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## Abstract Book Oral Presentations

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## Collaborative Care for Pain, Depression and Physical Inactivity in an Outpatient SCI Clinic: the SCI-CARE Study

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Oral Presentations 4, Room C2.5, September 13, 2018, 16:00 - 17:30

**Introduction:** Post-acute management of chronic pain, depression, and physical inactivity is often suboptimal. Alternative models for treating these conditions are needed.

**Research Objectives:** To test the effectiveness of collaborative care (CC) versus usual care (UC) to improve quality of life, pain, physical inactivity and depression in a spinal cord injury (SCI) clinic population.

**Design:** Single blind randomized controlled trial.

**Setting:** Outpatient SCI rehabilitation clinic.

**Participants:** 174 outpatients (UC285; CC289) who were on average 47.7 years old, 76% male, 69% white, 8% Hispanic, 47% tetraplegic, 45% on Medicare, 95% more than one year after SCI.

**Interventions:** A masters level collaborative care manager, integrated into the SCI clinic and supervised by content experts, provided assessment, coordination and treatment decision support to the primary team, adherence support and brief psychosocial interventions (cognitive behavioral therapy, motivational interviewing) to the patients in up to 12 in-person or telephone sessions.

**Main Outcome Measure(s):** Quality of life (WHOQOL-BREF-primary outcome), pain intensity (NRS), pain interference (NRS), physical activity (PARA-SCI SF), sedentary hours, and depression severity (SCL-20) at 4 and 8 months after randomization.

**Results:** Mixed effects linear regression on 4- and 8-month outcomes revealed:

WHOQOL-BREF did not improve significantly more in CC vs. UC at 4 (adjusted mean difference [AMD]=2.74,  $p=.10$ ) or 8 months (AMD=3.00,  $p=.08$ ). At 4 months, pain interference (AMD=-1.02,  $p<.005$ ), depression (AMD=-0.22,  $p<.05$ ), and satisfaction with care (AMD=0.39,  $p<.02$ ) improved more in CC vs UC. At 8 months, CC had greater improvement in pain interference (AMD=-1.25,  $p<.001$ ) and depression (AMD=-.21,  $p=.023$ ) than in UC. At 4 months, among participants focused on improving physical activity, the WHOQOL-BREF improved more in CC vs. UC (AMD=6.22,  $p<.05$ ).

**Conclusions:** CC demonstrates promise for improving pain, depression, and QOL after SCI. While few individuals focused on mood, intervening in pain and activity also led to reduction in depressive symptoms.

## Impact of Respiratory Muscle Training on Respiratory Muscle Strength, Respiratory Function and Sleep Disordered Breathing in Cervical Spinal Cord Injury

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Oral Presentations 2, Room C2.4, September 13, 2018, 11:30 - 13:00

Respiratory muscle weakness following spinal cord injury (SCI) impairs lung function and the ability to cough effectively. Respiratory complications, including sleep disordered breathing, are one of the leading causes of morbidity and mortality in people with acute and chronic SCI. Inspiratory muscle strength has been identified as the best discriminator to predict the likelihood of developing pneumonia in individuals with SCI. The predicted pneumonia risk threshold is 115% maximal inspiratory pressure (MIP), based on lesion-specific reference values – for AIS A/B, MIP<115% has a 50% probability of pneumonia compared to a 94% probability of not suffering a pneumonia if MIP>115%. We hypothesised that progressive respiratory muscle training (RMT) would increase inspiratory muscle strength, measured as MIP, improve respiratory function and obstructive sleep apnoea. Sixty-two adults with cervical SCI were randomized to perform active or sham RMT twice daily for 6-weeks. Comparative analyses of pre and post data were performed using the general linear model of univariate analysis using baseline values as the covariate. After 6-weeks there was a greater improvement in MIP in the active group compared with the sham group ( $p<0.001$ ). MIP increased by 33% in the active group compared with an 8% increase in the sham group. There were no significant improvements in maximal expiratory pressure, measures of respiratory function or the apnoea-hypopnea index. There were significant correlations ( $p<0.05$ ) between the change in MIP and inspiratory capacity, vital capacity and peak expiratory cough flow. Progressive RMT does increase inspiratory muscle strength in people with SCI, the magnitude of which is likely to be clinically significant. Measuring baseline MIP-based pneumonia risk thresholds and providing targeted RMT to at-risk individuals may reduce pneumonia rates post SCI.

## Mortality differentials between traumatic and non-traumatic spinal cord injury: a causal inference approach

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Oral Presentations 5, Room C2.5, September 15, 2018, 14:20 - 15:50

**Introduction:** The causal role of underlying health conditions on etiology of SCI and subsequent force of mortality is often speculated upon, but rarely measured. Use of directed acyclic graphs (DAGs) can inform causal inference and aid in identification of causal factors for premature mortality. The objective of the current study is to investigate differentials in the force of mortality according to SCI etiology.

**Methods:** This study uses data collected in the Swiss Spinal Cord Injury (SwiSCI) cohort, which includes permanent residents of Switzerland admitted for first rehabilitation at one of the specialized SCI rehabilitation centers between 1990-2011. Hazard ratios and survival probabilities were estimated using flexible parametric models. DAGs hypothesizing the causal relationship between SCI characteristics and premature mortality informed models for potential confounders.

**Results:** This study includes 2,435 cases of TSCI with 19,704.35 person-years (PYs) of follow-up and 376 recorded deaths; and 1,365 cases of NTSCI with 6,491.13 (PYs) and 552 recorded deaths. TSCI and NTSCI shared similarities in risk of premature mortality, with a higher risk observed for older ages, increased lesion severity, and etiology. However, when comparing risk of premature mortality for TSCI with NTSCI, notable differences in survival were observed, which increased with cumulative time since injury. For example, the survival of NTSCI was 3.4% (95% CI 2.0 to 4.7%) below that of TSCI at 10 years, expanding to 5.6% (95% CI 3.4 to 7.9%) after 20 years post-injury. These differences persisted after exclusion of cases with malignant etiology.

**Conclusions:** This study substantiates the benefits of a causal inference approach when inferring the potential impact of predetermined risk factors. We identified an added force of mortality attributable to SCIs of non-traumatic origin. Therefore, lack of discrimination between NTSCI and TSCI could contribute to misinformed conclusions in SCI literature.

## Platelet Rich Plasma (PRP) for managing sacral pressure ulcer (PU) in people with spinal cord injury- a phase I/II pilot study.

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Oral Presentations 2, Room C2.4, September 13, 2018, 11:30 - 13:00

Study Design: Single-blind, prospective, randomised control trial

Setting: Tertiary Centre, Delhi, India.

Methods: Sixteen participants with spinal cord injury with PU at sacral region were randomly allocated to a control or treatment arm. Participants in both groups received standard care for their PU. In addition, participants in treatment arm received PRP twice a week for 5 weeks. Outcomes were measured at baseline and 5 weeks. There was one primary outcome measure namely- pressure ulcer surface area. The 6 secondary outcome measures included depth of pressure ulcers, PUSH Score, SF 36, participant impression of change using visual analogue scale (VAS), clinician impression of change using VAS and participants' satisfaction using VAS.

Results: 62.53% of the participants had stage IV (n=10) and 18.75% had stage II (n=3) and stage III (n=3) PU. The mean percentage decrease of the pressure ulcer surface area was significantly more ( $t=7.6$ ;  $p=.0001$ ) in the treatment arm as compared to the control arm. The mean ( $\pm$ SD) change in the Pressure Ulcer Scale for Healing (PUSH) score was  $3.25\pm 1.28$  in the treatment arm and  $2\pm 1.3$  in the control arm. Two pressure ulcers completely healed in the treatment arm versus none in the control arm. No adverse events were observed in the treatment arm.

Conclusions: Local application of PRP through injection into the PU surface is safe and a feasible approach. The results of this pilot study are sufficiently positive to provide hope that this simple and cost-effective intervention that may heal pressure ulcer. The pilot data looks promising, however a larger multi-centric trial is required to substantiate this.

