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**A 01**

**BARRIERS TO DRIVING IN THE CEREBRAL PALSY POPULATION: AN ASSESSMENT OF PHYSICAL AND COGNITIVE DISABILITIES**

Berbrayer, David

**Hypothesis:**

To investigate the physical and cognitive disabilities that prevents the cerebral palsy (CP) population being capable of driving motor vehicles.

**Methods:**

This was a retrospective cohort study in which cerebral palsy were assessed by a government approved driving agency provided by a team of occupational therapists and specialized driving instructors.

A data collection form was used to record participant information. Inclusion criteria were patients with CP who had an assessment done between Jan 2005 and Jan 2006. Participants were grouped according to disability. Cognitive disability involved the OT using the Trail-Making Test (TMT) part B to assess attention and the Motor-Free Visual Perception Test (MVPT) to assess visual Information processing.

**Results:**

**Demographic Data**

|             |    |
|-------------|----|
| Male        | 12 |
| Female      | 7  |
| Age (17-19) | 11 |
| (20-25)     | 6  |
| (>25)       | 2  |
| N           | 19 |

| Outcome Data | Number | Rate % |
|--------------|--------|--------|
| Pass         | 5      | 26.3   |
| Fail         | 6      | 31.6   |
| Unknown      | 8      | 42.1   |

**Physical Disabilities**

|            | N  | N    | % | pass | fail | unknown |
|------------|----|------|---|------|------|---------|
| Diplegia   | 13 | 68.4 | 4 | 3    | 6    |         |
| Hemiplegia | 4  | 21.1 | 1 | 2    | 1    |         |



**Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings**

|              |   |     |   |   |   |
|--------------|---|-----|---|---|---|
| Triplegia    | 1 | 5.3 | 0 | 1 | 0 |
| Quadriplegia | 1 | 5.3 | 0 | 0 | 1 |

Mean scores of Trail Making Test B and Motor-Free Visual Perception Test and associated outcomes in persons with CP assessed at the SEHC driver assessment

|             | TMT-B (SD) | MVPT (SD) |
|-------------|------------|-----------|
| Pass (n=5)  | 71 (22)    | 37 (0.5)  |
| Fail (n=6)  | 150 (47)   | 29 (4)    |
| t statistic | 0.017      | 0.009     |

**Conclusion:**

Overall success rate of the driving program amongst persons with CP was 26.3%.

The high drop-out rate was 42.1%.

There was a statistical difference between passing and non-passing groups for both tests and the  $p < 0.05$  ( $p = 0.017$  for TMT-b and  $p = 0.009$  for MVPT).



**Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings**

**A 02**

**SOCIAL SUPPORT AND ITS EFFECT ON THE HEALTH RELATED QUALITY OF LIFE IN SPINA BIFIDA**

Berbrayer, David

**Hypothesis:**

Do young adult spina bifida experience improved quality of life by having social support in their childhood and adolescent years?

**Methods:**

This was a prospective quantitative study using the Health Related Quality of Life Questionnaire (HRQOL-Kirpalani 2000) consisting of 47 questions in 10 different domains. A “specific” HRQOL of 14/47 questions related to social, emotional and independence were analyzed as questions targeted by charitable agencies.

The inclusion criteria consisted of spina bifida (16-28 yrs) able to read and understand questionnaire on own.

**Results:**

10 participants:

5 female, 5 male

Ages 16-28 years

Completed HRQOL and “specific” HRQOL

|            | High Social Support | Medium Social Support | Low Social Support |
|------------|---------------------|-----------------------|--------------------|
| “Specific” | 55.5                | 50.5                  | 43.67              |
| HRQOL      | 198.5               | 194.25                | 161.87             |

Effect of Years at Camp on HRQOL and “Specific” HRQOL

|          |              |             |
|----------|--------------|-------------|
| Specific | 52.5 (N>5)   | 46.8 (N<5)  |
| Total    | 196.75 (N>5) | 174.4 (N<5) |

Effect of Disability Level on HRQOL

|          |                          |                        |
|----------|--------------------------|------------------------|
| Specific | 48 (High disability)     | 50.4 (low disability)  |
| Total    | 163.75 (High disability) | 200.8 (low disability) |

**Conclusion:**



**Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings**

There is no association between charitable support and total HRQOL.

There is a greater numerical improvement between total HRQOL than specific HRQOL suggesting confidences and independence penetrates other domains.

Greater functional ability leads to decrease in total HRQOL.

Greater functional ability is not associated with improved specific HRQOL.

Transition to adult is important.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 03

**THE INFLUENCE OF A CONCURRENT COGNITIVE TASK ON FOOT PEDAL REACTION TIME FOLLOWING TRAUMATIC, UNILATERAL TRANSTIBIAL AMPUTATION**

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West Park Healthcare Centre, Toronto, Ontario<sup>1</sup>, University of Toronto, Toronto, Ontario<sup>2</sup>

**Objective:** To evaluate the influence of a concurrent cognitive task on lower limb reaction (RT), movement and total response time among patients with traumatic, unilateral, transtibial amputation.

**Methods:** This study utilized a controlled trial design without randomization. Subjects included 5 patients with right (RTA) and 5 patients with left transtibial amputation (LTA) and 13 controls. Foot pedal RT and MT were measured for the left and right legs of all subjects. One block of 20 trials was completed under a simple RT condition; the second block of 20 trials was completed under a dual-task RT condition (counting backward from 100, 99, or 98 by 3s).

**Results:** Under the simple RT condition, controls demonstrated significantly faster RT than LTAs (237 + 28 vs. 257 + 41 ms;  $t(134.3) = 4.53$ ,  $p < .0001$ ), but not RTAs (252 + 56 ms;  $t(117.5) = 2.64$ , N.S.). Under the dual-task condition, controls demonstrated significantly faster RT than both LTAs (316 + 57 vs. 410 + 115 ms;  $t(118.9) = 7.80$ ,  $p < .0001$ ) and RTAs (446 + 117 ms;  $t(115.4) = 10.53$ ,  $p < .0001$ ). Neither RTAs (433 + 112 vs. 458 + 123 ms;  $t(47) = 1.09$ ,  $p = .28$ ) nor LTAs (405 + 108 vs. 416 + 122 ms;  $t(49) = .81$ ,  $p = .42$ ) demonstrated any significant differences between the intact and amputated legs under the dual-task condition.

**Conclusions:** Control and amputee subjects demonstrated comparable RT under the simple RT condition. However, under the dual-task condition, amputees demonstrated substantially greater slowing of RT in both the amputated and intact limbs. The results of this study appear to demonstrate a functional manifestation of central reorganization following transtibial amputation.

**Funding:** This Project was funded by a research grant provided by the Workplace Safety and Insurance Board (Ontario).



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**A 04**

**COMPENSATORY STEPPING IN RESPONSE TO POSTURAL PERTURBATION IN A GROUP OF WORKING-AGE, UNILATERAL, TRANSTIBIAL AMPUTEES**

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**Objective:** This study sought to compare compensatory stepping reactions in a group of working-aged subjects with unilateral, below-knee amputation and a group of age- and gender-matched controls.

**Methods:** Five unilateral, below-knee amputees (35-55 years) and four control subjects underwent 92 antero-posterior (a-p) and medio-lateral (m-l) perturbation trials delivered in random order. In 20 of these trials, subjects stood with symmetrical weight distribution at the start of the trial. Another 20 trials involved asymmetrical weight distribution (65% on intact limb), as is commonly observed among unilateral, lower-limb amputees. Temporal features of the stepping reactions were characterized using force plates.

**Results:** Subjects with transtibial amputation demonstrated a greater likelihood of instability following the initial compensatory stepping response, as evidenced by a larger proportion of trials resulting in multi-step reactions (mean rank = 28.62 vs. 15.98,  $p < 0.001$  for 50/50 trials; 27.40 vs. 17.50;  $p = 0.001$  for 65/35 trials); showed no preference for either the amputated or intact limb when executing the initial stepping response (mean rank = 6.0 vs. 6.0;  $p = .76$  for 50/50 trials; 9.0 vs. 9.0;  $p = .23$  for 65/35 trials); and delayed initiation of stepping response relative to controls (292 + 113 vs. 234 + 49 msec,  $p = .038$  for 50/50 trials; 341 + 40 vs. 257 + 47 msec;  $p < .001$  for 65/35 trials).

**Conclusion:** The results of this study suggest greater instability among amputees as evidenced by more multi-step reactions.

**Funding:** This Project was funded by a research grant provided by the Workplace Safety and Insurance Board (Ontario).



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**A 05**

**CANNABINOIDS FOR THE MANAGEMENT OF SPINAL CORD INJURY AND MULTIPLE SCLEROSIS RELATED SPASTICITY: A VALID TREATMENT OPTION?**

Short, Christine MD

**Key Words:** spasticity, cannabinoids, spinal cord injury, multiple sclerosis

**Objective:** To explore the effect of cannabinoids on spasticity by analyzing four clinical cases where these agents were used when conventional treatments had failed.

**Method:** A case series. Four patients (one with multiple sclerosis and three with spinal cord injury) in our neurorehabilitation clinic were treated with nabilone and/or sativex® when conventional treatments were not fully controlling their spasticity symptoms. We used a visual analog scale (VAS) in our clinic to track the subjective improvements in spasticity and clinical tools including the Ashworth's scale, adductor severity scales and gait assessments to measure spasticity at baseline and follow-up of our patients. We also follow qualitative descriptions of function.

