic levels. Standard warfarin order set, warfarin dosing and reversal protocol, and pharmacy dosing record to monitor daily dose and international normalized ratio (INR), were developed and approved. A hospital-wide policy and procedure was developed that outlined pharmacists’ role in dosing, monitoring and maintaining a daily patient-specific warfarin profile. Baseline data on warfarin-related ADEs was collected, a pharmacy trial program was then implemented, and a follow-up data collection for comparison to baseline indicated a reduction from 19% warfarin-related ADEs to 5.5% of all reported ADEs.

Poster presented at Illinois Council of Health System Pharmacists, St. Charles, IL.

Information Connections: A Website for Parents of Children with Developmental Disabilities and Chronic Conditions


In the Age of Information, information is power. Parents want information and frequently rely on the Internet. However, it can be difficult to navigate and sort through hundreds of Web sites to find high quality up-to-date information about the topic of interest; searches often result in information that is redundant, conflicting, or out-of-date. In August 2009 and again in March 2010 the Medical Library at Marianjoy Rehabilitation Hospital pursued and was awarded funding from the National Library of Medicine. The objective was to develop a Web site for parents of children with developmental disabilities and chronic conditions with a focus on autism, cerebral palsy, Attention Deficit Hyperactivity Disorder (ADHD), Down syndrome, and traumatic brain injury. A preliminary model Web page was developed on the basis of an initial needs assessment and focus group sessions with stakeholders. Five local organizations serving children with developmental disabilities Navigational architecture was developed based on the data from needs analysis, interviews, focus sessions, and online surveys. Having developed a better understanding of the health information needs of parents with developmental disabilities and chronic conditions, the Information Connections Web site was designed and launched in late April 2011. Information Connections will serve as an information portal with a special focus on autism, cerebral palsy, ADHD, Down syndrome, and traumatic brain injury, and is available to the general public (parents and pediatricians) looking for up to date, reliable information on developmental disabilities and chronic conditions.

Poster presented at Illinois Chapter, American Academy of Pediatrics Annual Educational Conference, Lisle, IL.
Critical Analytical Resources for Workforce Agility and Strategic Thinking with Data

Ruroede, K. (2011, September)

Everywhere in healthcare we are surrounded by data and evidence demands. Turning multiple data initiatives into useful information requires a composite of administrative, clinical, financial, quality, outcomes, and research leadership that share a common goal to appropriately harvest organizational data. Higher level analytical resources and skills are important aspects to empower leadership and staff alike, with the tools to understand and interpret data from various vantage points. Inpatient Rehabilitation Facilities (IRF) need to understand how organizational data is collected, retained, analyzed, and reported for external accreditation, financial reimbursement, regulatory compliance, and future pay-for-performance evidence. Understanding the financial dimensions in tandem with clinical meaningfulness are critical links for organizations to effectively mobilize change and improve performance. Within an evolving healthcare reform environment, various federal reimbursement models under consideration, and electronic health record conversions, the ability to maximize informational awareness is imperative. This presentation will share an approach to data analysis skill development and research knowledge dissemination within the workforce, who can then apply it to practice in partnership with respective leadership. This familiarity is in everyone’s best interest for success in generating workforce intellectual capital to help ensure regulatory compliance, optimal reimbursement, and maximize patient outcomes.

Presentation at American Medical Rehabilitation Providers Association 8th Annual Educational Conference, Miami Beach, FL.

Incidence of Missed Therapy Due to Side Effects of Opioid Use; Nausea, Vomiting, Constipation and Lethargy


The objective of this study was to determine the amount of missed therapy due to side effects in common with opioid use, including nausea, vomiting, constipation, and lethargy (illness). This was a retrospective case review over six months. The setting was a musculoskeletal unit of an acute inpatient rehabilitation hospital. Participants included musculoskeletal rehabilitation patients receiving opioids. The main outcome measures included total hours of therapy, total hours of therapy missed, and hours of therapy missed due to illness. In total, 8,559 hours of therapy were provided and 179.25 hours of therapy missed (2.09%). 69.75 hours of missed therapy due to illness (0.81%). Nearly 40% of missed therapy was due to side effects in common with opioids. It is imperative that patients have pain relief in order to perform therapy. However, it is not ideal to administer medications with side effects that cause the patient to miss therapy. Many patients were switched to medications such as tramadol, however without the required pain relief to continue therapy. Another disadvantage of many opioids is the need for multiple stool softeners, laxatives, and anti-emetics. Tapentadol is a new opioid pain reliever which in clinical trials has shown fewer gastrointestinal (GI) side effects. This study has prompted further research to investigate the usefulness of a new opioid such as tapentadol in the acute inpatient rehabilitation setting to limit the amount of GI side effects that lead to half of all missed therapy.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Orlando, FL.
Opioids Causing Increased Incidence of Missed Therapy


The objective of this study was to determine the amount of missed therapy due to the side effects of opioid use; including nausea, vomiting, constipation, and lethargy. This was a retrospective case review over six months. Seventy-two musculoskeletal rehabilitation patients were identified having missed therapy due to illness. The main outcomes identified were hours of therapy missed and number of patients that missed therapy due to opiate side effects, number of patients with gastrointestinal side effects, as well as number of patients taking anti-emetics and bowel meds. Patients were identified to have a direct correlation between opioid use and missed therapy due to side effects by analyzing administration time of medications and date and reason for missed therapy.

47/72 patients missed 45.47 hours of therapy due to opiate side effects. 40/47 patients had gastrointestinal (GI) side effects. Twenty-five patients were taking anti-emetics, 38 were taking greater than three bowel meds of which 26 required a suppository. Sixty-five percent of patients that missed therapy due to illness were on a narcotic and missed therapy due to its side effects. A better approach would be to manage pain without having to use additional medications to manage side effects. These additional medications and the need for therapists to make-up treatment on the weekend increase the overall cost to treat the patient. Tapentadol is a new opioid which in clinical trials has shown fewer GI side effects. This study has prompted further research to investigate the usefulness of a new opioid such as Tapentadol to help reduce the frequency of side effects leading to missed therapy and ultimately reducing the cost to treat. Future research will include a cost analysis versus benefit ratio of using Tapentadol in the rehabilitation setting.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV.

Charting a Course for Value Innovation: Practical Tips for Adopting a Blue Ocean Strategy® in Your Practice


The presentation demonstrated how leaders of physician practices can employ a Blue Ocean strategic framework in their practice setting in order to help them to differentiate their practices through the creation of value and innovation designed to transcend traditional competition in the market place. The concepts of Blue Ocean Strategy®, developed by W. Chan Kim and Renée Mauborgne, builds off the use of dual metaphors: red ocean market places where there is a great deal of competition fighting each other, turning the waters red with the blood of one another; and blue oceans where businesses transcend competition and create new and innovative value offerings for consumers in clear and unbroken waters. The framework defines how businesses can develop strategies focused on the evaluation of price, costs, and services to develop new and profitable lines of business. Examples of Blue Ocean companies are those who create new ideas and means of service delivery to the market in a manner previously not considered. The Blue Ocean Strategy® approach has a great deal of appeal, but enacting it in the health care market space can come with a number of challenges. Blue Ocean Strategy® can be adapted to a health care provider context by shifting the focus to the simultaneous pursuit of quality service delivery and maintenance of tight expense controls. The creation of value-based partnerships with referral sources that are mutually beneficial (i.e., optimize CMS/payer incentives for quality) will similarly open uncontested market space for those providers who are able to capitalize on the opportunity.

Presentation given at American Medical Group Association, San Diego, CA.
Medication Reconciliation: Effect of Pharmacist Review and Interventions on Preventing Potential Medication Errors upon Admission to Inpatient Rehabilitation Facility


Patients are admitted to 128 bed rehabilitation hospital from acute care hospitals with multiple medication lists including 24 hour medication administration record, discharge reconciliation, and patient home medication list. These discharge medication reconciliation lists, usually completed by nurses are not always accurate, as supported by various studies. This makes admission medication reconciliation a challenge for our resident physicians. The purpose of this retrospective review was to determine the incidence of admission related medication reconciliation errors and impact of pharmacist intervention in preventing potential errors. A review of these documented interventions was performed from July 2009 to June 2010. The total number of medication reconciliation interventions documented by pharmacists was 4,372. The reconciliation discrepancies noted were categorized as: medication omission (n=2395, 55%), wrong dose/route/dosage form (n=1364, 31%), missing dosing parameters (n=259, 6%), wrong medication (n=197, 4.5%), incomplete orders/missing information (n=87, 2%), therapeutic duplications (n=39, 0.9%) and allergy to ordered medication (n=31, 0.7%). The total number of patients admitted during the study period was 2,806 making the average admission reconciliation error rate of 1.5% per patient admitted. This comprehensive review revealed numerous potential admission reconciliation errors that were averted due to pharmacist interventions, which is essential for preventing medication errors and enhanced patient safety.

Poster presented at Illinois Council of Health System Pharmacists, Bloomington, IL.

Outcomes of Implementing Hypoglycemia Management Protocols at an Inpatient Rehabilitation Facility


Effective inpatient glycemic control is associated with reduced morbidity and mortality and reduced cost to healthcare institutions. The American Diabetes Association recommends that hospitals have a standardized plan for treating patients with hypoglycemia. Prior to standard hypoglycemia protocol implementation at this institution, several rapid responses (RR) and code blues led to patients being transferred to the nearest emergency room (ER) facility. When patients are admitted to the rehabilitation hospital from acute care hospitals, changes in medical management, dietary intake and activity levels make it imperative to adjust diabetic drug therapy, including insulin dosing, to prevent severe adverse events. The purpose of this study was to describe outcomes after implementation of a consensus-developed hypoglycemia protocol and insulin management guidelines in a 128-bed rehabilitation hospital. Adverse drug reaction (ADR) reports of hypoglycemia due to insulin were reviewed and baseline data collected, leading to development of a standard hypoglycemia management protocol and standard insulin sliding scales. Follow-up data collection for comparison to baseline indicated a reduction from 54% of all RR events due to hypoglycemic symptoms decreased to 12.5%; and a reduction from 25% of hypoglycemic RR events discharged to the ER decreased to 0% following the new protocol implementation.

Poster presented at Illinois Council of Health System Pharmacists, Bloomington, IL.
Clinical Clips: Education on the Run


Patient acuity is higher, lengths of stay are shorter and there are still only 24 hours in a day. So how do we (clinical educators) provide the education nurses need in a practical manner that recognizes the demands on their time? Clinical Clips is one way we are meeting our staff nurse education needs. The program was designed by a Clinical Nurse Specialist with the intention of providing short, clinically focused presentations on a single topic at a time. Staff input regarding topics was solicited and used, in consultation with Nurse Managers, to identify the topics staff nurses felt were most important. The programs are 15 minutes in length and provided on all three shifts. Each topic is presented a total of seven times with rotation to all the nursing units. Timing of the presentations has been adjusted based on staff feedback and the day of the week is varied to allow exposure to the largest number of staff possible. Staff response has been favorable, with some nurses coming in on a day off to attend Clinical Clips. Some nurses use this venue as a way to informally consult the Clinical Nurse Specialist regarding patient or staff issues. A synopsis of the presentation is sent out to the entire nursing staff after each presentation. Clinical Clips has been a time and cost effective way to address education needs and strengthen rapport between staff nurses and the Clinical Nurse Specialist.

Presentation given at Association of Rehabilitation Nurses Annual Conference, Nashville, TN.

The Journey to Discharge: Working in Harmony


The inpatient rehabilitation process can be bewildering to patients and families. As the length of stay has decreased, the acuity of our patients has increased. Despite our best efforts, patients and families may feel that they are not prepared for discharge. The Journey to Discharge™ concept developed from efforts to clearly communicate the stages a patient travels through on their path to discharge from inpatient rehabilitation. A major component of this process was patient centered communication. Nurses are comfortable with planning for discharge from the time of admission but patients and families can perceive this as rushing them out the door. Providing a Journey to Discharge™ roadmap allows us to help patients identify their goals while acknowledging that time required to achieve goals varies between individuals. Taking this project from concept to implementation and revisions was a multidisciplinary collaboration involving everyone from bedside clinicians to the CEO and physicians. The idea of a map was selected since it is familiar to most people. Both staff and patients provided feedback on the original document. The Journey to Discharge™ was piloted on a single unit with the Case Manager and Medical Director of that unit by introducing the tool to patients and families. Clinicians were provided with frequently asked questions and talking points to use during patient education. Within three months the entire hospital was using the tool. Journey to Discharge™ has undergone revisions since its implementation to increase communication effectiveness. We have seen increased patient satisfaction on scores and decreased concerns about not being prepared for discharge.

Presentation given at Association of Rehabilitation Nurses Annual Conference, Nashville, TN.
The Journey to Discharge: Ending on the Right Note


The transition from inpatient rehabilitation to home or another level of care can trigger a sense of risk and uncertainty for many patients. In fiscal year 2009, leadership at Marianjoy Rehabilitation Hospital noted overall patient satisfaction scores had plateaued. One problem area identified was dissatisfaction with discharge planning and transition between levels of care. A multi-disciplinary team of leaders and clinical staff developed a service excellence initiative now known as Your Journey to Discharge™. The creation and implementation of this concept led to the realization that our patients needed more personalized follow-up than a survey could provide. The post discharge follow-up call from a licensed registered nurse started in late 2010 and its effectiveness exceeded expectations. The call consisted of ten questions and is made 24 to 72 hours post discharge. Not only does it help confirm adherence to discharge plans and proactively address any medical or other concerns that arise post discharge, but it may help reduce the risk of re-hospitalization. Patients have expressed appreciation for the opportunity to ask questions and get specific advice. This in turn positively impacts their perception of the quality of care provided. Overall discharge-specific patient satisfaction scores increased dramatically from 75% in FY 2010 to 84% in FY 2011. Additionally, the data collected from these calls has been useful for tracking trends, identifying opportunities for new process improvement initiatives, and communicating staff recognition. This service excellence initiative has supported multidimensional benefits.

Presentation given at Association of Rehabilitation Nurses Annual Conference, Nashville, TN.

Clinical Referral Liaison: Setting the Tone


This presentation describes the Clinical Referral Liaisons’ role as the initial team member involved in assisting patients and their families on their journey along road through rehabilitation. One aspect of our role is to provide potential patients and family’s assurance by educating them on the role physical rehabilitation will play in their medical and physical recovery. This consists of a spectrum from the inpatient setting to outpatient services. We utilize our comprehensive pre-admission tool which provides crucial information that can be easily accessed by other members of the interdisciplinary rehab team. With this in place, our patients are better prepared affording them a successful rehabilitation experience. Marianjoy provides a unique model consisting of collaboration between physiatrist and liaison with our consulting hospitals. This allows us increased availability to meet the expectations of our referral hospitals and securing patient satisfaction.

Presentation given at Association of Rehabilitation Nurses Annual Conference, Nashville, TN.
Evaluation of Healthcare Professionals Attitudes toward Research as Consumers and Practitioners


The purpose of this descriptive study was to evaluate nurses and allied health professionals’ perceptions about data mindfulness, research knowledge, attitudes, and capacity to engage in research supported clinical practices. Healthcare delivery is rapidly changing to improve quality of care and evidence the American population deserves in safe healthcare environments. Data and measurement that accurately discriminate on quality levels are essential to demonstrate providers’ accountability in patient-centered care coordination across the continuum of healthcare delivery settings. Supportive data evidence derived from quality initiatives and research applications are critical to all healthcare provider stakeholders, beginning with healthcare professionals’ attitudes toward research. Additional study background information follows: (1) the impetus for this study came about after the authors’ failed attempt to harvest retrospective medical record data for an inpatient rehabilitation facility study due to missing data, (2) inconsistency and variability in documentation among clinical professionals and limited ability to answer the primary research questions, (3) retrospective data collection revealed stark difference between clinicians and researchers’ documentation of data and outcomes of variables, (4) the importance for rehabilitation professionals to embrace the available research and statistical tools as consumers of data and researchers, (5) the powerfully persuasive skills that statistics, research methodology, and computer competencies represent to support business, strategic, and clinical decisions, (6) clinical or rehabilitation outcome reports contain statistical language that needs to be understood before information can be effectively used, and (7) all healthcare related jobs contain some responsibility related to data collection, management, or analysis that can empower and effect change.

Poster presented at American Medical Rehabilitation Providers Association 8th Annual Medical Rehabilitation Educational Conference, San Diego, CA.

Navigating Change: Applying Blue Ocean Strategy® in the Post-Acute Care Setting


Rehabilitation providers will need to establish their value to acute-care referral sources as their focus shifts toward episodes of care, prevention of readmissions, and improved efficiency of care delivery. This will require a new paradigm for creating a system focused on the delivery of innovative medical services built upon a patient-centered foundation of quality outcomes and value. Blue Ocean Strategy® offers a conceptual framework for the creation of value and innovative service delivery which can be adopted within the context of a health care marketplace. This presentation offered creative rehabilitation leaders a number of tools to begin meeting the challenges of the new reality they find themselves in as the entire industry moves away from the traditional pay-for-play structure to one emphasizing overall quality and value across episodes of health and wellness. Examples of how Marianjoy Rehabilitation Hospital adopted this framework during annual planning were shared to highlight the practicality of the Blue Ocean Approach in strategic planning for a rehabilitation organization.

Presentation given at American Medical Rehabilitation Providers Association 8th Annual Medical Rehabilitation Educational Conference, San Diego, CA.
Antibiotic Stewardship in an Inpatient Rehabilitation Hospital


There is no published experience on antibiotic stewardship programs (ASP) at inpatient rehabilitation facilities (IRF). Forty-eight percent of IRF patients receive antibiotics (ABX). At a 120 bed free-standing IRF, the most common indication for ABX use is urinary tract infection (UTI). The purpose of this study was to evaluate the effectiveness of pharmacist-led ASP compared to a novel program led by a multi-professional team of physicians, nurses and pharmacists implementing guidelines to reduce the treatment of asymptomatic bacteriuria (ASB) with a goal of achieving 50% reduction in six months. The study was conducted over 52 months divided into three periods. The baseline period was observation only. Intervention one period included pharmacists performing concurrent review and feedback on all antibiotic orders. The intervention two period included a novel stewardship model with pharmacists’ role enhanced by: concise guidelines defining ASB and unnecessary ABX treatment; mandatory education on guidelines for all physicians and nursing staff; active support by senior leadership team amplifying importance of the program. The current study was limited to enteral ABX as 84% of the total antibiotics dispensed were enteral. Days of therapy (DOT) was estimated by dividing total number of doses dispensed by usual prescribing frequency for each drug. Outcomes were DOT/1000PD and percent of ASB treated. Pharmacist review and feedback reduced ABX use by focusing on the prescribing role of the physician but did not address the role of nursing in prompting physicians to diagnose and treat UTI. Setting a specific institutional goal of reducing treatment of ASB, active administrative support, developing clear guidelines, and engaging nurses and physicians in an ongoing ASP dramatically improved performance and reduced ABX use.

Poster presented at Infectious Disease Week, San Diego, CA.

Retrospective Analysis of Rivaroxaban versus Fondaparinux for Thromboprophylaxis after Joint Replacement at an Inpatient Rehabilitation Facility


The purpose of this study is to compare effectiveness and safety of the new oral Factor Xa inhibitor rivaroxaban to fondaparinux, an injectable anticoagulant, for prevention of venous thromboembolism (VTE) after hip or knee arthroplasty within an inpatient rehabilitation facility (IRF). Multiple studies reported have compared rivaroxaban with enoxaparin for thromboprophylaxis; however, there are no studies reported comparing safety and effectiveness of rivaroxaban versus fondaparinux. Patients admitted to an IRF during a 12 month period following lower extremity joint replacement who received either rivaroxaban or fondaparinux for VTE prevention. Primary effectiveness outcome included occurrence of deep vein thrombosis (DVT) and pulmonary embolism (PE). Primary safety outcomes were any major or non-major bleeding events. In a preliminary analysis of 48 patient records (25 patients on rivaroxaban; 23 patients on fondaparinux), no DVT or PE events were recorded. No major bleeding event occurred in patients prescribed rivaroxaban compared to 4.3% in patients prescribed fondaparinux. A minor bleeding event occurred in 4% of patients prescribed rivaroxaban compared to 4.3% in fondaparinux group. Data collection is ongoing as rivaroxaban is a relatively new oral anticoagulant in the IRFs formulary. Preliminary study results support similar effectiveness and safety with both anticoagulants in regards to VTE prevention and bleeding events. Additional data analysis will continue across the study period.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Atlanta, GA.
Darbepoetin alfa Protocol Implementation in an Inpatient Rehabilitation Hospital: The Pharmacist’s Impact


More than 20 million people aged 20 years or older in the United States have chronic kidney disease (CKD). Patients with CKD, including dialysis patients, lose the ability to make red blood cells (RBC) and become anemic because erythropoietin, a key hormone synthesized in the kidney responsible for RBC maturation in the bone marrow is deficient. Erythropoietin stimulating agents (ESAs) such as darbepoetin alfa (DARB) play a major role in the management of anemia due to CKD. However, due to the increasing evidence of serious life threatening adverse events associated with ESAs, strategies were recommended by ESAs manufacturers and the FDA to enhance their efficacy and reduce harm. Some of these recommendations in CKD patients are to: (1) use the lowest dose needed to avoid blood transfusions, (2) maintain hemoglobin (Hgb) between 10-11g/dL, and (3) ensure adequate iron levels before and during ESAs use. These have been proven to help achieve target Hgb levels, decrease ESAs utilization, and decrease adverse events associated with its use. The purpose of this retrospective review is to assess the pharmacists’ impact on implementation of DARB protocol. The use of DARB at Marianjoy Rehabilitation Hospital (MRH) has primarily been for the management of anemia in CKD patients; however it has been inappropriately prescribed for unapproved indications such as postoperative anemia or anemia of unknown etiology. These have been primarily governed by physicians with no processes in place for pharmacists’ interventions. Optimal use of DARB entails assessment of appropriate indication, dosing, lab ordering and monitoring in patients prescribed DARB. These were attained when DARB protocol was implemented and a superior outcome was seen when the protocol was driven entirely by pharmacists.

Poster presented at American Society of Health System Pharmacists Mid-Year Clinical Meeting, Las Vegas, NV.

Impact of Antibiotic Stewardship Program on the Treatment of Asymptomatic Bacteriuria


Antibiotic Stewardship is a rational, systematic approach to the use of antibiotics (ABX) in order to achieve optimal outcomes by selection of appropriate agent, at the correct dose and for appropriate duration. The primary goal of antibiotic stewardship is to optimize clinical outcomes, improve patient’s safety and reduce resistance and adverse events. There is little published experience on the antibiotics stewardship programs (ASP) at inpatient rehabilitation facilities. Asymptomatic bacteriuria (ASB) is common and urinary tract infection (UTI) is the most common indication for ABX use. ABX are prescribed for 48% of patients in our rehabilitation setting and ABX use for treating UTIs is often inappropriate. Despite the presence of evidence-based guidelines on the diagnosis and management of UTIs vs. ASB, it is often misdiagnosed as UTI and inappropriately treated. The purpose of this study was to evaluate the effectiveness of ASP lead by multiprofessional team consisting of physicians, nurses, and pharmacists in reducing the treatment of ASB.

Poster presented at American Society of Health System Pharmacists Mid-Year Clinical Meeting, Las Vegas, NV.
Analysis of Attitudes and Beliefs of Physical Therapists Toward Low Back Pain Management Post-Attendance at a Continuing Education Course


The objective of the study was to investigate whether education alone can affect the behaviors and beliefs of physical therapists in their therapeutic approach and management of patients presenting with low back pain. This was a prospective, repeated measures design. Eleven physical therapists who work with orthopedic and neurological patients who experience low back pain participated in the course. Participation in a six hour CEU course for physical therapists was conducted by the pain team including physiatrists, which included lectures with an experiential lab in the afternoon. Course content covered philosophy of pain management, pharmacological management, role of nutrition and several intervention strategies. The therapists completed the same scale after attending the course. The Pain Attitudes and Belief Scale for Physiotherapists is a 31-item survey that was completed pre/post attendance at the pain CEU course. This self-report scale discriminates between a biomedical and biopsychosocial orientation of therapists in their management of patients with reported low back pain. Returned pre/post-attendance questionnaires were analyzed using Wilcoxon Signed Ranked test. There were five cases where rank decreased from precourse opinion to post course opinion, 20 cases where rank increased, and 17 cases of no change on behavioral orientation items (p < 0.003). With respect to biomedical items, there were 41 cases where rank decreased precourse to postcourse opinion, 30 cases where rank increased, and 27 where there was no change (p < 0.095).

Physical therapists who participated in pain CEU course demonstrated significant change in their attitudes and beliefs as evaluated by PABS-PT for the behavioral orientation items, but not for the biomedical items. Variations exist between behavioral and biomedical attitudes and beliefs regarding treatment of chronic low back pain, emphasizing the need for more outcomes research in this area as well as a larger sample size to identify the most effective approach for shaping clinical practice.

Poster presented at Association of Academic Physiatrists, New Orleans, LA.

Tapentadol Reduces Incidence of Missed Therapy


The objective for the study was to determine the amount of missed therapy due to side effects of Tapentadol compared to traditional opioids. This was a retrospective case review over 12 months. Nineteen rehabilitation patients were identified having taken Tapentadol for pain relief. An additional 3,907 patients were identified having taken Hydrocodone for pain relief. The main outcome identified was whether therapy had been missed during the hospital stay. It was then determined whether the side effects of Tapentadol were responsible for the missed therapy by analyzing the administration time of medications and the date and reason for missed therapy. Four out of 19 patients receiving Tapentadol missed therapy at some point during their stay. It was determined that none of the patients receiving Tapentadol missed therapy due to its side effects. Six-hundred ten out of 3907 (15.6%) patients receiving Hydrocodone missed therapy due to illness (nausea, vomiting, constipation, and lethargy) during their stay. Previous studies indicated that 40% of all missed therapy was due to side effects in common with opioids. This study showed 0% of patients receiving Tapentadol missed therapy due to its side effects. Two patients were found to have missed therapy 48 hours after their last dose of Tapentadol, one was initiated on Tapentadol after missing therapy, and the fourth patient was found to have missed therapy due to recently having a cardiac anti-arrhythmic medication increased. Of the patients in this study receiving Hydrocodone, 15.6% missed therapy due to illness. Another prior study found that 65% of patients that missed therapy due to illness could be directly linked to side effects of opioid use. Based on this information, over 10% (396) of the patients receiving Hydrocodone can be directly linked to having missed therapy due to its side effects. Future research will include a double-blinded randomized trial tracking the incidence of missed therapy of patients on Tapentadol versus Hydrocodone.