## Endogenous cortisol delivery following spinal cord injury: Clinical implications

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Oral Presentations 3, Room C2.5, September 13, 2018, 11:30 - 13:00

**Background:** Trauma elicits a stress response, activating the hypothalamic-pituitary-adrenal (HPA) axis (cortisol, transported by corticosteroid-binding globulin (CBG)), SNS - sympathoneural (noradrenaline) and sympathoadrenal (adrenaline) systems. We hypothesised that spinal cord injury may lead to suboptimal responses of immunomodulatory cortisol-CBG.

**Methods:** Four spinal units in Australia and New Zealand participated in this multi-site, assessor-blinded, randomised controlled trial (ACTRN12611001079932). Participants had sustained a traumatic SCI ASIA Impairment Scale [AIS] A, B or C, T12 or above, less than 4 weeks previously. Participants were randomised to passive or FES-assisted cycle ergometry four sessions per week for 12 weeks. Blood samples (visits 0, 1, 2, 3, 4, 8, 12) were obtained for the analysis of total and free cortisol and CBG determined as total, high-(ha), low-(la) affinity %.

**Results:** 24 subjects participated (38.4 ±15.6 years, 23 male, 11 tetraplegic, 14 AIS A; 4 B. Circulating total and free cortisol levels were comparable to historic controls without injury : baseline (15.5 ±days) 438 ±110 units, and 45.5 ±16.4 nmol/L-1 respectively, and week-12 349 ±189, 32.6 ± 20.4. Serial evaluation of total, la- and haCBG revealed the low haCBG levels: baseline: 487 ±97; 197 ±78; 290 ±56 nmol.L-1; and week-12 507± 66, 198 ± 74, 309 ±66 nmol.L-1; p>0.05.

**Discussion:** The lack of the expected centrally mediated cortisol rise and CBG depletion from neutrophil elastase may lead to a lack of cortisol's action in protecting viable peri-injury tissue, potentially exacerbating the effects of spinal injury.

## Restoration of Active Hand Opening in C5/6 Tetraplegia – The Supinator to Posterior Interosseus Nerve Transfer

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Oral Presentations 1, Room C2.5, September 13, 2018, 09:00 - 10:30

**Introduction:** Restoration of functional hand opening in spinal cord injury (SCI) patients has long been a challenge for upper limb reconstructive surgeons. Nerves transfers offer a promising functional option for C5/6 tetraplegic patients. This study presents the outcomes of 27 consecutive patients (42 limbs) who underwent supinator nerve to posterior interosseus nerve transfer for restoration of active finger and thumb extension.

**Methods:** A single centre study comprising a team of 3 reconstructive surgeons and 2 occupational therapists. 27 consecutive patients with C5 to C7 tetraplegia underwent supinator nerve to posterior interosseus nerve transfer in isolation or combination with other upper limb nerve and/or tendon transfers to restore other functions. Prior to surgery, all patients had preserved biceps and supinator function but absent finger and thumb extension. All patients received follow up hand and occupational therapy and rehabilitation.

**Results:** The outcome measures assessed included manual muscle power testing, first webspace opening and patient satisfaction. Patients had a minimum of 12 months follow-up. At latest follow-up the average Medical Research Council (MRC) grade of muscle power achieved for both finger and thumb extension was 3.4. An average of 90mm of 1st webspace opening was achieved in this cohort.

**Discussion:** Resulting functional gains from the supinator nerve to posterior interosseus nerve transfer included opening the hand to place it around objects, releasing objects, using extended fingers to type or use electronic devices and extending the hand in greeting. This nerve transfer provides a promising option for restoration of finger extension in C5/6/7 tetraplegia with a high patient satisfaction rate and amelioration of functional reconstruction of the tetraplegic upper limb.

## The Pain Course: Exploring the feasibility of an Internet-Delivered Pain Management Program for adults with spinal cord injury (SCI)

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Oral Presentations 4, Room C2.5, September 13, 2018, 16:00 - 17:30

**Introduction:** There is now substantial evidence for the efficacy and acceptability of internet-delivered psychologically-based interventions for adults experiencing common mental health difficulties as well as chronic pain. Such interventions are attracting substantial interest for their potential to overcome common barriers (e.g., stigma, cost, distance, mobility restrictions) to psychologically-based care.

**Methods:** This study examined the feasibility and preliminary outcomes of a modified version of a validated internet-delivered pain management program, the Pain Course, for adults with spinal cord injury (SCI). A single-group feasibility open trial design was employed and sixty-eight patients participated in the 8-week program. Participants were supported through the program with weekly contact from a Clinical Psychologist.

**Results:** Eighty-five percent of participants provided data at post-treatment and 76% of participants completed all 5 lessons of the course. High levels of satisfaction were observed and relatively little clinician time (M = 93.16 minutes; SD = 52.76 minutes) was required per participant to provide the course.

Preliminary evidence of clinical improvements in pain-related disability (ds  $\geq$  0.53.; avg. improvement  $\geq$  20%), depression (ds  $\geq$  0.44.; avg. improvement  $\geq$  24%), anxiety (ds  $\geq$  0.41.; avg. improvement  $\geq$  26%) and average pain levels (ds  $\geq$  0.46.; avg. improvement  $\geq$  13%) were observed at post-treatment, which were maintained or further improved to 3-month follow-up. These improvements were reflected in overall improvements in self-reported quality of life (ds  $\geq$  0.31; avg. improvement  $\geq$  16%).

**Conclusion:** These findings highlight the potential of emerging internet-delivered interventions as an acceptable, efficacious and cost-effective approach for overcoming barriers and increasing access to evidence-based psychosocial care among adults with SCI.

## Morphology of large myelinated axons at 6 to 180 months post spinal cord injury. (SCI) in donor (supra-lesional) and recipient (infra-lesional) nerves utilised for nerve transfers.

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Oral Presentations 3, Room C2.5, September 13, 2018, 11:30 - 13:00

Morphology of large myelinated axons at 6 to 180 months post spinal cord injury. (SCI) in donor (supra-lesional) and recipient (infra-lesional) nerves utilised for nerve transfers.

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Three spinal cord zones, 1) injury, 2) supra-lesional 3) infra-lesional, are loosely demarcated after a SCI. It is widely assumed that nerves from zones outside the SCI injury zone are normal. However, we have shown that peripheral nerves undergo secondary detrimental changes within 18 months post SCI. In particular, myelin thickening, folding and demyelination that can lead to spinal motor neuron death. We obtained peripheral nerves biopsies from patients undergoing nerve transfers, to determine if these axon changes are progressive, leading to LMN death over time. Emerging interventions that seek to reanimate muscle depend on the provision of intact functional peripheral nerves. An understanding of the temporal changes in peripheral nerves post SCI is essential if we are to achieve the best outcomes.

Objective: to directly assessed the morphology of large myelinated axons in nerves that are available for biopsy at the time of surgery.

Methods: supinator (n=7) posterior interosseous (n=4) anterior interosseous (n=1) and ECRB (n=1) nerve samples were collected from 7 patients, 5, 8, 16, 20, 60, 76, 180 months post-SPI. Specimens were fixed in 2.5% Glutaraldehyde, processed, embedded in Araldite Epon, cut, mounted onto slides, and stained with methylene blue for light microscopy.

Results. 75% to 100% of Supinator nerve axons were relatively normal in 5 of 7 patients. Only 35% and 22% of axons were normal in the 60 month and 180 month respectively.

100% of axons in the 76 (AIN) and 180 (PIN) month specimens were normal. The ECRB was 90% normal. The remaining PIN nerves in 4 of 7 patients contained 30% to 90% of abnormal axons. One had a reduced axon density and numerous demyelinated fibres.

Conclusion: Large myelinated axon abnormalities were not more common in nerves of patients with older SCI although other aspects of these nerves need to be assessed.