**Results:** In four consecutive cases treated with prescribed cannabinoids we observed significant improvements in spasticity. The average reduction in spasticity severity based on VAS was 52.5% (range 30% - 90%). This correlated with improvements in function and clinical improvements on physical exam as well. In two cases the individuals had been using medical marijuana prior to starting oral or sublingual cannabinoids. In one case use of medical marijuana was decreased and in a second case it was completely discontinued as a result of instituting prescribed cannabinoids.

**Conclusion:** Use of prescribed cannabinoids may lead to a clinically meaningful reduction in spasticity in persons with spinal cord injury and multiple sclerosis. These agents need to be further evaluated as therapeutic agents for the treatment of spasticity in upper motor neuron syndromes.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**A 06**

**PARALYTIC POLIOMYELITIS IN UPPER EXTREMITY: AN EMG REPORT**

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**Objective:** To describe a unique presentation of paralytic poliomyelitis in upper extremity.

**Method:** A case report.

**Presentation:** A 53 years old female patient was admitted for left tibia-fibula fracture with a right flail shoulder with uniform shoulder girdle muscle atrophy and glenohumeral subluxation. Patient gave history of poliomyelitis and right shoulder dislocation before her first birthday.

**Result:** On examination, she had uniform right shoulder atrophy with 3+ inferior shoulder subluxation, restricted active and passive supination of right forearm to 30°, muscle strength was 0/5 in right shoulder, 3-4/5 in elbow. Muscle strength in rest of the right upper extremity and left upper extremity was 5/5. Sensations were intact in both upper extremities. EMG/NCS showed normal NCS of right median, ulnar and radial nerves. Needle EMG study of right UE was normal in Pronator Teres, Extensor Indices and right cervical paraspinal muscles. Triceps showed incomplete interference pattern while Pectoralis Major, a clavicular portion showed large amplitude MUAP. There was no insertional activity in right Deltoid, Supraspinatus, Teres Major, Rhomboid and Biceps muscles.

**Discussion:** Peripheral neuropathy or brachial plexopathy is ruled out by normal sensation on physical examination with normal NCS. Normal EMG of paraspinal muscles, absence of pain with variable motor involvement rules out root injury. Common features of the spinal paralytic poliomyelitis include asymmetric involvement in proximal muscle groups. Typical EMG findings of polio include large amplitude MUAP secondary to neuropathic process. But one may see absence of insertional activity in involved muscles without typical findings after long standing severe muscle atrophy.

**Conclusion:** Typical EMG findings of polio may be absent in chronic severe paralytic polio.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 07

**GUILLAIN-BARRE SYNDROME SECONDARY TO WEST NILE VIRUS: A CASE REPORT**

Ginsberg, A DO. Arif, M. Joshi, T. Sanjeev Agarwal MD

**Objective:** A case report intended to broaden the clinical differential of the causes of Guillain-Barre syndrome.

**Setting:** Inpatient rehabilitation unit.

**Patient:** 78 year old Male.

**Case Description:** Patient with past medical history of Renal calculus, BPH and HTN was initially brought to the Emergency room because of generalized ascending weakness predominantly in the lower extremities with muscle strength on admission approximately 4/5 bilaterally in lower legs and 4+/5 in his upper legs. Patient had dull reflexes, normal tone and an inability to walk. Upper extremities were within normal limits. Patient also had some non specific mental status changes as per his family. The patient was diagnosed with Guillain-Barre syndrome secondary to West Nile virus. The patient underwent five sessions of plasmaphoresis and spent two weeks in the inpatient rehabilitation unit. The patient was discharged home after making full functional recovery.

**Discussion:** The causes and frequency of acute paralysis with West Nile Virus infection are incompletely understood and have been attributed to Guillain- Barre syndrome, a poliomyelitis like syndrome, and a generalized myeloradiculitis. WNV-associated weakness may occur without other findings suggestive of WNV disease. WNV-associated neurologic signs include tremors, myoclonus and parkinsonism. A neutrophilic pleocytosis may be present soon after onset of WNV disease. Patients may require prolonged hospitalization and inpatient rehabilitation with considerable loss in productivity and significant health costs.

**Conclusion:** In patients with new onset paralytic symptoms attributed to GBS or anterior myelitis, the West Nile Virus should be considered in the differential.

**Key Words:** Guillain-Barre, Rehabilitation, West Nile virus



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 08

**THE EFFECTIVENESS OF BOTULINUM NEUROTOXIN A IN IMPROVING  
PLANTARFLEXOR MUSCLE SPASTICITY AND GAIT IN CHRONIC STROKE**

Stephen Bagg, Alison C. Novak, Brenda Brouwer

**Objective:** This study examined the effects of Botulinum Toxin A (BTX-A) treatment on plantarflexor muscle spasticity and gait performance following stroke.

**Methods:** Seven chronic hemiparetic stroke subjects with plantarflexor hypertonicity underwent three dimensional, bilateral gait analysis at normal walking speed which provided joint displacement information for the ankle and knee throughout stance. Isokinetic (30°/s) dorsiflexor and plantarflexor strength was assessed on a dynamometer. As well, the Tardieu Scale and measures of ankle range of motion (ROM) provided a clinical impression of spasticity and ankle stiffness. Data were collected at baseline, two weeks post BTX-A injection (T1) of the ankle plantarflexors and 10 weeks later (T2).

**Results:** Significant improvements in peak dorsiflexion ( $p=0.032$ ), peak plantarflexion ( $p<0.05$ ) and the ankle angle at initial contact ( $p=0.028$ ) were found at T2 relative to baseline. No statistically significant kinematic changes were found at the knee. However, there was a trend towards reduced knee hyperextension throughout stance ( $p=0.084$ ) at T2. The knee was in a position of hyperextension for  $46.8 \pm 36.2\%$  of the stance phase at T2 compared to  $64.2 \pm 38.6\%$  of the stance phase at baseline. In terms of muscle performance post-injection, a trend towards increased peak dorsiflexor strength was seen ( $p=0.089$ ) whereas there was no change in plantarflexor force generation.

Clinically, 5 of the 7 subjects showed spasticity reduction at T1 as indicated by the Tardieu Scale. No changes in active or passive ROM were seen post-injection in the group as a whole.

**Conclusions:** Improvements in gait kinematics were seen following BTX-A treatment. There were, however no corresponding changes of significance in ankle muscle strength or ROM suggesting that these bedside clinical indicators may not be useful when assessing the benefits of BTX-A treatment. In combination, these findings indicate that subjects were generally better able to use their available range of motion while performing functional tasks such as gait.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**A 09**

**OUTCOMES OF INDIVIDUALS WITH BOTH TRANSFEMORAL AND TRANSTIBIAL AMPUTATION**

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**Objective:** To evaluate the functional outcome of individuals with both transfemoral and transtibial amputations secondary to peripheral vascular disease.

**Methods:** A retrospective chart review followed by phone interview. The primary outcome measures were the discharge 2 minute walk test, Frenchay Activities Index, and the Houghton Scale.

**Results:** There were 31 dysvascular individuals identified to have a combination of transfemoral/transtibial (TF/TT) amputation admitted to our institution from February 1998 to June 2007. The mortality rate was 68%. There were 8 surviving amputees. The average discharge 2 minute walk test score was 31.9m. Of these, the average FAI was 15.3. The average Houghton Scale score for the transtibial prosthesis was 2.1. The average Houghton Scale score for use of both a transtibial and transfemoral prosthesis was 1.5. Comparisons between groups based on initial amputation revealed a significant difference of being fit with a transfemoral prosthesis. Those whom initially had a TT amputation were less likely to be fit with a TF prosthesis ( $X^2=4.76, P<.05$ ). In addition, individuals with more than 4 co-morbidities tend not to be fit with a transfemoral prosthesis.

**Conclusion:** The overall functional outcome of individuals with a combination of TF/TT amputation is poor. Individuals who initially had a TT amputation or more than four co-morbidities are generally not fit with a TF prosthesis.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**A 10**

**TRAUMATIC SPINAL CORD INJURY IN NOVA SCOTIA: A PROVINCIAL  
EPIDEMIOLOGICAL STUDY**

Sepideh Pooyania MD; Christine Short, MD, FRCPC, Sean Christie MD, FRCSC

**Objective:** To describe the epidemiology of traumatic spinal cord injury (SCI) in Nova Scotia by comparing two separate five-years cohorts.

**Methods:** Data was gathered from the Nova Scotia Rehabilitation Centre SCI database. This contains records for all SCIs admitted to our tertiary trauma centre following their injuries. Subjects were identified according to the following criteria: admitted to hospital during 1981-1985 (Cohort I) and 1998-2002 (Cohort II), with diagnosis of traumatic SCI. We evaluated etiology, incidence, age, sex and level and completeness of injury.

**Results:** The first cohort (1981-1985) contained ninety individuals with spinal cord injury and the second cohort (1998-2002) contained fifty-nine. The age-standardized rates showed a significant decline in incidence over time, from 20.71 SCI per million in 1981-1985 compared to 12.64 per 1 million in 1998-2002. (P value = 0.004) There was a significant increase in the mean age in cohort II compared to cohort I; 44.92 years from 33.4 years respectively (P value 0.0006). There was no statistically significant difference in the male female ratios. The incidence of MVAs remained the number one cause of injury in both groups (53.3% and 47.5% respectively). There was a trend toward an increase incidence of falls in the later cohort II (28.8% compared to 18.8%), however the difference was not statistically significant.