Poster presented at Association of Academic Physiatrists, New Orleans, LA.
Cost-Benefit Analysis of Tapentadol versus Hydrocodone


The objective of the poster was to determine the cost to treat difference between Tapentadol and Hydrocodone. This was a retrospective case review over six months. Forty-seven patients were identified to have missed therapy due to opioid side effects. The main outcomes identified were amount of therapy made up on the weekend, cost to make up therapy, cost of medication usage based on frequency of bowel medication, antiemetic and pain medication usage, and equivalent cost of Tapentadol usage. Forty-seven patients required 165 hours to be made up on the weekend due to missed therapy. This resulted in $8,225.00 spent to make up the lost therapy time. $679.25 was spent on bowel medications, antiemetics, and pain medication for the 47 patients who missed therapy. This totaled $8,904.25 spent on the patients on traditional opioid medication to make up missed therapy due to opioids and combat their side effects with medication. The equivalent cost to treat each patient with Tapentadol is $4,112.50 in pain medication cost. Projected cost to make up missed therapy while on Tapentadol is $4,000.00, totaling $8,112.50. Treating each patient with Tapentadol will save an estimated $800.00 biannually for each floor of the rehab hospital. While Tapentadol is a more expensive medication than traditional opioids, the savings are estimated to be due to the low side effect profile. It is estimated that the use of Tapentadol in the appropriate patient will decrease the amount of bowel medications, antiemetics, and missed therapy by 50%. Other benefits include decreased nursing time spent distributing medications and toileting, decreased need for therapists on the weekend, improved patient satisfaction, and improved quality of care. The estimates in this study will lead to future research to calculate the actual cost of a patient’s hospital stay on Tapentadol.

Poster presented at Association of Academic Physiatrists, New Orleans, LA.

Developing an Electronic Health Record that Promotes Continuity of Care and Supports Interdisciplinary Collaboration in a Rehabilitation Setting


In 1996, the Marianjoy Rehabilitation Hospital Nursing Department transitioned into computerized documentation. Over the years, the electronic health record (EHR) evolved due to various external mandates for regulatory and accreditation compliance. The EHR became more complicated, redundant, time consuming, and a source of frustration for nursing and took nurses away from the bedside. During a Joint Commission survey in October 2009, they recommended that nursing reformat their EHR documentation to assure clearer communication and improve documentation flow. The EHR was criticized for being ineffective in communicating patients’ current condition and the nursing plan of care. Nursing was hampered due to a fractionated EHR architectural design and flow of patient care data. This situation also impacted the interdisciplinary teams’ efficiency with sharing critical information for coordinated patient care. In addition, the American Recovery and Reinvestment Act of 2009 required all hospitals to become meaningful users of the electronic health records by 2014. Nursing and hospital leadership supported the redesign of EHR documentation with an Information Systems alliance. Throughout the project, evaluation methods were used to measure success and obtain stakeholder feedback. A marketing plan was implemented by the nursing project leader that involved nurses at all levels to assist with testing, education, and launching of the new nursing documentation. Approximately 240 new nursing screens were built for this project and the system launched in February 2012. The EHR nursing documentation revisions was a two year commitment requiring strategic, methodical development, and implementation. The goal to have an effective EHR conducive to interdisciplinary collaboration was attained for the ultimate benefit of patients’ served and was well received by Joint Commission during a subsequent accreditation visit.

Poster presented at American Medical Providers Association 11th Annual Medical Rehabilitation Educational Conference, Amelia Island, FL.
Creating Strategic Alliances for Coordination of Post-Acute Care

Yosko, K., Brady, J. (2013, September).

The health care marketplace continues to shift from volume-based to value-based reimbursement. As a result, providers of inpatient rehabilitation are feeling added pressure to continually demonstrate their value to acute-care referral partners in order to maintain their place in the overall continuum of care. Rehab providers are uniquely positioned to achieve this by leveraging their ability to help facilitate the coordination of patient needs across the continuum of care, resulting in improved overall patient outcomes. This presentation will detail how Marianjoy Rehabilitation Hospital has been working with its primary referral acute care partners to establish a reliable channel of patients into the facility by developing an approach which balances patient-centered care with an understanding of the needs and goals of the acute care providers. Practical strategies and tactics for varying levels of partnership with referral sources will be highlighted and discussed.

Presentation given at American Medical Rehabilitation Providers Association 9th Annual Medical Rehabilitation Educational Conference, Amelia Island, FL.

Putting the Puzzle Pieces Together for IRF-PPS Quality Reporting


This case study describes a single inpatient rehabilitation hospital (IRH) organizational approach to organize and report quality metrics that satisfy compliance under the Medicare Final Rule and other regulatory requirements. Today's quality driven inpatient rehabilitation hospital environment demands coordination across multiple departments to effectively comply with data reporting requirements. Medicare’s IRF-PPS quality reporting requirements for submission of new or worsened pressure ulcers and catheter associated urinary tract infections (CAUTI) necessitate IRFs interdepartmental coordination. State Departments of Public Health and third party insurers also have established expectations for objective quality performance reporting. The presenter outlines the quality evaluation initiatives that include financial, clinical, and meaningful quality data the rehabilitation facility is accountable to report. The presentation describes resources and tools within the workplace to effectively participate in important data driven agendas. Methods to assemble disparate data from sources into one location for subsequent data warehousing, analyses, and reporting were addressed. Illustrations of potential multidisciplinary quality and research opportunities applicable to healthcare reform and future pay for performance mandates were also discussed. Strategic planning is essential to position a quality management infrastructure that enables regulatory compliance with external reporting and internal performance improvement engagement.

Presentation given at American Medical Providers Association 11th Annual Medical Rehabilitation Educational Conference, Amelia Island, FL.
**40 Years of Caring with Spirit: Physical Medicine and Rehabilitation Treatment, Research, and Education at Marianjoy Rehabilitation Hospital**


In 1972, Marianjoy opened its doors as the first free-standing rehabilitation hospital in the suburbs of Chicago. The name Marianjoy was derived to honor its founders, the Wheaton Franciscan Sisters who are Daughters of the Sacred Hearts of Jesus and Mary (Marian), as well as reflecting St. Francis’ philosophy for living a simple life of faith and joy. At Marianjoy, physicians employ a programmatic approach to care of patients suffering from stroke, brain injury, musculoskeletal issues, spinal cord injuries, and other conditions requiring physical medicine and rehabilitation (PM&R) care and therapy. This is done in partnership with colleagues in the acute and postacute care settings to ensure patients experience seamless transitions across the continuum of care settings. Physicians at the Marianjoy Medical Group have maintained a long-term commitment to training and education of future PM&R physicians. In 1986, under the leadership of Dr. Richard Harvey, residents in PM&R from RUSH University began rotating through Marianjoy Rehabilitation Hospital. In 1989, the program expanded to include residents from Loyola University. Based on the need for PM&R education, leaders from Marianjoy elected to gain accreditation for its own self-sustaining residency program in 1994, making the facility the first teaching hospital in DuPage County, Illinois and the only community-based program in the area. Since that time, more than 69 PM&R physicians have graduated from the Marianjoy residency program and gone on to serve as leaders in the field. The future of medical education remains strong at Marianjoy following its affiliation with the Rosalind Franklin University of Medical Sciences in 2012. Marianjoy physicians now serve in leadership roles, guiding PM&R instruction at the school, promoting research, and clinical excellence in the field of PM&R.

Poster presented at American Academy of Physical Medicine & Rehabilitation (AAPM&R) Annual Assembly, National Harbor, MD.

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**Evaluation of Comprehensive Pain Management Program with Utilization of a Functional Assessment Tool**


The objective of the study was to evaluate progress of patients enrolled in a comprehensive pain management program by showing objective evidence of physical improvement with utilization of a functional assessment tool. The setting is an outpatient pain treatment center. Participants: 104 chronic pain patients (65 female, 39 male).

The Marianjoy Pain Functional Assessment Tool (MPFAT) was used to evaluate progress of patients enrolled in a 21-day comprehensive interdisciplinary pain management program consisting of physical therapy, functional conditioning, psychology, education, biofeedback, and medication management. MPFAT was used for initial and end of program evaluations. Measured outcomes as defined by the MPFAT included: subject’s assessment of perceived physical ability, visual analog pain scores, six minute walk test, fast walking 10 meters, handgrip strength, sit to stand repetitions, lifting adjustable weighted object, step-ups, subject’s estimate of perceived exertion, and assessment of pain behavior using Modified University of Alabama-Birmingham Pain Behavior Scale. Paired sample t-tests used for comparison between initial and end of program evaluations respectively. Patients significantly (p<0.05) improved in all facets of MPFAT measured outcomes with exception of perceived physical ability and handgrip strength. Pain behavior scores were reduced by average of 1.95 (p<0.005) points. It appears plausible to conclude that a comprehensive pain management program is beneficial for patients’ with chronic pain as evidenced by the positive significant functional improvements shown with utilization of the MPFAT. The hope of this study is to promote greater awareness of the potential benefits that a well-designed comprehensive pain management has to offer and the practicality of utilization of a tool such as the MPFAT.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, National Harbor, MD; and, (2013, October) at Midwest Pain Society, Chicago, IL.
Marianjoy Pain Functional Assessment Tool for Objective Analysis of Chronic Pain Patients


The purpose of this study was the development of functional assessment tool for chronic pain patients that provides practitioners with a common outcome evaluation to quantify patients’ progress during a pain management program. It was hypothesized that the functional assessment tool developed will show objective evidence of decreased physical capabilities by patients with chronic pain relative to healthy participants’ outcomes. The setting is an outpatient pain treatment center. The participants included 31 healthy control participants and 104 chronic pain patients. A literature review was performed initially to assimilate various individual functional tests into a single comprehensive assessment tool which was named, Marianjoy Pain Functional Assessment Tool (MPFAT). Collection of data was obtained utilizing MPFAT on healthy control subjects and initial assessments of chronic pain patients enrolled in a comprehensive pain management program. The MPFAT outcomes were based upon subject’s assessment of initial self-physical ability, visual analog pain score, six minute walk test, fast walking 10 meters, handgrip strength, sit to stand repetitions, lifting adjustable weighted object, step-ups, subject’s estimate of perceived exertion, and assessment of pain behavior using Modified University of Alabama-Birmingham Pain Behavior ScaleAll performance outcomes measured by the MPFAT showed significantly lower (p<0.05) baseline physical function measures of chronic pain patients compared to healthy control subjects, with exception of hand grip strength. The framework provided by MPFAT showed objective evidence of physical decline in the chronic pain patient study group compared to controls, as hypothesized. Thus, it may be plausible for the MPFAT to be further used in other pain management program settings to objectively track patient progress.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, National Harbor, MD; and, (2013, October) at Midwest Pain Society, Chicago, IL.

Post-Intensive Care Syndrome (PICS): The Role of Speech-Language Pathologists


Post-Intensive Care Syndrome (PICS) identifies impairments in physical, cognitive, or mental health arising after critical illness and persisting beyond hospitalization. This session introduces and describes PICS and its impact on patients and families, discusses Speech-Language Pathologists’ roles during critical care recovery and rehabilitation, and provides resources for assessment and treatment.

Platform presentation at the American Speech Language Hearing Association Annual Convention, Chicago, IL.
Safety, Effectiveness and Cost Analysis of Rivaroxaban versus Fondaparinux for Thromboprophylaxis after Joint Replacement at an Inpatient Rehabilitation Facility


The purpose of this study was to compare safety, effectiveness, and cost of the new oral Factor Xa inhibitor rivaroxaban to fondaparinux, an injectable anticoagulant, for prevention of venous thromboembolism (VTE) after hip or knee arthroplasty within an inpatient rehabilitation hospital (IRH). Multiple reported studies have compared rivaroxaban with enoxaparin for thromboprophylaxis; however, there are no studies reported comparing safety, effectiveness and cost of rivaroxaban versus fondaparinux. Anticoagulants commonly used for thromboprophylaxis require parenteral administration or require dose monitoring due to unpredictable pharmacodynamic properties. Rivaroxaban is the first available orally active anticoagulant that does not require dose monitoring. The institutional review board approved this retrospective cohort study at a 127 bed free-standing IRH. Data was collected on the patient sample of convenience that were either status post total knee arthroplasty or total hip arthroplasty, admitted to the IRH over a 24 month period (January 2011 to December 2012). Primary effectiveness outcomes were composite of any deep vein thrombosis (DVT), proximal and/or distal; non-fatal, symptomatic, objectively confirmed pulmonary embolism (PE); and all-cause mortality. Primary safety outcomes were any major or non-major bleeding events (defined in poster). Cost comparison was done by calculating cost of total doses of rivaroxaban dispensed and the cost of equal number of fondaparinux doses. Analysis of 314 patient records (199 patients on rivaroxaban and 115 patients on fondaparinux) indicated no PE events during their IRF stay. No VTE occurred in the patients prescribed rivaroxaban compared to 0.87% in fondaparinux group. Major bleeding events occurred in 0.5% of patients prescribed rivaroxaban compared to 1.74% in fondaparinux group. Minor bleeding events occurred in 1% of patients prescribed rivaroxaban compared to 1.74% of patients in fondaparinux group. Direct acquisition cost analysis revealed savings of approximately $13,000.00 (52% lower costs than fondaparinux) in the patients treated with rivaroxaban. In this study, rivaroxaban provided a safe and effective alternative to fondaparinux for prevention of VTE in postoperative total hip or knee replacement patients in the IRF setting. Rivaroxaban was also found to be favorable with respect to cost of acquisition, and ease of drug administration.

Poster presented at American Society of Health System Pharmacists Mid-year Clinical Meeting, Orlando, FL.

Financial Impact of Pharmacy and Therapeutics (P&T) Committee on an Acute Inpatient Rehabilitation Hospital Bottom-Line


The pharmacy operating costs makes up a significant portion of the hospital total budget. And in light of reimbursement cuts from Medicare and Medicaid, hospital administrators continually seek ways to improve efficiency and control costs without affecting optimal patient-care. Although pharmacy is a major cost center in most hospitals, it plays a critical role in patient safety and clinical outcomes which is central to the healthcare reform reimbursement act. The purpose of this study was to estimate the financial impact of the pharmacy and therapeutics committee (P&T) on drug formulary and ultimately the bottom line of an inpatient rehabilitation hospital. The P&T committee consists of multidisciplinary clinicians working closely together to improve patient care, reduce drug costs, formulary management, and optimize clinical efficacy. In 2010, the cost savings were attributed primarily to anticoagulants and insulin therapeutic interchanges; in 2011 to central nervous system stimulants and antibiotics; and in 2012 to erythropoiesis stimulating agents. The total estimated direct drug expense (DE) savings achieved due to P&T formulary streamlining were $175,000.00, $147,000.00, and $45,000.00 in 2010, 2011, and 2012 respectively. The pharmacy DE ratio to total pharmacy operating expenses (OE) during those years declined accordingly to 45%, 40%, and 37%. This was a significant reduction compared to previous years when DE to OE ratio was over 50%. In the era of value-based reimbursement and accountable care models, increasing healthcare and drug costs, cost containment strategies and specifically drug, cost control through P&T committee initiatives can have a positive impact on the bottom-line of an inpatient rehabilitation hospital.

Poster presented at American Society of Health System Pharmacists Mid-year Clinical Meeting, Orlando, FL.
Rivaroxaban as a Bridge to Warfarin in a Patient on Chronic Warfarin for Venous Thromboembolic Disease.


Rivaroxaban is a novel oral anticoagulant approved as an alternative to warfarin for reducing stroke risk in patients with nonvalvular atrial fibrillation, treatment of deep vein thrombosis (DVT) and pulmonary embolism (PE), reducing the recurrence of DVT and PE, and for DVT prophylaxis following knee or hip replacement surgery. This case illustrates the use of rivaroxaban as bridge therapy to warfarin in a 69-year-old female, admitted to an acute inpatient rehabilitation facility, following elective right knee replacement surgery for severe degenerative arthritis. Patient had been maintained on warfarin for venous thromboembolism (VTE) disease pursuant to unprovoked PE and DVT diagnosed in August 2009. Patient was morbidly obese and had a previous medical history that included hypertension, lower extremity venous stasis with varicose veins and type II diabetes mellitus. Hematologist recommended the use of rivaroxaban postoperatively as bridge to warfarin until her international normalized ratio (INR) was in the therapeutic range of 2-3. There is no label indication for its use as bridge therapy and no study or consensus based clinical experience for this use has been documented. Moreover, the coadministration of warfarin and rivaroxaban will have an additive effect on prothrombin time (PT) and INR. In the acute care hospital, warfarin was started postoperatively the day of surgery at a dose of 10 mg and rivaroxaban was started the following morning at 10 mg. When patient was admitted to our acute inpatient rehabilitation facility, patient was on day four of warfarin and day three of rivaroxaban. Once a therapeutic INR was achieved, patient remained within the therapeutic range for the remaining 22 days of stay with minor variation. There were no bleeding events or evidence of bleeding during patient’s 31 day stay and hemoglobin increased steadily from admission. Bilateral lower extremity edema was noted, but no evidence of DVT. Although more studies would be required to determine if rivaroxaban is a safe and effective alternative to current anticoagulants used to bridge, this patient was successfully bridged to warfarin using rivaroxaban 10 mg without incident.

Poster presented at American Society of Health System Pharmacists Mid-year Clinical Meeting, Orlando, FL.

Improvement to Physical Therapy Student Clinical Education Program.


This project evaluated physical therapy students’ clinical rotations within the Marianjoy network and identified factors associated with a higher quality learning experience. This quality improvement project investigated the skills and knowledge of both student interns and clinical instructors (CI) using the American Physical Therapy Association (APTA) Student Clinical Experience Survey. Based on research and APTA’s Professional Behaviors for the 21st Century Professional, the following skills were identified as necessary for success of students and clinicians: collaboration and consultation with others, critical thinking, integration of evidence into practice, responsibility for communication related to their patient’s care across various settings, provision of cost effective services, flexibility and openness, and commitment to learning. As adult learners, students want to apply what they have learned and value coaching and constructive feedback to be able to assess their progress and growth. Clinical instructors are essential for the student’s application of classroom knowledge into clinical practice. The clinical instructor may need to modify their communication and teaching style to match the student’s learning style, level of understanding and experience. Prior research indicates the use of formal CI training is an essential component to prepare and design effective fieldwork programs and to bridge the gap between theory and practice. Further, to enhance the effectiveness of clinical instructors, organizations can assist CIs in the development of their leadership and educational skills. Improved leadership skills will enhance CI’s skill set, confidence, and ability to better meet the needs of students in professional programs.

Poster presented at Combined Sections Meeting (CSM) of APTA, Las Vegas, NV.
Retrospective Analysis of Rivaroxaban versus Fondaparinux for Thromboprophylaxis after Joint Replacement at an Inpatient Rehabilitation Facility


The purpose of this study is to compare safety, effectiveness, and cost of the new oral Factor Xa inhibitor rivaroxaban to fondaparinux, an injectable anticoagulant, for prevention of venous thromboembolism (VTE) after hip or knee arthroplasty within an inpatient rehabilitation hospital (IRH). Multiple reported studies have compared rivaroxaban with enoxaparin for thromboprophylaxis; however, there are no published studies reported comparing safety and effectiveness of rivaroxaban versus fondaparinux.

Study participants were patients admitted to an IRF during a 26 month period following lower extremity joint replacement who received either rivaroxaban 2.5mg subcutaneously or fondaparinux 10mg orally for VTE prevention. Primary effectiveness outcome included occurrence of deep vein thrombosis (DVT) and pulmonary embolism (PE). Primary safety outcomes were any major or non-major bleeding events (defined in poster). Analysis of 345 patient records (230 patients on rivaroxaban and 115 patients on fondaparinux), no PE events occurred in either group. No VTE occurred in rivaroxaban group compared to 0.87% in fondaparinux group. Major bleeding events occurred in 0.4% of patients prescribed rivaroxaban compared to 1.74% in fondaparinux group. Minor bleeding events occurred in 0.9% of patients prescribed rivaroxaban compared to 1.74% of patients in fondaparinux group.

Rivaroxaban provided a safe and effective alternative to fondaparinux for prevention of VTE. Therefore, it may be plausible to conclude that rivaroxaban is a comparable and effective alternative to fondaparinux in the inpatient rehabilitation setting for postoperative total hip or knee replacement patients.

Poster presented at Association of Academic Physiatrists, Nashville, TN.
Marianjoy therapists employ a wide variety of technology and techniques to assist patients in reaching their therapy goals.
Anticipatory Postural Adjustments in Children with Hemiplegia and Diplegia


Anticipatory postural adjustments (APAs) play an important role in the performance of many activities requiring the maintenance of standing posture. However, little is known about if and how children with cerebral palsy (CP) generate APAs. Two groups of children with CP (hemiplegia and diplegia) and a group of children with typical motor development performed arm flexion and extension movements while standing on a force platform. Electromyographic activity of six trunk and leg muscles and displacement of center of pressure (COP) were recorded. Children with CP were able to generate anticipatory postural adjustments and produce directionally specific APAs and COP displacements similar to those described in adults and typically developing children. However, children with diplegia were unable to generate APAs of the same magnitude as children with typical development and hemiplegia and had higher baseline muscle activity prior to movement. In children with diplegia, COP was posteriorly displaced and peak acceleration was smaller during bilateral extension compared to children with hemiplegia. The outcomes of the study highlight the role of APAs in the control of posture of children with CP and point out the similarities and differences in anticipatory control in children with diplegia and hemiplegia. These differences may foster ideas for treatment strategies to enhance APAs in children with CP.
Auxiliary Sensory Cues Improve Automatic Postural Responses in Individuals with Diabetic Neuropathy


A loss of sensation in the lower limbs, observed in individuals with diabetes as well as elderly individuals, contributes to postural instability, altered gait patterns, increased risk of falling, and decreased quality of life. The objective of this study was to determine if somatosensory cues delivered to sensate areas of the lower limbs above the ankle joints enhance the control of posture in individuals with peripheral neuropathy. Twelve subjects with sensory neuropathy due to diabetes participated in static and dynamic balance tests with and without auxiliary sensory cues provided to the lower limbs without stabilizing the ankle joints. During the tests the subjects were required to stand on a fixed or moving computer controlled platform with their eyes open or closed. Equilibrium scores and response latency were obtained. For all tests, equilibrium scores were significantly larger in experiments with auxiliary sensory cues in comparison with conditions without cues (P < .05). Smaller latency scores were recorded in conditions with auxiliary sensory information. The results indicate that auxiliary sensory cues improved automatic postural responses. The observed enhancement of automatic postural responses has clinical implications that aid in the understanding of postural control in individuals with peripheral neuropathy. Future controlled trials could examine whether devices that provide auxiliary sensory cues can improve balance, mobility, and the performance of daily activities.

Early and Late Components of Feed-Forward Postural Adjustments to Predictable Perturbations


The purpose was to investigate two types of feedforward postural adjustments associated with preparation to predictable external perturbations. Nine subjects stood on a wedge, toes-up or toes-down, while a pendulum impacted their shoulders. EMGs of leg and trunk muscles were analyzed within the framework of the uncontrolled manifold hypothesis. Early postural adjustments (EPAs) were seen 400–500 ms and anticipatory postural adjustments (APAs), 100–150 ms prior to the impact. EPAs and APAs were also seen in the time profiles of muscle modes representing muscle groups with linear scaling of the activation levels. Center of pressure shifts were stabilized by co-varied adjustments in muscle mode magnitudes across trials. The index of these multi-muscle synergies showed two anticipatory synergy adjustments (ASAs) drops (prior to EPA and APA in each subject. The findings were consistent between the two conditions. The results show that feed-forward postural adjustments represent a sequence of two phenomena, EPAs and APAs. Each of those is preceded by ASAs that reduce stability of a variable that is to be adjusted during the EPAs and APAs. The findings fit a hierarchical scheme with synergic few-to-many mappings at each level of the hierarchy based on the referent body configuration hypothesis. The results show the complexity of the postural preparation to action. Potentially, they have implications for the current strategies of rehabilitation of patients with neuro-motor disorders characterized by impaired postural control.
Feedforward Postural Control in Individuals with Multiple Sclerosis during Load Release


The purpose of this study was to investigate the organization of anticipatory postural adjustments (APAs) in individuals with multiple sclerosis (MS) during self-initiated perturbation in the sagittal plane. Eleven individuals with MS and eleven age-and-gender matched healthy controls were asked to hold a 2.27 kg load in the extended arms and release it using fast arm abduction movements. Electrical activities of six leg and trunk muscles as well as displacements of the center of pressure (COP) were recorded. The results indicate that individuals with MS demonstrate: (1) a reduced magnitude of APAs, (2) delayed latency of APAs, and (3) smaller anticipatory COP displacement as compared to healthy control subjects. Moreover, in spite of individuals with MS being mildly affected, their balance capacity was significantly diminished. Thus, the outcome of this study demonstrates the underlying impairment in anticipatory postural control of individuals with MS and provides a background for development of rehabilitation strategies focused on balance restoration in this population.

Anticipatory Postural Adjustments in Individuals with Multiple Sclerosis


Individuals with multiple sclerosis (MS) frequently exhibit difficulties in balance maintenance. It is known that anticipatory postural adjustments (APAs) play an important role in postural control. However, no information exists on how people living with MS utilize APAs for control of posture. A group of individuals with MS and a group of healthy control subjects performed rapid arm flexion and extension movements while standing on a force platform. EMG activity of six trunk and leg muscles and displacement of center of pressure (COP) were recorded and quantified within the time intervals typical for APAs. Individuals with MS demonstrated diminished ability to produce directional specific patterns of anticipatory EMGs as compared to control subjects. In addition, individuals with MS demonstrated smaller magnitudes of anticipatory muscle activation. This was associated with larger displacements of the COP during the balance restoration phase. These results suggest the importance of anticipatory postural control in maintenance of vertical posture in individuals with MS. The outcome of the study could be used while developing rehabilitation strategies focused on balance restoration in individuals with MS.