## Development, Reliability and Validity of the Queensland Evaluation of Wheelchair Skills (QEWS)

Miss Emilie Gollan<sup>1,2,3</sup>, Prof Lisa Harvey<sup>2</sup>, Mr Joshua Simmons<sup>1,3</sup>, Mr Roger Adams<sup>2</sup>, Dr Steven McPhail<sup>4,5</sup>

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Oral Presentations 1, Room C2.5, September 13, 2018, 09:00 - 10:30

**Introduction:** There are currently several ways to assess the wheelchair skills of people with spinal cord injury (SCI). Each of the existing assessments have their strengths, however none are quick to administer while providing a summary of a person's wheelchair skills that is sensitive to the types of changes seen in people with acute SCI. The purpose of this study was to develop and examine the reliability and validity of a test constructed to objectively assess the skills of manual wheelchair users with SCI.

**Methods:** Phase 1: Four Delphi panel rounds with clinical experts were used to develop the QEWS. Phase 2: Intra-rater and inter-rater reliability of the QEWS items were examined in 100 people with SCI. Phase 3a: Concurrent validity was investigated by examining the association between QEWS total scores and physiotherapists' global ratings of wheelchair skill performance. Phase 3b: Construct validity was tested in 20 people with recent SCI by examining change in QEWS total scores between when they first mobilised in a wheelchair and scores obtained 10 weeks later.

**Results:** Phase 1: The QEWS was developed. Phase 2: The intra-class correlation coefficients reflecting the intra-rater reliability and the inter-rater reliability for the QEWS total score were found to be 1.00 and 0.98, with scores being within one point of each other 96% and 91% of the time, respectively. Phase 3a: The QEWS total scores were comparable with the global rating of wheelchair skill performance ( $r^2 = 0.93$ ). Phase 3b: The QEWS scores changed by a median (interquartile range (IQR)) of 4 (1 to 6) points over the 10-week period following first wheelchair mobilisation.

**Conclusion:** The QEWS is a valid and reliable tool for measuring wheelchair skills in individuals with SCI. The QEWS is efficient and practical to administer and does not require specialised equipment.

## Time to first urinary tract infection (UTI) after traumatic spinal cord injury (SCI) predicts subsequent UTI incidence; A Western Australian inpatient cohort study

Ms Louise Goodes<sup>1</sup>, Ms Gabrielle Simpson<sup>1</sup>, Dr Alethea Rea<sup>1</sup>, Dr Kevin Murray<sup>1</sup>, Dr Peter Boan<sup>2</sup>, Ms Anne Watts<sup>2</sup>, Ms Jen Bardsley<sup>2</sup>, Ms Carly Hartshorn<sup>3</sup>, Dr Jeff Thavaseelan<sup>3</sup>, Assoc Prof James Brock<sup>4</sup>, Prof Sarah Dunlop<sup>1</sup>

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Oral Presentations 3, Room C2.5, September 13, 2018, 11:30 - 13:00

Time to first urinary tract infection (UTI) after traumatic spinal cord injury (SCI) predicts subsequent UTI incidence; A Western Australian inpatient cohort study

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Introduction: Following SCI, UTI results in significant morbidity and is a major cause of hospital re-admissions. Bladder management differs at spinal units around Australia and New Zealand and the relationship between early management and subsequent infection rates is largely unknown.

Methods: A retrospective audit was undertaken of all new cases (n=73) of adult SCI managed at both Royal Perth and Fiona Stanley Hospitals from January 2015 – February 2017. Bladder management and UTI incidence was mapped using data from hospital electronic databases, patient medical records and nursing fluid balance charts. Modelling of infection rates and infections during nursing-administered intermittent catheterisation (staff-IC) involved generalised linear models.

Results: Protocols for staff-IC were adhered to closely (84.2% ICs performed within 6.5 hours, 94.4% within 8 hours, only 3.4% of volumes >800mL). The rate of symptomatic UTI was 1.1 starts/100 days; symptomatic UTI by multi-resistant organisms 0.1/100 days. Modelling of potential drivers of UTI showed that the only predictor of higher infection rate was shorter time to first UTI (p-value 0.003). During staff-IC periods, high volumes and interruptions requiring IDCs led to increases in infection rate during the following week (107%, p-value < 0.001; 90%, p-value 0.002 respectively). Delayed ICs (>8 hours) did not change infection rate.

Conclusions: Time to first UTI, high IC volumes and IC interruptions predict higher UTI rates in acute SCI. Preventing early UTIs and high bladder volumes may optimise bladder management both acutely and in chronic SCI.

## Testosterone replacement therapy with and without Resistance Training may Decrease Visceral Adiposity in Men with Spinal Cord Injury

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Oral Presentations 5, Room C2.5, September 15, 2018, 14:20 - 15:50

**Background:** Visceral adipose tissue (VAT) is considered as an independent cardio-metabolic risk factor after SCI. VAT may increase secretion of inflammatory cytokines and negatively impact metabolic health after SCI. Neuromuscular electrical stimulation (NMES)-resistance training (RT) has been shown to evoke skeletal muscle hypertrophy and decreases ectopic adiposity after chronic SCI. The combined effects of testosterone replacement therapy (TRT) and RT on VAT as well as VAT to subcutaneous adipose tissue (VAT: SAT) ratio has yet to be investigated.

**Design:** A Randomized controlled clinical Trial (NCT01652040)

**Setting:** Research Clinical Laboratory in a Medical Center

**Methods:** Twenty-two men with motor complete SCI (C5-T11) were randomized into either TRT+RT group (n=11; 37±12 years; 80.6±15.5 kg; 25±4.5kg/m<sup>2</sup>) or TRT-only group (n=11; 35±8years; 78±9 kg; 25.4±4 kg/m<sup>2</sup>) for 16 weeks. The TRT+RT group participated in a progressive ankle weight lifting program using NMES, twice weekly for 16 weeks while sitting in their wheelchairs. The TRT was provided daily via transdermal testosterone patches (4-6 mg/day) that were alternated on their shoulder for 16 weeks. Multi-axial magnetic resonance imaging was used to measure trunk VAT and SAT in men with SCI. VAT were quantified in the anatomical regions between liver and kidneys (VATL-k), between kidneys and umbilicus (VATK-U), between iliac crests and femoral heads (VAT IC-FH) and total VAT (VATtotal). Mixed model analysis of variance was used to determine the effects of interventions on VAT and VAT: SAT ratio.

**Results:** In the TRT+NMES-RT group, lifted weights significantly (P< 0.0001) increased over the 16-week training period for the right (19.6±6.5 lbs.) and the left (20±6.1 lbs.) legs. VATL-k decreased (P = 0.027) in both TRT+RT (73±57 to 67.5±49.5 cm<sup>2</sup>; P = 0.07) and TRT only (69± 37 to 64±42 cm<sup>2</sup>; P =0.17). VATK-U decreased (P = 0.01) in both TRT+RT (135±100 to 116±77 cm<sup>2</sup>; P = 0.1) and TRT only (119±69 to 64±42 cm<sup>2</sup>; P =0.014). VAT IC-FH decreased (P = 0.032) in both TRT+RT (89±53 to 76±40 cm<sup>2</sup>; P = 0.05) and TRT only (80.5±39.5 to 78±41 cm<sup>2</sup>; P =0.47). VATtotal decreased (P = 0.01) in both TRT+RT (101±71 to 88±55 cm<sup>2</sup>; P = 0.07) and TRT only (91.5±49.5 to 84.5±49 cm<sup>2</sup>; P =0.049).

**Conclusion:** TRT administered at 4-6 mg/day with and without RT caused mobilization and decreased of VAT in men with SCI at different levels of trunk region as well as for the total trunk VAT. The findings have significant cardio-metabolic health implications for men with chronic SCI.

