Podium Session One:

0935 Abstract 1

An implementation science approach to improving physical activity for people in the community after stroke. Marie-Louise Bird. Postdoctoral Fellow, GF Strong Rehabilitation Research Centre

Objective: Community exercise could further increase recovery after discharge from rehabilitation, but opportunities and participation are low. This project aims to use an implementation approach to improve participation in community-based exercise after stroke.

Design: Stakeholder focus groups and interviews using an Integrated Knowledge Translation approach.

Settings: In health service and community.

Participants: Between five and fifteen people from each of four stakeholder groups - people after stroke and their carers; health service clinicians; community centres and stroke support organisations; exercise professionals. A representational advisory committee oversaw the project.

Methods: In the first of two rounds of focus groups, participants provided perspectives on the type of exercise needed, referral pathways into the program and implementation factors to optimise adoption commitment. Focus groups were recorded, transcribed and thematically analysed, informing the development of a framework for consultation in the second focus group round.

Results: Forty-two people provided informed consent. Pragmatic information about components of the exercise intervention (e.g., dose and delivery) were categorized as program, people and processes. Two pathways to the program - accessed straight from rehabilitation or self-referred from the community were identified. Thematic analysis identified a strong sense of belonging as driving participation in stroke-specific classes. The capacity for the community sector to offer a continuing service was seen as addressing issues with medical services availability.

Conclusions: These study data support the need for, and characteristics of, implementation of stroke-specific exercises in community centres with multiple referral pathways, which will inform our implementation, evaluation of program fidelity and outcomes.

0948 Abstract 2

Reducing compensatory movements in stroke therapy through the use of robotic devices and augmented feedback. Bulmaro Valdés. Biomedical Engineering, PhD Candidate, UBC.

Objectives: To investigate if the trunk compensatory movements of people with stroke could be reduced by employing augmented feedback (visual and force), and to examine if one of the feedback modalities was more efficacious than the other in reducing this compensatory tendency.

Design: Randomized crossover trial.

Setting: Research laboratory.

Participants: 15 community dwelling adults (64 ± 11 years) with non-traumatic ischemic or hemorrhagic stroke (> 3 months post-stroke).

Intervention: In a singles session, participants received augmented feedback about their trunk movements during a bimanual virtual reaching task. Force feedback (60 trials) was delivered through two robotic devices, and visual feedback (60 trials) through a computer monitor.

Main Outcome Measure: Primary: Change in anterior trunk displacement. Secondary: Index of curvature, trunk rotation, RMS error of hands' movements, reaching time, and a post-test questionnaire.

Results: Both feedback conditions reduced trunk compensation. The secondary outcome measures did not improve. No feedback condition was superior to the other one.

Conclusions: Force and visual feedback show promise as two modalities that could be employed to reduce trunk compensatory movements of people with stroke. The question of which feedback is more efficacious at reducing trunk compensation, remains unanswered. Using technology to provide the feedback that works best for each individual might be a more effective approach than finding one modality that works for individuals with all levels of motor, cognitive and sensory impairment.

1001 Abstract 3

An EEG controlled exoskeleton for upper extremity rehabilitation after stroke: A case study.

Xin Zhang. PhD Candidate, MENRVA Research Group, SFU

Objective: Stroke affects motor abilities and impairs the performance of daily activities [1]. Rehabilitation is the key to early motor recovery. However, conventional therapy is labour and cost intense, which limits the outcomes of the rehabilitation [2]. Robotic devices provide solutions for the high cost of conventional rehabilitation therapy [3]. Literature suggests that stroke survivors should actively engage in exercises and practice daily tasks repetitively for the recovery of the function [4][5][6]. In this case study, we explored the efficacy of an EEG controlled exoskeleton (robotic device) to actively engage chronic stroke survivors in repetitive daily tasks (for example: cleaning plate, pick up box etc.).

Methods: We developed an elbow exoskeleton (Fig.1) controlled by electroencephalography (EEG) to perform preprogramed simple daily activities. While performing these activities, participants engage in kinaesthetic imagination of the activity, the EEG system assesses the participant's intentions (move vs. rest motor command) and the load cell judges the movement direction. Here, we present a case study with a 34-year-old man who was 11 years post stroke. He participated in six weeks of training (3 times/week, 1 hour each session) with our EEG-controlled exoskeleton. Fugl Meyer (FM) and Wolf Motor (WM) assessments were the outcome measures administered every two weeks to monitor any motor changes with the training.

Results and Conclusion: The training was well tolerated by the participant. He could utilize EEG and load cell to control the exoskeleton to finish the training tasks. He was engaged in repetitive tasks during every session. There was no significant change in the FM score but he improved in Forearm to Box (83%) and Hand to Box (75%) tasks of WM assessment. Overall, participants improved by 12 % in WM test. The preliminary result of this case study suggests that the participant was actively engaged in the repetitive tasks and gained better control after the training.