Postural Control in Response to an External Perturbation: Effect of Altered Proprioceptive Information


The purpose of the study was to investigate the role of altered proprioception on anticipatory (APAs) and compensatory (CPAs) postural adjustments and their interaction. Nine healthy adults were exposed to external perturbations induced at the shoulder level while standing with intact or altered proprioception induced by bilateral Achilles tendon vibration. Visual information was altered (eyes open or closed) in both the conditions. Electrical activity of the eight trunk and leg muscles and center of pressure (COP) displacements were recorded and quantified within the time intervals typical for APAs and CPAs. The results showed that when proprioceptive information was altered in eyes open conditions, anticipatory muscle activity was delayed. Moreover, altered proprioceptive information resulted in smaller magnitudes of compensatory muscle activity as well as smaller COP displacements after the perturbation in both eyes open and eyes closed conditions. The outcome of the study provides information on the interaction between APAs and CPAs in the presence of altered proprioception.
**The Effect of Decreased Visual Acuity on Control of Posture**


The goal of this study was to investigate the effect of visual acuity on the anticipatory postural adjustments (APAs) and compensatory postural adjustments (CPAs) components of postural control. Ten individuals participated in the experiments involving perturbations induced by a pendulum while their visual acuity was altered. The different visual acuity conditions were no glasses, blurred vision induced by wearing glasses with positive or negative lenses, and no vision. EMG activity of trunk and leg muscles and ground reaction forces were recorded during the typical anticipatory and compensatory periods. In the no vision condition the subjects did not generate APAs, which resulted in the largest displacements of the center of pressure (COP) after the perturbation (p<0.01). In all other visual conditions APAs were present showing a distal to proximal order of muscle activation. The subjects wearing positive glasses showed earlier and larger anticipatory EMGs than while wearing negative glasses or no glasses at all. The study outcome revealed that changes in visual acuity induced by wearing differently powered eye glasses alter the generation APAs and as a consequence, affect the compensatory components of postural control. The observed changes in APAs and CPAs in conditions with blurred vision induced by positive and negative glasses suggest the importance of using glasses with an appropriate power. This outcome should be taken into consideration in balance rehabilitation of individuals wearing glasses.

**Role of Ankle Foot Orthoses in the Outcome of Clinical Tests of Balance**


The purpose of this study was to investigate the effect of ankle-foot orthoses (AFOs) on the outcome of balance assessment. Ten healthy subjects participated in clinical tests of balance with and without bilateral AFOs. The following clinical tests were performed: the Modified Clinical Test of Sensory Interaction on Balance (MCTSIB), the Limits of Stability (LOS), and the Functional Reach test. A statistically significant effect of AFOs was seen in the outcomes of the MCTSIB test (p = 0.042), LOS test (p = 0.021) and Reach test (p = 0.003). The results indicate that the use of AFOs may impede the performance of clinical tests of balance. This outcome should be taken into consideration while performing balance evaluations with patient populations in the clinic.
Does the Type of Somatosensory Information from the Contralateral Finger Touch Affect Grip Force Control while Lifting an Object?


The magnitude of grip force used to lift and transport a hand-held object is decreased if a light finger touch from the contralateral arm is provided to the wrist of the target arm. The purpose of this study was to investigate whether the type of contralateral arm sensory input that became available with the finger touch to the target arm affects the way grip force is reduced. Nine healthy subjects performed the same task of lifting and transporting an instrumented object with no involvement of the contralateral arm and when an index finger touch of the contralateral arm was provided to the wrist, elbow, and shoulder. Touching the wrist and elbow involved movements of the contralateral arm; no movements were produced while touching the shoulder. Grip force was reduced by approximately the same amount in all conditions with the finger touch compared to the no touch condition. This suggests that information from the muscle and joint receptors of the contralateral arm is used in control of grip force when a finger touch is provided to the wrist and elbow, and cutaneous information is utilized when lifting an object while touching the shoulder. The results of the study provide additional evidence to support the use of a second arm in the performance of activities of daily living and stress the importance of future studies investigating contralateral arm sensory input in grip force control.

Effect of Light Finger Touch in Balance Control of Individuals with Multiple Sclerosis


Deficit in balance control is a common and often an initial disabling symptom of multiple sclerosis (MS). The purpose of this study was to investigate if a light finger touch contact with a stationary surface is effective in improving upright postural stability in MS. Eleven individuals with relapsing–remitting MS were standing on a force platform with eyes open and closed, feet shoulder width apart and together, and with a light touch contact of the right index finger with a stable surface and without any contact. Balance was evaluated using center of pressure measures. Individuals with MS demonstrated significant postural instability in the absence of visual inputs and with reduced base of support (p < 0.05). The availability of a light finger touch contact with a stable surface was effective in reducing postural sway in both, the sagittal and frontal planes, in all experimental conditions (p < 0.05). Light finger touch contact is effective in improving postural control in people with MS and can be considered as a useful balance rehabilitative strategy.

The Role of Clinical and Instrumented Outcome Measures in Balance Control of individuals with Multiple Sclerosis


The aim of the study was to investigate differences in balance control between individuals with multiple sclerosis (MS) and healthy control subjects using clinical scales and instrumented measures of balance and determine relationships between balance measures, fatigue, and disability levels in individuals with MS with and without a history of falls. Twelve individuals with MS and 12 healthy controls were evaluated using the Berg Balance Scale and Activities-specific Balance Confidence Scale, Modified Clinical Test of Sensory Interaction on Balance, Limits of Stability Tests as well as Fatigue Severity Scale, and Barthel Index. Mildly affected individuals with MS had significant balance performance deficits and poor balance confidence levels (P < 0.05). MS group had higher sway velocities and diminished stability limits (P < 0.05), significant sensory impairments, high fatigue and disability levels (P < 0.05). Sway velocity was a significant predictor of balance performance and the ability to move towards stability limits for the MS group. For the MS-fallers group, those with lower disability levels had faster movement velocities and better balance performance. Implementation of both clinical and instrumented tests of balance is important for the planning and evaluation of treatment outcomes in balance rehabilitation of people with MS.
Exercise Approaches to Ameliorate Fatigue in People with Multiple Sclerosis


People with multiple sclerosis (MS), a chronic disease of the central nervous system without a known cure, often experience fatigue that affects their quality of life. The goal of this article was to review the available literature on the role of the efficacy of different intervention modalities in reducing the effects of fatigue in patients with MS. We reviewed 47 studies available in PubMed, Academic Search Premier (EBSCO host) and Cochrane databases until March 2013 that focus on the role of the mind and body approach and exercises in minimizing fatigue in individuals with MS. The reviewed studies showed the effectiveness of Yoga, Tai Chi, and neurocognitive exercises based interventions in ameliorating levels of fatigue and improving quality of life in individuals with MS. This focused review suggests that a variety of approaches involving Mind and Body interventions and exercise modalities can be used individually or in combination to deal with fatigue in individuals with MS. The review also provides a basis for further research focused on evaluation of the effectiveness of each of these modalities in resolving the effects of fatigue in patients with MS.

Use of the Wii Gaming System for Balance Rehabilitation: Establishing Parameters for Healthy Individuals


This study was designed to establish balance parameters for the Nintendo® (Redmond, WA) Wii Fit Balance Board system with three common games, in a sample of healthy adults, and to evaluate the balance measurement reproducibility with separation by age. This was a prospective, multivariate analysis of variance, cohort study design. Seventy-five participants who satisfied all inclusion criteria and completed an informed consent were enrolled. Participants were grouped into age ranges: 21–35 years (n = 24), 36–50 years (n = 24), and 51–65 years (n = 27). Each participant completed the following games three consecutive times, in a randomized order, during one session: Balance Bubble (BB) for distance and duration, Tight Rope (TR) distance and duration, and Center of Balance (COB) on the left and right sides. COB distributed weight was fairly symmetrical across all subjects and trials; therefore, no influence was assumed on or interaction with other Nintendo® Wii Fit measurements. Homogeneity of variance statistics indicated the assumption of distribution normality of the dependent variables (rates) was tenable. The multivariate analysis of variance included dependent variables BB and TR rates (distance divided by duration to complete) with age group and trials as the independent variables. The BB rate was statistically significant (F = 4.725, p < 0.005), but not the TR rate. The youngest group’s BB rate was significantly larger than those of the other two groups. Nintendo® Wii Fit can discriminate among age groups across trials. The results show promise as a viable tool to measure balance and distance across time (speed) and center of balance distribution.

The Effect of Lateral or Medial Wedges on Control of Postural Sway in Standing


The purpose of this study was to evaluate the effects of lateral and medial wedges on postural sway. Twenty healthy volunteers (mean age range of 28.45 ± 3.34) participated in the study. They stood barefoot with eyes open or closed on each of the three surfaces: 108 lateral wedges, 108 medial wedges, and no wedges. Force platform data were collected and the mean and root mean square (RMS) distance, range, and velocity and the mean frequency of the center of pressure (COP) were calculated in the anterior-posterior (AP) and medial-lateral (ML) directions. Standing on both lateral and medial wedges was associated with improved postural stability seen through the decreased mean and RMS distance of COP displacement in ML direction. The results of this study suggest that standing on either lateral or medial wedges might enhance postural control in standing.
Frequency Analysis Approach to Study Balance Control in Individuals with Multiple Sclerosis


Deficit in balance control is a common and often an initial disabling symptom of multiple sclerosis (MS). The purpose of this study was to investigate if a light finger touch contact with a stationary surface is effective in improving upright postural stability in MS. Eleven individuals with relapsing–remitting MS were standing on a force platform with eyes open and closed, feet shoulder width apart and together, and with a light touch contact of the right index finger with a stable surface and without any contact. Balance was evaluated using center of pressure measures. Individuals with MS demonstrated significant postural instability in the absence of visual inputs and with reduced base of support (p < 0.05). The availability of a light finger touch contact with a stable surface was effective in reducing postural sway in both, the sagittal and frontal planes, in all experimental conditions (p < 0.05). Light finger touch contact is effective in improving postural control in people with MS and can be considered as a useful balance rehabilitative strategy.

Aging and Balance Control in Response to External Perturbations: Role of Anticipatory and Compensatory Postural Mechanisms


The ability to maintain balance deteriorates with increasing age. Anticipatory postural adjustments (APAs) and compensatory postural adjustments (CPAs), are known to be affected in the elderly. We examined the effect of aging on the ability of older adults to utilize APAs and its effect on subsequent control of posture (CPAs). Ten elderly individuals were exposed to external predictable and unpredictable perturbations applied to the upper body in the sagittal plane. Body kinematics, electromyographic activity of 13 muscles, and ground reaction forces were analyzed during the anticipatory and compensatory phases of postural control. The elderly were capable of recognizing an upcoming predictable perturbation and activated muscles prior to it. However, the older adults used different muscle strategies and sequence of muscle recruitment than that reported in young adults. Additionally, when the perturbations were unpredictable, no APAs were seen, which resulted in large CPAs and greater peak displacements of the center of pressure (COP) and center of mass (COM) following perturbations. As opposed to this, when the perturbations were predictable, APAs were seen in older adults resulting in significantly smaller CPAs. The presence and utilization of APAs in older adults also improved postural stability following the perturbation as seen by significantly smaller COP and COM peak displacements. Using APAs in older adults significantly reduces the need for large CPAs, resulting in greater postural stability following a perturbation. The results provide a foundation for investigating the role of training in improving the interplay between anticipatory and compensatory postural control in older adults.
Isolated and Combined Effects of Asymmetric Stance and Pushing Movement on the Anticipatory and Compensatory Postural Control


The objective of this study was to investigate effects of symmetric and asymmetric stance and pushing movement on anticipatory postural adjustments (APAs) and compensatory postural adjustments (CPAs). Ten healthy volunteers stood symmetrically (feet parallel) or asymmetrically (one foot forward and the other backward) and pushed a handle with both hands or right or left hand. Bilateral EMG activity of the trunk and leg muscles and center of pressure (COP) displacements in the anterior–posterior (AP) and medial–lateral (ML) directions were recorded and analyzed during the APAs and CPAs. Isolated asymmetry of stance was associated with larger muscle activity of the backward leg while isolated asymmetry of pushing movement induced larger trunk muscle activity on the contralateral side. A combined asymmetry of stance and pushing movement resulted in the increase or decrease of the thigh muscle activity and ML COP displacement depending on whether both asymmetries were induced on the same side of the body or on opposite sides. Both isolated and combined asymmetries affect APAs and CPAs in pushing. Using combined asymmetry of stance and arm movement might be beneficial in performing pushing activity. The outcome of the study provides a basis for studying postural control in individuals with unilateral impairment while performing daily tasks involving pushing.

Support Surface Related Changes in Feedforward and Feedback Control of Standing Posture


The aim of the study was to investigate the effect of different support surfaces on feedforward and feedback components of postural control. Nine healthy subjects were exposed to external perturbations applied to their shoulders while standing on a rigid platform, foam, and wobble board with eyes open or closed. Electrical activity of nine trunk and leg muscles and displacements of the center of pressure were recorded and analyzed during the time frames typical of feedforward and feedback postural adjustments. Feedforward control of posture was characterized by earlier activation of anterior muscles when the subjects stood on foam compared to a wobble board or a firm surface. In addition, the magnitude of feedforward muscle activity was the largest when the foam was used. During the feedback control, anterior muscles were activated prior to posterior muscles irrespective of the nature of surface. Moreover, the largest muscle activity was seen when the supporting surface was foam. Maximum center of pressure (CoP) displacement occurred when subjects were standing on a rigid surface. Altering support surface affects both feedforward and feedback components of postural control. This information should be taken into consideration in planning rehabilitation interventions geared towards improvement of balance.
Acute Inpatient Rehabilitation for Pediatric Patients with Guillain-Barré: A Case Report
This case describes pain control for pediatric patients with Guillain-Barré syndrome in acute inpatient rehabilitation. During the 2009-2010 flu season, we encountered 3 pediatric patients, ages three, seven and eleven, with Guillain-Barré Syndrome undergoing acute inpatient rehabilitation. We examined the similarities and dissimilarities in their presentations to predict which therapies, modalities, as well as medications may yield the best functional outcome for such patients. Specifically, we looked at pain on initial presentation and its treatment to allow for improved participation in therapies. Secondly, we examined the importance of therapeutic heated pool therapy and its ability to build confidence in these patients toward motor recovery. We began treatment with gabapentin and titrated up the dose to treat what we believed to be neuropathic pain in these patients exacerbated by lower extremity weight-bearing and touch of any kind. Our patients improved in their tolerance to touch and weight-bearing in response to gabapentin and desensitization techniques. Additionally, their mobility improved with daily strengthening and range of motion (ROM) exercises in a heated therapeutic pool. After initially requiring moderate to maximum assistance for their mobility and activities of daily living on admission to our inpatient pediatric unit, they were discharged home at an independent or modified independent level and were able to be weaned off of gabapentin at the time of discharge. As debilitating as Guillain-Barré Syndrome can be in adults, it presents a special challenge in children. Multimodal treatment of neuropathic pain and the confidence building as well as the physiologic effects of heated aqua therapy must be a mainstay of acute inpatient rehabilitation in this patient population.

Poster presented at Association of Academic Physiatrists, Phoenix, AZ.

Pain, Muscle Spasm and Myotonia Congenita in a 23-year-old Male: A Case Report
This case describes a 23-year-old male patient with diagnoses of pain, muscle spasm, and Myotonia Congenita. This patient, with multiple episodes of worsening lower extremity weakness, underwent acute inpatient rehabilitation after admission to acute care for inability to walk and severe pain. The patient had profoundly elevated creatinine kinase. Initial evoked potentials revealed motor unit action potentials of reduced amplitude consistent with myopathy. Needle EMG/NCV of the lower extremity revealed extensive repetitive myotonic discharges and spontaneous abnormal potentials consistent with muscle spasm. After performing an extensive genetic marker analysis which was positive for a gene variant sequence, we confirmed the diagnosis of Myotonia Congenita. The patient presented with severe muscle spasm, hypesthesia, and allodynia of his back and lower extremities rendering him nearly immobile. We initiated treatment with oral baclofen and titrated up the dose. We utilized tizanidine initially which was replaced by cyclobenzaprine as an adjunctive agent. Aggressive treatment with antispasmodic medication in conjunction with the use of applied heat, therapeutic ambient temperature and aqua therapy successfully improved functional outcome. Initial Functional Independence Measures (FIM) on admission was moderate to maximum assistance for mobility and lower extremity activities of daily living. Discharge FIM scores were modified independent. Patient returned home with a walker and lower extremity orthoses. A month after discharge, patient was able to ambulate, drive, and return to work without assistive devices. Muscle spasms became less painful allowing for weaning off of cyclobenzaprine while remaining on oral baclofen. This case of Myotonia Congenita presented a special challenge with respect to acute inpatient rehabilitation due to the patient’s severe pain related to muscle spasm on initial presentation. Patients with Myotonia Congenita require an aggressive multimodal approach utilizing heat and antispasmodic medication to return them to their previous level of productivity and independence.

Poster presented at Association of Academic Physiatrists, Phoenix, AZ; and, (2011, September) at American Association of Neuromuscular & Electrodiagnostic Medicine, San Francisco, CA.
Severe Quadriceps Weakness due to Late Diagnosis of Peripheral Neurofibroma


This case describes a 39-year-old female patient who presented with numbness over left anterior thigh in January 2006. Examination showed absent left patellar reflex. Patient noticed quadriceps weakness with atrophy and underwent neurophysiological testing, revealing left femoral mononeuropathy. Symptoms including left anteriomedial thigh numbness, anterior knee pain and quadriceps weakness slowly progressed over four years. Four lumbar spine MRI at different times revealed mild degenerative disc disease with no evidence of nerve root impingement. Four years after the onset of symptoms, pelvic MRI was consistent with lobulated lesion extending along the course of left femoral nerve from neural foramina to the inguinal ligament. Preoperative left knee extension muscle strength was 3/5, hip flexion was 5/5 and hip adduction was 5/5. Patient underwent exposure of retroperitoneal space, dissection of left femoral nerve for neurofibromatous changes, and excision of seven inches of femoral nerve tumor. Pathology showed plexiform neurofibroma. Postoperative left knee extension muscle strength was 1/5. Neurofibromas are benign neural sheath tumors arising from intraneural supporting cells. Such tumors are characteristic of neurofibromatosis Type I but also occur sporadically (1 in 6000). Pelvic neurofibromas can reach significant size due to vague lower extremity symptoms refractory to workup. In our case, we have demonstrated typical clinical presentation and progression of retroperitoneal femoral nerve neurofibroma. Complete resection is preferred to prevent local recurrence and malignant transformation. Therefore, early surgical treatment is essential for protecting maximum nerve function and preventing spinal cord invasion.

Poster presented at Association of Academic Physiatrists, Phoenix, AZ.

Phenytoin Induced Toxic Polyneuropathy


This case describes a 73-year-old male patient with long standing history of seizure disorder who was on phenytoin for 30 years presenting with weakness and paresthesias in bilateral upper and lower extremities. Physical examination revealed a well-developed male with diffuse weakness 4/5 throughout all muscle groups. Reflexes were symmetric and 2+ throughout except Achilles which were absent bilaterally. Sensory examination of light touch, pin prick, and proprioception were intact except for vibratory sense which was absent in four limbs. Electrodiagnostic testing was performed on both upper and lower extremities. There was no response from all of the sensory nerves tested while all motor nerves examined showed prolonged latencies, decreased compound muscle action potential (CMAP) amplitudes, and reduced conduction velocities. Monopolar needle examination was most significant for abnormal spontaneous activity in left tibialis anterior, bilateral medial gastrocnemius, and bilateral dorsal interosseous pedis. Bilateral H-reflex was unobtainable and F-waves were 80% and 20% absent in left common peroneal and right ulnar nerves, respectively. There was electrophysiologic evidence of a moderately severe sensory-motor, axonal and demyelinating, polyneuropathy in all four limbs. Long-term phenytoin therapy is associated with usually a subclinical polyneuropathy with typical manifestations that include lower extremity areflexia and sensory deficits mainly affecting vibration without any pinprick and proprioception sensory or motor impairments. Electrodiagnostic testing usually reveals reduced sensory nerve action potential (SNAP) and CMAP amplitudes and normal to mildly reduced conduction velocities. Risk for abnormalities is greater with high serum levels or long therapy duration. Neuropathy caused by phenytoin is reversible unless there is axonal involvement, and severity of nerve involvement dictates recovery duration. We present a patient with chronic phenytoin sensory-motor neuropathy with demyelination and axonal loss caused by long duration therapy and poorly controlled blood levels.

Poster presented at Association of Academic Physiatrists, Phoenix, AZ.
Nitrous Oxide Abuse Induced Vitamin B12 Deficiency with Degeneration of the Dorsal Spinal Cord in an Iraqi War Combat Veteran


Nitrous oxide inhalation by healthcare providers has been previously described as causing injury to the dorsal columns in the spinal cord by interfering with the body’s utilization of vitamin B12. There have been other cases describing the effects of nitrous oxide abuse on the neurologic system, but none describing the effects on function and none described in veterans. This case describes a 29-year-old male Iraqi combat veteran with vitamin B12 deficiency from nitrous oxide abuse leading to degeneration of the dorsal spinal cord and resulting paraplegia. The patient reported sudden lower extremity weakness two days prior to admission to the VA Medical Center while playing basketball. Initially, vitamin B12 level was 136 pg/ml (200-900pg/ml) and further questioning revealed that the patient had an extensive substance abuse history and that patient was also using large quantities of nitrous oxide multiple times a day. Initial physical examination revealed weakness in the patient’s wrists and hands and in the lower limbs symmetrically. Reflexes were symmetric throughout, toes were down going bilaterally, but clonus in the lower limbs was noted. Sensory examination found severe proprioception deficits in the lower limbs. Coordination was poor in both the upper and lower limbs. Patient’s gait was ataxic and unstable. Patient also had urinary retention and he required catheterization. MRI of cervical and thoracic spine showed abnormal signal and edema throughout the dorsal columns. Electrodiagnostic testing revealed electrophysiologic evidence of a mononeuropathy at the left wrist and nominal evidence of a polyneuropathy in the lower limbs. Sympathetic skin responses suggested a component of autonomic dysfunction as well. After his laboratory studies improved with vitamin B12 supplementation, the patient was admitted to the acute inpatient rehabilitation unit where he made significant functional gains in his mobility and self-care activities. Nitrous oxide abuse can cause severe neurologic impairments by effecting vitamin B12 utilization and informing patients about the risks of nitrous oxide abuse may deter use.

Poster presented at Association of Academic Physiatrists, Phoenix, AZ.

The Role of Anticipatory Postural Adjustments in Compensatory Control of Posture


To counteract a variety of body perturbations that humans encounter in daily life while maintaining postural stability, the central nervous system employs two principal control mechanisms, anticipatory (APAs) and compensatory (CPAs) postural adjustments. While the individual roles of these two mechanisms have been extensively studied, the interplay between the two remains unattended. The purpose of this study was to determine the role of APAs in subsequent control of posture, specifically its relationship with CPAs in controlling body balance. Eight health young adults were exposed to external predictable (eyes open) and unpredictable (eyes closed) perturbations of identical magnitudes applied at the shoulder level while standing. EMG activity of trunk and leg muscles, joint angles, center of mass (COM) and center of pressure (COP) displacements were recorded. It was hypothesized that with utilization of APAs, compensatory muscle activity would be significantly reduced, resulting in smaller COM and COP displacements following a perturbation, thereby enhancing body stability. Strong APAs and significantly smaller CPAs were seen in all muscles during predictable perturbations as opposed to unpredictable perturbations which were associated with an absence of APAs and five times greater CPAs (p<0.05). Consequently with the availability of APAs, the COM displacement after the perturbation peaked at 17 Â± 5.5 mm and COP displacement peaked at Â± 3.6 mm while in the absence of APAs, COM peak displacement was 1.6 times larger, reaching 28 ± 9.6 mm and COP peak displacement was twice greater reaching 60 ± 14 mm (all p<0.01). Interestingly, the timings of each of the COM and COP peak displacements were consistently similar between conditions, thus independent of the availability of APAs. The outcome of this study highlights the role of APAs in maintaining balance and illustrates the interplay between anticipatory and compensatory mechanisms of postural control.

Presentation given at Progress in Motor Control VII Conference, Cincinnati, OH.
**Postural Control in Response to a Perturbation: Role of Vision and Additional Support**


The purpose of this study was to review the role of vision and additional support on anticipatory (APAs) and compensatory (CPAs) postural adjustments and their interaction. Eight healthy adults were subjected to external perturbations induced at the shoulder level while standing with and without holding onto a walker in full vision and while blindfolded. Electrical activity of the trunk and leg muscles and center of pressure (COP) displacements were recorded and quantified within the time intervals typical of APAs and CPAs. The results showed that with full vision there was no difference in both APAs and CPAs in standing with and without holding onto a walker. With subjects holding onto a walker, CPAs in standing blindfolded were comparable to CPAs in full vision: this was seen in changes in the electrical activity of most of the muscles at the individual muscle joint and the muscle group levels as well as in COP displacements. The findings suggest that: (1) in conditions where vision is available, vision overrules simultaneously available proprioceptive information from the support, and (2) while in conditions where vision is not available, proprioceptive information from the support or support itself could be substituted for vision. It is impossible to suggest that using a non-stabilizing support could be a valuable strategy to improve postural control when vision information is not available or compromised.

Presentation given at Progress in Motor Control VII Conference, Cincinnati, OH.

**Atypical Presentation of Weakness: Cocaine Induced Peripheral Neuropathy**


Cocaine is used by more than 14 million people worldwide. The most prevalent use and abuse occurs in North America. It is the illegal drug most associated with ER visits, with estimated 450,000 visits in 2005. It is well known that cocaine can cause cerebral vasoconstriction, cerebral vascular diseases, and ischemic and hemorrhagic strokes. Yet it is rarely reported that cocaine abuse can induce peripheral neuropathy secondary to ischemia of the nerves. This case describes a 26-year-old male with significant history of only cocaine abuse for three to four years and initially presented to the ER secondary to weakness in the left leg after cocaine use three days ago. The workup revealed that patient was in renal failure secondary to rhabdomyolysis which resolved after intravenous fluids administration. Yet patient continued to have left leg weakness only. Patient underwent computed tomography, MRI, and magnetic resonance angiography of the head, entire spine, and major cerebral vessels which did not show any abnormalities. Further electrodiagnostic workup showed there was no sensory response and severely diminished motor response (15% when compared to the right) in the left lower extremity while the responses on the right limb were normal. There was no evidence of lumbar nerve roots involvement bilaterally. This case highlights an atypical presentation of peripheral neuropathy. The diagnosis of cocaine-induced neuropathy was especially challenging in this case; most physicians attributed the weakness to rhabdomyolysis. Furthermore, the case raises awareness that peripheral neuropathy can often be misdiagnosed especially in cocaine users.