## Diagnostic accuracy of a two-stage screening model for obstructive sleep apnoea in chronic tetraplegia

**Ms Marnie Graco**<sup>1,2</sup>, Dr Rachel Schembri<sup>1</sup>, Mrs Susan Cross<sup>3</sup>, Dr Shirin Shafazand<sup>4</sup>, Dr. Najib Ayas<sup>5</sup>, Dr Viet Vu<sup>6</sup>, Dr. Warren Ruehland<sup>1</sup>, Dr. Mark Nash<sup>4</sup>, Dr. Ching Li Chai-Coetzer<sup>7</sup>, Mr Peter Rochford<sup>1</sup>, Mr Thomas Churchward<sup>1</sup>, Prof Sally Green<sup>8</sup>, Prof David Berlowitz<sup>1,2</sup>

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Oral Presentations 2, Room C2.4, September 13, 2018, 11:30 - 13:00

**Background:** Obstructive sleep apnoea (OSA) is highly prevalent in people with spinal cord injury (SCI). Polysomnography (PSG) is the gold-standard diagnostic test for OSA, however PSG is expensive and frequently inaccessible, especially in SCI. A two-stage model, incorporating a questionnaire followed by oximetry, has been found to accurately detect moderate to severe OSA (MS-OSA) in a non-disabled primary care population. This study investigated the accuracy of the two-stage model in chronic tetraplegia using both the original model and a modified version for tetraplegia.

**Methods:** An existing dataset of 78 people with tetraplegia was used to modify the original two-stage model. Multivariate analysis identified significant risk factors for inclusion in a new tetraplegia-specific questionnaire. Receiver Operating Characteristics (ROC) curve analyses of the questionnaires and oximetry established thresholds for diagnosing MS-OSA. The accuracy of both models in diagnosing MS-OSA was prospectively evaluated in 100 participants with chronic tetraplegia across four international SCI units.

**Results:** Injury completeness, sleepiness, self-reported snoring and apnoeas were included in the modified questionnaire, which was highly predictive of MS-OSA (ROC Area Under Curve 0.87(95%CI 0.79-0.95)). The 3% oxygen desaturation index was also highly predictive (0.93(0.87-0.98)). The two-stage model with modified questionnaire had a sensitivity and specificity of 83%(66-93) and 88%(75-94) in the development group, and 77%(65-87) and 81%(68-90) in the validation group. Similar results were demonstrated with the original model.

**Conclusion:** Implementation of this simple alternative to full PSG could substantially increase the detection of OSA in patients with tetraplegia and improve access to treatments.

## Resilience among family members after SCI: Associations with indicators of positive adjustment

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Oral Presentations 5, Room C2.5, September 15, 2018, 14:20 - 15:50

**Introduction:** Much of the focus on family member adjustment to their relative's SCI has been upon caregiver burden and distress. Less is known about the role that resilience might play in contributing to family wellbeing after SCI. The aim of this study was to examine the association between resilience and potential mediating factors of positive family adjustment; and the association between resilience and the psychological wellbeing of family members.

**Methods:** Family members (n=50) providing support to a person with SCI were recruited from two SCI rehabilitation units in Sydney, Australia. Participants completed scales for both mediating (Connor Davidson Resilience Scale, CD-RISC; Herth Hope Index, HHI; General Self-Efficacy Questionnaire, GSEQ; Medical Outcome Study Social Support Survey, MOS-SSS) and outcome variables (Positive and Negative Affect Scales, PANAS; General Health Questionnaire, GHQ-28; SF-36, Mental Health Subscale, MH; Caregiver Burden Scale, CBS). Demographic information for both family members and the injured relatives was collected.

**Results:** The average score for family members on resilience was 74.18 comparable with previous studies. There was a strong positive correlation between resilience and other potential mediating factors namely hope ( $r=.76$ ), self-efficacy ( $r=.66$ ), and social support ( $r=.58$ ). Regarding psychological well-being, resilience was strongly associated with positive affect ( $r=.75$ ). Moderate negative correlations were also observed between resilience scores and psychological distress, measured by the GHQ-28 ( $r=-.40$ ), as well as caregiver burden (CBS,  $r=-.49$ ).

**Conclusions:** Resilience was strongly associated with a range of potential mediating factors for family psychological well-being. The negative associations with psychological distress and caregiver burden suggest it may also play a protective role in relation to negative family outcomes.

## Efficacy and safety of mirabegron for the treatment of neurogenic detrusor overactivity due to spinal cord injury – secondary analysis of the prospective, randomised double-blind, placebo-controlled study

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Oral Presentations 3, Room C2.5, September 13, 2018, 11:30 - 13:00

**Introduction:** Mirabegron is approved for treatment of idiopathic overactive bladder, however the data about use of mirabegron in patients with spinal cord injury (SCI) are missing. The aim of this secondary analysis was to assess efficacy of mirabegron in the treatment of NDO in the SCI patients.

**Methods:** Originally, this was a prospective, multi-centre, randomised, double blind, placebo controlled study enrolling patients with NDO due to SCI and multiple sclerosis. After 2 weeks lasting wash out period, eligible subjects were randomised in 1:1 ratio to active treatment (mirabegron 50 mg) (Group A) or placebo (Group B) for 4 weeks treatment period. Urodynamic parameters, 24hours pad weight test (PWT) and patient – reported outcome variables were assessed at randomisation and at the end of study visit. Safety assessments included the monitoring of the incidence and severity of adverse events over the study period. Changes in time and differences between groups were assessed using non-parametric Kruskal-Wallis one-way ANOVA test.  $p$  values  $\leq 0.05$  were considered statistically significant.

**Results:** Total of 49 patients with SCI were enrolled into the study. There was an increase of cystometric capacity ( $p=0.0218$ ), increase of volume at first detrusor contraction ( $p=0.0004$ ) and improvement of bladder compliance ( $p=0.0016$ ) in mirabegron group comparing to placebo, while no significant change in maximal detrusor pressure was detected in any group ( $p = 0.7541$ ). Treatment with mirabegron was associated with the clear numerical trend to reduce urine leakage as measured by 24hours PWT ( $p=0.0613$ ). There were statistically significant changes in all patient – reported outcome variables in favour to mirabegron group – Patient Perception of Bladder Condition scale ( $p=0.0042$ ), I – QoL questionnaire ( $p=0.0185$ ) and Treatment satisfaction - visual analogue scale ( $p=0.0002$ ).

**Conclusions:** Mirabegron 50 mg improves both urodynamic and patient – reported outcome variables in patients with NDO due to SCI.

## Education, referral, and prescription improve physical activity, psychosocial predictors, and fitness in individuals with spinal cord injury

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Oral Presentations 5, Room C2.5, September 15, 2018, 14:20 - 15:50

**Introduction:** The remarkable number of reported barriers to physical activity (PA) participation in individuals with spinal cord injury (SCI) suggests that PA-enhancing interventions tailored to the individual are needed. However, developers of behavioural PA interventions have often neglected to consult end-users (e.g. individuals with SCI, physiotherapists) in intervention design. Furthermore, it has yet to be shown in a randomized controlled trial (RCT) that behavioural PA interventions can improve aerobic fitness in individuals with SCI. This study examined the effects of a PA intervention developed in collaboration with over 300 individuals with SCI and physiotherapists and its effects on PA behaviour, aerobic fitness, and psychosocial predictors of PA in individuals with SCI. **Methods:** Twenty-eight men and women with chronic SCI (C4-L3, age=45.0±11.5yrs, YPI=16.4±12.4) were stratified by baseline PA level and randomized to an intervention or control group. The intervention group received an introductory personal training session followed by 8, weekly 15-minute PA behavioural coaching sessions. The control group was wait-listed. PA was assessed using accelerometers and self-report at baseline, week 4, 7, and end-intervention and aerobic fitness and psychosocial predictors of exercise were assessed before and after the intervention using survey methods and an incremental exercise test, respectively. **Results:** Comparing intervention to control at end-intervention, the intervention group showed 17% higher accelerometer-measured PA ( $7.0 \times 10^5 \pm 2.7 \times 10^5$  versus  $6.0 \times 10^5 \pm 3.9 \times 10^5$  vector magnitude counts;  $p=0.014$ ), 500% higher self-reported moderate-vigorous PA ( $280.3 \pm 309.3$  versus  $48.2 \pm 69.5$  min/day;  $p=0.026$ ), and 19% higher  $VO_2$ Peak ( $1.3 \pm 0.4$  versus  $1.0 \pm 0.4$  L/min;  $p<0.001$ ). Psychosocial predictors of physical activity (outcome expectancies, intentions, self-efficacy, self-regulation, knowledge, and social support) were also significantly more positive in the intervention group compared to control. **Conclusions:** This is the first RCT to demonstrate that a behavioural PA intervention co-created by end-users can sufficiently improve PA to increase aerobic fitness in individuals with SCI.