References

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1014 Abstract 4

The effect of dropped foot stimulation on gait parameters and walking speed in stroke subjects.

Maura Whittaker. Physiotherapist, Private Practice

Objectives: To identify gait parameters contributing to increased walking velocity in a cohort of stroke subjects who underwent assessment with a dropped foot stimulator.

Design: Gait metrics of 21 subjects demonstrating a minimum 10% increased walking speed with DFS were analysed using Mobility Lab (APDM, Portland, Oregon) a laptop based gait analysis system. DFS was provided with an Odstock dropped foot stimulator (Odstock Medical, Salisbury, UK).

Setting: Community

Participants: 21subjects – 10 males/11 females, ages 11-70 years, minimum 2 years post stroke onset.

Interventions: After practice walks, to allow subjects to acustomize to walking with DFS, test walks were scheduled. Walk 1, without FES, was the baseline for comparison with subsequent FES walks. At least 3 test walks/subject were completed. Subjects walked per test for a maximum of 60 seconds.

Main Outcome Measure: Walking velocity, cadence, stride length and gait cycle time

Results: Cadence, stride length (affected and nonaffected limb) and GCT were found to have a positive correlation with increased gait speed. Mean walking speed improved by 42%; mean affected limb stride improved by 33%, nonaffected limb by 22%; cadence by 16%. GCT showed a 17% reduction.

Conclusions: In normal walking, increased cadence and stride length are associated with increased walking velocity. Results here show that DFS, through its effect on both affected and nonaffected limb stride, cadence and gait cycle time, can improve these key gait parameters leading to increased velocity in stroke gait. Improved weight bearing on the affected limb may explain the improvement in the nonaffected stride.

Podium Session Two:

1050 Abstract 5

Falls in the rehabilitation facility: who, why and how? Alexander Wilson. Medical Student, UBC

Objective: Falls in the hospital can lead to significant patient harm, decreased quality of life, as well as increased length of hospital stays. Several risk factors associated with falling in the rehabilitation setting have been established and the incidences of falls have been compared between groups. A patient's length of stay, age, specific diagnoses, specific medications, functional independence measure scores, and comorbidities are some of the factors that have been associated with falls. Furthermore, it appears that rehabilitation wards experience the highest incidence of inpatient falls compared to acute care and surgical wards. This may be because rehabilitation patients are encouraged to move beyond their comfort zone and be more active as part of the rehabilitation process. Limited research on spinal cord injury (SCI) outpatient populations has shown that subsequent fall related injuries after the initial SCI are common. There appears to be a need for research that investigates risk factors for falling among SCI inpatient populations so that targeted interventions can be developed. Our objectives are to compare the rates of, causes of, injuries resulting from, and risk factors for falls among three inpatient units: spinal cord injury (SCI), acquired brain injury (ABI), and neuromuscuoloskeletal (NMS). Our hope is that the knowledge gained will help to develop population specific interventions to reduce the rate of falls and to improve our understanding of SCI inpatient falls.

Design/Method: We conducted a retrospective patient chart review on reported falls during a five-year period (2011-2016) within a regional rehabilitation center. Data related to demographics (e.g. patient age, gender, medication profile, admission diagnosis, spinal cord injury level, length of stay) as well as falls (causes, degree of injury, and time in which the incident occurred) was analyzed to determine the factors contributing to falls within SCI patient populations.

Results: The rate of falls at GFS has declined from 18.95% in 2011 to 11.80% in 2015. SCI patients had the highest fall incidence at 20.17% whereas ABI and NMS had rates of 17.67% and 9.75% respectively. The most common reported cause of fall for all units was transferring, the second most common cause was the moving with a wheel chair or walker, and the third most common cause was miscellaneous bending/leaning/reaching activities. Most falls for all units did not result in injury through the pattern of harm varies across units. There was no significant difference in timing of falls, with 54.13% of all falls occurring in the 07:00-14:59 nursing shift. Most falls across all units occurred on the patient's floor. SCI patients fall a median of 7 weeks into their rehabilitation whereas the median number of weeks for ABI and NMS was 5 and 3 respectively. SCI patients had median admission FIM scores of 71 while NMS and ABI had median scores of 90 and 60 respectively. Multivariate analysis showed that among SCI and ABI units, patients who fell earlier in the rehabilitation had increased risk of falling ($p<0.01$) and that SCI patients with low thoracic (below T10) AIS A or B injuries had increased fall risk compared to SCI patients with thoracic (T1-T10) SCI AIS C,D, or E injuries. Furthermore, SCI patients who fell between 8:00am-3:59pm and ABI patients who fell between 12:00am-7:59am had higher fall risk than those in their unit who fell between 4:00pm-11:59pm ($p<0.05$).

Conclusion: The results of the study compared the major causes and potential risk factors for falls among individuals in the SCI, ABI, and NMS units admitted for inpatient rehabilitation. We hope that this information will allow us to develop recommendations for fall prevention specific to the patients admitted to the SCI unit.