Poster presented at American Association of Neuromuscular & Electrodiagnostic Medicine, San Francisco, CA.
Unusual Presentation of Meralgia Paresthetica in Young Iraqi Combat Veterans


Meralgia paresthetica is also known as Bernhardt-Roth syndrome named for the German and Polish neuro-pathologists who first observed it in the 1900s. It is a syndrome that describes numbness or pain in the outer thigh usually caused by nerve compression of the lateral femoral cutaneous nerve (LFCN). Of interest, the term meralgia paresthetica comprises four Greek roots, which together denote “thigh pain with anomalous perception”. Most cases of meralgia paresthetica arise from entrapment of the LFCN as it traverses under the inguinal ligament. Most common causes include compressing panniculus in obese individuals, tight garments or belts around the waist, and scar tissue within proximity of the inguinal ligament. Diabetes and pregnancy are contributing factors as well. It has also been reported that nerve injury can occur during local or regional surgeries such as iliac crest bone harvesting, hip prosthesis, aorto-femoral bypass. The surgical causes account for 17% of cases in one case series of 120 individuals. Interestingly, seat belt injury after motor vehicle accident is a less common cause. Meralgia paresthetica has also been noted in individuals who are avid long-distance walkers and/or cyclists. One plausible explanation is that it is a result of local ischemia during repetitive muscle stretching. Yet it is seldom reported that bullet proof vests can be culprits. The author presents two cases of young veterans with lateral thigh pain which was overlooked by their depression, alcohol abuse, and post-traumatic stress disorder.

Poster presented at American Association of Neuromuscular & Electrodiagnostic Medicine, San Francisco, CA.

Enhancement of Anticipatory Postural Control Following a Single Training Session


Anticipatory (APAs) and compensatory (CPAs) postural adjustments are two control mechanisms used by the central nervous system (CNS) to deal with perturbations associated with many daily activities. Generation of optimal APAs (muscle activation prior to an upcoming perturbation) in healthy young adults significantly minimizes the body’s center of mass (COM) and center of pressure (COP) displacements following a perturbation. On the other hand, a lack of APAs relates to massive CPAs (muscle activation after a perturbation), resulting in large displacements of the body’s COM and COP thereby increasing the risk of losing balance. Likewise, impairment of APAs in older adults, characterized by delayed onset and reduced magnitude of muscle activity, acts as a source of postural instability. Thus, we investigated the immediate effects of a single training session in improving anticipatory postural control in the elderly. It was hypothesized that in older adults, training related improvements in APA generation would reduce COP and COM displacements following a perturbation, thereby indicating increased postural stability. Participants included seven healthy older adults (65+ years). The single training session involved 130 catches of a medicine ball (2 or 4 lbs.), selected depending on the subject’s body mass. The subjects were tested pre and post training using the pendulum paradigm wherein they were exposed to external predictable perturbations (magnitude = 3% of body weight) applied at the shoulder level while standing. After a single training session, early onsets and increased magnitudes of anticipatory activity and smaller compensatory activity were seen in most of the postural muscles. Single training session focused on improvements in anticipatory postural control enhanced postural preparation prior to the upcoming balance threat. Increased utilization of APAs resulted in improved postural stability after the perturbation. The findings of this study suggest that older adults may benefit from rehabilitation approaches focused on enhancing anticipatory postural control. Future studies are needed to assess the long term effect of training interventions in individuals with balance impairments.

Presentation given at the 20th Annual Meeting of European Society of Movement Analysis for Adults and Children (ESMAC), Vienna, Austria.
Use of the Wii Gaming System for Balance Rehabilitation: Establishing Parameters for Healthy Individuals


The purpose of this study was to (1) establish balance parameters (norms) for the Nintendo® Wii Fit Balance Board system with three common programs, in a sample of healthy adults, and (2) evaluate the balance measurement reproducibility with separation by age. An Institutional Review Board approved this prospective, descriptive study of a healthy subject convenience sample for exploratory analysis. Seventy-five healthy, volunteer subjects were approved for recruitment and were divided into three age groups (21-35, 36-50, and 51-65). The subjects underwent the balance evaluation with the Nintendo® Wii Fit. Each subject completed the following tests three consecutive times during one session: (1) Balance Bubble, (2) Body Fit Test Center of Balance, and (3) Tight Rope Walking. The order of testing programs was randomized for each subject. Detailed mean parameters are not reported given the partial sample at this point; however, several general observations can be provided. The distance and duration for the Balance Bubble test means are much larger than the Tight Rope Walking tests, perhaps indicating Balance Bubble is the easier of the two Nintendo® Wii Fit Balance Board tests. Participants generally increased performance across trials. Center of Balance distributed weight percentages were fairly equal across all trials on right and left sides. The preliminary results of parameters based upon analysis of a partial sample of participants, the Nintendo® Wii Fit illustrates promise as a viable tool to measure and treat balance dysfunction. The Nintendo® Wii Fit is a potential cost-effective and innovative alternative for rehabilitation balance programs in the clinical setting. Preliminary analysis also suggests that the Nintendo® Wii Fit Balance Board can discriminate between participants on balance measurement and age.

Poster presented at Illinois Physical Therapy Association Fall Conference, Galena, IL; (2012, February) at the Combined Sections Meeting (CSM) of APTA's Specialty Sections, Chicago, IL; and, (2013, January) at the Combined Sections Meeting (CSM) of APTA's Specialty Sections, San Diego, CA.

The Role of Anticipatory Postural Adjustments in Balance Control of Older Adults


The central nervous system uses anticipatory (APAs) and compensatory (CPAs) postural adjustments while dealing with perturbations associated with various daily activities. The utilization of APAs in compensatory control of posture has been established in healthy young adults: generation of optimal APAs (muscle activation prior to an upcoming perturbation) significantly minimizes the body's center of mass (COM) and center of pressure (COP) displacements following a perturbation. On the other hand, a lack of APAs relates to massive CPAs (muscle activation after a perturbation), resulting in large displacements of the body's COM and COP thereby increasing the risk of losing balance. However, the role of APAs in balance control of healthy older adults is not known. It is likely that impairments of this pertinent interplay between APAs and CPAs could act as a source of instability in older adults, predisposing them to frequent balance loss. Therefore, the objective of the study was to investigate the effect of aging on the utilization of APAs in compensatory control of posture. It was hypothesized that as compared to young adults, APAs in older adults would be characterized by delayed onset and reduced magnitude, resulting in larger displacements of the COP and COM following a perturbation. A group of healthy young (22 to 35 years) and older (65 years and up) adults were exposed to external perturbations (3% of body weight) applied at the shoulder level while standing. Two types of perturbations (identical in magnitude), predictable (eyes open) and unpredictable (eyes closed) were applied. While the APA-CPA interplay was maintained with aging; delayed onsets and reduced magnitude of APAs were seen in majority of the muscles in older as compared to younger adults. The findings of this study demonstrate that reduced APA utilization in older adults leads to decreased postural preparation prior to an upcoming balance threat thereby resulting in greater COM displacements following a perturbation. Thus, the outcome of this study suggests that older adults may benefit from rehabilitation approaches focused on enhancing anticipatory postural control.

Abstracts of the 2011 Annual Meeting of the Society for Neuroscience, Washington, DC.
Receptive & Expressive Aphasia after Temporal Lobectomy Due to Intractable Epilepsy: A Case Report


This case describes a 59-year-old left-handed female who was diagnosed with intractable epilepsy 15 years prior. Despite pharmacologic management, patient continued to have uncontrolled seizure activity and conceded to placement of a vagus nerve stimulator with suboptimal results. Patient then agreed to undergo a right temporal lobectomy and was without speech, neurologic deficit or seizure activity for approximately 10 years. However, five years ago the patient began to experience unrelenting seizures that were progressive in nature and frequency. Video EEG monitoring revealed epileptogenic activity necessitating surgical intervention. Patient consented to left partial temporal lobectomy with electrode placement and monitoring. Patient tolerated the procedure well, yet continued to have seizures. Patient was taken back to OR for aggressive left temporal lobectomy and subcortical resection. Patient again tolerated the procedure well, yet was now aphasic. Subsequent MRI imaging revealed no acute hemorrhage or infarct. Upon admission to the inpatient rehabilitation hospital, patient was unable to comprehend or produce intelligible speech consistent with receptive and expressive aphasia. Boston Diagnostic Aphasia Examination (BDAE) results were in the lowest percentile in many categories upon initial evaluation. After two weeks of intensive speech therapy, patient continued to improve with regard to language production and comprehension. Repeat BDAE was administered at discharge in which the patient made significant improvements globally scoring in the highest percentile in many categories. This is the first reported case, to our knowledge, of severe receptive and expressive aphasia following temporal lobectomy for intractable epilepsy. Speech language pathology investigation and analysis must be performed after temporal lobectomy to detect speech/language deficits.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Orlando, FL.

Reduced Acuity Conditions during Control of Posture when Subjected to External Perturbations


The purpose of this study was to investigate the effect of visual acuity on the anticipatory (APAs) and compensatory (CPAs) components of postural control. Ten individuals participated in the experiments involving perturbations induced by a pendulum while their visual acuity was altered. The different visual acuity conditions were no glasses, blurred vision induced by wearing glasses with positive or negative lenses, and no vision. EMG activity of trunk and leg muscles and ground reaction forces were recorded during the typical anticipatory and compensatory periods. In the no vision condition the subjects did not generate APAs, which resulted in the largest displacements of the center of pressure (COP) after the perturbation (p<0.01). In all other visual conditions APAs were present showing a distal to proximal order of muscle activation. The subjects wearing positive glasses showed earlier and larger anticipatory EMGs than subjects wearing negative glasses or no glasses at all. The study outcome revealed that changes in visual acuity induced by wearing differently powered eye glasses alter the generation APAs and as a consequence, affect the compensatory components of postural control. The observed changes in APAs and CPAs in conditions with blurred vision induced by positive and negative glasses suggest the importance of using glasses with an appropriate power. This outcome should be taken into consideration in balance rehabilitation of individuals wearing glasses.

Presentation given at 99th Indian Science Congress, India.
Rehabilitation of Multiple Nerve Injuries following Rhabdomyolysis and Compartment Syndrome: A Case Report


The case diagnosis is nerve injury to left median, ulnar, and sciatic nerves from compartment syndrome. Electrodiagnostic studies suggested complete axonotmesis of the left ulnar and sciatic nerves with partial axonotmesis of the left median nerve. This case describes a 26-year-old male with a history of traumatic assault and loss of consciousness presented with rhabdomyolysis, extensive muscle injury, and compartment syndrome after 15 to 20 hours of immobilization while lying on his left side. The left deltoid, forearm, and gluteal regions were involved. He underwent fasciotomies of all three of these regions, with an additional procedure of muscle debridement. He was noted on physical exam to have diminished sensation of the L4, L5, and S1 dermatomes of the left lower limb and weakness of the left wrist extensors and flexors. He had no finger movement in the upper limb and no plantar flexion or dorsiflexion strength in the left lower limb. Total motor Functional Independence Measure (FIM) scores improved over rehabilitation hospital course from 48 to 64. Also, total cognitive FIM scores improved from 29 to 34. He was discharged home at modified independence status. Presented here is a rare electrodiagnostic study of severe nerve damage from immobilization, compartment syndrome, and tissue necrosis following over 15 hours of surgical delay. Despite multiple nerve injuries, significant motor gains were made during rehabilitation. Furthermore, cognitive function improved as pain medications were tapered. Compartment syndrome is a recognized mechanism of entrapment and nerve injury. In cases of severe nerve injury, acute inpatient rehabilitation is critical to recovering function.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV.

Dystonic Storm and Rhabdomyolysis Following Acute Viral Illness


This is a case series of two patients with quadriplegic cerebral palsy (CP). Patients with CP and movement disorder may develop dystonic storm following acute viral illness. This retrospective case series includes two fragile patients with quadriplegic CP. Patient 1 (Pt1) is a 4-year-old male with a past history of spastic, dyskinetic, quadriplegic cerebral palsy with a seven day history of acute viral illness, feeding intolerance, and recent weaning of artane prior to admission. Pt1 exhibited acute dystonic episodes, along with rhabdomyolysis at height of illness. Patient 2 (Pt2) is a 4-year-old male with a past history of spastic quadriplegic cerebral palsy, Gross Motor Function Classification System (GMFCS) Level IV, and dystonia with a two-day history of fever, cough, congestion, and rhinorrhea prior to admission. Pt2 also developed acute, refractory dystonia and rhabdomyolysis. Both patients were known to have had sick contacts prior to admission. Pt1’s brother had viral gastroenteritis, and Pt2’s otherwise healthy father had been hospitalized with pneumonia. Pt1’s CK peaked at 3057, and Pt2’s CK peaked at 3181 and also tested positive for influenza and right upper lobe pneumonia. Pt1 had been g-tube reliant for several years; Pt 2 previously ate pureed foods but required nasogastric-tube feeds during and after his illness. Pt2 required mechanical ventilation for respiratory failure and had a prolonged and complicated hospital course. His function worsened to GMFCS V and he ultimately required g-tube placement. Patients with cerebral palsy and movement disorder can develop severe and life-threatening acute dystonia and rhabdomyolysis following acute viral illness. Though the sequelae are rare, it is nonetheless an important consideration when caring for these patients.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV.
Feedforward and Feedback Components of Postural Control and their Relationship: What’s Known and Not?


The central nervous system (CNS) uses feedforward and feedback mechanisms of postural control while dealing with a variety of body perturbations that humans encounter in daily life. Feedforward postural control is referred to the activation of the trunk and leg muscles seen prior to the forthcoming body perturbation. Feedback postural control is the activation of muscles seen after the body perturbation has already occurred and it is initiated by the sensory feedback signals. The individual roles of these two mechanisms of postural control in maintenance of vertical posture as well as the relationship between the two mechanisms will be discussed.

Presentation given at VI Congresso Brasileiro de Comportamento Motor, Sao Paulo, Brazil.

Anticipatory Postural Adjustments: What We Know and What We Don’t


Humans commonly experience perturbations applied to their body resulting in the displacement of the body’s center of mass (COM) closer to or beyond the boundaries of the base of support, thus compromising balance. The central nervous system (CNS) uses two main strategies to restore balance if it is distorted by a perturbation: (1) anticipatory postural adjustments (APAs) seen as the activation of the trunk and leg muscles prior to the expected body perturbations; APAs serve to minimize the displacement of the body’s COM, and (2) compensatory postural adjustments (CPAs) that are initiated by the sensory feedback signals and used as a mechanism of restoration of the position of COM after a perturbation has already occurred. The role of anticipatory postural control in maintenance of vertical posture as well as the relationship between the anticipatory and compensatory components of postural control will be discussed.

Presentation given at Motor Control 2012 Conference, Wisla, Poland.

The Role of AFOs in the Outcomes of Clinical Tests of Balance


The efficacy of AFOs in improving gait in patients is well documented, however the role of commonly prescribed lower limb orthoses in balance control is not completely investigated. The presentation will review new data on the role of AFOs in the outcome of commonly used clinical tests of balance. The results of recent experiments as well as literature data will be presented and discussed.

Presentation given at AOPA National Assembly and combined New England Chapter Meeting, Boston, MA.

The Effect of AFOs on Balance: Proprioceptive Effects of AFOs


This presentation focused on the review of the role of proprioception in the maintenance of static and dynamic balance as well as on the recent research findings associated with the proprioceptive effects of AFOs on balance in patients with compromised distal sensation.

Presentation given at AOPA National Assembly and combined New England Chapter Meeting, Boston, MA.
Lance-Adams Syndrome: A Rehabilitation Challenge


The case diagnosis is Lance-Adams Syndrome following drug overdose. This case describes a 29-year-old male with attention deficit disorder, anti-social personality and schizoaffective disorder with a 12 year history of poly-substance abuse who presented with dysarthria and involuntary jerky movements of trunk and all four extremities aggravated by intentional movements. Four months prior to this admission patient sustained cardio-pulmonary arrest by overdosing on heroin-cocaine mix and smoking synthetic marijuana K2 leading to anoxic brain injury. Pertinent examination consisted of the St. Louis University Mental Status (SLUMS) of 23, dysarthria, action myoclonus of trunk, bilateral upper and lower extremities, 5/5 power in all muscle groups, 1+ reflex, and intact sensation. Patient’s hospital course was complicated with one episode of seizure following which antiseizure medication dosage was increased. Patient’s therapies were customized to negate the action-induced myoclonus. Upon admission, patient was requiring moderate assistance for activities of daily living/mobility activities. At the time of discharge, patient’s functional status improved to stand-by assist except for bed to chair transfer and ambulation with two-person assistance was necessary, primarily to prevent fall even though patient was able to perform with modified independence. Less than 150 cases of Lance-Adams Syndrome are reported in the literature, making it one of the rare movement disorders. Hyopxic injuries to cerebellar Purkinje fibers have been hypothesized as possible cause. Early differentiation from myoclonic status epilepticus and customizing comprehensive inpatient rehabilitation with appropriate anti-epileptic medication is vital for disability limitation. Customizing the physical and occupational rehabilitation therapies considering the nature of myoclonus, action-induced myoclonus is a real challenge and the most essential component on which the rehabilitation outcome will depend. Incidence of Lance-Adams Syndrome may be rare and sporadic, but it is imperative for the physiatrists to be aware of this incurable syndrome in order to provide adequate medical management and thereby positively impact rehabilitation outcome.

Poster presented at Association of Academic Physiatrists, New Orleans, LA.

Bilateral Lower Extremity Weakness in a Patient with Anorexia Nervosa and Steroid Myopathy: A Case Report


Anorexia nervosa can increase the risk for developing localized compression neuropathies, which can manifest as bilateral lower extremity weakness. This case describes a 49-year-old female with chronic glucocorticoid deficiency from chronic intermittent steroid use for the treatment of asthma develops bilateral lower extremity weakness when her steroids are tapered during her hospitalization in the intensive care unit for the treatment of dehydration. Pertinent findings on physical examination consist of abnormal manual muscle testing with 4/5 strength in bilateral upper extremities, 3/5 strength in bilateral hip flexors, 2/5 strength in bilateral knee extensors, 1/5 strength in bilateral ankle dorsiflexors, and 3/5 strength in bilateral ankle plantar flexors. Neurological examination is normal with intact cranial nerves II-XII, intact sensation to light touch and pinprick, symmetric reflexes, and intact finger-to-nose testing. Electromyography and nerve conduction studies reveal evidence of myopathy and superimposed isolated peroneal neuropathy in the patient’s bilateral lower extremities with no evidence of radiculopathy, plexopathy, or peripheral neuropathy. Anorexia nervosa typically causes more complications of the central nervous system than of the peripheral nervous system. A comprehensive literature search reveals nine documented cases of isolated peroneal neuropathy in patients with anorexia nervosa. However, this case is the first reported one of an anorexia nervosa patient with superimposed isolated bilateral peroneal neuropathies complicated by steroid myopathy. If not properly treated, anorexia nervosa can lead to chronic malnutrition and subcutaneous tissue loss. In certain settings like the intensive care unit, patients with chronic malnutrition and subcutaneous tissue loss are at an increased risk for developing localized compression neuropathies, such as the bilateral peroneal neuropathies seen in this patient with anorexia nervosa and steroid myopathy. Anorexia nervosa can lead to chronic malnutrition and subcutaneous tissue loss, which predispose patients to localized compression neuropathies in certain high-risk settings like the intensive care unit.

Poster presented at Association of Academic Physiatrists, New Orleans, LA.
Guillain Barré Syndrome in Patient with Limb Girdle Dystrophy and Approach to Rehabilitation: A Case Report


This case describes a 61-year-old male with a history of limb girdle muscular dystrophy who experienced a seven day period of progressive upper and lower extremity weakness and numbness two weeks after receiving a shingles vaccination shot. Previously, the patient was independent for all activities of daily living and only required the use of a quad cane to ambulate. Upon presentation to the hospital, patient had severe tetraparesis. Patient underwent an extensive multidisciplinary workup and was ultimately diagnosed with Guillain-Barré Syndrome. Patient responded well to plasmapheresis treatments and was subsequently admitted for acute inpatient rehabilitation. Two months later, patient returned home with 75% of his premorbid function. This case illustrates a rare occurrence of Guillain-Barré Syndrome in a patient with Limb Girdle Muscular Dystrophy. The rehabilitation of a patient with an acute polyneuropathy and an underlying chronic neuromuscular disorder can be challenging. Affected patients will most likely have a longer rehabilitation course with different goals than most patients affected with polyneuropathies. They may have compensatory techniques which should be incorporated into their rehabilitation program. It is important not to work against any preexisting body postures which have developed from their chronic condition. Due to a more difficult recovery, it is imperative to address things like alternative therapies, mobility aids, and home modifications early in their rehabilitation. Patients with chronic underlying neuromuscular conditions who are affected with acute polyneuropathies should undergo a rehabilitation program that is set at an appropriate pace, that incorporates compensatory techniques and body postures from their chronic neuromuscular condition as well as include early integration of mobility aids and home modifications. This case will illustrate the challenges of such a rehabilitation course and the unique therapies used to successfully rehabilitate this unique patient.

Poster presented at Association of Academic Physiatrists, New Orleans, LA.

Stance-Related Changes in Postural Control During Hand Pushing


A number of occupational and leisure activities that involve pushing are performed in symmetrical or asymmetrical stance. The goal of this study was to investigate early postural adjustments (EPAs), anticipatory postural adjustments (APAs), and compensatory postural adjustments (CPAs) during pushing performed while standing. Ten healthy volunteers stood in symmetrical stance (with feet parallel) or in asymmetrical stance (staggered stance with one foot forward) and were instructed to use both hands to push forward the handle of a pendulum attached to the ceiling. Bilateral EMG activity of the trunk and leg muscles and the center of pressure (COP) displacements in the anterior-posterior (AP) and medial-lateral (ML) directions were recorded and analyzed during the EPAs, APAs, and CPAs. The EMG activity and the COP displacement were different between the symmetrical and asymmetrical stance conditions. The COP displacements in the ML direction were significantly larger in staggered stance than in symmetrical stance. In staggered stance, the EPAs and APAs in the thigh muscles of the backward leg were significantly larger, and the CPAs were smaller than in the forward leg. There was no difference in the EMG activity of the trunk muscles between the stance conditions. The study outcome confirmed the existence of the three components of postural control (EPAs, APAs, and CPAs) in pushing. Moreover, standing asymmetrically was associated with asymmetrical patterns of EMG activity in the lower extremities reflecting the stance-related postural control during pushing. The study outcome provides a basis for studying postural control during other daily activities involving pushing.

Presentation given at International Conference Progress in Motor Control IX, Montreal, Canada.
Direction Specific Limits of Stability in Individuals with Multiple Sclerosis


Impaired postural stability with decreased limits of stability is often an initial and disabling symptom leading to falls in individuals with multiple sclerosis (MS). Knowing the direction specific impairment of balance in MS is crucial for evaluating the efficacy of balance rehabilitation. Ten individuals with MS (mean age 54 ±10.32 years) with relapsing and remitting type and ten age and gender matched healthy controls participated in the study. Limits of stability test was conducted using the Balance Master® protocol (NeuroCom, USA). The subjects were required to shift their center of mass in different directions following the random appearance of targets shown on the computer monitor. The eight directions were: forward, backward, right, left, forward-right, forward-left, backward-right, and backward left. Each target was shown for eight seconds. Movement reaction time (RT), movement velocity (MVL), endpoint excursion (EPE), maximum excursion (MXE), and directional control (DCL) were measured. There were significant differences between the individuals with MS and controls for DCL (F=15.58, p<0.001), EPE (F=18.11, p<0.001) and MXE (F=4.75, p<0.001). The post hoc comparison showed significantly decreased limits of DCL in forward (p=0.04), backward-right (p=0.008) and backward-left (p=0.010) directions. In addition, the MXE and EPE showed significantly lower values in backward-right (MXE, p=0.009; EPE, p=0.008) and backward-left (MXE, p=0.005; EPE, p=0.006) diagonal directions. Individuals with MS demonstrated direction specific impairment of limits of stability predominantly in forward, backward-right and backward-left diagonal directions. This information might help in optimizing balance rehabilitation programs in individuals with MS.

Presentation given at National Multiple Sclerosis Society Conference, Denver, CO.

Right Medial Scapular Winging Due to Idiopathic Long Thoracic Nerve Palsy


The case diagnosis is right-sided idiopathic isolated long thoracic nerve palsy. This case describes a 25-year-old, right-handed male audio-visual technician with five-year history of episodic pain and weakness in right shoulder. Pain usually was sharp, localized to right shoulder and associated with weakness upon waking up and lasted 2-3 days with spontaneous recovery. Intervals between the episodes were significant for constant 3/10 dull pain which was aggravated to sharp pain by overhead activities and push-ups. However, the most recent episode in March 2013 was different in that it was only spontaneous weakness for abduction above shoulder and persists to date. Patient was evaluated by his PCP and referred for shoulder MRI for further evaluation of right upper extremity weakness. In PMR clinic patient was found to have isolated medial winging of right scapula and abduction weakness. Other significant histories are chronic low back pain and bilateral carpal tunnel syndrome. MRI revealed mild supraspinatus and infraspinatus tendinopathy with mild infraspinatus interstitial tearing, and mild tearing of posterior/superior and inferior labrum. EMG revealed bilateral median mid palm sensory nerve action potential (SNAP's) with fibrillation and positive sharp waves in right serratus anterior muscle on needle EMG. Patient was enrolled into physical therapy program focusing mainly on range of motion exercise, stretching and strengthening of rhomboids, trapezius and levator scapulae while avoiding strenuous activity during this expectant management period and planned for electrophysiology re-evaluation in six months. Complete physical examination with EMG ruled out any other nerve or muscle involvement. MRI findings of the right shoulder, with no history of trauma are most likely due to scapulothoracic stabilizer imbalance. Thus, right-sided idiopathic isolated long thoracic nerve palsy was diagnosed by exclusion. Patients with shoulder pain warrant a complete and careful examination of shoulder including scapulothoracic motion. Although no incidentally diagnosed cases have been documented, a better understanding and awareness of this lesion will lead to early diagnosis and appropriate management.