## Unique Predictors of Perceived Injustice and Depression – Evidence for Distinct Psychological Constructs

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Oral Presentations 4, Room C2.5, September 13, 2018, 16:00 - 17:30

**Introduction:** Given the interaction between psychological and physical health, an understanding of psychosocial functioning after SCI is essential. Perceived injustice—the belief that one’s pain/injuries are undeserved and attributable to another’s error or negligence—has been identified as a predictor of negative physical and psychosocial outcomes in acute and chronic pain conditions. It has been suggested that perceptions of injustice may be a surrogate for depression after SCI. Therefore, the purpose of the present study was to identify unique predictors of perceived injustice and depression within the first year after SCI.

**Methods:** Participants were 75 (51 male) adults receiving acute inpatient rehabilitation following SCI. Mean age was 48 years. Level of injury was as follows: 43 cervical, 24 thoracic, and 4 lumbar. ASIA Impairment Scale (AIS) scores were as follows: 15 A, 9 B, 18 C, and 18 D. Measures were given during inpatient rehabilitation and again one year post-injury. Depressive symptoms were assessed with the PHQ-8 and perceived injustice with the Injustice Experience Questionnaire (IEQ). General linear models were fit to examine the multivariable relationship between predictors and each outcome (IEQ and PHQ-8) at two time points – acute rehabilitation and at one year post-discharge.

**Results:** During acute rehabilitation, pain intensity, time since injury, PTSD, and perceived disability explained 45% of the variance in perceived injustice. In contrast, only perceived disability and PTSD were significantly associated with depressive symptoms ( $r^2=0.31$ ). Similarly, at one year post-injury, unique predictors of injustice emerged that were not related to depressive symptoms. Pain, depressive symptoms, age, and time since injury accounted for 44% of the variance in perceptions of injustice, whereas no significant predictors of depressive symptoms were identified.

**Conclusion:** We identified unique predictors of injustice perception one year post-discharge. Results suggest injustice perception is distinct from depression supporting targeted interventions for each construct.

## Bisphosphonate use is associated with lower levels of the bone-derived hormone osteocalcin

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Oral Presentations 3, Room C2.5, September 13, 2018, 11:30 - 13:00

**Introduction:** Osteocalcin is a hormone produced exclusively by osteoblasts in the bone microenvironment that circulates in blood and signals in a paracrine fashion via functional receptors in the pancreas, muscle, adipose tissue, testis, and brain. Undercarboxylated osteocalcin regulates glucose metabolism by increasing  $\beta$ -cell proliferation and insulin synthesis, muscle metabolism by increasing insulin sensitivity in myocytes, fat metabolism by increasing insulin sensitivity and adipokine production (adiponectin) in adipocytes, and reproductive status by stimulating testosterone production in the testis. Osteoclastic bone resorption is required for the hormonal activation of osteocalcin. Bisphosphonates are anti-resorptive drugs that block osteoclastic bone resorption. The goal of this study was to determine if total osteocalcin levels were lower in bisphosphonate users with SCI.

**Methods:** We assessed the association between clinical and demographic factors, bisphosphonate use, and circulating total osteocalcin levels in 219 men with chronic spinal cord injury (>3 years post-injury) and in 51 males without spinal cord injury. Bisphosphonate use was defined as active use of an oral or injected bisphosphonate for at least 1 year prior to testing. Total osteocalcin levels in serum were quantified by ELISA. Percent body fat was determined by whole body DXA.

**Results:** Total osteocalcin levels did not vary significantly between men with and without SCI. We found that total osteocalcin levels were significantly lower in bisphosphonate users, were positively associated with circulating interleukin-6 levels, and were negatively associated with percentage body fat.

**Conclusions:** Bisphosphonate use is associated with lower total osteocalcin levels. These findings suggest that the commonly prescribed bisphosphonates may exacerbate SCI-related infertility and glucose dysregulation by altering the circulating level and hormonal activity of osteocalcin.

## Energy needs in people with spinal cord injury undergoing surgical repair of chronic pressure injuries

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Oral Presentations 2, Room C2.4, September 13, 2018, 11:30 - 13:00

### Introduction

Consensus dietetic guidelines for people with spinal cord injury (SCI) who have pressure injuries (PIs) recommend an increased energy intake to optimise wound healing, but evidence to support this is limited. The impact of PI surgical repair on energy needs is also unknown. The aims of this study were to determine the resting energy needs of people with SCI admitted to hospital with established chronic PIs and investigate the energy burden of PI surgical repair and healing. A secondary aim was to observe weight change from pre-surgery until hospital discharge.

### Methods

Data was collected at the bedside following an overnight fast of  $\geq 8$  hours. Resting energy expenditure (REE) was measured using indirect calorimetry (canopy hood) for  $\geq 20$  minutes one week pre-surgery, one week post-surgery, on removal of stitches and on return to unrestricted wheelchair sitting with complete healing (at discharge). Weight was measured one week pre-surgery and at discharge. Clinical energy prescription was based on measured REE.

### Results

To date, eight individuals have undergone surgery to repair chronic PIs (100% male, median age 52 years [range 41-72 years]; C4-T10 AIS A-B, n=1 spina bifida). Pre-surgery, dietetic guidelines for energy prescription overestimated energy requirements by 30-70% in seven of eight individuals. There was no change to REE across time points ( $<10\%$  variation), with the exception of one individual who experienced a clinically significant (30%) increase in REE one week post-surgery, possibly due to infection. Despite energy prescription individualised to REE, weight gain between 2-17kg was observed in three quarters of individuals.

### Conclusion

The presence of chronic PIs, surgical repair or subsequent healing do not impact the energy needs of people with SCI and weight gain is common. Current guidelines recommending increased energy prescription conflict with these data and may increase risk of unintentional weight gain over the course of healing.

## Renegotiating relationships after spinal cord injury.

Dr Jo Nunnerley<sup>1,2</sup>, Dr Johnny Bourke<sup>1</sup>, Prof Sarah Derrett<sup>2</sup>, Dr Martin Sullivan<sup>1</sup>

<sup>1</sup>*Burwood Academy of Independent Living, Christchurch, New Zealand*, <sup>2</sup>*University of Otago, Dunedin, New Zealand*

Oral Presentations 4, Room C2.5, September 13, 2018, 16:00 - 17:30

Spinal Cord Injury (SCI) can have substantial consequences for the injured person, and also their family/whānau. Family members can adopt either formal or informal care roles when the person returns home, and people with high-level care requirements may also need non-family support workers. This study looks at the importance of these relationships during the transition from hospital to home.

### Method

Nineteen SCI participants from the New Zealand longitudinal study (n=118) were interviewed six months post-discharge from either of New Zealand's two spinal units. Data were analysed using the qualitative framework method.

### Results

Three themes captured participants' relationship experiences during the time of transition: Role disruption, examines how participants' pre-SCI family/whānau relationships underwent change as previously understood parameters of engagement were disrupted. A Balancing act, explores the challenge of renegotiating previously-understood parameters, and the balancing required by participants and whānau. In A Stranger in the Room we contend relationships between participants and support workers was (necessarily) new to the participant, but also to their family/whānau who also had an 'outsider' in their home. The specifics of 'their' relationship was also new to the support worker; as such, negotiating the parameters of this relationship was three-way – and could only occur on transition home.