**Conclusion:** This research has provided epidemiologic results that suggest the nature of SCI in Nova Scotia is changing with time. In more recent years there appears to have been a decrease in incidence of SCI in the province, an increase in the mean age of the SCI population and a possible increase of falls as a cause. This data supports the importance of maintaining databases in special populations for better understanding of epidemiologic changes and how they can be used to maximize prevention and improve patient care.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 11

VENOUS THROMBOEMBOLISM FOLLOWING SPINAL CORD INJURY

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**Objective:** To systematically review the published literature, for the prevention and treatment of deep venous thromboembolism (DVT) post spinal cord injury (SCI).

**Methods:** MEDLINE®/Pubmed, CINAHL®, EMBASE®, and PsycINFO® databases were searched for articles addressing the treatment of DVT post SCI. Studies included randomized controlled trials (RCTs), non-RCTS, cohort, case-control, case series, pre-post, post-interventional studies and case studies were included only when no other studies were available. Two assessment tools were used to evaluate methodological quality, PEDro scale and the Downs and Black tool. Levels of evidence using a modified Sackett scale were assigned to the interventions.

**Results:** Twenty-three studies met inclusion criteria. Thirteen studies examined various pharmacological interventions for treatment or prevention of DVTs in individuals with a SCI. The remaining studies investigated non-pharmacological treatments. There was strong (Level 1) evidence that low molecular weight heparin (LMWH) was more effective in reducing venous thromboembolic (VT) events with less bleeding complications when compared to the standard subcutaneous heparin prophylaxis. There was strong (Level 1) evidence that an adjusted dose of UFH (invariably higher) was more effective than 5000 units subcutaneously every 12 hours although bleeding complications were more problematic. There was, evidence, albeit limited (Level 4), for the following treatments in reducing DVTs post-SCI: 1) sequential pneumatic compression devices or gradient elastic stockings; 2) a comprehensive prophylactic treatment of external pneumatic compression, gradient pressure stockings and low dose heparin; 3) a comprehensive prophylactic regimen of pharmacological and physical measures, which was more effective in preventing venous thrombosis post-SCI when instituted earlier rather than later. There was also limited (Level 3) evidence that inferior vena cava filters reduces the risk of pulmonary embolism in high-risk SCI patients. Once a DVT had developed that was limited (Level 4) evidence that LMWH subcutaneously was a safe and cost effective alternative to intravenous heparin in SCI patients.



**Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings**

**Conclusions:** Although there appears to be intuitive benefit to combining treatment (i.e. pharmacological with mechanical treatment) the evidence suggests pharmacological measures are the more important of the two for prophylaxis.

This work was supported by the Ontario Neurotrauma Foundation and the Rick Hansen Man in Motion Research Fund.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 12

**ABSTRACT**

**A REVIEW OF TREATMENT OF PAIN FOLLOWING SPINAL CORD INJURY**

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**Objective:** To conduct a systematic review of published research evidence for the non-pharmacological treatment of pain post spinal cord injury (SCI).

**Methods:** The following four databases MEDLINE®/PUBMED, CINAHL®, EMBASE®, and PsycINFO® were searched for articles addressing the treatment of pain post-SCI. Studies included in the present review were randomized controlled trials (RCTs), non-RCTS, cohort, case-control, case series, pre-post and post interventional studies and if necessary case studies. The PEDro and Downs and Black assessment tools were used to evaluate all chosen articles for methodological quality. A level of evidence using a modified Sackett scale was assigned to each intervention.

**Results:** It has been found that over 50% of SCI patients develop chronic pain. Pharmacological treatments had more evidence of effectiveness than non-pharmacological interventions. For pharmacological interventions there was evidence of a therapeutic benefit of anticonvulsants for drugs such as gabapentin and pregabalin. Medications that showed some effect in reducing pain included local anaesthetics (lidocaine and intravenous ketamine) and intrathecal baclofen which reduced dysesthetic and musculoskeletal pain associated with spasticity post-SCI. In contrast, tricyclic antidepressants have not been shown to have a benefit and the studies looking at the effectiveness of opioids and cannabinoids have shown only limited benefits; however, clonidine and morphine given together have a synergistic pain-relieving effect. For non-pharmacological interventions there was evidence that a pain management program may improve some outcomes, that a shoulder exercise protocol reduces the intensity of shoulder pain post-SCI and that acupuncture may reduce pain in some patients. There was strong evidence supporting the use of transcranial electrical stimulation to reduce post-SCI pain. There was limited evidence supporting the benefit of visual imagery, stable magnetic field therapy, TENS, spinal cord stimulation and a number of destructive neurosurgical procedures.

**Conclusion:** Although more research is needed there is growing evidence upon which treatment of pain in the SCI patient can be formulated based on best research to date.

This work was supported by the Ontario Neurotrauma Foundation and the Rick Hansen Man in Motion Research Fund.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**A 13**

**BOTULINUM TOXIN TYPE A AND POST STROKE SPASTICITY AND FUNCTION: A STUDY OF THE DIFFERENT OUTCOME MEASURES USED IN RCTS**

Harpreet Sangha, Robert Teasell, Norine Foley, Katherine Salter, Sanjit Bhogal

**Introduction:** Spasticity and loss of function in an affected limb are common post stroke. Botulinum toxin type A has convincingly demonstrated efficacy in reducing such spasticity but there is a relative paucity of data regarding its functional benefit. We hypothesize that one of the reasons for the difficulty in demonstrating functional benefit from focal chemodenervation is the myriad of different outcome measures used in assessing functional outcomes.

**Objective:** To measure the types and patterns of use of the different outcome measures used in RCTs studying the efficacy of botulinum toxin type A (BTXA) in post stroke spasticity.

**Methods:** A systematic search of five electronic databases (MEDLINE, CINAHL, PubMed, Excerpta Medica Database, and the Cochrane Database) for all published RCTs involving BTXA in the treatment of post stroke spasticity was carried out. Data retrieval was carried out by three independent investigators. The different outcome measures used in each included study were abstracted and also categorized as either a measure of spasticity, function, quality of life, or pain. The frequency of use of each outcome measure in the medical literature was then tabulated.

**Results:** A total of 18 RCTs were included in the study. A total of 45 different types of outcome measures were used. Virtually all (17 of 18) studies used either the Ashworth or Modified Ashworth Scale to measure changes in spasticity. Twenty-two different measures of (body, motor, ambulatory, and general) function were utilized. The most commonly used functional outcome measure was the Fugl-Meyer Scale, appearing in 4 studies. Various quality of life and pain scales were also used.

**Conclusion:** Although there is great uniformity amongst researchers with regards to outcome measures used as they relate to spasticity, there is a vast number and variety of measures used to assess functional outcomes. Such heterogeneity makes it difficult to carry out more definitive summative statistical methods, such as meta-analysis, or to arrive at consensus statements. This in turn, may explain why the literature outlines the efficacy of BTXA with respect to reducing spasticity more definitively than it does changes in function. There is a need for standardization of appropriate functional outcome measures amongst researchers investigating the treatment of post stroke spasticity with BTXA.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**A 14**

**PAEDIATRIC INTERVENTIONS IN ACQUIRED BRAIN INJURY REHABILITATION**

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**Purpose:** To review the interventions available to remediate deficits related to a moderate-to-severe acquired brain injury or traumatic brain injury (ABI/TBI) within the paediatric population.

**Methods:** The literature was searched for studies examining the effectiveness of interventions used in the paediatric population following a moderate-to-severe ABI. The following databases were used in this search: PubMed, CINAHL®, PsycINFO®, EMBASE®, ERIC and Child Development and Adolescent Studies. To be included in this review, articles had to meet the following inclusion criteria: study population included 3 or more participants, 50% of the study population was diagnosed with a moderate or severe ABI/TBI and an intervention was examined. Articles were scored for quality using either the Downs and Black or PEDro evaluation tools.

**Results:** Following an extensive search of the various databases, a total of 42 studies were chosen and evaluated. Of those selected 42.8% were not scored for study quality due to the study design; thus the majority of the conclusions drawn were based on moderate or limited evidence. Areas investigated include: acute interventions, behavioural therapies, cognitive therapies, communication, family supported interventions, community-based interventions, social integration, and pharmacological interventions. The efficacy of several interventions was assessed, including: bracing, Botulinum toxin A, fluid resuscitation, dopaminergic medication, along with several others. Sequelae of a variety of treatments were also investigated. Examples include feeding, induced hypothermia, and constraint induced movement therapy (CMIT).

**Conclusions:** Future research should include a more in-depth examination of the various impairments and difficulties associated with an ABI/TBI in the paediatric population. For more information on the Evidence-Based Review of Acquired Brain Injury (ERABI) please visit the web site [http://www.abiebr.com/index\\_home.html](http://www.abiebr.com/index_home.html).



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**A 15**

**AN UPDATE OF THE SYSTEMATIC REVIEW OF THE REHABILITATION OF  
MODERATE TO SEVERE ACQUIRED BRAIN INJURIES**

Nora Cullen<sup>1</sup>, Mark Bayley<sup>1</sup>, Robert Teasell<sup>2,4,5</sup>, Shawn Marshall<sup>3</sup>, Maureen Hildritch<sup>4</sup>, Corbin Lippert<sup>4</sup>, Penny Welch-West<sup>4</sup>, Pat McCabe<sup>4</sup>, Margaret Weiser<sup>4</sup>, Connie Ferrie<sup>4</sup>, Laura Rees<sup>2</sup>, Anna McCormick<sup>2</sup>, Linh Tu<sup>5</sup>, and Jo-Anne Aubut<sup>5</sup> for the ERABI team.