Poster presented at Association of Academic Physiatrists, Nashville, TN.
Gluteal Compartment Syndrome, an Uncommon but High Morbidity Cause of Lower Extremity Weakness and Pain: A Case Report


The case diagnosis is lower extremity weakness and pain secondary to non-traumatic gluteal compartment syndrome. This case describes a 49-year-old female with a history of diabetic neuropathy who presented to the emergency department with acute left lower extremity weakness associated with increased numbness and pain upon waking up on the floor after an unclear amount of time. Based on imaging, laboratory results and clinical history, the diagnosis of compartment syndrome of the left gluteal compartment was made in a timely fashion and the patient underwent a fasciotomy of the left gluteal compartment. With time and a comprehensive postoperative rehabilitation program, the patient regained most of her baseline strength and independent function. Gluteal compartment syndrome may be a complication of prolonged immobilization often associated with alcohol intoxication, drug overdose, improper surgical positioning, and trauma. This case study illustrates how a timely diagnosis of gluteal compartment syndrome can result in effective treatment and recovery. The occurrence of compartment syndrome in the limbs is well documented. The incidence in the gluteal region, however, is exceptionally rare. Due to the high risk of long term neurologic impairment, considering this syndrome in one’s differential diagnosis is critical. This case provides an overview of this unique syndrome as well as how to manage it from a rehabilitation perspective.

Poster presented at Association of Academic Physiatrists, Nashville, TN.

Training-Related Enhancement of Anticipatory Postural Adjustments in Older Adults


Balance control in older adults is diminished as a result of impaired anticipatory postural adjustments (APAs). Optimal APAs are marked by early onset of muscle activation with reference to moment of perturbation (T0). A recent study demonstrated that APAs in older adults were improved with a single session training of catching a ball. The aim of the present study is to see if multiple sessions training leads to enhancement of APAs and if this improvement is retained after the training. Two healthy older adults (mean age-72) participated in 10 weeks case-control study. The study had three phases, training P1 (training), break P2 (break), and training P3 (training). Typical training session for Subject One involved catching of 2lbs/4lbs medicine ball while standing in four different body stability positions. Subject Two did not participate in any training. Both subjects took part in similar assessments at the start and end of each phase: they were subjected to an external perturbation applied to upper body while EMG of trunk and leg muscles was recorded. After training Subject One exhibited improved APAs marked by early activation of the trunk and leg muscles in relation to perturbation (T0). Before P1 (training) biceps femoris muscle (BF) 58.

Presentation at University of Illinois Chicago Students Research Forum #85.
The Role of Asymmetry of Posture and Arm Movement during Performance of Functional Activities Involving Pushing


A number of occupational and leisure activities involve pushing. Pushing an object with one hand or when standing with one foot in front induces asymmetrical loading of the body. The aim of the study was to investigate how the vertical torque and the center of pressure (COP) displacement change in response to the changes in the symmetry of pushing movement and stance. Ten healthy young volunteers stood on the force platform with feet parallel or with the right foot forward or backward and they were instructed to use two hands, or right or left hand only to push the handle of the pendulum attached to the ceiling. The magnitude of vertical torque (Tz) and COP displacement in the medial-lateral (ML) direction were calculated and analyzed. When pushing symmetrically, the Tz and COPML magnitudes were close to zero. The positive peak Tz values were observed when pushing with right hand, regardless of the foot position indicating the counterclockwise trunk rotation. The negative peak Tz values were recorded in the left hand-pushing conditions indicating the clockwise trunk rotation. Thus the changes in Tz were determined by the arm used to push. The COPML displacement was mainly determined by the foot position. When standing with the right foot forward, COPML shifted towards the left side prior to the onset of pushing (0.5 s) and then to the right side. The opposite pattern could be seen while standing with the left foot forward. Changes in the Tz magnitude reflect the additive or subtractive effects of the combined asymmetry of stance and pushing movement. Additive and subtractive combined asymmetry-related changes were also seen in the COPML displacements. The findings provide information on the importance of evaluating the vertical torque and COP displacement together when studying occupational and leisure activities involving asymmetry of arm movement and foot position.

Presentation at 2014 Combined Annual Meeting of CSCTR and MWAFMR, Chicago, IL.

Multidirectional Reactive Step Training: A Novel Approach to Improve Mobility in Individuals with Multiple Sclerosis — A Pilot Study


Individuals with multiple sclerosis (MS) commonly experience mobility limitations that pose a serious challenge to achieve independent living. Rehabilitation approaches to improve mobility in individuals with MS are limited. This study evaluated the feasibility of supervised multidirectional reactive stepping training on improvement of mobility in individuals with MS. Three individuals with relapsing-remitting MS (mean age 54.6±4 years; mean Expanded Disability Status Scale score 3±0.5) participated in training (30 min/session for 3 days/week for 4 weeks) focused on multidirectional visual cue based reactive stepping. Each session consisted of three 10-minute training sets with two minute rests between sets. Subjects stood in the central position and were required to step into eight targets as quickly as possible following a randomly appearing visual cue indicating the specific direction to step. The eight floor targets were color marked with a distance of 18” forward, right, left, forward-right, forward-left directions and 9” backward, backward-right and backward-left directions. Subjects were required to step with the preferred leg, followed by the other leg, and returning to the central position as quickly as possible. Initially, visual cue settings were set at 2:4 (ON:OFF) ratio. During the ON period, the light signal (cue) was displayed and during OFF period, the light was off. The progression was made by decreasing the OFF period by one second per week until the subjects could reach 2:2 (ON:OFF) ratio. Subjects were assessed before and after training using reaction time (sec), movement velocity (m/sec) and directional control (%), Tinetti performance oriented mobility assessment (POMA), distance (cm) reached in the forward reach test (FRT) and maximal step length (MSL), duration (cm) to complete four square step test (FSST), 10 meter walk test, and five times sit to stand test. A significant improvement in POMA gait (p=.037) and balance (p=.031) scores, FSST (p=.027), FRT (.011), MSL (p=.033), five times sit to stand test (p=.042), 10 meter walk test (p=.014) and reaction time composite score (p=.037) were observed after training. No significant differences were found in movement velocity composite score (p=.094) and directional control score (p=.103).

Submitted to the 28th Annual Meeting of the Consortium of Multiple Sclerosis Center (CMSC), Dallas, TX.
Biomechanical Analysis of Isolated and Combined Asymmetry in Pushing


The objective of this study is to investigate effects of symmetric and asymmetric stance and pushing movement on anticipatory (APAs) and compensatory (CPAs) postural adjustments. Ten healthy volunteers stood symmetrically (feet parallel) or asymmetrically (one foot forward and the other backward) and pushed a handle with both hands or right or left hand. Bilateral EMG activity of the trunk and leg muscles and center of pressure (COP) displacements in the anterior-posterior (AP) and medial-lateral (ML) directions were recorded and analyzed during the APAs and CPAs. Isolated asymmetry of stance was associated with larger muscle activity of the backward leg while isolated asymmetry of pushing movement induced larger trunk muscle activity on the contralateral side. A combined asymmetry of stance and pushing movement resulted in the increase or decrease of the thigh muscle activity and ML COP displacement depending on whether both asymmetries were induced on the same side of the body or on opposite sides. Both isolated and combined asymmetries affect APAs and CPAs in pushing. Using combined asymmetry of stance and arm movement might be beneficial in performing pushing activity. The outcome of the study provides a basis for studying postural control in individuals with unilateral impairment while performing daily tasks involving pushing.

Presentation at 7th World Congress of Biomechanics, Boston, MA.

Hand and Arm Assessment for Healthy Children

Luy, E.

There are many assessments that measure hand function in children; however there are very few tools that are efficient and effective for measuring the progress of constraint-induced movement therapy in children with neurological injury. A number of pediatric assessments measure fine motor skills with the dominant hand, as well as bilateral hand skills and function are available; however, they are extensive assessments that require advanced certification, are expensive, and are time consuming. These tests are not easily accessible to therapists with limited financial and time resources. A quick, inexpensive assessment tool is needed to measure arm function in children with hemiplegia in order to determine the effectiveness of constraint-induced movement therapy programs for children with neurological injuries. The purpose of this study is to obtain normative data on healthy children between the ages of 3 and 12 of hand skills with the non-dominant hand. This study is a prospective study using a convenience sample of healthy volunteers. Thirty typically developing children between the ages of 3 and 12 who complete the consenting process will be invited to participate in the study and complete the Marianjoy Pediatric Arm Use Assessment. The specific aim of this study is to establish normative information for hand skills for the non-dominant hand on the following tasks: transfer beanbags, transfer cubes, place large pegs, place small pegs, finger opposition, active shoulder flexion, passive shoulder flexion, active wrist extension, passive wrist extension, and grip strength.
Marianjoy uses an interdisciplinary approach with prosthetics and orthotics provider, Scheck & Siress, in order to best serve patients following an amputation.
Grip Force Control in Individuals with Hand Osteoarthritis


Individuals with hand osteoarthritis (OA) experience pain and stiffness that could result in significant limitations in the performance of everyday activities involving upper extremities. The purpose of this study was to evaluate grip force control in individuals with hand OA during the lifting of an object. The study design used was a case-control study. Ten females with hand OA and a group of age-matched females performed two functional tasks: lifting an instrumented object vertically while the load was suddenly changed and lifting and placing the object on a shelf. Load Force Peak, Grip force at liftoff, Grip Force Peak, Time Lag, and Latency were measured and analyzed. Individuals with hand OA were able to modulate the magnitude and temporal parameters of grip force; however, they applied higher grip forces (at liftoff \( p < 0.002 \); Grip Force Peak \( p < 0.039 \)) and demonstrated a longer latency (\( p < 0.015 \)) to manipulate the instrumented object when compared with the control subjects. The Load Force Peak and Time Lag were not significantly different between the two groups. Detailed information about how individuals with hand OA perform prehension activities of daily living (ADLs) will help to better understand the limitations of grip force control in these individuals.
**A Relationship Between Hand Function and Grip Force Control in Individuals with Hand Osteoarthritis**


Hand osteoarthritis (OA) usually results in decreased strength and function of the hand and deficits in motor control. However, no data exists on the relationship among these symptomatological features of hand OA. Ten females with hand OA and ten matched, nondisabled control subjects participated in this study. The outcomes of the Moberg Pickup Test (MPUT) and other functional hand tests were correlated with the measures of grip force control obtained during the performance of a functional task of lifting and transporting a handheld object. Strong correlations existed between the MPUT and parameters of grip force control, such as latency (r = 0.85) and force at the moment of liftoff (r = 0.72), seen in these patients. The established strong correlation between the MPUT and parameters of grip force control might help researchers and clinicians better understand how deficits in controlling grip forces affect hand function in patients with hand OA.

**Obtaining Glenoid Positioning Data from Scapular Palpable Points in Vitro**


Both clinical and biomechanical problems affecting the shoulder joint suggest that investigators should study force transmission into and out from the scapula. To analyze force transmission between the humeral head and the glenoid, one must know the position of the glenoid. Studies have analyzed the position of the scapula from the positions of three palpable points, but the position of the glenoid relative to three palpable points has not been studied. Dry scapulae (N = 13) were subjected to X-rays and a critical angle, Θ (which relates the plane determined by the three palpable points on the scapula to a plane containing the glenoid center and the first two palpable points) was calculated. The mean value for Θ was 28.5 ± 5.60 degrees. The obtained Θ allows us to determine the position of the glenoid from three palpable points. This information could be used in calculation of forces across the shoulder joint, which in turn would allow optimizing the choice of strengthening exercises.

**MUSCULOSKELETAL POSTERS & PRESENTATIONS**

**Persistent Right Hip Pain in a Young Patient with Multiple Sclerosis Exacerbation Secondary to Undiagnosed Chondroblastoma**


Chondroblastoma is usually a benign bone tumor and only consisted of 1% of all bone cancers in the United States. Patients who have benign chondroblastoma may present with limited activities secondary to pain. Malignant chondroblastomas do occur but are extremely rare and are associated with high mortality. The majority of the patients with chondroblastoma present within the first three decades of life. Yet it was reported the presenting ages vary from 2 to 83. This case describes a 58-year-old female with multiple sclerosis (MS), and trigeminal neuralgia who was initially admitted to an acute hospital secondary to an episode of weakness and pain in the left upper and lower extremities. A CT of the head was negative for hemorrhage or strokes. MRI images of the brain and cervical, thoracic, lumbar and sacral spines showed stable lesions related to MS. Patient’s weakness and pain were attributed to the MS exacerbation secondary to a urinary tract infection. During patient’s stay at the acute hospital, patient began to experience right hip pain which was on the opposite side of the symptoms yet patient did not inform any physicians. Patient was then transferred to a rehabilitation hospital. A few days prior to her discharge, patient began to ambulate less. Upon persistent inquiries of rehabilitation physicians, patient revealed right hip pain. The initially X-ray demonstrated a rather large cystic lesion at the right trochanteric area. Further imaging studies with CT and MRI deepens the surgical oncologist’s suspicion of chondroblastoma. Due the large size of the lesion, patient was scheduled to undergo excision of the tumor to prevent pathological fractures. Rehabilitation physicians should be vigilant and not hesitate to look for tumors in patients who had extensive prior imaging studies.

Poster presented at Association of Academic Physiatrists, Phoenix, AZ.
Grip Force Control in Individuals with Hand Osteoarthritis


Hand osteoarthritis (OA) is the most common degenerative joint dysfunction which usually is the reason for the decreased strength and function of the hand and deficits in motor control. However, no data exists on the relationship between the parameters of grip force control and the tests that are commonly used in clinical practice to assess hand function. Therefore, the purpose of this study was to investigate the relationship between the outcomes of clinical tests and ability of individuals with OA to control of grip force. Ten healthy subjects and 10 individuals with hand OA who filled classification criteria for hand OA of the American College of Rheumatology participated in the study. The subjects were evaluated using the following clinical and laboratory tests: (1) maximum isometric grip force, (2) Moberg Pick-Up Test (MPUT), (3) Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, (4) pain visual analog scale, and (5) grip force control during lifting an instrumented object. The outcomes of clinical tests were correlated with the grip force control variables. Strong correlations between MPUT and both latency ($r = 0.903$) and grip force at lift-off (FMLO) ($r = 0.758$) were found in patients with hand OA. The observed strong correlation between MPUT, latency and FMLO might help to better understand how the grip force control deficits impact hand function in patients with hand OA. Moreover, using MPUT may be a simple alternative to evaluate the ability of individuals with OA to perform functional tasks involving application of grip force.

Presentation given at Progress in Motor Control VII Conference, Cincinnati, OH.

Comparative Subacute Rehabilitation Outcomes of Anterior and Posterior Total Hip Arthroplasties


The aim of this study is to compare the rehabilitative outcomes of two common approaches in total hip arthroplasties in the subacute setting. A comprehensive list of patients admitted for subacute rehabilitation of total hip arthroplasties between July 2009 and February 2011 was obtained. Based on the surgical approach documented in electronic medical records, we then separated the patients into the anterior or posterior approach group. Main Outcome Measures were length of stay (LOS), admission FIM score, discharge FIM score, FIM gain, and disposition following rehabilitation. Sixty patients were admitted to the subacute rehabilitation unit following total hip arthroplasties during our time frame and only 10 (16.6%) underwent anterior approaches. Admission FIM scores were found to be significantly higher in the anterior approach group (p-value = 0.028) than in the posterior approach group. Comparison of the two groups’ LOS shows the anterior approach group tended to be shorter than the posterior approach group (p-value = 0.106). No significant difference was found between the two groups in discharge FIM scores (p = 0.164) and FIM gains (p=0.364). Patients undergoing post-operative subacute rehabilitation for anterior total hip arthroplasties have significantly higher admission FIM scores as compared to patients with posterior approach total hip arthroplasties. Anterior approach total hip arthroplasties also tend to have a shorter LOS and higher discharge FIM scores than posterior total hip arthroplasties. Significantly higher admission FIM scores support the idea that anterior hip precautions are less restrictive of many activities of daily living, when compared to posterior precautions.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Orlando, FL.
Rehabilitation Challenges in Patient with Dwarfism Status Post Total Hip Replacement


This case describes a 32-year-old female with history of Dwarfism who underwent a left total hip arthroplasty via posterior approach. Patient was placed on toe-touch weight bearing due to intra-operative prosthetic fracture. Patient underwent a two week acute inpatient rehab course. This case posed to be challenging from a rehab perspective due to patient’s short stature (3 ft., 2 inches, 106 lbs.) in combination with weight-bearing restrictions. Patient required unique modifications with regards to transfers, toileting, activities of daily living, and gait training. These tasks were particularly challenging due to her weight bearing restrictions. Push-up blocks were used under slide-board transfers. Modified bedside commode with height of 10 inches from floor to seat was used for toileting. A wider pediatric gait trainer with 12-inch bilateral platform attachments was used to aid in ambulation. Other special equipment patient required included custom sock aid, long-handled sponge, and custom fabricated toilet aid. Prior to modifications, patient required assistance of two people with transfers and toileting; maximum assistance for gait going five feet; minimum assistance for grooming and maximum assistance for bathing. By end of two week program with modifications, patient improved to modified independent for transfers including toilet transfers, supervision for toileting, and minimum assist for gait going 20 feet with special pediatric platform walker, supervision for grooming and bathing. This case provided interesting insight with regards to challenges associated with patient’s dwarfism. With the modifications applied, the patient was successfully discharged home independently.

Poster presented at Association of Academic Physiatrists, New Orleans, LA.

Does Anterior Total Hip Arthroplasty Result in Superior Rehabilitation Outcome?


Posterior total hip arthroplasty has been the most common surgical approach in treating advanced osteoarthritis not amenable to conservative measures. Less commonly, the anterior approach has been used. Because of less restrictive anterior hip precautions we embarked on a study with an objective to report if there was any improved functional outcome in this patient group compared to posterior. Retrospective medical chart review of all total hip arthroplasty patients who were community dwellers prior to arthroplasty admitted to subacute unit of a free standing rehabilitation hospital between July 2009 and June 2013 were included in this study. Based on the surgical approach they were assigned into anterior and posterior groups. Admission and discharge Functional Independence Measure (FIM) scores, FIM gain, length of stay (LOS) and discharge disposition were analyzed by a series of t-tests to evaluate significance of FIM characteristics. There were 35 anterior (20%) and 139 posterior hip arthroplasty patients. Anterior surgical approach patients were younger, had shorter acute care and post-acute care LOSs, greater admission FIM motor, greater admission cognitive FIM, greater discharge motor and cognitive FIMs, greater motor FIM gain, greater FIM gain per day, and greater FIM gain overall, however none of these were statistically significant. The initial outcomes from both approaches are equivocal though there was a trend for anterior approach patients to do better than posterior. This trend may be biased because of the small sample size, younger age group, and better admission FIM scores.

Poster presented at Association of Academic Physiatrists, Nashville, TN.
Comparative Safety & Efficacy of Rivaroxaban in VTE Prophylaxis in Inpatient Rehabilitation Post Hip & Knee Replacement Surgery

Rao, N.; Agarwal, N.; Sririgiraju, P.; Aliga, N.; Ruroede, K.; Gnanapragasam, P.; Tancredi, N.; Afolarin, H.; Mekheil, M.

Venous Thromboembolism (VTE) which encompasses deep vein thrombosis (DVT) and pulmonary embolism (PE) is a serious complication after hip and knee arthroplasty procedures resulting in increased morbidity and mortality. Enoxaparin, Fondaparinux, and Warfarin are commonly used to prevent VTE after hip and knee joint replacement surgery. Comparative studies with Enoxaparin have demonstrated efficacy and safety of new oral factor Xa inhibitor Rivaroxaban in preventing VTE after joint replacement surgery. There are no studies reported in the literature comparing efficacy and safety of Rivaroxaban with Enoxaparin, Fondaparinux, and Warfarin anticoagulants in patients undergoing inpatient rehabilitation after hip and knee replacement surgery. Enoxaparin and Fondaparinux are both given in the form of subcutaneous injections. Warfarin is orally administered like Rivaroxaban, however Warfarin has a narrow therapeutic window, both food and drug interactions, involves routine blood monitoring, and unpredictable dose response. Rivaroxaban is once-a-day orally administered medication, reported to have minimal or no drug interactions, does not require coagulation monitoring, and improves patient compliance. The purpose of this 18-month medical record review study is to compare the efficacy and safety of Rivaroxaban with Enoxaparin, Fondaparinux, and Warfarin in a convenience sample of patients undergoing inpatient rehabilitation after hip and knee replacement surgery. Investigators hypothesize there will be no statistically significant differences in the incidence of VTE and complications of major or minor bleeds in status-post hip and knee replacement surgical patients who were prophylactically treated with Rivaroxaban, compared to patients treated with Enoxaparin, Fondaparinux, and Warfarin during inpatient rehabilitation.

Comparative Subacute Rehabilitation Outcomes of Anterior & Posterior Total Hip Arthroplasties

Rao, N.; Devara, D.; Aliga, N.; Ruroede, K.; Gnanapragasam, P.

The incidence of total hip arthroplasties (THA) has increased over the past two decades and is now considered to be one of the most successful surgical procedures today. The most common surgical approach to assess the joint capsule is the posterior approach. The posterior lateral approach also called the Kocher-Langenbeck approach, gains exposure to the hip by splitting the Gluteus Maximus muscle and dissecting off the short external rotators on the posterior aspect of the hip. The anterior approach, also called the Smith-Petersen approach, gains exposure to the hip without detachment of the surrounding muscles. This minimally invasive surgery performed through the anterior lateral approach potentially lead to reduction in operative trauma with this similar soft tissue wound, a reduction in postoperative pain, and early mobilization accomplished by preserving muscle insertions. Theoretically these improvements should result in a shorter hospitalization, convalescence, and rehabilitation period. The choice of which surgical approach to use is dependent upon surgeons preference which in turn is a reflection of surgeons training and experience. Following hip arthroplasty procedures, patients are admitted to inpatient rehabilitation based upon functional decline. There are currently no studies reported in the literature comparing anterior and posterior surgical approach outcome following hip arthroplasty procedures. The purpose of this retrospective medical chart study is to compare the two surgical approaches for patients admitted to the subacute rehabilitation program with regard to rehabilitation outcomes; admission and discharge Functional Independence Measure (FIM) scores, FIM gain, length of subacute stay, and discharge disposition.
The new Marianjoy Assistive Rehabilitation Technology Institute offers advancements that benefit individuals with disabilities in order to maximize functional independence.
Unusual Warfarin Complication: Hematomyelia


This case describes a 72-year-old female with quadriparesis caused by hematomyelia. Patient had history of aortic valve replacement, cardiac pacemaker, atrial fibrillation, extensive lacunar infarcts, gait and balance disorder, multiple falls, and on warfarin, aggrenox, and aspirin. Patient initially presented for right upper extremity weakness two days after a fall. Head CT showed no sign of hemorrhage. International normalized ratio (INR) was in therapeutic range. Next day, patient progressively weakened and became quadriplegic. Spine CT showed hyperdensity in spinal cord at C5-C6 level. Neck CT angiogram showed fusiform elongated hyperdensity which was consistent with hemorrhage. Warfarin, aggrenox, and aspirin were discontinued. Coagulopathy was reversed. Spine CT was performed on a daily basis with mild resolution in hemorrhage. Patient was discharged to acute inpatient rehabilitation facility. On admission, patient had ASIA-A C4 tetraplegia with preserved movement in only right elbow flexion of 2/5 and left elbow flexion of 3/5 muscle strength. On third day of admission, patient was emergently discharged to acute care due to hypotension. Hematomyelia is the rarest form of intraspinal hemorrhage. Anticoagulant therapy associated with trauma is the well-recognized cause. Emergency correction of coagulopathy and evacuation of the hematoma offer the best chance of minimizing spinal cord damage. Early signs of hematomyelia must be immediately suspected in any patient on warfarin who develops new onset myelopathic symptoms, especially motor weakness.

Poster presented at Association of Academic Physiatrists, Phoenix, AZ.
Mood Alterations Following Dural leak as a Complication of Laminectomy: Case Report


This case describes a 78-year-old female with low back pain radiating down right lower extremity status post L4-L5 laminectomy and posterior lateral fusion with pedicle screw fixation. Patient was diagnosed with intractable low back pain secondary to lumbar spinal stenosis that failed conservative measures. Patient underwent elective L4-L5 laminectomy and decompression of nerve roots L4-L5, L5-S1 with posterior lateral fusion and screw fixation of pedicles. Patient was transferred to acute inpatient rehabilitation. At admission, total Functional Independence Measure (FIM) score was 80. Five days post-op, patient complained of unrelenting headaches that were not present prior to surgery. Patient began exhibiting bizarre behavior along with iteration of inappropriate responses. Patient noted to experience mood lability and acute psychotic symptoms. Patient had no past medical or family history of psychiatric illness. All laboratory investigations were negative and vital signs were without abnormality. Patient was sent to acute care hospital. Total FIM score at discharge was 78 following a 10 day initial stay. Patient was found to have an epidural fluid collection extending to T12. Patient underwent evacuation of epidural hematoma and repair of dural leak. Patient was returned to acute inpatient rehabilitation. At readmission, patient's total FIM score was 80 and symptoms of headache and psychosis resolved. Her total rehabilitation length of stay was prolonged, with second stay of 11 days and total FIM score was 86. She required continued rehabilitation in sub-acute setting for 14 additional days. After 35 days of total rehab patient was discharged home with total FIM score of 94. Early recognition of this early epidural fluid collection complication by physiatrists could result in quickened treatment and hastened rehabilitation stay.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Atlanta, GA.

Thoracic Epidural Abscess Manifesting as Small Bowel Obstruction with Progressive Lower Extremity Weakness: A Case Report


This case describes a 65-year-old male with past medical history significant for type 2 Diabetes Mellitus and previous small bowel resection who was having back pain after outdoor activities four days prior to presenting to an acute care hospital. Patient’s pain was moderate in the mid thoracic and localized. Patient was seen in ER, given Flexeril and Norco, but never demonstrated any fever or neurological change in his extremities. Patient then re-presented to the ER for severe abdominal pain, emesis, and dehydration. Patient underwent CT scan indicating small bowel obstruction. Patient failed conservative management and exploratory laparotomy with lysis of adhesions was performed. Five days post-resection, the back pain persisted and then developed right hemiparesis, progressing into bilateral lower extremity paresis, right greater than left. MRI revealed a posterior epidural abscess from T2-T7, and emergent incision and drainage was performed with cultures yielding gram positive cocci in pairs; IV antibiotics were started. A right foot drop was diagnosed and a short course of ankle foot orthosis was applied. Spinal cord injury results in decreased bowel motility yielding higher incidence of obstruction. The obstruction can lead to distention and referred pain to the back, masking the true etiology. Epidural abscess occurs 2.8 cases in 10,000 admissions and can lead to serious complications if untreated with the classic presentation including a triad of fever, spinal pain, and neurological deficits. Patients rarely present with all three symptoms, but once neurological impairment starts, urgent intervention is required. Epidural abscess should be considered clinically to prevent permanent neurological deficits.