### Conclusion

SCI necessitates a renegotiation of relationships and, for some, also involves the negotiation of a new type of relationship with support workers. Understanding the ways a SCI may affect relationships can enable rehabilitation services to better-support people with SCI and their family to prepare for their transition home.

## Validity and Reliability of the International Spinal Cord Injury Quality of Life Basic Data Set in Thai Version

Dr. Luntarima Suttinoon<sup>1</sup>, Dr. Sintip Pattanakuhar<sup>1</sup>, Dr. Siam Tongprasert<sup>1</sup>, Dr. Tinakorn Wongprakaran<sup>2</sup>

<sup>1</sup>Department of Rehabilitation Medicine, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand, <sup>2</sup>Department of Psychiatry, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand

Oral Presentations 4, Room C2.5, September 13, 2018, 16:00 - 17:30

Study Design: Descriptive Study

Objectives: To examine the content validity, criterion validity and test-retest reliability of the Thai version of the International Spinal Cord Injury Quality of Life Basic Data Set (ISCI-QoL).

Setting: Department of Rehabilitation Medicine, Maharaj Nakorn Chiang Mai, Thailand

Subjects: Traumatic spinal cord injury (SCI) and Non-traumatic SCI patients, age more than 18 years old, understanding and able to read Thai language

Methods: After informed consent, participants were assigned to complete 2 questionnaires, The Thai-version of the ISCI-QoL and WHO-QoL BREF, by themselves. The ISCI-QoL consists of three single items on satisfaction with life as a whole (W-QoL), physical health (P-QoL) and psychological health (M-QoL). After 2 weeks, the patients were evaluated by telephone to assess test-retest reliability.

Results: From the calculated participants of 130, data of 50 patients were available. Mean age was 42.56 years (SD 11.69) and mean time after SCI was 19.60 (SD 10.30). 30% were group A, B and C paraplegia. Mean scores were 7.02 (SD 1.78) for W-QoL, 6.86 (SD 2.15) for P-QoL and 7.24 (SD 1.64) for M-QoL. Strong content validity (0.66) and internal consistency (Cronbach's alpha 0.845) were found between the items. For the criterion validity, moderate correlations were found between W-QoL and overall score of WHO-QoL BREF (0.549), P-QoL and physical health score of WHO-QoL BREF (0.479), and M-QoL and psychological health score of WHO-QoL BREF (0.419). Notice that the correlation was increased to moderate to strong degree (0.622) when using mean of three satisfaction scores to compare with overall score of WHO-QoL BREF. The test-retest reliability of ISCI QoL was indicated excellent reproducibility, ranged from 0.878-0.891.

Conclusion: The Thai version of ISCI-QoL showed good test-retest reliability. The validity was acceptable and could be used to assess quality of life in Thai SCI individuals.

## The effects of activity-based therapy on mobility, functional abilities and quality of life after SCI: Participants' perceptions and experiences.

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Oral Presentations 5, Room C2.5, September 15, 2018, 14:20 - 15:50

The effects of activity-based therapy on mobility, functional abilities and quality of life after SCI:  
Participants' perceptions and experiences.

Authors: Camila Quel de Oliveira, PT1,2; Anita Bundy, ScD1; Kathryn Refshauge, PhD1; James Middleton, PhD3; Glen Davis, OAM PhD1.

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**Introduction:** There is growing evidence that activity-based therapies (ABT) can promote improvement in muscle strength, balance and functional abilities following a spinal cord injury (SCI). The exercises included in an ABT program are performed out of the wheelchair, involving weight bearing of the lower limbs (mainly in standing) and other modalities to facilitate movement in paralysed muscles. Exercising in the upright position has been shown to impact positively on quality of life and well-being for people with disabilities. Therefore, the present study sought to examine the perceived effects, life context, experiences and feelings of people with SCI from participating in a community-based multimodal ABT exercise program using a qualitative approach.

**Methods:** Eight individuals with SCI who participated in a multimodal ABT program for a period longer than eight weeks were interviewed via an open-ended semi-structured interview. An inductive thematic analysis, involving a systematic process of coding and identifying themes, was conducted.

**Results:** Two main themes and nine subthemes related to the participants' perceived benefits, opinions and feelings for the program were identified. The two main themes were: "Reduced impact of disability and increased life involvement (with a sense of return to life as before)" and "The program is different from usual rehabilitation". Participants reported increased confidence to attempt new tasks, which reflected in greater independence and community participation. They acknowledged that the environment of the program and the exercises performed had a positive effect on well-being. Participants' responses that were representative of each theme were used to describe each theme.

**Conclusion:** There was an overall sense of enjoyment from participating in the program with participants reporting benefits in many areas that surpassed the physical domain. Our findings suggest that a multidisciplinary team approach that includes occupational therapists and psychologists could maximise the benefits achieved by ABT programs in the community.

## Skin physiology changes after local heat treatment in patients with complete paraplegia in the paralyzed and the unaffected area

**Dr Anke Scheel-Sailer<sup>1</sup>**, Nushaba Aliyev<sup>1</sup>, Alessia Wildisen<sup>2</sup>, PhD Simon Annaheim<sup>3</sup>, Dominique Jud<sup>2</sup>, PhD Jörg Krebs<sup>1</sup>, PD Dr. med. Reto Wettstein<sup>4</sup>

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Oral Presentations 2, Room C2.4, September 13, 2018, 11:30 - 13:00

**Introduction:** Standardized local heating is discussed to improve skin condition in the context of pressure ulcer treatment and preconditioning to reduce complication after flap surgery. The aim of this study is to observe skin physiology in patients with complete paraplegia after standardized heat application either with water filtered infrared A radiation (wIRA) (HydroSun, Müllheim, DE) or with thermal water therapy (TWT) (Hylotherm, Argenbühl Eisenharz, DE) in a paralyzed area (thigh) and an unaffected area (upper arm).

**Method:** Prospective intervention study. 15 patients with complete paraplegia between Th2 and Th12, at least 12 weeks after the lesion were included. In a 24-degree celsius acclimatized room the patients received heat applications either with wIRA or WWT at the thigh and the upper arm. Three half hour applications were followed by half an hour rest between the applications. We measured temperature (MRS 12 Logger and Optris PI 400), skin redness (Mexameter® MX18) and blood perfusion (PeriFlux System 5000) as a baseline, after the interventions and at the next morning. The wellbeing was tested with a visual analogue scale.

**Results:** We included 15 patients, 3 women, 12 men, mean age 44±10 years. In all patients, both heat applications were well tolerated, without burns or other side effects. Temperature (p 0.005-0.008) as well as blood perfusion increased significantly (p 0.005-0.013). Skin redness did not change significantly. Blood perfusion and temperature showed a trend to increase more and faster in the wIRA group. There was a significant increase after the first application (arm p=0.011 arm, leg p=0.001). After the second and third application, no significant difference was observed. No significant differences in any parameter were observed between the paralyzed and non-paralyzed area.

**Conclusion:** Patients with paraplegia can be treated safely with both interventions, and perfusion increases significantly. No differences were found between both areas. The effects on wound healing should be investigated further.

## Validation of the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) for patients with non-traumatic spinal cord lesions (NTSCLs).

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Oral Presentations 1, Room C2.5, September 13, 2018, 09:00 - 10:30

**Aim.** The ISNCSCI are the gold standard for the evaluation of patients with traumatic spinal cord injuries. They are widely used also in patients with NTSCLs. However, there is no study showing the psychometric characteristics of ISNCSCI in NTSCLs. This study is aimed at evaluating the validity of ISNCSCI in patients with NTSCLs.