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**Objective**

To conduct a systematic review of the rehabilitation literature of moderate to severe acquired brain injuries (ABI) from traumatic and non-traumatic causes.

**Methods**

A review of the literature from 1980 to 2007 was conducted. Inclusion criteria consisted of the following:  $\geq 50\%$  of subjects diagnosed with ABI,  $\geq 3$  patients in sample, and there was an intervention with measurable outcomes. Once an article was selected, the methodological quality was assessed using the Downs and Black scale, a well accepted tool for the assessment of randomized controlled trials (RCTs) and non-RCTs as well as the Physiotherapy Evidence Database (PEDro) scale for RCTs only. A level of evidence using a modified Sackett scale was assigned to each intervention.

**Results**

Of the 17,000 reference titles selected, 800 abstracts were chosen for a detailed review. 514 interventional studies met inclusion criteria, of which 145 were RCTs; however, only 65 (12.7%) were of significant quality to be considered strong Level 1 evidence. Most RCTs were found in the areas of acute, cognitive, and sensory motor interventions. Of the remaining studies, 142 (27.7%) (non-RCTs, cohort, or low quality RCTs with a PEDro score  $< 6$ ) were considered Level 2 evidence, and 27 (5.3%) case control studies provided Level 3 evidence. The majority ( $n=212$ , 41.3%) were pre/post and case series and were rated as Level 4 evidence. The remaining studies ( $n=67$ , 13.1%) included observational and case studies and were considered Level 5 evidence.

**Conclusion**

Despite the large body of literature addressing ABI rehabilitation interventions, only 28% were found to be RCTs and less than half of those selected were not considered strong evidence. Therefore strong levels of evidence were limited or not possible for most areas of ABI rehabilitation. Due to the high proportion of interventional studies found, there appears to be a need to improve upon the methodological quality of ABI rehabilitation research.

This work was supported by the Ontario Neurotrauma Foundation.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**A 16**

**AN INNOVATION IN HIP FRACTURE CARE IS HELPING OLDER PERSONS TO RETURN HOME: A NEW INTEGRATED MODEL OF CARE**

**Background:** A hip fracture is a significant threat to an older person's independence and ability to live in the community. Health care services are fragmented especially for patients with cognitive issues. Acute care stays are 9 to 15 days or longer and most patients are then streamed either for long rehabilitation stays or to long term care despite previous success living at home.

**Methods:** A new integrated model of care, focused on patients coming from home, is improving hip fracture care in acute settings and enabling new access to rehabilitation with transitions as early as day 5 regardless of cognitive status. For 35 Greater Toronto Area organizations, this system change features partnerships between hospitals and the community, evidenced-based clinical pathways, education for all health professionals about delirium and dementia, strategies for ongoing facilitation of best practice, and monthly feedback using performance indicators.

**Results:** 1. Over 70% of patients are now accessing rehabilitation earlier, have rehabilitation stays of 26 days, and for most patients (85%) the chance to return home. The new model of care improves the system for hip fracture patients helping them receive the right care in the right place at the right time and new opportunities to return home.

2. Based upon Ontario CIHI data prior to the project and conservatively comparing to the real time data results from August and September 2007, it is evident that through improvements in patient flow and with more patients returning home, there are considerable reductions in system bed pressures and significant cost savings that are being achieved. Conservative estimates show the LOS in both acute care and inpatient rehab has decreased by 5 days each. This has resulted in 8700 less patient days per year in acute care (at 450\$ / day – source JPPC) and 6600 less patient days in inpatient rehab (at 300\$ /day – source JPPC). These LOS improvements correlate to savings of 5.9 million dollars per year and create the opportunity for more patients to access and flow through the system. In addition, tempered results to date show an estimate of 500 patients with a hip fracture per year would avoid LTC placement and be returned home to independent living in the community. This would equate to a yearly savings of 11.8 million dollars (22,771 \$ per year- source JPPC).

**Conclusion:**

The TJN integrated model of care was expected to create system efficiencies that would result in overall cost savings in the care delivery for patients following a hip fracture. No additional resources have been infused into the participating hospitals and the large majority of these patients were likely accessing CCAC resources prior to their hip fracture. Hence, a conservative approximation from the early patient data demonstrates that the integrated model of care for patients following a hip fracture has not only patient benefits through improved access and standardization of care, but also true ongoing cost savings of upwards of 17 million dollars per year across the GTA.

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Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**A 17**

**THE COURSE OF FATIGUE DURING INPATIENT REHABILITATION IN PATIENTS WHO HAVE SUSTAINED A TRAUMATIC BRAIN INJURY**

Catherine Paramonoff, MD; Hugh Anton, MD

**Background:**

Fatigue is common in patients who have sustained traumatic brain injuries (TBI). Few studies have looked at the course of fatigue in the early recovery time period.

**Objective:**

To describe the prevalence and course of fatigue early after TBI in patients admitted to an inpatient rehabilitation program, and to identify possible factors associated with fatigue.

**Methods:**

Pilot study using a prospective case series design. Subjects were interviewed using standardized fatigue measures on admission; every 2 weeks while an inpatient; and at discharge. Primary measures were the Fatigue Severity Scale (FSS), Daily Fatigue Impact Scale (D-FIS), and Barrow Neurological Institute Fatigue Scale (BNI). For the confounding factor of depression, the Centre for Epidemiologic Studies Depression Scale (CES-D) was chosen. Background information was collected from the chart.

**Results:**

Eleven subjects, with a heterogeneous mix of TBI and concomitant injuries, were enrolled over six months. Average days post injury was 86 days. 73% (8) were male. Mean age was 38. 55% had sustained a severe TBI, (5 male and 1 female). BNI showed 8 subjects (73%) were above the mean (as compared to BNI originally published normal population data) and 4 (36%) were 2 SD above the mean, and for FSS the numbers were 7 (64%) and 4 (36%) respectively. The trend for increased or unchanged fatigue during rehabilitation was 6 (54%) for BNI, 7 (64%) for FSS, and 5 (45%) for D-FIS. There was no correlation with severity of injury. The CES-D showed 5 subjects (45%) to be depressed initially, with 9 demonstrating improvement, and only 3 subjects remaining depressed. Further analysis is in process and will be presented at the meeting.

**Conclusion:**

Based on this limited pilot study, it appears fatigue may be a significant problem in a subset of patients with TBI admitted to acute rehabilitation.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**A 18**

**BEDSIDE MANAGEMENT IN INTENSIVE CARE AND THE DEVELOPMENT OF JOINT CONTRACTURES**

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**Objective:** To relate musculoskeletal management of physiotherapy (PT) and occupational therapy (OT) services in the intensive care unit (ICU) with the development of joint contractures, and describe the impact of joint contractures on care needs and patient function.

**Methods:** A descriptive study investigating joint contractures in patients remaining in ICU for two weeks or more. In 155 ICU patients we extracted data on the numbers of patients assessed in PT, the time until first assessment, the number of treatments per week and the contribution of OT to detecting joint contractures. We also extracted data on burden of care in hospital, mobility and level of independence at discharge. Characteristics of patients with and without joint contractures were compared using the Chi-Square statistic or Fischer Exact test where appropriate; differences at  $p < 0.05$  were considered statistically significant.

**Results:** In ICU, 96.1% patients were assessed by a PT on average 2 days after the ICU admission and 37.4% by an OT. However only 77.2% of patients had their ROM assessed on average 7 days after the admission. Most patients were treated 7 times per week by a PT. After transfer to the ward, a higher percentage of patients with joint contractures (69.2%) received 6-7 treatments per week compared to patients with no contractures (23.8%;  $p \leq 0.05$ ). At hospital discharge, a greater proportion of patients with joint contractures had a lower level of mobility and required more assistance, but the comparisons did not reach statistical significance. OT contributions to identifying joint contractures revealed important both in ICU and on the ward (both  $p \leq 0.05$ ).

**Conclusion:** Most patients received PT attention in ICU presumably for respiratory needs since ROM assessment delayed by approximately 1 week and not performed at all in 22.8% of patients. More resources were diverted to patients with joint contractures while on the hospital ward and showed a trend to poorer mobility and less independence on discharge home. Devoting timely resources to joint health in ICU may not only decrease burden of care in hospital but also disability levels on hospital discharge.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 19

**BLUEPRINT FOR IMPROVING STROKE REHABILITATION IN CANADA**

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Stroke is a major source of disability, in Canada as well as other developed countries, which carries with it a high toll in terms of personal suffering for the stroke survivor and their family, in addition to the associated economic costs. Despite the impressive body of evidence describing effective and feasible stroke rehabilitation practices, stroke survivors, their families and health professionals currently do not benefit from a rehabilitation system that is well-organized and evidence-based. Moreover, evidence from other jurisdictions suggests that rehabilitation in Ontario and Canada falls well below the “gold standard” being set by other countries. Using best evidence, we make the case for needed changes to the current system based on five principles of care known to be important to achieving optimal outcomes: 1) Admission to specialized interdisciplinary stroke rehabilitation units; 2) Early admission to stroke rehabilitation; 3) Intensive stroke rehabilitation therapies; 4) Task-specific rehabilitation therapies and; 5) Well-resourced outpatient programs. More specific elements within those 5 rehabilitation principles based on best evidence include greater training of rehab clinicians in stroke rehab care, a no wait policy for moderately severe strokes, more active stimulating rehab environments, weekend therapy, holiday and sick therapy time coverage, more careful regulation of therapists’ schedules, reduced paperwork, moving away from Bobath therapeutic approaches, focusing on tasks important to the patients and dramatically increasing outpatient therapeutic resources. Implementation of these strategies would be expected to result in improved functional gains, reduced lengths of stay more efficient use of resources and significant cost-savings.