Poster presented at Association of Academic Physiatrists, New Orleans, LA; and (2013, October) at American Academy of Physical Medicine & Rehabilitation Annual Assembly, National Harbor, MD.
Heavy Lifting Causing Hemorrhagic Syrinx with Subsequent C2 ASIA A Spinal Cord Injury: A Case Report


This case describes a 59-year-old female with a long history of type II diabetes and hypertension who suffered a C2 ASIA A spinal cord injury following a hemorrhagic syrinx while transferring a patient at work. Patient presented twice to an emergency department with symptoms of increasing extremity weakness and numbness, loss of bowel and bladder function, and neck pain. MRI showed a heterogeneous signal from the inferior medulla to T3. Patient was diagnosed with a hemorrhagic syrinx. Two days later, patient underwent a C1-C7 decompressive laminectomy, had a tracheostomy and PEG tube placed, and spent six weeks at a long-term care facility before being sent to acute inpatient rehabilitation hospital. Admission Functional Independence Measure (FIM) was 48. Patient’s tracheostomy tube was eventually capped and later removed. After a month of rehabilitation, patient was able to navigate terrain utilizing a sip and puff system on patient’s power chair, improved left trapezius elevation to 1/5, and improved right plantar flexion strength to 1/5. Patient was discharged home to continue long-term goals such as modified power chair independence over advanced terrain and discerning autonomic dysreflexia signs and symptoms as an outpatient. While rare, a syrinx should be on the differential in a patient with a headache or backache, especially if accompanied by appropriate level sensory changes or lower motor neuron signs. Any increase in cerebral spinal fluid (CSF) pressure can suddenly increase the syrinx and cause unpredictable results; in patient’s case – transferring a heavy load was hypothesized to have torn patient’s syrinx causing a hemorrhage.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, National Harbor, MD.

Acute Inpatient Rehabilitation of an Individual with Rare Intradural Cavernous Lymphangioma Causing Thoracic Myelopathy: A Case Report


This case describes an 83-year-old female patient with thoracic myelopathy due to recurrent thoracic intradural cavernous lymphangioma. Patient had initial presentation of progressive gait ataxia and weakness in the lower extremities. MRI revealed a cystic structure found inside the thecal sac with compression of spinal cord. Patient underwent resection of cystic lesion in May 2012 with symptoms improvement. Pathology report confirmed an intradural cavernous lymphangioma. Approximately four months later, symptoms began to worsen with imaging revealing recurrence of lymphangioma in proximity of the original site. Patient underwent a second surgical intervention with T4-T9 laminectomies and resection in September 2012. Patient was then transferred to acute inpatient rehabilitation unit in an affiliated community hospital for functional upgrading of severe ataxia and neurogenic bladder. Shortly after this rehabilitation course, patient had a third recurrence of the cyst, requiring cysto-peritoneal shunting and subsequent re-admission in acute inpatient rehabilitation finally resulting in stabilization and mild improvement in her symptoms. With each of the three presentations, patient was noted to have moderate paresis and significant sensory impairments, specifically with proprioception, sensation to light touch, and pinprick in lower extremities, resulting in severe gait ataxia. Other barriers to rehabilitation included neurogenic bowel/bladder and neuropathic pain. Only a few cases of lymphangioma of the spine have been reported. This is the first reported case, to our knowledge, of a patient with intradural cavernous lymphangioma in an acute inpatient rehabilitation setting. Intradural lymphangioma requires close clinical follow up for recurrence. If not responsive to surgical resection, a combination of cysto-peritoneal shunting and acute inpatient rehabilitation may result in improved functional status.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, National Harbor, MD.
C5 Palsy after Cervical Laminectomy: A Case Report


This case describes a 76-year-old male with a history of mechanical fall and resultant neck pain, but normal neurological examination, who was found with severe cervical stenosis from C3-4 to C6-7 on cervical MRI investigation. Patient underwent C3-T1 laminectomy and fusion, and immediately post-op was noted to have 0/5 strength in the bilateral C5 myotomes (shoulder abduction and elbow flexion) as well as diminished pinprick sensation in the bilateral C5 dermatomes. Re-imaging of the cervical spine showed only post-op findings and no signs of spinal cord or nerve root impingement. Neurologic symptoms persisted through three week acute inpatient rehabilitation stay and upon discharge patient was modified independent for transfers and gait, while requiring minimal assistance for activities of daily living. Unilateral C5 palsy is not an uncommon complication after cervical laminectomy and fusion surgeries with the rate reaching as high as 10.6%. Symptoms can include paralysis of the deltoid and/or bicep brachii, with possible sensory deficits and/or intractable pain in the corresponding dermatome. Though no direct causality can be linked with incidences, there are some anatomical considerations hypothesized. The rootlet and root of C5 are shorter than in other segments and may be more prone to tethering during vertebral body shifting. C5 is usually the apex of cervical lordosis and the midpoint of decompression, which could place greater shifting movement at this segment. While 70% of affected patients show complete recovery from paralysis within 7.9 months, 30% remain with residual motor paralysis. Physicians and patients need to be aware of the potential risk of C5 palsy after cervical fusion surgery.

Poster presented at Association of Academic Physiatrists, Nashville, TN.
Marianjoy’s Stroke Rehabilitation Program has earned the Joint Commission Stroke Rehabilitation Specialized Accreditation.
Compelled Body Weight Shift Approach in Rehabilitation of Individuals with Chronic Stroke


This study was designed to evaluate the effectiveness of the Compelled Body Weight Shift (CBWS) therapy approach in the rehabilitation of individuals with chronic stroke. CBWS involves a forced shift of body weight toward a person’s affected side by means of a shoe insert that establishes a lift of the nonaffected lower extremity. 18 individuals with chronic, unilateral stroke (mean age 57.7 ± 11.9 years, with a range of 35–75 years; mean time since stroke 6.7 ± 3.9 years, with a range of 1.1–14.1 years) who showed asymmetrical stance were randomly divided into two groups: the experimental group received six weeks of physical therapy combined with CBWS therapy, and the control group received only physical therapy. Both groups underwent a battery of identical tests (Fugl-Meyer Assessment, Berg Balance Scale, weight bearing, and gait velocity) before the start of the rehabilitation intervention, following its completion, and three months after the end of therapy. After the intervention, weight bearing on the affected side (measured with the Balance Master®) increased in the experimental group to a larger degree compared to the control group (9.7% vs 6.4%). Similarly, gait velocity increased 10.5% in the experimental group compared to the control group. Improvements in weight bearing and gait velocity were maintained in the experimental group after the three-month retention period. The study outcome revealed that a six-week intervention involving CBWS therapy could result in long lasting improvement of the symmetry of weight bearing and velocity of gait in individuals with chronic stroke.
Monitoring Community Mobility with Global Positioning System Technology after Stroke: A Case Study


Stroke survivors often experience difficulty returning to activities and places they deem important to their social, leisure, and occupational aspirations. The extent to which stroke survivors return to community mobility and their ability to navigate and access locations they deem meaningful have not been objectively measured. We used global positioning system technology (GPSt) to measure the community mobility of a person poststroke, and to assess the relationship between GPSt measures and clinical measures of mobility.

The participant was a fifty-six-year-old male who sustained a right pontine stroke. At discharge from rehabilitation, patient’s Six-Minute Walk Test distance was 73 m. Patient was fitted with a GPS unit and an accelerometer attached to a single belt and instructed to wear the devices at all times when out of bed. After identifying ten target locations that were important to patient’s goals, patient was monitored for five separate one-week periods, on the first, fifth, and ninth weeks and at six and twelve months after discharge. During the first ten weeks, patient averaged 7.6 target visits (70%) and 26.7 trips per week. At one year, patient’s Six-Minute Walk distance score was 287.5 m. Accelerometry data revealed that patient remained primarily sedentary. Target visits and trips per week did not change substantially over the course of one year, and compliance wearing the GPS unit was variable. Given the limited correlation in gait speed and distance with target attainment and trips, these outcomes likely measure different constructs for this subject. GPSt may offer insights into participation for stroke survivors following rehabilitation.

Compelled Body Weight Shift Technique to Facilitate Rehabilitation of Individuals with Acute Stroke


The study evaluates the effectiveness of Compelled Body Weight Shift (CBWS) approach in the rehabilitation of individuals with stroke. CBWS involves a forced shift of body weight towards a person’s affected side by means of a shoe insert that establishes a lift of the nonaffected lower extremity. Eleven patients with acute stroke were randomly assigned to experimental and control groups. The experimental group received a two-week conventional physical therapy combined with CBWS and the control group received only a two-week conventional therapy. Weight bearing, gait velocity, Berg Balance Scale, and Fugl-Meyer Assessment scores were recorded before and after the intervention. Weight bearing on the affected side increased in the experimental group and decreased in the control group. The increase in gait velocity with treatment was significant in both the groups ($p < 0.05$). However, the experimental group ($p = 0.01$) demonstrated larger improvements in gait velocity compared to the control group ($p = 0.002$). Berg Balance and Fugl-Meyer scores increased for both the groups. The implementation of a two-week intervention with CBWS resulted in the improvement in weight bearing and gait velocity of individuals with acute stroke. The present preliminary study suggests that CBWS technique could be implemented as an adjunct to conventional rehabilitation program for individuals with acute stroke.
**Pregait Balance Rehabilitation in Acute Stroke Patients**


Rehabilitation interventions designed to enhance balance control in individuals with acute stroke are quite limited. The goal was to develop and assess a technique of early pregait balance training involving the use of a combination of force platform visual feedback/force platform (VF/FP) and the unweighting system in individuals with recent stroke. A total of 28 individuals with acute stroke were randomly divided into the experimental and control groups: individuals included in the experimental group received one week of treatment on the basis of retraining balance utilizing visual biofeedback (Balance Master®) while provided with a body weight support harness system, whereas the individuals in the control group received conventional treatment. Both the groups undertook identical tests (Fugl-Meyer balance test, Functional Independence Measure test for gait, and Fugl-Meyer lower extremity assessment) before the start of treatment and after its completion. Individuals in the experimental group showed larger gains as seen in the increased scores on the Fugl-Meyer balance test and the Functional Independence Measure test for gait compared with the control group. The outcome of the study provides a basis for future investigations of the applicability of intervention in early balance rehabilitation of individuals with neurological disorders.

** Inserts Improve Symmetry, Velocity in Stroke Patients**


Learned disuse of the affected limb can lead to weight-bearing asymmetries in patients with stroke-related hemiparesis. Compelled Body Weight Shift (CBWS) therapy, using shoe inserts to force loading of the affected limb, can help patients achieve a more symmetrical gait. The results of several of our studies show that implementation of CBWS therapy resulted in the immediate and long lasting improvement of weight bearing symmetry and gait velocity in individuals with stroke. The achieved improvement was still present in individuals with chronic stroke three months after treatment. These findings support the use of the CBWS techniques to facilitate rehabilitation of individuals with acute and chronic stroke.

**The Effects of Two Different Ankle-Foot Orthoses on Gait of Patients with Acute Hemiparetic Cerebrovascular Accident**


The research objective was to compare the effects of two types of ankle-foot orthoses (AFO) on the gait of patients with cerebrovascular accident (CVA) and to evaluate their preference in using each AFO type. Thirty individuals with acute hemiparetic CVA were tested without an AFO, with an off-the-shelf carbon-fiber AFO (CF-AFO), and with a custom polymer AFO (P-AFO) in random order at the time of initial orthotic fitting. Gait velocity, cadence, stride length, and step length were collected using an electronic walkway and the subjects were surveyed about their perceptions of each device. Results indicated subjects walked significantly faster, with a higher cadence, longer stride, and step lengths, when using either the P-AFO or the CF-AFO as compared to no AFO (p < .05). No significant difference was observed between gait parameters of the two AFOs. However, the subjects demonstrated a statistically significant preference of using P-AFO in relation to their balance, confidence, and sense of safety during ambulation (p < .05). Moreover, if they had a choice, 50.87 ± 14.7% of the participants preferred the P-AFO and 23.56 ± 9.70% preferred the CF-AFO. It was concluded that AFO use significantly improved gait in patients with acute CVA. The majority of users preferred the P-AFO over the CF-AFO especially when asked about balance and sense of safety.
**Merci Clot Retrieval and Functional Recovery: A Case Series**

This case series describes Mechanical Embolus Removal in Cerebral Ischemia (MERCI) clot retrieval and functional recovery for two patients with ischemic middle cerebral artery (MCA) infarct undergoing acute inpatient rehabilitation. Cases include a seventy-one-year-old male and a seventy-six-year-old female developed unilateral weakness, slurred speech and confusion. Neuroimaging confirmed ischemic infarcts in the MCA. They underwent MERCI procedures—one with intra-arterial TPA. MERCI involves cannulation of ipsilateral common carotid artery proceeding to MCA M2 branch via internal carotid. MERCI microcatheter and retrieval device was advanced distal to clot. Angiography performed before and after retrieval demonstrated recanalization. Both were lethargic with poor mentation which improved to Alert & Oriented x3 post procedure. Both patients’ initial motor and cognitive Functional Independence Measures were minimum-maximum assistance. Average length of stay for acute inpatient stroke rehabilitation at our facility is 3-4 weeks. On discharge, the male’s right upper extremity manual muscle testing was 4/5 proximally, 3/5 distally, and 4/5 for right lower extremity muscles. His length of stay was three days. He was discharged home independent without assistive devices. On discharge, the female’s left upper extremity manual muscle testing was 4/5 and left lower extremity was 5/5. Her length of stay was thirteen days. The patient was discharged home modified independent. MERCI clot retrieval, with or without intra-arterial TPA, following acute ischemic MCA infarct improved functional outcome and shortened length of stay in our Stroke Unit for our patients. MERCI may ameliorate the ischemic penumbra associated with functional deficits following stroke and may reduce the recovery time for neural tissue due to removal of inflammatory foci.

Poster presented at Association of Academic Physiatrists, Phoenix, AZ

**Persistent Hiccups after Right Cerebellar Ischemic Stroke**

A hiccup or singultus is generally regarded as a benign condition in which there is an involuntary spasmodic contraction of the diaphragm and unilateral intercostal muscles. The causes of persistent or intractable hiccups were found to be more than a hundred, ranging from stress, alcohol use, postsurgical procedures, agitation of the phrenic or vagus nerves and strokes. This case describes a fifty-six-year-old male with a history of diabetes mellitus and hypertension who has had persistent hiccups since undergoing transesophageal echocardiogram (TEE) as a diagnostic study for stroke. It is well-known that strokes which affect the pontine and midbrain regions are prone to cause hiccups because such regions govern phrenic and vagus nerves. Interestingly, patient suffered right cerebellar not pontine or midbrain stroke. It is theorized that while patient was in left lateral decubitus position during TEE, patient’s neck was positioned in a way in which the cervical nerve roots of phrenic nerve was unintentionally stretched which resulted in persistent hiccups which have resulted in dysphagia and vomiting. Nonpharmacological methods have proven to be ineffective. Medications such as chlorpromazine, metocloproamide and baclofen were not beneficial. As a result, patient has undergone two treatments of acupuncture and patient’s symptoms completely resolved. The acupuncture points used included areas in scalp (GV 20), chest (LR 13 &14), knee (GB 34 & ST 36), and foot (LR 3). Hiccups are usually benign and transient. Yet in stroke patients they can lead to aspiration and dysphagia. While Western Medicine perceives hiccups as spasm of the diaphragm, Traditional Chinese Medicine (TCM) believes such phenomenon as an imbalance of Ying and Yang of the stomach and liver. Thus the meridian points of the liver were chosen for acupuncture.

Poster presented at Association of Academic Physiatrists, Phoenix, AZ
Compelled Body Weight Shift Technique to Facilitate Rehabilitation of Individuals with Stroke


Individuals with stroke-related hemiparesis commonly exhibit asymmetry in quasistatic standing postures and during functional movements. A Compelled Body Weight Shift technique (CBWS) was developed to help individuals suffering from the effects of a stroke improve weight bearing and stance symmetry. The aim of this study was to assess the efficacy of CBWS in the rehabilitation of individuals with acute and chronic strokes. Two groups of patients with acute stroke (n=11, University of Illinois Chicago site) and chronic stroke (n=18, Marianjoy Rehabilitation Hospital) participated in the study. Each group was randomly divided into experimental and control subgroups. The experimental subgroups received conventional physical therapy combined with CBWS therapy (two weeks for patients with acute stroke and six weeks for those with chronic stroke) and the control subgroups received only conventional therapy. CBWS involved a forced shift of body weight towards a person’s affected side by means of a shoe insert that establishes a lift of the nonaffected lower extremity. All the subjects underwent a battery of identical tests before the start of the rehabilitation intervention and following its completion. The chronic group was also tested three months after the end of treatment. After the intervention, weight bearing on the affected side increased in the experimental subgroup of acute patients and decreased in the control subgroup. Weight bearing increased in both subgroups of chronic patients; however, the level of increase was larger in the experimental subgroup than in the control group. An increase in gait velocity was also observed after treatment. The implementation of the CBWS therapy resulted in the improvement of symmetry in weight bearing and gait velocity in individuals with stroke. The achieved improvement was still present in individuals with chronic stroke four months after treatment.

Presentation given at the 6th International Posture Symposium, Smolenice Castle, Slovakia.

Mechanical Embolus Retrieval in Cerebral Ischemia Clot Retrieval & Functional Outcome in Stroke Rehabilitation: A Case Series


This case series describes five patients with ischemic middle cerebral artery (MCA) infarcts who underwent inpatient rehabilitation after Mechanical Embolus Removal in Cerebral Ischemia (MERCI) procedure. The participants included five consecutive endovascular cases, each participant forty-eight years and older with symptoms of acute stroke, presented to acute care between zero and eight hours with confirmed arterial occlusion of the MCA or one of its terminal branches by neuroimaging. All patients underwent MERCI procedure. Angiography performed before and after clot retrieval demonstrated reperfusion. Functional recovery was followed in acute inpatient rehab. Reperfusion via MERCI procedure is strongly associated with improved functional outcomes and reduced mortality. Functional recovery, measured by discharge Functional Independence Measure (FIM) scores, discharge setting, and length of stay, was improved for four out of five patients who underwent MERCI procedure followed by acute inpatient rehabilitation. All patients had unilateral hemiplegia which improved to at least 3/5 muscle strength post-procedure. On admission to rehabilitation, all patients’ initial motor and cognitive FIM was minimum-maximum assistance. Average length of stay for stroke rehabilitation at our facility is three-four weeks. Four out of five patients’ lengths of stays were thirteen days or less with community discharge at modified independent. One of the five patients’ courses was complicated by intracranial hemorrhage with continuance in subacute rehabilitation. All patients’ manual muscle testing of hemiparetic limbs improved to at least 4/5 on discharge. The patient with hemorrhagic conversion also recovered muscle strength of 4/5. MERCI clot retrieval following acute ischemic MCA infarct improved functional outcome and shortened length of stay for four out of five patients undergoing acute inpatient stroke rehabilitation. Further ongoing prospective case studies may reveal that the majority of these patients have good response to interdisciplinary rehabilitation following the procedure.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Orlando, FL.
Management of Cortical Deafness with Speech Therapy: A Case Study


This case study describes a forty-two-year-old adult who had pure word deafness and auditory agnosia due to bitemporal infarcts from recurrent cerebrovascular accidents (CVA's). The management of this type of condition is very challenging. Information about this rare and difficult case will be discussed. Few treatment programs exist in the literature. Doyle and Holland (1982) describe a treatment approach that was compensatory and focused on establishing a sign language program for an individual with pure word deafness. Burger and Wertz (1983) describe a treatment program for a patient with cortical deafness and reported it was successful due to the structure and redundancy of the program. However, the auditory discrimination and comprehension improvement did not demonstrate generalization when compared pre and post treatment with a variety of language measures. The only measure that demonstrated significant improvement was similar to the treatment program. This case report illustrates a unique patient who presented with pure word deafness and auditory agnosia following a second stroke. Patient was able to make progress during speech language treatment and the following treatment techniques were helpful: (1) repetition; (2) lip reading; (3) written cues; (4) length of utterance; and (5) patient guiding topic.

Poster presented at American Speech Language Hearing Association, San Diego, CA.

Predictive Model for Discharge Location following Acute Stroke Rehabilitation


The purpose of this study was to identify variables that predict patients who are discharged home as compared to those discharged to a subacute facility. All patients admitted to the stroke unit of an inpatient rehabilitation hospital from February 2010 to March 2011 were assessed. Inclusion criteria were a cerebrovascular accident (CVA) within the past 30 days as confirmed by chart review. Exclusion criteria included a previous stroke, MD order for limited weight bearing, and patients who were not independent ambulators prior to the CVA. There were 221 patients who met criteria, with 21 patients being emergently discharged, thus leaving 200 patients that were included in the final data analyses. The mean age was 71 years (+/-13 years) with 100 males and 100 females. There were 164 patients with ischemic CVAs and 36 hemorrhagic CVAs. During each patient’s inpatient rehabilitation stay the Berg Balance Scale, Postural Assessment of Stroke Scale (PASS), and Functional Independence Measure (FIM) scores were collected at both admission and discharge. A Canonical Discriminant Model was completed using the following predictive values: age, time from CVA onset to rehabilitation admission, change in Berg score, change in PASS score, change in FIM Motor Composite Score, Motor FIM efficiency, and length of stay (LOS). The patients were categorized into two groups based on discharge destination, with 120 patients discharged to the community and 76 patients discharged to a subacute facility (four patients excluded based on discharge outside groups). The canonical discriminant model utilizing these variables was 82% predictive of discharge location. The variables of age, length of time of CVA onset to rehabilitation admission, change in Berg scores, change in FIM Motor Composite Scores, and length of stay were statistically significant between groups (p< .05). The only measure that did not demonstrate a statistical significance was the change in PASS score. These results demonstrate that there is a possibility to predict a patient’s discharge destination by analyzing these variables. This data may allow therapists and families to start discharge planning at an earlier point in the patient’s rehabilitation stay.

Poster presented at the Combined Sections Meeting (CSM) of APTA’s Specialty Sections, Chicago, IL.
Outcomes Measures in Acute Stroke Rehabilitation: A Comparison of the Berg Balance Scale and the PASS Test


The primary purpose of this study is to evaluate the feasibility of testing all patients admitted into acute rehabilitation on the stroke unit with an objective balance/postural control measure. The two balance measures chosen for testing are the Berg Balance Scale and PASS Test. The secondary purposes are to look at the objective changes in test scores to determine response to change, to determine the flooring and ceiling effects of the tests with the inpatient stroke rehabilitation population, and to determine the reliability and validity as compared to the Functional Independence Measure (FIM) motor composite score. It is hypothesized the Berg Balance Scale and the PASS test will demonstrate a positive response to change during acute rehabilitation. All patients admitted to the stroke unit of a rehabilitation hospital from February 2010 to March 2011 were assessed for appropriateness. There were 221 patients who met criteria, with 21 patients being emergently discharged, thus leaving 200 patients that were included in the final data analyses. Functional Independence Measure (FIM) scores were completed at admission and discharge as part of the rehabilitation program. The mean change score for the Berg Balance Scale from admission to discharge was 19 points (+/- 12) with a statistically significant change (p< .005). The mean change score for the PASS test was 11 points (+/- 6) with a statistically significant change (p< .005). The mean change in the FIM motor composite score was 17 points (+/- 19). The mean number of days between initial and discharge testing was 17 days. Pearson correlation found significant correlation between all three measures at the .01 level. These two measures show a significant change during the inpatient rehabilitation stay. Patients who were at a lower functional level demonstrated more gains in the PASS test. Patients who were at a higher functional level demonstrated more gains in the Berg scale. Results show that both the PASS test and the Berg Balance Scale demonstrated a significant change in each patient and are feasible to use with the acute stroke rehabilitation population. This study also shows that the PASS test and Berg Balance Scale correlate significantly with FIM motor composite score.

Poster presented at the Combined Sections Meeting (CSM) of APTA’s Specialty Sections, Chicago, IL.

Critical Illness Myopathy Secondary to Heat Stroke Complicated by Multi-Organ Failure


This case report describes a 35-year-old male marathon runner who collapsed during a triathlon secondary due to a heat stroke. Patient was found to have a temperature of 42 degrees and was aggressively cooled before being admitted to the ICU. Patient eventually developed multi-organ failure that included Disseminated Intravascular Coagulation (DIC), acute liver failure, acute renal failure, and altered mental status. Ultimately, patient required hemodialysis until patient’s acute renal failure resolved. Patient also developed significant rhabdomyolysis with paresis in all four extremities and was subsequently diagnosed with critical illness myopathy. Once stabilized, patient was admitted for acute inpatient neuromuscular rehabilitation where patient received appropriate physical and occupational therapy. Impressive gains were seen at discharge in terms of gait, strength, and balance. Critical illness myopathy (CIM) is a common finding in approximately 25% of critically ill patients. The most important risk factor for developing neuromuscular weakness is exposure to intravenous glucocorticoids. Patients will typically develop rhabdomyolysis with elevated serum creatine kinase levels and will demonstrate flaccid muscle weakness or quadriplegia. Nerve conduction studies and electromyography can help confirm the diagnosis. Although CIM is usually reversible, appropriate rehabilitation can aid in significantly improving a patient’s functional capacity, physical fitness, and quality of life. It is important to assess for muscular and sensory function when evaluating ICU patients, especially those who are receiving long term intravenous glucocorticoid treatment. Flaccid paralysis in addition to respiratory failure may result as complications of CIM. Although it is important to treat the underlying cause, it is equally important that patients who have developed CIM receive the proper therapy in an acute rehabilitation setting that will restore their functional capabilities.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV.
**Tinnitus and Sensorineural Hearing Loss Following Acute Bilateral Hemorrhagic Pontine Infarcts: A Case Report**


This case describes a 37-year-old male who presented in an unresponsive state to an acute care hospital in hypertensive emergency with a blood pressure of 204/121. Computed tomography scan of the head revealed acute bilateral hemorrhagic pontine infarcts greater along the right side of midline with associated surrounding edema and effacement of basilar cisterns and fourth ventricle. Patient was evaluated by neurosurgery and treated conservatively with mannitol and antihypertensive medications. Cerebral angiogram was negative. Three weeks after admission, patient was transferred to acute inpatient rehabilitation. In addition to left facial weakness and left-sided hemiplegia, patient complained of bilateral sensorineural hearing loss with tinnitus in the left ear. Otoscopic examination revealed moderate amounts of cerumen in both ears with some dried blood in the right ear. Eight weeks after patient’s stroke, the patient continued to have tinnitus in the left ear with bilateral sensorineural hearing loss. Otolaryngology removed impacted cerumen from both ears, which only slightly improved patient’s sensorineural hearing loss. Audiology was consulted for outpatient evaluation following discharge from acute inpatient rehabilitation. Hemorrhagic strokes make up a minority of all cerebrovascular accidents, occurring in approximately 12 to 15 per every 100,000 individuals. Pontine hemorrhages are rare, comprising 5 to 12% of all hemorrhagic strokes, with bilateral pontine involvement even less frequent. Based upon the literature review, this case is the third reported one involving tinnitus and sensorineural hearing loss following acute pontine infarcts. Although rare, pontine infarcts can affect the cochlear nuclei and corresponding vestibulocochlear nerves, leading to tinnitus and sensorineural hearing loss.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV.