**Methods.** We examined all patients with NTSCLs aged over 18, provided that cognitive status allowed collaboration to the examination. We recorded:

- demographic and clinical data
- neurological status was assessed by two different examiners at a distance of 48-72 hours according to the ISNCSCI, recording: right and left motor/sensory level, Neurological Level of Injury, total, upper limbs (UEMS) and lower limbs (LEMS) motor scores, light touch and pin prick scores, ASIA Impairment. One examiner also assessed the functional status of patients through Spinal Cord Independence Measure (SCIM).

**Statistics:**

- Descriptive statistics: mean and standard deviation for continuous data; percentages for non-continuous data
- Inter-rater reliability and convergent validity with the SCIM by Spearman R and Intra-Class Correlation Coefficient.
- The agreement of lesion levels and AIS between the two examiners by K Agreement

**Results:** 53 patients were evaluated (36M, 17F, age 60.6±15.5 years), for a total of 78 evaluations. Ten patients presented with AIS A, 3 with B; 14 with C and 26 with D. Lesion was cervical in 14 patients, thoracic in 21, lumbar in 18. The inter-rater reliability was between 0.864 and 0.988 for all the variables. The correlation between SCIM subscale "self-care" and UEMS was 0.480 and the correlation between LEMS and the subscale "mobility" was 0.727. The agreement of AIS and levels varied between 0.949 and 0.579.

**Conclusions:** The ISNCSCI in a population of subjects with NTSCLs showed good psychometric characteristics thus representing a reliable tool for clinical and research assessment.

## Optimizing motivation and physical activity among adults with paraplegia through telerehabilitation: A pilot randomized controlled trial

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Oral Presentations 5, Room C2.5, September 15, 2018, 14:20 - 15:50

**Introduction.** Using theory-based approaches and innovative methods such as telerehabilitation could provide a solution to enhance physical activity among adults with spinal cord injury (SCI). Grounded in self-determination theory, we conducted an 8-week pilot telerehabilitation randomized controlled trial (RCT) among adults with paraplegia. The purpose was to determine if intervention participants had greater increases in autonomous motivation (i.e., valuing and enjoying physical activity) and physical activity than control participants.

**Methods.** Adults with paraplegia [M(age)= 51.32 years, SD(age)= 12.07 ; 68% men, M(years since injury)= 14.14; SD(years since injury)= 12.33] were randomized to the intervention group (n = 10) or the control group (n = 12). Intervention participants received eight weekly individualized physical activity counselling sessions, while the control group was asked keep their daily routine. Participants completed self-reported questionnaires at baseline, mid, and end of the intervention. Using hierarchical regressions, change in explained variance ( $\Delta R^2$ ) of 0.02, 0.13, and 0.26 represented small, moderate, and large effects of the intervention, respectively.

**Results.** Compared to the control group, the intervention group had moderate changes in autonomous motivation at mid ( $\Delta R^2 = .12$ ) and end of intervention ( $\Delta R^2 = .17$ ). Similarly, the intervention group saw greater changes in total physical activity at mid-intervention ( $\Delta R^2 = .16$ ) and large changes at end of the intervention weeks ( $\Delta R^2 = .23$ ).

**Conclusions.** This pilot RCT is the first to demonstrate the effectiveness of a self-determination theory, telerehabilitation intervention on increasing autonomous motivation and physical activity among adults with SCI. We now have evidence to transition this pilot RCT to a full trial.

**Acknowledgement.** This research project was supported by a Craig H. Neilsen Psychosocial Research Pilot Grant.

## Differences in positive and negative pain variables for people with spinal cord injury: A comparison of in-patient and out-patient samples.

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<sup>1</sup>*University Of Buckingham, Buckingham, United Kingdom*

Oral Presentations 4, Room C2.5, September 13, 2018, 16:00 - 17:30

### Introduction

It is estimated that over 62% of people with a spinal cord injury (SCI) experience chronic pain, (Ullrich, Jensen, Loesser & Cardenas, 2007), and SCI pain is unusually resistant to standard pain management programmes (Perry, Nicholas & Middleton, 2010). The development of a tailored programme requires a profile of the biological, psychological, and social characteristics of chronic pain sufferers with SCI, but the existing knowledge base is fragmented. This study examines the range and interactions of the characteristics that could be involved.

### Method

A cross-sectional study was employed with 60 in-patients of the National Spinal Injuries Centre, UK, and 47 out-patients who had been out of hospital for a minimum of two years. Participants completed two pain assessment questionnaires and six psychological assessments and provided salivary cortisol samples to assess the biological marker of stress.

### Results

T Tests showed that there were no significant differences between in-patient and out-patient participants on the more negative variables of depression, anxiety, mental defeat, perceived stress and pain catastrophizing. However, in-patients showed greater resilience to their injury, greater pain acceptance and received more solicitous responses from their significant other than out-patients. Out-patients had higher catastrophic negativity in relation to their injury. The in-patient and out-patient data sets were then combined to carry out a multiple regression to see how well the negative variables predicted pain intensity. The model was significant overall, but only perceived stress and pain catastrophizing contributed significantly.

### Conclusion

The results suggest that people with SCI may have greater resilience and find pain easier to accept whilst they have the support of hospital staff. Once they leave hospital they become less resilient and experience greater negativity in relation to their injury. Catastrophic thinking and stress are particularly important where pain is concerned and should be included in treatment interventions.

## GETTING THE UPPER HAND – DISTAL NERVE TRANSFERS FOR PINCH AND GRASP IN TETRAPLEGIA

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Oral Presentations 1, Room C2.5, September 13, 2018, 09:00 - 10:30

**Abstract:** Distal nerve transfers to reconstruct grasp and pinch perform better than the brachialis to anterior interosseous nerve transfer in mid-cervical spinal cord injury. Combining a distal nerve transfer for grasp and pinch in one hand with a traditional tendon transfer reconstruction in the other, and a supinator to posterior interosseous nerve transfer for hand opening bilaterally, may improve the range of functions achieved.

**Keywords:** Nerve transfer, anterior interosseous nerve, spinal cord injury, reanimation, tetraplegia

### Introduction

Results for the brachialis to anterior interosseous nerve transfer for restoration of grasp and pinch in tetraplegia in our unit have been disappointing. In a retrospective review of 13 brachialis to anterior Interosseous nerve (AIN) transfers in our unit an MRC grade of 3 or more for finger flexion and thumb flexion was attained in only 47% and 54% of cases respectively. The mean MRC grade for flexor digitorum profundus (FDP) was 2.5 and for flexor pollicis longus (FPL) was 2.1. This prompted a re-evaluation of the use of this transfer and a shift, where donor nerves were available, to the use of more distal nerve transfers for grasp and pinch and the use of tendon transfers for reconstruction of grasp and pinch in the contralateral hand. The combination of these two types of transfers for grasp and pinch gives patients one “power hand”, reconstructed with tendon transfers, and one more natural- looking and open hand, reconstructed with nerve transfers, which still has functional strength but which performs better in open hand functions such as in grasping larger objects, typing, swiping on mobile devices, self-catheterisation and in social interactions. This study presents the outcomes of 8 patients undergoing distal nerve transfers for re-animation of grasp and pinch all with at least 12 months of follow up.

### Methods

The records of 8 cervical spinal cord injured patients who underwent nerve transfer surgery, at a single institution between 2013 and 2017 was undertaken. All patients had nerve transfers targeting the AIN using a donor nerve arising distal to elbow. Patients’ post-operative power was graded using the MRC grading system and lateral pinch and grasp was measured in the extensor carpi radialis brevis (ECRB) to AIN group. Functional outcome measures including the Action Research Arm Test (ARAT), the Modified Grasp-Release Test (MGRT), and the Spinal Cord Independence Measure (SCIM) were also employed in this group.