This project was funded by a grant from the Canadian Stroke Network.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**A 21**

**THE DOCTOR IS IN THE HOUSE: VALIDATION OF A TOOLKIT FOR  
MONITORING PATIENTS WITH ALS IN THEIR HOMES**

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**Background**

Persons with Amyotrophic Lateral Sclerosis (PALS) and other neurodegenerative disorders require frequent assessment by health care professionals to manage their progressive conditions. Due to our vast geographical area and Canadian weather, and that specialists are typically located in larger urban areas, new technologies and consultation methods to deliver effective and efficient health care services in Canada is needed.

**Objective**

Validation of a toolkit that allows accurate quantitative measurement of key health indicators for PALS in their home or community.

**Method**

New prototype tools developed by the research team that allow 3-D measurement of dynamic human motion characteristics in the field, have been validated. We describe a pilot study with PALS where quantitative information about knee, elbow, and grip strength and movement are being captured in the home using these novel prototype tools. Combined with commercially available spirometry, O<sub>2</sub> saturation/heart rate monitor, and weight scale, these sensors have been assembled as a toolkit for in-home evaluation. The ALS Function Rating Scale (revised) as a validated outcome for disease progression is administered monthly. This is a three phase pilot project, and data analysis strategies are being developed that detect small changes in health indicators over time. Initial phase includes equipment acquisition and integration into a user-friendly portable health status toolkit, ethical approvals and client identification. The second phase consists of three small scale implementations (3 clients per trial for six month trial periods), clinical data analysis, and user feedback on comfort, ease of use and satisfaction. Initial assessment by Physiatry, followed by three and six month follow-ups, compares the 'in-person' evaluations with those based on the toolkit monitoring system. The final phase will include data analysis, discussion of results with stakeholders, and publication and presentation of final results.

**Results**

Early project results will be presented.

**Conclusions**

We anticipate validating a toolkit that will enable Health Professionals to monitor their clients with ALS in their homes.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 22

**MYELITIS WITH SYRINX FORMATION: A CASE REPORT**

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**Setting:** Inpatient Rehabilitation Unit.

**Patient:** A 51 year old female with paraplegia.

**Case Description:** The patient with past medical history of Rheumatoid arthritis, pulmonary fibrosis and asthma developed urinary incontinence, constipation, numbness and burning of right lower extremity and left foot over a course of few days and was finally admitted on her fourth presentation to emergency room. Initial physical examination revealed sensory level L2 on right side to light touch and cold, normal tone, normal muscle strength in all extremities except 0/5 in right lower extremity, normal rectal tone with intact perianal sensations, 1+ deep tendon reflexes with down going plantars. MRI revealed syrinx extending from C7 to T10.

**Assessment/Results:** Over a course of next few days, she developed rapid weakness of the left lower extremity with sensory deficit below T 4-5. She was started on steroids with the impression of autoimmune myelitis. Repeat MRI with contrast showed patchy enhancement of spinal cord at T4-8 with a differential diagnosis of myelopathy, transverse myelitis, cord mass lesion or infarction. She remained paraplegic with urinary incontinence in spite of steroid treatment. She needed maximum assistance with ADLs, transfers and ambulation.

**Discussion:** CSF-flow obstruction is regarded as a mandatory factor for the development of syringomyelia. However, syringomyelia in inflammatory spinal cord lesions without evident CSF-flow obstruction may be secondary to accumulation of vasogenic edema. Syrinx associated with myelitis has been found to be non-communicating, which develops during the acute phase and disappears after steroid treatment.

**Conclusion:** Myelitis can contribute to development and rapid expansion of syringomyelia with permanent neurological damage. Early detection and prompt treatment may result in functional improvement in this rare disorder.

**Key words:** Paraplegia, Syrinx, Myelitis



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**A 23**

**DIAGNOSTIC CHALLENGE OF TRAUMATIC SPINAL FRACTURE IN MENTALLY CHALLENGED PATIENTS**

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**Objective:**

Diagnosis and treatment of traumatic spinal injuries is problematic in patients who are unable to cooperate with a detailed history and neurological examination. The following case report details a patient, unable to cooperate with an initial trauma assessment due to mental retardation, leading to delayed diagnosis and surgical treatment with a resultant poor early functional outcome.

**Methods:**

Physical examination, radiological examination, neurosurgical intervention, inpatient rehabilitation and review of literature.

**Results obtained:**

A 23 year-old male with mental retardation was ejected from a van during a motor vehicle accident. The patient was evaluated and discharged from a local hospital after initial evaluation. Two weeks later, the patient was brought by caregivers to the our rehabilitation clinic for evaluation of lower extremity weakness and bladder incontinence. Patient was admitted for further evaluation. Patient was classified as ASIA B T10 with bladder and bowel involvement. CT scanning with coronal and sagittal reformats demonstrated disruption of the posterior spinal elements at eight, ninth, and tenth thoracic levels. The T9 facets joints were broken with fracture fragments in the spinal canal. MRI confirmed spinal cord compression at the T9 region with associated ligamentous disruption. The patient was started on steroids and subsequently underwent T8-10 laminectomy and T7-12 fusion. During in-patient rehabilitation, the patient did not have significant change in his neurological status.

**Conclusion:**

Detailed history including mechanism of injury, detailed physical and radiological examination, strict adherence to trauma protocols and high index of suspicion may be helpful in reducing the incidence of missed spinal injuries.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 25

**DEVELOPMENT OF AN UPPER LIMB PROSTHESIS FOR VIRTUAL  
REHABILITATION – A PRELIMINARY REPORT**

Linassi G, Churko J, Mehr S, Li Pi Shan R, Dinh A

**Objective:** Design, develop, and test a real world simulated upper extremity prosthesis (SiP) capable of interacting with a virtual rehabilitation environment.

**Methods:** Phase I, currently underway, began with an extensive literature review to identify the design requirements for the prototype. Field interviews were concluded with medical personnel (Amputee Program, Department of Physical Medicine and Rehabilitation, University of Saskatchewan), experienced prosthetic wearers and the Saskatchewan Abilities Council. A masters student (Department of Electrical Engineering, University of Saskatchewan) is designing and building the prototype. MEMS sensors, which include 3-D accelerometers and gyroscopes, were selected to detect the motion and position of the SiP. Linear displacement sensors are attached to cables which are intended to measure the tension of the presumptive hook. All sensors are connected to an embedded microcontroller which has various interface modules such as analog-to-digital converters, PWM, and time counters. A compact printed circuit board has been made to integrate into the SiP, and will host the microcontroller, some of the sensors, and the power supply regulators. Upon successful integration, the system will be tested to verify its functionality. The focus of the testing will be the accuracy and the stability of the system.

**Results:** A prototype is undergoing development as proof of concept. Initial motion data from the SiP system has been compared and verified with that of a standard commercial motion analysis tool. Data streams providing x,y,z coordinates have been captured and translated into real time graphical form.

**Conclusion:** Preliminary design results of a simulated upper extremity prosthesis indicate three dimensional motional analysis is feasible, opening the way for interaction within a virtual reality rehabilitation environment planned for phase II of the project.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**A 26**

**MASKING EFFECT OF PRIOR CERVICAL PATHOLOGY IN ACUTE CERVICAL SPINAL TRAUMA SETTINGS**

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**Objective:**

Acute cervical spinal injury in patients with prior history of cervical spine pathology can make diagnosis and treatment more challenging and can lead to adverse outcome in the settings of acute cervical injuries.

**Methods:**

Physical examination, radiological examination, neurosurgical intervention, inpatient rehabilitation and review of literature.

**Results obtained:**

50 years old female, restrained driver in a motor-vehicle accident, had moderate neck pain, which she did not report and considered as contributory effect of her history of cervical vertebral degeneration and went home. Few hours later, patient presented to emergency room with right sided weakness, low back pain and urinary incontinence. A lumbosacral spine CT and later MRI were obtained, which failed to show any acute changes. Pt was started on intravenous methylprednisolone and continued on dexamethasone. Her weakness persisted which warranted a cervical spine MRI next day, which revealed right C5-6 disc-herniation superimposed on broad-based disc-osteophyte complex with significant impingement on the right aspect of the cervical cord and nerve root. No fractures were noticed. Patient was started on a cervical collar. Patient's symptoms started improving after 48 hours. Patient was transferred to in-patient rehabilitation facility for an aggressive rehabilitation course. Patient improved significantly over next 10 days. Upon discharge, patient was ambulating without assistance and full urinary control had returned.

**Conclusion:**

A detailed physical and radiological examination, strict adherence to trauma protocols and high index of suspicion may be helpful in detecting injuries superimposed on prior cervical pathology.

**Funding sources:** None



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56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 27

**DELAYED SPINAL CORD INJURY FOLLOWING ELECTRICAL TRAUMA  
A CASE STUDY**

Jennifer Salter and Alan Casey

**Background**

Spinal cord injury (SCI) following high-voltage electrical trauma is uncommon and rarely described in the literature. Case studies describe a delayed onset of incomplete SCI which primarily affects the corticospinal tracts. Although delayed SCI is not a life-threatening condition, complete recovery of motor control is rare. We present the first known case at the Winnipeg Health Sciences Centre Spinal Cord Rehabilitation Unit of SCI following electrical injury.