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**Weight Supported Pre-Gait Balance Rehabilitation in Acute Stroke Patients**


Rehabilitation intervention designed to enhance balance control in individuals with a stroke unable to stand unassisted are quite limited. As such, the goal was develop and assesses a technique of early pre-gait balance training for individuals with acute stroke. Twenty-eight individuals with acute stroke who exhibited difficulties in standing unassisted were randomly divided into the experimental (mean age 63.6±16.8 years old, 11 males and 3 females) and control (mean age 62.3±10.3 years of age, 12 males and 2 females) groups: individuals included in the experimental group received one week treatment based on retraining balance utilizing visual biofeedback (Balance Master®) combined with the Biodex® body weight support system while the individuals in the control group received conventional treatment. Both groups of subjects underwent identical tests (Functional Independence Measure (FIM) score for gait, Fugl-Meyer (FM) balance score, FM lower extremity score, and Balance Master® tests: Modified Clinical Test of Sensory Interaction in Balance (CTSIB), Limits of stability, and Rhythmic Weight Shifting) before the start of treatment and after its completion. Individuals in the experimental group showed larger gains compared to the control group. This was seen in the increased FM balance scores and FIM scores for gait. The conclusion is that early pre-gait balance training for individuals with acute stroke unable to stand unassisted is feasible. The outcome of the study provides a basis for future investigation of the WSPBT technique focusing on pre-gait balance training in individuals with neurological disorders and the elderly.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV.
Lumbosacral Plexopathy after Substance-Induced Stroke in Young Adult


This case describes a 20-year-old white male with history of poly-substance abuse, bipolar disorder, hypertension, and respiratory arrest due to drug-induced MI with residual neurocognitive deficits was found unresponsive after heroin overdose. Primary survey showed hypovolemic shock, acute respiratory failure due to hypoxia/aspiration pneumonia and acute renal failure. Toxicology screen positive for heroin and marijuana. CT Head imaging was negative. However, brain MRI showed restricted diffusion to left basal ganglia and frontal lobe with damage to the bilateral cerebellum and thalamus cortical white matter. He suffered from both toxic-metabolic and hypoxic encephalopathy. Patient developed bilateral lower extremity weakness, much greater right than left, associated with numbness in the bilateral medial legs. Gait and balance were ataxic, but he denied back pain, leg pain or recurrent falls. Physical exam showed right lower extremity brisk reflexes and proximal weakness of quadriceps and adductors. EMG/NCS was performed to delineate peripheral neuropathy from central process. Results suggest a nerve lesion at the level of the lumbosacral plexus affecting roots L2 through L4. Lumbosacral plexopathy is most commonly caused by direct compression/mass effect due to hemorrhage or tumor, peripheral polyneuropathy due to chronic diabetes, or birth trauma in women. Iatrogenic etiologies include complications of pelvic or hip surgery, radiation therapy exposure, coagulopathy causing spinal artery ischemic syndrome or epidural-induced hemorrhagic complications. Blunt trauma is a rare etiology due to the relative protected location of the plexus within the axial skeleton. In the case of this patient, potential causes of lumbosacral plexopathy may include polysubstance-induced coagulopathy or arterial ischemia.

Poster presented at Association of Academic Physiatrists, Las Vegas, NV.

Pediatric Constraint-Induced Movement Therapy: Group Treatment Case Series


This presents two pediatric case studies involving the use of constraint-induced movement therapy. Both cases demonstrate improvements in functional hand use and upper extremity active range of motion. The implications for the use of this type treatment will be addressed. Constraint-induced movement therapy in a group treatment setting was shown to be effective in improving hand and arm use for two children in three categories. While these results are encouraging, a larger sample size, more intensive treatment, and more sensitive measures may be needed to effectively demonstrate improvement in hand and arm use in children with hemiparesis. Constraint-induced movement therapy continues to show promise as a strategy for treating children with hemiparesis.

Poster presented at Illinois Occupational Therapy Association, Lisle, IL.

Foreign Accent Syndrome in Stroke Patient: Case Study


This case study describes a 59-year-old female who presented with Foreign Accent Syndrome (FAS) following a Cerebrovascular accident (CVA). MRI of the head revealed an acute ischemic infarct in the left corona radiate and left basal ganglia. EEG showed partial seizure activity. Patient was admitted to a free standing rehabilitation hospital five days post stroke. An initial speech pathology evaluation was conducted six days post stroke. Total length of stay for patient in acute rehabilitation was 28 days. Following the discharge from acute rehabilitation, patient was transferred to subacute rehabilitation and was then discharged to home after four months poststroke. Identification of FAS and implementation of treatment techniques to address phonological processes, consonant and vowel production as well as rhythm and prosody changes can result in improved overall intelligibility and recovery of premorbid speech patterns. This improvement in speech production contributed to quality of life for this patient.

Poster presented at American Speech Language Hearing Association, Atlanta, GA.
The Effects of Two Different Ankle-Foot Orthoses on the Gait of Acute Stroke Patients with Hemiplegia


The objective of this study is to compare the effects of an off-the-shelf carbon-fiber ankle-foot orthosis (CF-AFO) to a custom polymer AFO (P-AFO) on the gait of acute stroke patients with hemiplegia. This is a prospective, case-controlled study, taking place in a Prosthetic/Orthotics Clinic in the acute rehabilitation hospital. Acute stroke patients with hemiplegia (n=27) were tested with no AFO, and then with an off-the-shelf CF-AFO and a P-AFO in random order at the time of initial orthotic fitting. Gait parameters such as velocity, cadence, stride length and step length were collected using an electronic walkway under the no-AFO, P-AFO, and CF-AFO conditions. All the data were subjected to Shapiro-Wilk test for normality. One way repeated measures ANOVA were performed with AFO factors (3 levels: No AFO, CF-AFO, P-AFO) separately for velocity, cadence and stride length. Split-Plot ANOVA was performed with AFO factors (3 levels: No AFO, CF-AFO, P-AFO) and side (involved and uninvolved) to analyze the differences in step length. Pairwise comparisons with Bonferroni corrections were used for further analyses of significant effects. For all tests, statistical significance was set at p < 0.05. Subjects walked significantly faster, with a higher cadence, longer stride and longer step length (involved and uninvolved side) when using either the P-AFO or CF-AFO as compared to no AFO. Although the P-AFO did show more effect on all parameters than the CF-AFO, the difference between the two AFOs was never statistically significant. Acute stroke patients with hemiplegia will benefit from either a carbon or polymer AFO as opposed to no AFO. No significant difference found between the two AFOs.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Atlanta, GA.

Foreign Accent Syndrome in Stroke Patient: Case Study


This case describes a 53-year-old female who presented to ER with acute right hemianesthesia with foot drop. MRI revealed acute ischemic infarct in the left corona radiata and left basal ganglia. Patient was also noted to have a speech production most consistent with a German accent. Despite previous studies in French and Spanish, patient only spoke English and had never left the country. During the initial speech evaluation, some unusual findings in her speech pattern included vowel distortions, inconsistent consonant conversions and significant deviations in pitch pattern. These are changes more often associated with foreign accent syndrome rather than dysarthria. Patient was treated in speech therapy with the presumed diagnosis of foreign accent syndrome. Patient received 90 minutes of speech therapy daily with use of biofeedback to increase awareness of speech output. Therapy addressed consonant patterns, prosody, intonation, and vowel modifications. Follow-up occurred four months after the stroke and patient was noted to have regained most of a native accent along with scoring a 100% intelligibility score as opposed to 80% on admission. This case illustrates one of less than 100 known cases of foreign accent syndrome in the world, and provides an overview of this rare syndrome and how to more effectively diagnose and treat it. Recognition of this speech disorder is imperative to receiving appropriate speech therapy leading to a successful recovery. Early recognition of foreign accent syndrome and implementation of known techniques in the treatment of this disorder can result in a quicker recovery of their speech pattern along with a significant improvement in the quality of their life.

Poster presented at American Academy of Physical Medicine & Rehabilitation Annual Assembly, Atlanta, GA.
**Heterotopic Ossificans Complicating Right Hemiparesis in a Woman with Ischemic Left MCA Stroke**


The diagnosis is heterotopic ossificans (HO) invading the right hip joint two months post ischemic left medial cerebral artery (MCA) stroke. This case describes a 68-year-old female with history of atrial fibrillation, congestive heart failure, hypertension, and hyperlipidemia, presenting to ER with right hemiparesis and severe aphasia due to left ischemic MCA stroke involving the insula and Wernicke’s area. Patient’s hospitalization was complicated by a retroperitoneal hematoma requiring exploratory laparotomy with hemicolectomy. Patient had flexion contracture of her right hip with pain on acute rehabilitation admission exam. Initial x-ray showed nonspecific calcifications lateral to the right hip. Follow-up computerized tomography (CT) highlighted a 4 cm mass with calcifications within the mass extending around the right iliac wing into the fossa. Therapy with non-steroidal anti-inflammatory drugs (NSAIDs) and Didronel was started. Heterotopic ossificans is the spontaneous formation of bone in soft tissues and most often affects the hip joint. The exact pathophysiology remains unknown however it is thought to originate from osteoprogenitor stem cells within the affected tissues. This condition is commonly seen in spinal cord injury (up to half), traumatic brain injury, and post hip arthroplasty (up to 90% in older populations with osteoarthritis). Heterotopic ossification in poststroke hemiplegia is rare; reported incidence is 0.5-1.2%. The rarity of this complication can cause it to be overlooked and have a significant impact on the early functional recovery of the neurologically impaired patient. Treatment is often NSAID therapy, namely, indomethacin daily, along with bisphosphonate therapy. The early diagnosis confirmation is crucial as treatment choices are not without risks. Heterotopic ossificans can spontaneously form in stroke patients after limb disuse. This condition should be on the differential of stroke patients with joint pain and restriction.

Poster presented at Association of Academic Physiatrists, New Orleans, LA.

**CADASIL Syndrome and Stroke Rehabilitation Implications**


This case describes a 63-year-old male, diagnosed with cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL), who was admitted to acute rehabilitation after suffering a right parietal cortical infarct with left hemiparesis. On admission, patient’s functional status was dependent for upper and lower body dressing, with maximal assistance needed for all transfers. Patient’s rehabilitation stay was complicated by an episode of grand mal seizure, chest pain, and emotional lability with suicidal ideation; all of which required transfer to an acute care hospital for proper management as well as early discharge. Due to all the interruptions in his stay patient’s functional gains were limited to moderate assistance for upper and lower body dressing with moderate assistance for sit to stand transfers. Patient demonstrated many symptoms a CADASIL patient may develop. Patients may develop epileptic seizures after they have experienced at least one stroke. CADASIL patients may have an eight-fold higher risk of myocardial infarction than in the general population. Among other cardiovascular risk factors, diabetes and the presence of CADASIL syndrome show a significant association with myocardial infarction. The vascular effects seen in CADASIL patients produce diminished autoregulation in vascular tone impairing the coronary vasculature to keep up with needed perfusion. CADASIL patients commonly show lesions along the corticobulbar tracts that can cause emotional lability. Severe depression is also a common symptom. CADASIL patients may require rehabilitative assistance during some point in their disease so it is critical physiatrists are aware of all the possible sequela that may develop as a result of this microvascular disease. Management of medical issues in a timely manner will optimize such patients’ rehabilitative outcomes.

Poster presented at Association of Academic Physiatrists, New Orleans, LA.
The Effects of Two Different Ankle-Foot Orthoses on the Gait of Acute Stroke Patients with Hemiplegia


The objective of this study is to compare the effects of an off-the-shelf carbon-fiber ankle-foot orthosis (CF-AFO) to a custom polymer AFO (P-AFO) on the gait of acute stroke patients with hemiplegia. This is a prospective, case-controlled study at a Prosthetic/Orthotics Clinic in an acute rehabilitation hospital. Acute stroke patients with hemiplegia (n=29) were tested with no AFO, with a CF-AFO, and a P-AFO in random order at the time of initial orthotic fitting. Gait parameters such as velocity, cadence, stride length and step length were collected using an electronic walkway under the no AFO, P-AFO, and CF-AFO conditions. Subjects also completed an L-test in each condition, and provided responses to a survey about their perceptions of each device. All the data were subjected to Shapiro-Wilk test for normality. One way repeated measures ANOVA were performed with AFO factors (3 levels: No AFO, CF-AFO, P-AFO) separately for velocity, cadence and stride length. Split-Plot ANOVA was performed with AFO factors (3 levels: No AFO, CF-AFO, P-AFO) and side (involved and uninvolved) to analyze the differences in step length. Direct comparison of L-test completion times was done along with correlation with practical feedback from study subjects. L test Pairwise comparisons with Bonferroni corrections were used for further analyses of significant effects. For all tests, statistical significance was set at p < 0.05. Subjects walked significantly faster, with a higher cadence, longer stride, and step lengths (involved and uninvolved side) and shorter L test completion times when using either the P-AFO or CF-AFO as compared to no AFO. Although the P-AFO did show more effect on all parameters than the CF-AFO, the difference between the two AFOs was never statistically significant. Acute stroke patients with hemiplegia will benefit from either a carbon or polymer AFO as opposed to no AFO. There is, however, no significant difference between the two AFOs in this population.

Cerebral Venous Sinus Thrombosis (CVST) in a Forty-Nine Year Old Female on Oral Contraceptives


This case describes a 49-year-old female noted by husband to be in confusional state. The patient presented to acute inpatient rehab with impaired coordination of left extremities, truncal ataxia, neurocognitive deficits, and aphasia. The patient was having difficulty conversing, naming objects, and was disoriented. The patient complained of occipital headaches and right retroauricular pain for the past two months. The patient was evaluated on two occasions, underwent physical therapy for headaches and eventually was diagnosed with mastoiditis, and treated with Augmentin. After little relief and the acute confusional episode, the patient was admitted to an acute care hospital and was found to have an upper jugular venous, right transverse, and sigmoid sinus thrombosis with right tempoparietal infarction. The patient was initiated on heparin as well as coumadin and subsequently developed hemorrhagic transformation with an increase in intraparenchymal hematoma and early uncal herniation necessitating a right hemicraniectomy. The acute care hospital course lasted 15 days followed by a 12-day acute inpatient rehab stay. The patient had significant global aphasia, left hemiparesis and truncal ataxia. There is no consensus on specific treatment, but rehabilitation is necessary to return these patients back to their premorbid functional ability. Cerebral venous sinus thrombosis (CVST) is a rare cause of stroke and presents with a broad spectrum of neurological findings often making diagnosis on initial presentation very challenging. Numerous therapy methodologies were instituted and the patient made significant functional gains with a discharge disposition to home at a modified independent level.

Poster presented at Association of Academic Physiatrists, Nashville, TN.
**The Relationship between Pedometer Feedback and Gait Speed Improvements in Acute Stroke Rehabilitation**

Keller, S., Burns, M., Zielke, D., Cohee, E., Hanson, L., Ruroede, K.

During acute stroke rehabilitation, one of the most common patient goals is improvement in the ability to ambulate. Patients in acute rehabilitation participate in three hours of therapy daily but it is unclear the total amount of ambulation that occurs daily. The current gait training literature suggests approximately 1,000 to 2,000 steps per day are required to improve stepping and step quality. While current evidence supports that on average patients are only ambulating 357 steps per session with a physical therapist. Therefore, it is important to determine a low cost method of monitoring the number of steps patients take during the rehabilitation day. The use of pedometers will provide therapists with a recording method as well as a feedback tool to improve the number of steps they take daily. In addition, it is important to determine if increasing the number of steps taken during the rehabilitation day correlates with improvements in gait speed or impacts discharge location. The purpose of this study is to gain a better understanding of the number of steps patients take daily and if pedometer feedback enhances the intensity of ambulation. This prospective, observational study involves the collection of standard clinical information with a retrospective analysis of the number of steps patients at this functional level take each day during acute rehabilitation in patients following a cerebrovascular accident (CVA) admitted to Marianjoy Stroke Unit. The primary goals of this study are to measure the total number of steps taken per day by a patient in acute stroke rehabilitation and to determine if a relationship exists between the number of steps taken daily and improvements in gait speed, gait Functional Independence Measure (FIM) change, and discharge destination. The secondary objective of the study is to evaluate the feasibility of utilizing low cost equipment (i.e. pedometers) to provide feedback and encouragement to the patient undergoing inpatient stroke rehabilitation in order to increase their intensity of activity both during and outside of therapy sessions.

**Role of Ankle Foot Orthoses in the Outcome of the Functional Reach Test**

Rao, N., Aruin, A., Krieger, R., Chaudhuri, G.

Ankle-foot orthoses (AFOs) are commonly prescribed to compensate for the effects of impairments on walking (such as inadequate dorsiflexion in swing). However, since AFOs force adaptive behavior on the individual as they restrict movements of the ankle joints, balance could be affected. While a number of studies of the efficacy of AFOs in improving ambulation in individuals with stroke were conducted, very little research has been performed to evaluate the effect of AFOs on balance ability of patients who use AFOs. In particular, no studies were conducted on the effect of AFOs in performance of the Functional Reach Test, one of the clinical tests of functional balance in individuals suffering from stroke. The purpose of this study is to investigate the role of AFOs in performance of the Functional Reach Test. This study is an observational study looking at performance on the Functional Reach Test with 50 individuals who have had a stroke, use an AFO and can stand at least 30 seconds unsupported. The Functional Reach Test will be performed by each individual two times, once with the AFO and once without the AFO. Investigators hypothesize the following for the results of this study: (1) individuals with stroke who use AFOs will be able to participate in the Functional Reach Test, (2) the Functional Reach Test outcome in individuals with stroke will be smaller while using AFOs compared to conditions without AFOs and (3) AFO-related differences in the Functional Reach Test performance will be observed during performance of the two parts (reaching forward and reaching laterally) of the test.
Common Diagnoses & Treatment Recommendations for Visual Deficits in Stroke Patients in Inpatient Rehab

Hunt, S.

Visual deficits are some of the often overlooked symptoms of stroke survivors. Yet, these deficits can negatively impact cognition, mobility, and activities of daily living (ADLs). This research is designed to highlight the relationship between occupational therapists’ functional observations of visual deficits in inpatient rehabilitation and optometrists’ diagnoses and recommendations for treatment. The purpose of this study is to identify what, if any, relationship exists between the common visual symptoms identified by Marianjoy OT visual screening and the subsequent visual diagnoses and treatment recommendations made by an optometrist. This study is a retrospective, descriptive, chart review study. Specific aims of this study are to: (1) describe the overall patient population that demonstrate visual impairments and who participate in inpatient rehab including age, diagnosis, and gender, (2) investigate the relationship between the common visual symptoms observed by the OT in functional performance and the visual diagnoses and treatment recommendations made by the optometrist, (3) describe specific visual impairments found within the inpatient rehabilitation setting/population with an emphasis on the stroke and brain injury populations, and (4) describe treatment recommendations for the inpatient rehabilitation population based on evaluation results and functional symptoms. The results of this descriptive study will potentially allow visual deficits to be identified earlier and more accurately in treatment. Additionally, it will suggest appropriate treatment methods to maximize efficiency and effectiveness of visual intervention in an inpatient rehabilitation setting and allow for improved patient performance. Delay in diagnosis and treatment of visual deficits may delay patient progress and lead to a less effective rehab outcome.

Comparison of Berg Balance Scale and PASS Test in Acute Stroke Rehabilitation

Keller, S., Burns, M., Ruroede, K.

Following stroke, most patients demonstrate some degree of impairment in postural control. A large portion of therapy services address postural control and balance. Patients need to demonstrate postural control in both static and dynamic activities to regain independence during acute rehabilitation. It is important for therapists to find an objective measure to evaluate that postural control and the gains made during rehabilitation. The primary purpose of this study is to evaluate the feasibility of testing all patients admitted to acute rehabilitation on the stroke unit with an objective balance/postural control measure. The two balance measures chosen for testing are the Berg Balance Scale and Postural Assessment of Stroke Scale (PASS). The secondary purposes are to look at the objective changes in test scores to determine response to change, determine the floor and ceiling effects of the tests with the inpatient stroke rehabilitation population, and to determine the reliability and validity as compared to the Functional Independence Measure (FIM). The goal of the research is to enhance the therapist’s ability to objectively measure improvements in balance and postural control for the acute stroke rehabilitation patient. Participants included 200 stroke patients admitted to the inpatient rehabilitation stroke unit within 30 days of their stroke, who were independently ambulating prior to the stroke and had no previous history of stroke. All patients received the Berg Balance Scale, the PASS test, and FIM ratings at admission and discharge. All data was collected for this study and the investigators are completing final data analysis. Specific aims of the study are to: (1) determine the feasibility of performing the Berg Balance Scale and the PASS test on patients following stroke in inpatient rehabilitation in order to determine if (a) all patients admitted following stroke are able to complete the Berg Balance Scale and PASS test at both admission and discharge and (b) either the Berg Balance Scale or the PASS test are more responsive to change in score in the inpatient stroke rehabilitation population.
Measuring Post Rehabilitation Community Reintegration Using GPS Technology

Evans, C., Zielke, D., Ruroede, K., Keller, S., Hanke, T.

The outcome of rehabilitation is of interest to patients, healthcare providers and third party payers. Rehabilitation outcome measurements include measures of mobility or functional impairment as well as indices of satisfaction with community participation or reintegration. Factors not included in functional measures such as cognitive functioning may influence community reintegration thereby limiting the use of these measures to predict return to community activities. The use of questionnaires as indices of satisfaction with community reintegration has been explored but no direct and objective measurement of community reintegration has been made. The purpose of this study is to measure community reintegration in patients discharged from a rehabilitation center as well as to determine the feasibility, reliability and validity of GPS as a tool for measuring post-rehabilitation community reintegration. This study is currently in Phase II which involves comparing GPS-generated data on community movement of 12 patients enrolled in the study from the Marianjoy Rehabilitation Hospital. Patient participants were asked to wear a GPS unit after discharge from the hospital inpatient unit for 3 months. Other data collected included more traditional outcome measures in patients who had undergone rehabilitation secondary to a major illness, injury, or surgery and who were discharged to their home. The GPS generated data on community movement will be compared with data from more traditional, self-report outcome measures.

Weight Supported Pre-Gait Balance Rehabilitation in Acute Stroke Patients

Rao, N., Aruin, A., Krieger, K., Zielke, D., Sharma, A., Keller, S., Burns, M.

Stroke is the leading cause of serious, long-term disability among American adults. Approximately 700,000 people sustain a stroke each year in the United States, and nearly 400,000 survive with some level of neurological impairment and disability (Kelly-Hayes et al. 1998). The estimated annual burden from stroke-related disability is over $50 billion (AHA. 2003). Statistical data indicates that between 73% and 88% of first time strokes result in hemiparesis; a weakness and impaired control of muscles on one or both sides of the body that often results in an inability to stand and walk (Foulkes et al. 1988; Duncan et al. 1994). It is anticipated that stroke incidence and prevalence will grow and increasing numbers of people are expected to exhibit stroke-induced impairments including balance and gait difficulties. Despite the millions of dollars being spent annually for stroke rehabilitation (Dobkin,1995), little evidence exists that supports the efficacy of current and standard physical rehabilitation interventions for stroke (Parker et al. 1986; de Pedro-Cuesta et al. 1992). Developing alternative care plans that reduce the impact of hemiparesis in stroke survivors remains a top priority. This study evaluates a new treatment approach that includes early pre-gait balance training for stroke survivors. The investigators believe that a significant number of stroke patients who cannot stand unassisted and who participate in this balance rehabilitation will be able to participate in early gait retraining and will learn to walk again. One hundred patients with acute stroke will be randomly assigned to one of two groups. The experimental group will receive treatment involving the NeuroCom Partial Body Weight Support (PBSW) visual feedback/force platform (VF/FP) and conventional physical therapy. Control group participants will participate in conventional physical therapy only. Each subject will participate in two tests, one prior to beginning physical therapy and one after completion of physical therapy. Tests will be done using the Balance Master® computerized force platform system utilizing the harness and lift system allowing the subjects to be positioned on the force platforms with partial weight taken away by the lift. Investigators hypothesize participants involved in PBWS VF/FP balance training will be able to start gait rehabilitation sooner compared to the group of participants engaged in conventional pre-gait therapy.
Compelled Body Weight Shift Therapy in Individuals with Stroke-Related Hemiparesis

Aruin, A., Rao, N., Chaudhuri, G.