### Results

8 patients (7 male and 1 female) underwent surgery on 8 limbs. The mean age at spinal cord injury was 32 years (18-46). Excluding one outlier who underwent surgery at 2292 days post injury, patients had a mean time to surgery of 303 days (188- 435). AIS score on admission to the rehabilitation unit ranged from C3-6 and all patients had complete motor injuries. Patients who had an ECRB to AIN nerve transfer (n=4) all had an International Classification (IC) grade of 4 and those who had a supinator to AIN (n= 3) or brachioradialis

to AIN (n=1) transfer had an IC grade of 1. All patients had simultaneous tendon and/or nerve transfers to reconstruct other functions in the same limb. Patients were followed up a mean 800 days (433-1463) post-surgery. An MRC grade of 3 or more for both FPL and FDP was achieved in 87.5% of patients. The mean MRC grade for both FPL and FDP was 3.75. Patients achieved a mean grip strength of 2.9 kg (6.4lb) measured on a hand dynamometer and a mean pinch strength of 3.11 kg (6.9lb) measured on an adapted pinch meter. Functional outcomes were positive with improvements in scores, measured at 24 months post-surgery, for all the functional assessments listed above - ARAT mean pre surgery 16.5 and 33.7 post-surgery, SCIM mean pre surgery 30 and 41.7 post-surgery and GRT scores improved for every activity.

#### Discussion

Distal nerve transfers are superior to the Brachialis to AIN transfer for restoring grasp and pinch in terms of reliability and power. However, they can only be performed in lower level injuries. Combining tendon transfer reconstructions for grasp and pinch on the contralateral hand may increase the range and ease of functions that can be performed.

## A new measure of societal participation for people with spinal cord injury: Participation Assessed with Recombined Tools – Objective (PART-O)

**Dr. Gale Whiteneck<sup>1</sup>**, Dr. Jessica Ketchum<sup>1</sup>, Ms. Julie Gassaway<sup>2</sup>, Mr. Dave Mellick<sup>1</sup>, Ms. Stephanie Maunton<sup>1</sup>, Ms. Sara Huey<sup>1</sup>, Ms. Janice Tilley<sup>2</sup>

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Oral Presentations 1, Room C2.5, September 13, 2018, 09:00 - 10:30

**Introduction:** Participation is a key outcome after spinal cord injury (SCI) rehabilitation. The Craig Handicap Assessment and Reporting Technique (CHART) is the most frequently used measure of participation in SCI, but has been criticized for psychometric weaknesses (e.g., a skewed distribution and ceiling effects). The Participation Assessed with Recombined Tools – Objective (PART-O) is a participation measure developed for, and used widely in traumatic brain injury (TBI). PART-O content was based on CHART and other objective participation measures; thus it is not unique to TBI populations. The aim of this research is to determine the psychometric properties of PART-O in people with SCI.

**Methods:** The PART-O and CHART were administered to 468 people with SCI discharged from 2 large rehabilitation hospitals from 4 months to 40 years post injury as part of the SCI Model Systems anniversary interviews. The PART-O was administered again 2-4 weeks later to assess test-retest reliability. Rasch analysis was used to ensure a unidimensional linear measure and evaluate the psychometric properties of PART-O in SCI.

**Results:** To achieve unidimensionality and maintain ordered steps within item categories, 3 competing items (hours per week spent working, in school, and homemaking) were summed into a testlet, and infrequently endorsed categories were combined. The resulting measure was unidimensional (first contrast less than 2.00) with all items fitting well (no infit or outfit above 1.40 and no disordered categories in any item), and acceptable person separation (2.00) and reliability (0.80). PART-O had a normal distribution with no ceiling or floor effects. The test-retest reliability was 0.97 and the correlation between PART-O and CHART was 0.79.

**Conclusions:** The PART-O shows promise for expanding its use into SCI. It is highly correlated with the legacy CHART instrument, and it has advantages over CHART, of being a normally distributed linear measure without ceiling effects.

## Nerve transfer to achieve elbow extension—can we predict outcomes?

**Dr Nilay Yalcin**<sup>1</sup>, Mr Stephen Flood<sup>1</sup>, Mr Michael Weymouth<sup>1</sup>, Prof Mary Galea<sup>2</sup>, Dr Bridgette Hill<sup>1</sup>, Ms Catherine Cooper<sup>1</sup>, Ms Jodie Hahn<sup>1</sup>, Ms Natasha van Zyl<sup>1</sup>

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Oral Presentations 1, Room C2.5, September 13, 2018, 09:00 - 10:30

### Introduction:

Achieving satisfactory elbow extension as a part of surgical reanimation for the upper limb post cervical spinal cord injury (SCI) has been traditionally achieved with tendon transfers requiring lengthy immobilization. Nerve transfers offer an alternative with early mobilization. The aim of this study was to determine the patients who would benefit from nerve transfer surgery to achieve elbow extension by measuring a series of pre- and intra-operative factors and correlating them with outcomes.

### Methods:

Eighteen patients with cervical SCI (C4-C6) underwent nerve transfer surgery to re-animate the triceps muscle. The donor nerves used were Nerve to Teres Minor and /or the motor branch of the posterior division of the axillary nerve. Post-operatively, the patients underwent rehabilitation with hand therapy. Elbow extension strength was measured between 18-24 months post-op. SCI level, time to surgery post SCI, results of pre-op EMG of donor and recipient nerve's muscles and intra-operative nerve stimulation were correlated with outcomes.

### Results:

A total of 29 upper limbs in 18 patients were included in the study. Operations were carried out within 5-32 months (average 12 months) from injury. All patients had no elbow extension pre-operatively. The average post-op MRC grade was 2.72 (range 1-5). Three patients (4 limbs) had no improvement in elbow extension with nerve transfers. Whilst patients who had their transfers early (within 18 months) had better outcomes this trend did not reach statistical significance. Fibrillations measured on pre-operative EMG studies did not predict outcomes of the transfer. Patients who had motor injury at level C4 who then recovered to C5/C6 did not achieve as high post-op power as patients whose original injury levels were C5/C6. (MRC 2 vs 3).

### Conclusion:

Nerve transfer surgery is a valid procedure for re-animation of elbow extension in cervical spine injury for carefully selected patients.

## A preliminary evaluation of the innovative surgery to reconstruct thoracic breathing in patients with high cervical spinal cord injury

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Oral Presentations 2, Room C2.4, September 13, 2018, 11:30 - 13:00

**Introduction:** theoretically, the trapezius muscle strength is well preserved in patients with cervical spinal cord injury (CSCI) below C2 level and can be surgically transferred to the rib cage through the scapula to recover the lost thoracic breathing, thus to improve respiratory function and to enhance cough and expectoration. We developed an innovative surgical technique using the trapezius muscles that we call rib suspension surgery (or thoracic breathing reconstruction). The surgery is mainly applicable for high CSCI, which accounts for 18.5% of the population with spinal cord injury. Here, we report the preliminary evaluation of the effect of the surgery. **Methods:** The posterior ribs (from the fifth to the eighth) were suspended on the inferior angle of the scapula on each side using titanium cables, as well as muscles and myofascial tissue in the subscapular area. After the surgery, the patients were trained for synchronous contraction of the trapezius and diaphragm muscles, and electromyography (EMG) was performed to evaluate the synchronization. The clinical symptoms and pulmonary function were assessed within 1 week before surgery and at 2, 12 and 24 postoperative weeks. **Results:** Six patients with complete high CSCI received rib suspension surgery 84±26.7 days after spinal cord injury. Before the surgery, all of the patients presented with weakened cough, retention of respiratory secretions and dyspnea, while these symptoms alleviated postoperatively. The vital capacity (VC) was enhanced to be 1680±282ml at 2 weeks after the surgery, compared with 1085±92 ml (P<0.013). The EMG showed a synchronous muscle electrical activity between the trapezius muscles and diaphragm during deep breaths. **Conclusion:** The rib suspension surgery partially restored the thoracic breathing of the patients with high CSCI, thereby improving VC, cough and expectoration.

**Key words:** Reconstruction of thoracic breathing, high cervical spinal cord injury.

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