**Clinical**

Our patient was a previously healthy 34-year-old male who presented with delayed SCI following a high-voltage electrical trauma. He underwent multiple surgical procedures to the extensive burns that covered over 50% total body surface area. During the first week he developed gradual ascending paralysis. An accurate neurological exam, obtained 26 days post injury when sedation was discontinued, was consistent with C5 ASIA A (motor preserved to C5 and sensory preserved to T8). MRI and CT of the brain and spinal cord were normal. His course in hospital was complicated by spasticity, contractures, hypercalcemia and hypotension.

**Outcome**

The patient was transferred to the SCI rehabilitation program 120 days post injury with a FIM of 76. He showed progressive recovery of his upper extremities but only partial improvement of his lower extremities. At discharge, 224 days post injury, he was independent at wheelchair level with assistance needed for lower extremity dressing and had a FIM of 109. At 1.5 years post injury, he is able to ambulate at household level using canes, transfer independently, and drive. He continues to have spasticity of the adductor muscles which has been adequately treated with BOTOX.

**Conclusion**

Early rehabilitation by a team familiar with SCI is important in patients with SCI following electrical injury. Our research will highlight management of the secondary complications associated with this very unique population.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**A 28**

**FUNCTIONAL OUTCOME IN A PATIENT WITH HEMORRHAGIC STROKE AFTER ADMINISTRATION OF EPTIFIBATIDE**

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**Objective:** Efficacy of early rehabilitation and functional outcome after hemorrhagic stroke due to eptifibatide administration

**Methods:** Physical examination, radiological examination, neurosurgical intervention, inpatient rehabilitation and review of literature.

**Results obtained: Case Description:** 79 years old patient underwent percutaneous angioplasty of right coronary artery. During the procedure, dissection of left main artery ostium was noted. As the dissection was small, non-flow limiting, patient was continued with injection and procedure was concluded without further complications. Patient received Heparin along with continuous eptifibatide (GP IIb/ IIIa antagonist). Few hours later, patient complained of the severe headache. Eptifibatide was held and a CT scan was obtained. A large intraparenchymal hemorrhage involving the right parieto-occipital lobe was seen. Pt developed left sided weakness, hemi-neglect, sensory and proprioceptive deficit along with left pronator drift. Pt was started on bedside rehab immediately and subsequently transferred to in-patient rehabilitation.

**Assessment/ Results:** Patient showed significant improvement with rehabilitation. Intensive in-patient rehabilitation resulted in improvement in the hemi-neglect, significant improvement in ambulation distance along with ability to negotiate stairs. Upon discharge, patient was ambulating with a rolling walker and was spontaneously reaching over to the left side without verbal queuing.

**Conclusion:** Although hemorrhagic stroke secondary to eptifibatide administration is a rare complication but is associated with very high mortality rate. If patients are medically stable and started on early rehabilitation after the hemorrhagic stroke, functional outcome can be improved significantly.

**Funding sources:** None



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 29

**DRIVING EVALUATION SUCCESS RATES IN DISABLED POPULATION GROUPS:  
WHAT DETERMINES PERFORMANCE?**

Hillel M. Finestone, MD, Shawn C. Marshall, MD, Lynn Hunt, OT

**Objective:** To determine 1) whether the pass rate of patients taking a formal driving evaluation test differs between specific diagnoses/conditions and between those with cognitive vs. physical conditions, and 2) whether there are particular off-road and driving simulation tests that can predict driving success and aid physicians' decision-making.

**Methods:** Retrospective cohort study involving 593 consecutive patients referred to a rehabilitation centre-based driving evaluation program between 1995 and 2003. Subjects underwent off-road and on-road driving assessments. Poor performance on the off-road test prohibited an on-road assessment. The primary outcome was pass, failure or did not take the road test. The primary predictors considered were diagnosis type (physical [spinal cord injury, neuromuscular, amputee, musculoskeletal] vs. cognitive [stroke, traumatic brain injury, multiple sclerosis, other]), cognitive/visuospatial testing (Bell's test, Charron test, light scanner result, average reaction time, cross-checking test and Doron simulation test) and age. In univariate analysis,  $\chi^2$  tests were used to compare driving test status between the physical vs. cognitive diagnostic groups and performance results for each of the off-road evaluations. Significant variables were analysed by means of multivariate logistic regression.

**Results:** Of the 539 patients who took the on-road test, 273 (51%) passed on the first attempt. The final pass rate was 60% (359/596). More patients with a cognitive diagnosis than with a physical diagnosis failed (53% vs. 42%,  $p=0.01$ ). Stroke had the highest failure rate (47%). The more off-road tests failed, the greater the chance of failing the driving test. On logistic regression analysis, a cognitive diagnosis ( $p=0.07$ ), failing the simulation test three times ( $p=0.008$ ) or four or more times ( $p=0.01$ ) was significantly associated with driving test status, as was age ( $p<0.0001$ ).

**Conclusion:** In this population, cognitive diagnoses were more predictive of driving test failure than physical diagnoses. Increasing age was also predictive, as was failing multiple tests.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 30

**ELECTRODIAGNOSTIC OUTCOME OF ULNAR NERVE TRANSPOSITION**

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**Introduction:** Ulnar nerve transposition is a common surgical procedure for the treatment of ulnar neuropathy at the elbow (UNE). The most appropriate surgical technique (subcutaneous vs. submuscular) remains unknown. The usefulness of electrodiagnostic evaluation in following the course of UNE postoperatively remains controversial.

**Objective:** 1) To determine if Electrodiagnostic results improve following ulnar nerve transposition, and correlate with Functional measures.

**Methods:** Sixty two patients with clinical features of UNE were randomized to either SM or SC transposition. All patients underwent electrodiagnostic studies preoperatively and at 1 year postoperatively. The electrodiagnostic consultant was blinded to the surgical technique. Electrodiagnostic outcomes included motor nerve conduction velocity (CV) across the elbow, sensory nerve action potential (SNAP) amplitude of the fifth digit, and needle examination (NEE) for evidence of denervation.

**Results:** Sixty Two subjects (age  $52 \pm 15$  yrs) were studied. Overall, surgery resulted in significant improvement in CV ( $37 \pm 14$  pre;  $50 \pm 13$  post) but no significant improvement in the SNAP amplitude ( $8 \pm 12$  pre;  $11 \pm 11$  post). Needle EMG (NEE) and denervation pre operatively had no effect on outcome. Patient Rated Ulnar Nerve (PRUNE) Evaluation was improved and was a sensitive measure of functional change. A two-way analysis of variance showed no effect for SM versus SC transposition.

**Conclusions:** Functional and electrodiagnostic outcomes are improved following ulnar nerve transposition. Motor nerve CV across the elbow was significantly improved at 1 year. Denervation on NEE preoperatively had no significant impact on patient rated outcome measures (PRUNE or SF 36).



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 31

**THE EFFECT OF BEDREST ON LOWER LIMB FAT CONTENT AND MUSCLE ATROPHY**

G. Trudel, M. Lecompte, H. Uthoff

**Objective:** To study the effect of 60 days of bed rest alone, bedrest with exercise or bedrest with protein supplement on 24 volunteers' lower limb muscle fat content muscle and atrophy.

**Methods:** 24 women aged 25 to 40 underwent enforced bed rest for 60 days and were divided in 3 groups: control, exercise- including aerobic and resistive - and leucine-rich diet. We measured with magnetic resonance the type-1 fiber predominant gastrosoleus (GS) muscle and type-2 fiber predominant tibialis anterior (TA) fatty signal and cross-sectional area at baseline, 1 month and 2 months. Data were compared using repeated measures ANOVA.

**Results:** Significant fat accumulated were present in the gastrosoleus at one and two months (by  $3.8 \pm 1.4$  and  $7.3 \pm 2.7$  signal intensity units respectively; both  $p < 0.05$ ). In the tibialis anterior, the increases did not reach statistical significance. Both muscles atrophied significantly, the gastrosoleus (-25%) more so than the tibialis anterior (-12%). Exercise prevented muscle atrophy in the TA only. Among the intervention groups, exercise prevented atrophy in the TA ( $p < 0.05$ ). The muscle atrophy correlated with the fat accumulation in the GS ( $r^2 = -0.31$ ;  $p < 0.05$ ).

**Conclusions:** Fat accumulation can interfere with muscle function and potential for recovery. Two months of bed rest led to fat accumulation preferentially in the gastrosoleus type-1 muscle. Similarly, fat accumulation correlated with muscle atrophy only in the type-1 GS muscles. A complete exercise regimen did not prevent the fat accumulation in the GS. Specific countermeasures may be needed to address fat accumulation in prolonged bedridden states.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 32

**DO ABORIGINAL CANADIANS HAVE MORE PHANTOM LIMB PAIN AFTER LOWER LIMB AMPUTATIONS?**

A. ARNEJA, B. Y. ONG, E. W. ONG. University of Manitoba, Winnipeg, Canada.

**Objective:** We initiated a prospective study of stump and phantom limb pain after lower limb amputation. We assessed aboriginal (A) and non-aboriginal (NA) Canadian patients after lower limb amputation to determine if there is any difference between the two groups of patients in stump and phantom limb pain after lower limb amputations.