Profoundly impaired mobility is a major consequence of stroke. As a result, a large number of more than 700,000 people in America sustaining a stroke each year have limitations in motor ability and compromised quality of life. It is a fact that individuals with hemiparesis frequently bear the majority of their body weight through their uninvolved lower extremity. Asymmetry of stance and weight bearing has been recognized as a predictor of the ability to ambulate. Therefore, achieving symmetry of stance and gait is considered an important goal of rehabilitation. However, therapeutic interventions designed to enhance motor function and promote independence following stroke are quite limited. These investigators have developed a new technique that preliminary studies suggest can substantially improve gait pattern, reduce the incapacitating motor deficit of stroke patients, and increase their independence. The technique, termed Compelled Body Weight Shift (CBWS) therapy, involves lift of the nonaffected lower extremity through the use of shoe insert over a period of several weeks. During this time, more symmetrical weight bearing is facilitated while patients participate in physical therapy as well as regular daily activities. The research builds on findings from a pilot study that demonstrated significant gains in individuals with chronic unilateral stroke following CBWS therapy. The experimental design randomly assigns patients who are more than one year post stroke to two groups. The experimental group receives CBWS therapy combined with conventional physical therapy for a period of six weeks; the control group only receives conventional physical therapy. Immediate and longer-term (four months out) results from both groups will be compared. The specific aims are: (1) to test the efficacy of CBWS therapy compared to conventional therapy alone in improving gait and symmetry of weight bearing; and (2) to evaluate whether the improvement is sustained post CBWS therapy. If successful, the outcomes from the study could be used to refocus conventional rehabilitation strategies aimed at helping chronic stroke patients to achieve maximal independence in mobility activities of daily living.
The Marianjoy Swallowing and Voice Center is nationally known for research and clinical treatment using advanced equipment and technology.
How to Conduct Dysphagia Research in the Work Setting: Practical Tips for the Clinician


Practical and applied research is not beyond the reach of clinical speech-language pathologists (SLP). To the contrary, the world of dysphagia research needs hands-on practitioners contributing to the body of knowledge. The purpose of this editorial article is to provide the SLP clinician with an overview of some practical tips to consider when developing a research project and integrating research into everyday clinical practice. It is hoped these tips will make the thought of conducting research in the workplace a reality that is engaging, meaningful, and within reach for the busy clinician. The article addressed; defining the research question, understanding research designs and statistics, research rules and regulations, conducting and disseminating research findings, research timeframes, and some miscellaneous words of wisdom for consideration.
Swallowing Evaluation and Treatment for Individuals with Disordered Consciousness


Severe acquired brain injury (ABI) is a catastrophic event rendering a person unconscious; some survivors will remain unconscious for prolonged periods of time, posing many challenges for medical rehabilitation professionals providing services. For speech-language-pathologists (SLPs), the challenge is to develop meaningful treatment plans and goals. The purpose of this editorial article was to provide an overview of ABI, SLPs role in evaluating the cognitive status of this population in relationship to swallowing, meaningful measurements, and development of safe swallowing treatment plans. For persons surviving an ABI, there is a challenge in defining the status of consciousness as no universal definition is accepted. However, clinical consensus guidelines define states of disordered consciousness as; coma, vegetative state, and minimally conscious state—and suggest clinical criteria for emergence from minimal consciousness. The criteria are less controversial, but the lack of a gold standard for diagnosing these states remains problematic. The article addressed consciousness and disordered consciousness defining criteria, diagnosis limitations, confounders to interpretation of neurological marker test results, and behavioral assessments. The article also discusses the critical role of the SLP in diagnostic assessments of cognitive functioning and the state of evidence based practices through ABI research.

Dysphagia Outcomes for Patients with Feeding Tubes Undergoing Inpatient Rehabilitation (Abstract)


The purpose of this study is to investigate the outcomes of dysphagic patients with a feeding tube admitted to a freestanding rehabilitation hospital. This 18-month retrospective review was completed to determine outcome variables for age, Rehabilitation Impairment Category (RIC) diagnosis, and gender with final outcomes of interest including diet progression, length of stay (LOS), incidence of returning to per mouth (PO) feeds and three meals per day, feeding tube status at time of discharge, reason for continued tube use, and patient discharge destination. Forty males and 24 females (n=64) with mean age 65 years (±20 years) with RIC diagnoses of brain injury (37.5%), stroke (53.1%), and other neurological impairment (9.4%) who required the use of a feeding tube secondary to dysphagia were eligible. Diet level at time of admission consisted of 71.9% NPO, 6.3% therapeutic feeds, and 21.9% at three meals per day with a noted significant change (x² = 49.008, p<0.000) for diet level change at time of discharge consisting of 10.9% NPO, 21.9% therapeutic feeds, and 67.2% at three meals per day. Of the 64 patient admitted with a feeding tube, 59 (92.2%) were discharged with some PO feedings, with 48 of those (75%) discharged eating three meals per day. At time of discharge, 58 patients (90.6%) still required use of a feeding tube. Average length of stay was 23.5 days (±8.9 days) with a majority of patient discharging to subacute destinations (60.1%) or home (28.1%), with others to acute care (6.3%) or assisted living (1.6%), and expiration for 3.1%. A significant majority of patients with brain injury or stroke patient with a feeding tube secondary to dysphagia returned to three meals per day during their inpatient rehabilitation stay.

The Modified Barium Swallow and the Functional Endoscopic Evaluation of Swallowing


It is important for physicians and clinicians to have a basic understanding of the protocols for both the modified barium swallow (MBS) and fiberoptic endoscopic evaluation of swallowing (FEES), including indications for use, advantages, and disadvantages. The MBS and FEES are valuable swallowing diagnostic tools and show good agreement with diagnostic findings as related to tracheal aspiration, laryngeal penetration, pharyngeal residue, diet level, and compensatory swallow safety strategies. The determination of which procedure is needed to evaluate swallowing function is driven by specific patient characteristics and the field of view necessary to evaluate the suspected dysphagia. Both MBS and FEES should be considered the gold standard for evaluating the swallow.
**Swallowing Frequency: Impact of Accumulated Oropharyngeal Secretion Levels**


A prospective, descriptive study of 27 individuals with a known or suspected dysphagia was conducted to investigate the relationship between swallowing frequency, accumulated oropharyngeal secretions levels, and gustatory stimulation. Assessment of the secretion level was quantified with the use of a previously published five-point rating scale using endoscopy. Overall, a moderate relationship was found between the baseline swallowing frequency at rest and the amount of accumulated oropharyngeal secretion level (Pearson correlation .470, p=0.01). The study sample was divided into two groups based upon their secretion level. Group 1, n=19, mean age 59.7 years (SD=21.5 years), included subjects where their accumulated oropharyngeal secretion level was rated as 1 (normal) or 2 (mild). Group 2, n=8, mean age 69.78 (SD=8.35), included subjects where their accumulated oropharyngeal secretion level was rated as a 4 (severe) or 5 (profound). For Group 1, swallowing frequency increased from a baseline of 1.05 swallows to 5.26 swallows following gustatory stimulation and for Group 2 increased from a baseline of 0.125 swallows to 3.5 swallows. These results support that individuals who had a lower baseline swallowing frequency at rest demonstrated higher accumulated oropharyngeal secretion level as viewed by nasal endoscopy and regardless of secretion level that gustatory stimulation was effective as a modality to increase swallowing frequency. Increasing swallowing frequency may be a functional dysphagia treatment objective in order to improve the efficiency of the swallow and offer better management of accumulated oropharyngeal secretions.

**Clinical Utility of Blue Ice Chips with Patients who are NPO during the FEES: Pilot Data**


The use of blue ice chips in the assessment of dysphagia is a common practice with the belief that ice chips are less likely to be aspirated than an actual liquid or solid bolus. The presentation of ice chips as the preliminary trial during fiberoptic endoscopic evaluation of swallowing (FEES) for patients who are deemed at higher risk for aspiration has been recommended to indicate their potential to safely tolerate more challenging boluses. It has also been presumed to be safe for NPO patients or people who have difficulty with managing their secretions due to risk of aspiration. Additionally, it has been suggested as a therapeutic technique with the tolerance of ice chips being used to identify a patient’s candidacy for dysphagia rehabilitation program by increasing swallowing frequency and assisting with clearance of thick secretions. It is not clear, however, if the use of ice chips at the beginning of the FEES will indicate aspiration risk and its functional translation for diet recommendations. The purpose of this study is: (1) To investigate the clinical utility of using blue ice chips at the beginning of the FEES with patients who are NPO in order to assess its value as a potential indicator for aspiration risk during the subsequent FEES; and to investigate the relationship between aspiration of the blue ice chips at the beginning of the FEES and recommended diet level based upon the results of the FEES.

Poster presented at Dysphagia Research Society, San Antonio, TX; and, (2011, November) at American Speech Language Hearing Association, San Diego, CA.
How Do They Compare? Line Spread Test for Mealtime Liquids

This study reviews the findings of a quality improvement project investigating line spread test results for bariums and typically served mealtime liquids considered to be controversial consistencies (from the results of a survey). Findings revealed the majority of liquids assessed match the consistency to which they were perceived to correspond. The purpose of this study is to investigate the effect of temperature on barium consistencies and controversial mealtime liquids under conditions including 30-second oral hold and chilled service temperature. Comparing findings of a line spread test for mealtime liquids may change the current perception of certain consistencies’ thickness, as currently labeled by a rehabilitation hospital.

Poster presented at American Speech Language Hearing Association, San Diego, CA.

Water Access for Individuals with Dysphagia who Aspirate: Research Challenges

This study reviews a randomized controlled trial investigating the implementation of a water access protocol with individuals following brain injury who aspirate thin liquids. Findings reveal an increase in patient satisfaction and no adverse effects for participants. The protocol is summarized and the challenges of implementing this protocol are discussed.

Poster presented at Illinois Speech-Language-Hearing Association, Rosemont, IL.

Dysphagia Outcomes for Patients with Feeding Tubes Undergoing Inpatient Rehabilitation

The purpose of this study is to investigate the outcomes associated with patients who were admitted to a freestanding rehabilitation hospital with a feeding tube (FT) placed secondary to neurogenic dysphagia following stroke or brain injury. This study revealed:

1. A majority (67.2%) of brain injury or stroke patients admitted with a FT secondary to dysphagia were discharged eating three meals per day during their inpatient rehabilitation stay.
2. A majority (90.6%) of patients admitted to an inpatient rehabilitation hospital with a FT were discharged with the FT still in place.
3. A majority (60.1%) of patients admitted to an inpatient rehabilitation hospital with a FT were discharged to subacute facilities.
4. A significant improvement was observed from admission to discharge across all diet levels.
5. A majority (62.5%) of the participants continued to require FT supplementation, providing rationale as to why the FTs remain in place despite tolerance of per mouth (PO) feeds.

Poster presented at Dysphagia Research Society, Toronto, Ontario, Canada.
Water Access for Individuals with Dysphagia who Aspirate: Research Challenges


This study reviews a randomized controlled trial investigating the implementation of a water access protocol with individuals following brain injury who aspirate thin liquids. Findings reveal an increase in patient satisfaction and no adverse effects for participants. The protocol is summarized and the challenges of implementing this protocol are discussed. Dysphagia management is a multi-faceted issue, including medical care, rehabilitation, and ethical concerns. Aspiration pneumonia, dehydration, and decreased quality of life are common concerns for dysphagia practitioners who work to increase patient safety and comfort. Traditional dysphagia management for patients who aspirate includes thickening of liquids and use of compensatory strategies. Ideally, these recommendations are accepted and adhered to without issue, as a temporary solution for swallowing disorders, until a patient recovers. However, in the brain injury population, patients often have decreased awareness of their swallowing deficits, poor recall of prescribed strategies, and refusal of mechanically altered diets. Recent reports of use of free water protocols at several institutions have shown promise in reducing these clinical limitations (Langdon, 2009). However, there continues to be lacking evidentiary support, beyond anecdotal information, to show outcomes that promote patient safety and an increase in quality of life. This makes implementation of free water protocols into clinical practice risky. This lack of evidence-based support is difficult to obtain due to several reasons that will be discussed.

Poster presented at International Brain Injury Association, Edinburgh, Scotland; and, (2012, November) at American Speech Language Hearing Association, Atlanta, GA.

Assessment Patterns of Dysphagia Treatment: A Quality Improvement Initiative

Pietrantoni, M., Brady, S., (2012, November).

This quality improvement project highlights the importance for speech-language pathology (SLP) programs to periodically evaluate their practice patterns as clinical development is an ongoing process. It is critical for large SLP groups to ensure treatment is based upon most recent evidence. Treatment choices, in addition to frequency, intensity, and specificity of exercises being utilized for dysphagia treatment are called into question within the SLP program. SLPs must be aware of the most effective evidence-based treatment options for functional swallow improvement. Further well designed treatment efficacy research is needed to establish best practice patterns regarding treatment of patients with dysphagia.

Poster presented at American Speech Language Hearing Association, Atlanta, GA.

Effects of Lingual Exercise on Dysphagia in Acute Rehabilitation Patients

Ng, K., Brady, S., Manypenny, C., VeSota, J., Quill, A. (2012, November).

This study investigated whether stroke patients with dysphagia in an acute rehabilitation facility would demonstrate improved lingual strength and swallowing function following Iowa Oral Performance Instrument (IOPI) exercise protocol. Results revealed both improved lingual strength and functional swallowing outcomes, and demonstrate support for use of the IOPI in the acute rehabilitation setting.

Poster presented at American Speech Language Hearing Association, Atlanta, GA.
**Swallowing Function for Pediatric Patients with a Tracheotomy Tube**

Birutis, R., Keen, M., Brady, S., Wesling, M. (2013, October).

Currently there is limited information available in the literature regarding swallow function with pediatric patients who also have a tracheostomy tube. The purpose of this study was to further explore the swallowing characteristics of pediatric patients (ages 0 to 18 years) with a tracheostomy tube at a freestanding rehabilitation hospital. This retrospective, descriptive study involved both pediatric inpatients and outpatients at a freestanding rehabilitation hospital who underwent an instrumental swallow exam of either a videofluoroscopic swallow study (VFSS) or a fiberoptic endoscopic exam of the swallow (FEES) within the last five years (2007-2012). The main outcome measures included the presence or absence of tracheal aspiration, laryngeal penetration, and pharyngeal residue during either the VFSS or FEES. Data analysis included non-parametric descriptive statistics on subjects’ demographics, independent t-tests on the continuous variables, and chi square analysis on the categorical variables. A total of 38 pediatric instrumental swallow exams (36 VFSS and 2 FEES) were completed across 22 patients (13 males, 9 females). Age range at the time of the swallow exam was from five months to 17 years with a mean age of 6.4 years (SD=6.1 years). Overall, tracheal aspiration was present during 39% (15/38) of the exams, laryngeal penetration was present in 50% (19/38), and pharyngeal residue was present with 45% (17/38) of the exams (see poster for additional details). Aspiration was more common in older children with a tracheostomy versus younger children. The children with a tracheostomy tube who demonstrate aspiration were also highly likely not to present with a cough response. No differences in aspiration rate were observed by duration of the tracheostomy tube or the underlying medical condition which necessitated the tracheostomy tube. These findings are important for dysphagia treatment planning and diet recommendations, as well as in caregiver dysphagia education and training. They underline the value of dysphagia screenings and instrumental assessments at different times in a growing child’s life.

Poster presented at American Academy of Cerebral Palsy & Developmental Medicine, Milwaukee, WI; and, (2013, November) at American Speech Language Hearing Association, Chicago, IL.

**The Effectiveness of the “Chin Tuck” Position during the Videofluoroscopic Swallow Study**

Chaudhuri, G., Brady, S., Ng, K., Quill, A., Stewart, J. (2013, November).

The chin tuck maneuver is a common postural technique used during the videofluoroscopic swallow study (VFSS) in an attempt to eliminate aspiration and/or to reduce or eliminate pharyngeal residue in the valleculae. This session reviewed the results of a study that explored the clinical usefulness of the chin tuck during the VFSS. Results revealed over a 12 month period, the chin tuck was used in approximately 30% (208/697) of the VFSS exams. With the majority of exams (54%), improvements were observed as documented by the VFSS with swallow function with use of the chin tuck posture during the VFSS. Using the chin tuck to eliminate aspiration was the most effective (55.4%) indication for use. It remains unclear why the chin tuck posture was effective with some patients but not effective with other patients with similar swallowing characteristics and patient characteristics. Additionally, since a small percentage of patients demonstrated a negative impact when using a chin tuck position, the recommendation to use the chin tuck posture should only be made after an instrumental assessment has been conducted to evaluate the impact this postural strategy may have upon the swallowing physiology for each specific patient.

Poster presented at American Speech Language Hearing Association (ASHA), Chicago, IL.
Sensitivity of the Blue Dye Food Test for Rehabilitation Patients with a Tracheostomy

This study explored the sensitivity and specificity values for aspiration of the blue dye food test (BDFT) in tracheostomized patients undergoing inpatient rehabilitation. Simultaneous BDFT and fiberoptic endoscopic evaluation of swallowing (FEES) procedures were conducted. Results revealed the sensitivity of the BDFT for positive identification of aspiration was only 40% when compared with FEES during simultaneous procedures. Additionally, the presence of higher levels of accumulated oropharyngeal secretion levels was found to be associated with an increased likelihood of a positive BDFT. Results further indicate that the BDFT is best used only as a screening tool for aspiration. The performance of the FEES is warranted following a negative BDFT for patients with a tracheostomy undergoing inpatient rehabilitation.
Poster presented at American Speech Language Hearing Association, Chicago, IL.

Radiation Exposure Time & Dosage during the Swallowing Exams for Rehabilitation Patients

It is important to periodically evaluate current practice patterns in order to determine if changes are needed to reduce radiation exposure times and levels during the videofluoroscopic swallow study (VFSS). This session will report on the results of a study evaluating radiation time and dosage during the VFSS in the rehabilitation setting. Swallowing disorders are commonly observed in patients undergoing rehabilitation. In order to effectively diagnose and treat these patients, the VFSS may be required. One concern with performing a VFSS is the exposure to radiation. The purpose of this quality improvement study was to evaluate radiation time and dosage during the VFSS in the rehabilitation setting and evaluate if the amount of radiation time and exposure differ by the following variables: adult versus pediatric exams; inpatient versus outpatient exams; initial diet prior to VFSS; post VFSS diet recommendations; and completion of an esophageal scan. The specific objectives of this study were: (1) overall, what is the average amount of radiation time and exposure levels rehabilitation patients receive while undergoing a VFSS in the rehabilitation setting?, and (2) does the amount of radiation time and exposure differ by the following variables: adult versus pediatric exams; inpatient versus outpatient exams; initial diet prior to VFSS; recommended diet following VFSS; and completion of an esophageal scan?
Poster presented at Association of Academic Physiatrists, Nashville, TN.

SWALLOWING ACTIVE RESEARCH PROJECTS

Pill Swallowing Ability in Rehabilitation Patients

Brady, S., Rao, N., Aliaga, N., Padalik, S., Srigiriraju, P.
Dysphagia is commonly seen in patients undergoing rehabilitation and is defined as difficulty with swallowing solids and/or liquids from the mouth to the stomach and involves the oral, pharyngeal, and esophageal phases of the swallow. The dysphagia may be the result of several different underlying medical conditions and/or diseases as the swallowing disorder may result from either a specific anatomic (i.e., tumor or genetic malformation) or physiological/functional issue (i.e., sensation loss, coordination, or muscle paralysis). Many rehabilitation patients following an acute illness or injury may experience new difficulty with swallowing and as such may experience difficulty when trying to swallow pills or tablets. The overall purpose of this study is to promote patient safety by identifying factors associated with safe pill swallowing for rehabilitation patients with dysphagia. This prospective, non-randomized, observational study includes patients that are referred to the Marianjoy Swallowing Center for a videofluoroscopic swallow study (VFSS). The current VFSS protocol at Marianjoy includes assessment of the ability to swallow a 12 mm barium tablet in order to evaluate swallow function for medications. The primary outcome of interest is if the inclusion of the barium pill during the VFSS changes the route or method pills are administered to the patient from pre-VFSS recommendations to post-VFSS recommendations. Secondary outcome measures includes the incidence of pill swallowing dysphagia observed with rehabilitation patients; the specific characteristics of the pill swallowing dysfunction observed; and the specific strategies that facilitate improve pill swallowing.
Lingual Strengthening Exercises for Dysphagia Following Stroke: Randomized Clinical Trial

Ng, K., Brady, S., Manypenny, C., Pietrantoni, M., VeSota, J.

Up to 78% of stroke patients have dysphagia, leading to a consistent prevalence of dysphagia and its complications in most medical facilities. Patients with dysphagia may suffer aspiration pneumonia, dehydration, malnutrition, and decreased quality of life. This results in decreased rehabilitative potential, longer hospital stays, and likely long-term nursing care needs. Adequate tongue strength is needed for a safe swallow. Pressures generated by the tongue propel the bolus through the oral cavity and pharynx, and through the pharynx into the esophagus. Tongue strength is correlated with the clearance of the bolus through the oral cavity, and is also associated with aspiration status. Researchers have begun to advocate for tongue strengthening exercises that follow the principles of strength training used in the fields of physical rehabilitation and exercise science. The Iowa Oral Performance Instrument (IOPI) measures the pressure generated when an air-filled bulb is compressed between the tongue and the hard palate. It was found that after an eight-week program, not only did lingual isometric pressure increase, patients also improved swallowing pressures. The purpose of this current study is to evaluate the effectiveness of the IOPI for tongue strengthening exercises, as compared to traditional dysphagia exercises, for patients with pharyngeal dysphagia after a stroke. In this current blinded, randomized clinical trial, patients are randomly assigned to one of two groups—IOPI or traditional dysphagia exercises. They participate in baseline measures, including an instrumental swallowing study, tongue strength measures using IOPI, objective swallowing measures, and self-assessment of their swallowing difficulty. Patients then participate in at least six treatment sessions. Investigators hypothesize that: (1) patients with dysphagia following a stroke will demonstrate greater improvement with lingual strength following exercise with the IOPI as compared to traditional treatment as measured by the IOPI, and (2) patients with dysphagia following a stroke will demonstrate greater improvement with swallowing function with the IOPI as compared to traditional treatment.
REFERENCES
2014 - 2000

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2013


2012


2011


2010


2009


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2005


2004


2003


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2001


2000


These references represent publications developed in part by the physicians of the Marianjoy Medical Group, Marianjoy clinicians, and affiliated researchers. Contact the Marianjoy Medical Library for additional information: www.MarianjoyLibrary.com.
Marianjoy Rehabilitation Hospital and Clinics/Marianjoy Medical Group’s Institutional Review Board (IRB) is responsible for the oversight of all research projects that involve human subjects, as those terms are defined by the Department of Health and Human Services (DHHS) regulations and Food and Drug Administration (FDA) regulations, whether research is funded or not funded. As a legal entity involved in the conduct of human subjects’ research, Marianjoy holds a Federal-wide assurance (FWA00007701) approved by the DHHS Office for Human Research Protection that is binding to compliance with the Code of Federal Regulations for IRB approved research.

The Health and Human Services Common Rule definition for research as written by the Code of Federal Regulations [45 CFR 46.102(d)] is defined as any systematic investigation, including research development, and testing and evaluation, designed to develop or contribute to generalizable knowledge.

The Food and Drug Administration definition for research as written in the Code of Federal Regulations 21 CFR 50.3(c) defines research as an experiment that involves a test article and one or more human subjects. The IRB has as its primary responsibility the protection of research subjects and assuring the privacy and confidentiality of subjects’ research data. To accomplish this goal, the IRB reviews research applications to consider those issues in design and conduct that could potentially affect the safety, rights, and welfare of human subjects.

Marianjoy’s IRB convenes monthly to review and act on submitted research applications under various categories of research risks to start, periodically review, and close out studies. Figure 1 provides the volume of IRB reviewed projects between the years 2008 - 2014. Marianjoy hosts an annual research symposium to showcase the bevy of research focused presentations at professional conferences. Figure 2 provides the number of conferences and posters or presentations Marianjoy professionals delivered between the years 2008 – 2014.
Figure 1
Marianjoy IRB projects approved 2008-2014

Figure 2
Marianjoy Professional Conference Participation 2008 - 2014

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SPECIAL THANKS TO THOSE GRANTORS WHO HAVE SUPPORTED US

At Marianjoy we believe research and education are core components of our larger healthcare mission. Everyday physicians and clinical associates work to advance both the art and science of rehabilitation by asking and answering questions designed to improve patient care and outcomes.

This important activity is made possible by the generous support of private foundations, government agencies, and individual donors who appreciate the value of the clinical research conducted at Marianjoy. On behalf of the Board of Directors and Administration, we would especially like to recognize the following organizations for their ongoing support;

- Community Foundation of the Fox River Valley
- Dr. Scholl Foundation
- Tellabs Foundation
- Walter J. and Edith E. Best Foundation
- Westlake Health Foundation

As a result of the generous support provided by these organizations and numerous other donors, Marianjoy continues to serve as a leader in the advancement of physical medicine and rehabilitation research. The findings of our clinical researchers are shared at local, regional, national, and international gatherings of physician and clinicians. This ensures that countless numbers of patients are touched by the Marianjoy spirit through these advances in the practice of rehabilitation medicine.

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In 2014, Marianjoy ranked in the 98th percentile for associate satisfaction as measured by Press Ganey.
The Marianjoy Assistive Rehabilitation Technology Institute offers solutions to everyday problems of daily living encountered by disabled individuals. The Institute consists of seven distinct centers that apply advancements in technology to benefit individuals with disabilities through maximizing functional independence, and expanding educational, vocational, recreational, and communicative opportunities.

- Assistive Communication and Daily Living Center
- Balance and Vestibular Center
- Driver Rehabilitation Center
- Gait Analysis and Mobility Center
- Prosthetic and Orthotic Center
- Swallowing and Voice Center
- Wheelchair and Positioning Center
Through the use of new technology, such as the KineAssist MX, Marianjoy therapists are creating improved comprehensive rehabilitation programs.
MARIANJOY ILLINOIS LOCATIONS:

- Marianjoy Rehabilitation Hospital
  Inpatient, Sub-acute, & Outpatient Services
  26W171 Roosevelt Road
  Wheaton, IL 60187
  630-909-8000

- Marianjoy at Oakbrook Terrace
  Physical Therapy, Outpatient Services & Integrative Pain Treatment Center
  17W682 Butterfield Road
  Oakbrook Terrace, IL 60181
  630-909-6500

- Marianjoy at Park Place of Elmhurst
  Sub-acute Services
  1050 South Euclid Avenue
  Elmhurst, IL 60126
  630-936-4129

- Marianjoy at Rush Oak Park Hospital
  Inpatient, Sub-acute, & Outpatient Services
  610 South Maple, Suite 3420
  Oak Park, IL 60304
  630-909-6480

- Marianjoy at Providence Health Care and Rehabilitation of Downers Grove
  Sub-acute & Outpatient Services
  3450 Saratoga Avenue
  Downers Grove, IL 60515
  630-969-9360

- Marianjoy at Providence Health Center
  Sub-acute & Outpatient Services
  13259 S. Central Avenue
  Palos Heights, IL 60463
  708-239-6060

- Marianjoy at Homer Glen
  Sub-acute Services
  Victorian Village
  12525 W. Renaissance Circle
  Homer Glen, Illinois 60491
  708-590-5050