**Method:** The University of Manitoba Human Ethics Committee approved the study. Patients who consented to take part in the study, were interviewed and assessed with standardized questionnaire and pain scale about stump pain, phantom limb sensation and phantom limb pain. The amount of pain was rated on a scale starting at 0 (no pain) to 10 (worse pain imagined). One hundred and thirty-four patients completed the assessments. There were 52 aboriginal Canadians and 82 non-aboriginal Canadians.

**Results:** The A patients were significantly younger (55.5+15.4 years vs 61.9+12.5 years P=0.026). More of the A patients have diabetes mellitus (85.4% vs 67.3% P=0.045). The two groups had similar frequencies in phantom sensations (86.5%, 82.9%); stump pain (71.2%, 72.0%); phantom limb pain (65.4%, 59.8%). The average amount of stump pain were similar (4.8+2.2, 4.3+2.1). The average amount of phantom limb pain were also similar (5.7+2.2, 5.0+2.4).

**Conclusion:** The data showed that aboriginal Canadians have lower limb amputation at a younger age and were more likely to have diabetes mellitus. There was no significant difference in stump pain or phantom limb pain between the aboriginal and non-aboriginal Canadians after lower limb amputations.



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56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 33

**CARDIOVASCULAR MORBIDITY AND MORTALITY, AND REAMPUTATION RATES AMONG PERSONS WITH LOWER EXTREMITY AMPUTATIONS DUE TO PERIPHERAL VASCULAR OCCLUSIVE DISEASE**

D. Priestley, A. Arneja

**Objectives:** To date, there are no Canadian studies looking at reamputation or cardiovascular complication rates in LE amputees secondary to PVOD and the difference between the aboriginal and non-aboriginal populations in complication rates.

**Methods:** The University of Manitoba Research and Human Ethics committee approved this study. In this retrospective study, we looked at the cardiovascular morbidity and mortality and reamputation rates in LE amputees over a five-year period (January 2001 to January 2006) for those admitted to our amputee rehabilitation unit (and followed in our outpatient clinic for management of risk factors and prosthesis fit) at Health Science Center in Winnipeg, Manitoba.

**Results:** Of the 204 patients admitted through our unit, 185 met inclusion criteria (51 aboriginal, 133 non-aboriginal). 79 (42.7%) had complications (40 revisions/ reamputations, and 39 cardiovascular complications - including 27 deaths) with an average duration to complication of 17.6 months. Our 1-year complication rate was 7.0% reamputations (contralateral), 3.2% revisions, and 6.5% deaths. The aboriginal population had a slightly higher reamputation/ revision rate (7.8%, 3.9%), but a lower death rate (3.9%) compared to the non-aboriginal population (9.8% and 7.5%). They also tended to be younger at first amputation (60.6 +/- 11.5 yrs compared to 66.5 +/- 12.6 years,  $p < 0.01$ ). In the aboriginal population, the greatest risk factors were diabetes (96.1%), HTN (88.2%), smoking (49%) then hyperlipidemia (37.3%). In the non-aboriginal population, the risk factors were HTN (84.2%), diabetes (78.2%), hyperlipidemia (50.4%) then smoking (46.6%).

**Conclusions:** We demonstrate lower 1-year complication rates compared to the published data. We also see a younger age of initial LE amputation, higher reamputation rate and lower death rates in our aboriginal versus non-aboriginal population. Funding for this project was by the War Amps of Canada.



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56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 34

**IMPACT OF THE SCIRE PROJECT**

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**Objective:** To determine the impact of the SCIRE project in terms of dissemination to the target community through peer-reviewed publications, presentations, website hits, and current spinal cord injury (SCI) initiatives.

**Methods:** In October 2006, the SCIRE project published an 800-page document that systematically assessed intervention and outcome measure literature pertaining to SCI rehabilitation. The document was made available to its target audience (clinicians, researchers, policy makers, and consumers) via book, CD, and online format. International SCI researchers and organizations were targeted to help facilitate the dissemination of SCIRE, either by linking to its website or sharing it with colleagues. Peer-reviewed journals were targeted for the publication of systematic review findings for each topic area. To assess the impact of the SCIRE project, we tracked its a) publication and presentation productivity, b) website hits and c) impact on SCI research and best practice initiatives.

**Results:** Since October, 2006 the SCIRE project has resulted in 13 peer-reviewed publications (~1/month), with an additional 1 article in-press, 7 articles in peer-review and 7 manuscripts in progress. Contributing authors have presented posters, presentations, and workshops at 28 meetings, including international SCI forums. The SCIRE website has had over 250,000 hits (averaging 807 hits/day) in part due to the overwhelming support of organizational websites posting links to the SCIRE website. Currently, SCIRE is being used to facilitate SCI gap analysis initiatives, including determining areas of sufficient or insufficient evidence requiring improved translation to practice or future research, respectively.

**Conclusion:**

Since the initiation of its dissemination phase, the SCIRE project has had widespread and immediate impact. The overwhelming support of this project has led to a planned Version 2, scheduled to be completed for Fall 2008.

**Support:** This project is supported by the Rick Hansen Man in Motion Foundation Research Fund and the Ontario Neurotrauma Foundation.

Word Count: 299 (not including title, authors, and affiliations)



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56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 35

**OBTAINING TOTAL NON-WEIGHT BEARING IN SEVERE CHARCOT  
ARTHROPATHY: A CASE STUDY**

Paulinder S. Rai, DO; Ramon Rosales, PT; David Chen, MSIV; Paul Pipia, MD; Sanjeev Agarwal, MD (Downstate Medical Center, Brooklyn, NY).

**Objective:** Limb preservation by aggressive non-weight bearing in Charcot Arthropathy.

**Methods:** A 59 year old male with past medical history significant for HTN, DM, ESRD on HD, with RLE DVT developed swelling and pain in right lower extremity and foot. History and physical examination were consistent with Charcot ankle and diagnosis was confirmed by radiographic evidence of severe bony destruction of foot and ankle. Use of non weight bearing brace and rehabilitation program was conducted to preserve limb and functional use of lower extremity.

**Results:** Patient was fitted with Patten Bottom brace and trained to ambulate with rolling walker for non weight bearing ambulation and stability. Patient was discharged home after short inpatient stay and followed up as outpatient. After successful resolution of acute phase of Charcot arthropathy, patient was fitted for Charcot Restraint Orthotic Walker (CROW) and weight bearing was successfully advanced.

**Conclusion:** Charcot arthropathy is a debilitating condition that has a profound impact on patient function. It is important for physicians to recognize this complication early and use a team approach that includes and experienced physiatrist and/or orthotist. To facilitate healing and treatment of Charcot joint in the acute phase, orthoses must often be designed to ensure non-weight bearing while still allowing for high levels of independence in ambulation.

**Key Words:** Charcot joint, Charcot arthropathy, Patten bottom brace, AFO, rehabilitation

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Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 36

**GADOLINIUM-INDUCED NEPHROGENIC SYSTEMIC FIBROSIS AND  
REHABILITATION MANAGEMENT: A CASE STUDY**

Paulinder S. Rai, DO (Downstate Medical Center, Brooklyn, NY); Melissa Kong OT; Jack Mensch, MD (Staten Island University Hospital); Sanjeev Agarwal, MD.

**Objective:** To describe the rehabilitation management and concerns of a rare form of Gadolinium induced systemic fibrosis.

**Setting:** Inpatient Rehabilitation Unit.

**Methods:** A 41 year old female with past medical history significant for ESRD on Hemodialysis, anemia, HTN, PE, asthma, pulmonary embolism and SVC thrombosis, presented to emergency department with complaint of lightheadedness. Patient underwent MRI with IV gadolinium as part of neurological work-up. Within several weeks patient began developing progressive skin changes and muscle stiffness. Muscle biopsy confirmed the diagnosis of nephrogenic systemic fibrosis. Rehabilitation team was consulted for evaluation and treatment.

**Results:** After intensive course of therapies, patient had significant functional improvement in activities of daily living, as well as improved sense of overall well-being.

**Conclusions:** Nephrogenic systemic fibrosis is a serious systemic disease that has been linked to exposure to Gadolinium during MRI. Gadolinium-containing contrast agents should be used only if clearly necessary in patients with renal failure. The physical consequences of fibrosis of skin and muscle tissues can lead to severe impairments in physical functioning for affected patients. The aggressive rehabilitation management of patients diagnosed with nephrogenic systemic fibrosis is a critical part of the treatment process.

**Key Words:** Nephrogenic systemic fibrosis, nephrogenic fibrosing dermatopathy, gadolinium, chronic kidney disease, end stage renal disease, rehabilitation

**Author Disclosure Block:** P.Rai, None; J. Mensch, None; S. Agarwal, None.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 37

**PARIETAL LOBE INFARCT RESULTING IN HYPERPHAGIA SYNDROME**

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**Objective:**

To study the effects of parietal lobe infarct resulting in increased appetite. Literature search for similar reports of concurrent occurrence of parietal lobe infarct and hyperphagia syndrome.

**Methods:**

Physical examination, radiological examination, neurological consultation, inpatient rehabilitation and review of literature.

**Results obtained:**

62 years old female was admitted to hospital after insidious onset of mental status changes for 3 days. CT scan revealed an acute left posterior parietal lobe infarct with superimposed acute petechial hemorrhages. In addition, there were right subinsular cortical lacunar infarcts. Due to hemorrhagic component, patient was not a candidate for anti-coagulation. Patient was started on aggressive inpatient rehabilitation. Patient was noted to have unusually high appetite. Pt's BMI was 21.7, which remained stable despite increased intake. There was no prior history of hyperphagia. Patient consumed double portions of meals and remained hungry. Her diabetes was controlled with insulin due to fluctuations secondary to her increased caloric intake. Patient had follow up CT scan with no change from the prior CT scan except resolution of the hemorrhage to smaller size. On Hospital day 40, patient continued to exhibit hyperphagia. Extensive laboratory work up, including TSH and cortisol, failed to reveal a secondary cause for patient's hyperphagia. Despite improvement in physical and psychological functioning, patient continued to have an increased caloric intake.

**Conclusion:**

Hyperphagia associated with thalamic lesions is well-documented. Despite extensive literature search, no case reports of similar occurrence were found. To our knowledge, this is the first case report of involvement of parietal lobe infarct resulting in hyperphagia.

**Funding sources:** None



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 38

**ANALYSIS OF ATTITUDES TOWARD ELDERLY INDIVIDUALS WITH  
TRAUMATIC SPINAL CORD INJURY AMONG REGISTERED NURSES: A CROSS-  
SECTIONAL STUDY**

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**Objective:** This cross-sectional study examines the potential factors that can influence attitudes toward elderly individuals among registered nurses (RNs) who care for individuals with traumatic spinal cord injury (SCI).

**Methods:** Kogan's Old People (KOP) questionnaire was sent to all RNs in both participating institutions. KOP includes 17 negatively-framed (KOP-) and 17 positively-framed questions (KOP+). Age, regularity in caring for SCI patients (weekly, monthly, sporadically, never), time of experience (<2years, 2-5years, 6-10years, >10years), education (college, university, postgraduate, other specialization) and work settings (acute care SCI unit, rehabilitation SCI unit) were included as co-variants. Data were analyzed using Mann-Whitney U test, Fisher's exact test and ANOVA.

**Results:** Among the respondents (response rate of 37%), there were 12 women from the rehabilitation center and 14 women from the acute care unit with mean age of 39.6 years (22-59 years). Univariate analyses showed no significant differences for KOP+ score in comparison with settings ( $p=0.625$ ), regularity ( $p=0.653$ ) or experience ( $p=0.975$ ). Higher level of education was significantly associated with greater KOP+ scores ( $p=0.006$ ). Also, there is a trend for an association between older age and greater KOP+ score ( $p=0.068$ ). There was no significant effect on the KOP- scores by age ( $p=0.983$ ), regularity ( $p=0.924$ ) or experience ( $p=0.711$ ). However, KOP- scores significantly differed between acute and chronic settings ( $45.5\pm 1.5$  versus  $56.2\pm 2.7$ , respectively;  $p=0.015$ ). Also, higher level of education was significantly associated with greater KOP- score ( $p=0.035$ ). There was a significant interaction between settings and education regarding KOP- scores ( $p=0.0006$ ). Mean ages of the RNs from both settings were comparable.

**Conclusion:** Our results indicate that a greater level of education positively influences attitudes toward elderly SCI patients represented by higher KOP+/KOP- scores. Given that the proportion of geriatric SCI patients is increasing, our study would suggest that specialized nursing training in geriatrics could overcome the potentially negative impact of ageism.



Canadian Association of Physical Medicine and Rehabilitation  
56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

A 39

**AGE AS A KEY DETERMINANT OF FUNCTIONAL RECOVERY AFTER  
REHABILITATION OF PATIENTS WITH SPINAL CORD DISEASE**

Julio C. Furlan, M.D., M.B.A., M.Sc., Ph.D.<sup>1,2</sup>; Sander Hitzig, PhD (Candidate)<sup>2</sup>; B. Catharine Craven, M.D., Ph.D., F.R.C.P.C.<sup>2</sup>

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**Objective:** This cohort study was undertaken to assess whether age influences functional outcomes of patients with spinal cord disease.

**Methods:** This cohort of patients included all consecutive patients with spinal cord disease who were admitted to a neurorehabilitation centre from January 2003 to April 2004. All patients consented to participate in this study. Functional assessments included Spinal Cord Independence Measure (SCIM) and Functional Independence Measure (FIM). Functional recovery was defined as the difference between baseline (on admission) and latest follow-up functional assessment. Potential major confounders included sex, level of injury and severity of injury as assessed by American Spinal Injury Association (ASIA) Impairment Scale (AIS). Data were analyzed using Mann-Whitney U test and linear regression analyses.

**Results:** There were 11 females and 19 males with a mean age of 54 years (range: 30 to 83 years) who were admitted for rehabilitation due to trauma (11/30) or a non-traumatic spinal cord disease (19/30). Mean baseline SCIM and FIM scores were  $55.1 \pm 4.3$  (range: 15-100) and  $82.7 \pm 3.6$  (range: 53-120), respectively. After a mean followup time of 71 days (range: 15-183 days), patients with spinal cord disease reached a mean SCIM of  $70.6 \pm 4.2$  (range: 27-100) and a mean FIM score of  $107.3 \pm 2.8$  (range: 73 to 126). Using SCIM, functional recovery was not associated with age according to unadjusted regression analysis (R-square=0.058, p=0.215) and multiple regression analysis after controlling for major potential confounders (R-square=0.285, p=0.504). Similarly, functional recovery as assessed using FIM was not associated with age according to unadjusted regression analysis (R-square=0.014, p=0.551) and multiple regression analysis adjusted for major potential confounders (R-square=0.241, p=0.644).

**Conclusion:** Age was not significantly correlated with functional recovery after rehabilitation for spinal cord disease. Our results, therefore, reinforce the need for individualizing treatment protocols for elderly patients with SCI who have the potential to functionally recovery.



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56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings

**RE04**

**HOW TO DIAGNOSE SUPERIOR LABRAL ANTERIOR POSTERIOR (SLAP) LESIONS**

Gaurav Gupta

**Introduction:** Acute trauma and repetitive overhead throwing can lead to pathology of the superior labrum and associated biceps tendon, known as superior labral anterior posterior (SLAP) lesions. SLAP lesions are associated with pain, and functional limitations, and do not respond to conservative, non-operative treatment.

**Objective:** To determine the clinical utility of physical examination tests and imaging to identify SLAP lesions.

**Methods:** A comprehensive literature review and critical analysis of clinical tests and imaging modalities, relevant to SLAP lesions, was conducted.

**Results:** There is no pathognomonic clinical test or combination of tests for diagnosing SLAP lesions. However, magnetic resonance arthrograms (MRA) have a strong ability to identify SLAP lesions.

**Conclusion:** Positive clinical tests and/or lack of response to conservative treatment should guide referral for MRA. Patients with positive MRA for SLAP lesions, or ongoing symptoms despite negative clinical and imaging tests, should be considered for diagnostic arthroscopy (i.e. gold standard).

**Word Count: 149**



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Conference Proceedings

**RR01**

**USING MODIFIED RANKIN SCORES TO EVALUATE STROKE REHABILITATION:  
A FUNCTIONAL INDEPENDENCE MEASURE DERIVATION**

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**Objective** – The modified Rankin Scale (mRS) is commonly used as a functional outcome measure in stroke trials, while rehabilitation facilities typically use the Functional Independent Measure (FIM<sup>TM</sup>), making comparison of acute stroke and rehabilitation interventions difficult. We propose a method of translating the FIM into the mRS.

**Methods** – Discharge functional scores for 294 patients completing stroke rehabilitation were used to develop a translation of FIM scores into mRS scores, which was then validated against the source dataset and an independent set of 48 patients. After applying this translation to yield admission mRS scores, we examined the relationship between gains on the 2 scales.

**Results** – There was 76.5% agreement between the direct and derived mRS scores with excellent correlation (Spearman's  $\rho$  0.92,  $\kappa_w$  0.91,  $p < 0.0001$ ). Agreement was 94.2% when dichotomized at  $mRS \leq 2$ . Validation performed on an independent dataset yielded similar agreement (68.7%; Spearman's  $\rho$  0.86,  $\kappa_w$  0.88,  $p < 0.0001$ ). Absolute FIM gains and FIM efficiencies correlated highly with mRS gains (ANOVA  $F=14-60$ ,  $p < 0.0001$ ), but a measure of relative FIM recovery best distinguished patients who improved on the mRS from those who did not ( $F=140$ ,  $p < 0.0001$ ).

**Conclusions** – Conversion to mRS scores from available rehabilitation FIM scores is feasible and demonstrates excellent reliability. This will allow direct outcome and cost comparisons for rehab interventions within the continuum of stroke care. Relative recovery of FIM deficits best reflects improvement on the mRS compared to absolute FIM changes or FIM efficiencies.



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56<sup>th</sup> Annual Scientific Meeting  
Conference Proceedings**

**MSE01**

**CONSIDERING THE ROLE OF QUADRICEPS MUSCLE WEAKNESS IN KNEE  
OSTEOARTHRITIS**

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The purpose of this review is to examine current understanding of the relationship between quadriceps muscle strength and osteoarthritis of the knee joint. While strength deficits are common in healthy older adults, they are often of greater magnitude in similarly aged patients with OA. The mechanisms responsible for the loss in muscle strength in knee OA may include those previously implicated in normal ageing processes, such as changes to muscle and motor unit morphology. In addition, neural mechanisms contributing to strength loss, such as reduced central drive (voluntary activation of the quadriceps muscle), due to alterations in joint architecture may occur independently of normal ageing processes. While the relevance of the neuromuscular system to the pathogenesis of disease is not fully understood, the effect of these deficits on pain and disability is well established and has widespread implications on the development and implementation of rehabilitation protocols.