Support: This projected is supported by the University Of British Columbia Foundations Of Medicine Summer Student Research Program.

1103 Abstract 6

What is the predictor for autonomic dysreflexia during urodynamic investigation in individuals with spinal cord injury? Matthias Walter, Postdoctoral Research Fellow, Autonomic Research Unit, ICORD

Introduction: Individuals with spinal cord injury (SCI) are affected by neurogenic lower urinary tract dysfunction (NLUTD). Urodynamic investigation (UDI), the gold standard to assess NLUTD in individuals with SCI, can induce autonomic dysreflexia (AD). Considering the high risks involved with sudden increase of systolic blood pressure during AD, we aimed to determine predictors for AD during UDI.

Methods: Between 2011 and 2015, continuous non-invasive cardiovascular monitoring synchronized to the ongoing UDI was performed in individuals with SCI.

Results: 300 individuals were included in our study. Logistic regression analyses revealed lesion level as the only significant independent predictor of AD during UDI. A lesion at T6 or above was associated with significant increased odds of AD during UDI (odds ratio (OR): 5.5, 95% confidence interval (CI) 3.2-9.4) compared to T7 or below. These heightened

odds persisted after additional adjustment for sex, completeness and stage of injury (adjusted OR (AOR): 6.6, 95% CI 3.8-11.7). Further stratification of different lesion level at T6 and above showed significant increased odds: C1-C4 (AOR: 16.2, 95% CI 5.9 to 57.9), C5-C8 (AOR: 12.2, 95% CI 4.9 to 35.8), T1-T3 (AOR: 5.2, 95% CI 2.1 to 14.5), and T4-T6 (AOR: 2.6, 95% CI 1.3 to 5.2) compared to T7 or below.

Conclusion: There is a significant relationship between the level of SCI and AD during UDI in individuals with SCI and NLUTD. Considering the high risks with AD such as stroke or even death, we strongly recommend continuous cardiovascular monitoring during UDI.

1116 Abstract 7

The value of quantified patient care: A retrospective review of using outcomes in clinical practice. Malena Rapaport. Prosthetic Resident, Barber Prosthetics Clinic.

Objectives: To share how routine collection of outcomes has shaped the care we provide for our patients, and enable us to make data-informed clinical decisions.

Design: Barber Prosthetics Clinic (Vancouver, Canada) developed a standardized outcome measures (OM) protocol. This was done by selecting OMs based on psychometric properties, interpretability and ease of use that covered several domains of interest (balance and mobility) and defined time intervals within each care episode where these measures would be used. Four practitioners (three C.P (c) and one prosthetic resident) implemented this protocol and documented examples of how this data has proven useful. Data from patients receiving care between 2015-2017 was extracted and analyzed using descriptive statistics.

Setting: Barber Prosthetics Clinic (Vancouver, Canada) from 2015 until present.

Participants: Patients with new prescriptions between 2015-2017.

Interventions: Collection of a standardized set of OMs at pre-defined intervals in time throughout patients' episodes of care.

Main Outcome Measure: Activity-Specific Balance Confidence (ABC) Scale, Prosthetic Limb Users Survey of Mobility (PLUS-M), 2 minute-walk test, walking frequency measured with Stepwatch TM Activity Monitor.

Results: Outcomes data allowed us to objectively evaluate patients' progress, and adjust interventions based on quantifiable goals. We are also able to contribute to our understanding of normative values and interpretation of OMs, enabling us to analyze OM scores in a more meaningful way to improve patient care resulting in improved, more data-informed care. By sharing OM scores, we motivated our patients and improved communication with them and the rehabilitation team.

Conclusion: By using standardized OMs in clinic, we are able to make data-informed decisions, motivate our patients and improve communication.

1129 Abstract 8

Is practice enough? Do aging adults need wheelchair propulsion training? Megan MacGillivray. PhD Candidate, Rehabilitation Sciences.

Objectives: To identify immediate and lasting effects of wheelchair propulsion training, based on variable practice and sporadic feedback, on wheeling biomechanics in aging adults.

Design: 3-arm Randomized Controlled Trial (intervention (i.e. training), active control (i.e. practice), inactive control (i.e. control)).

Setting: Human mobility laboratory.

Participants: Able-bodied adults (50 yrs and older) with no prior wheeling experience.

Intervention: Wheelchair propulsion training incorporating variable practice and sporadic feedback delivered over six 20-minute sessions. Each training session consisted of two 5-minute wheeling blocks on a treadmill separated by 10 minutes of discussion and videos to reinforce training received during wheeling.

Main outcome measure: Biomechanical data (e.g. kinetics) was collected with an instrumented wheel at baseline, post training, and 2-weeks following training to examine retention. Push length and frequency were the primary outcome variables of interest.

Results: The three groups, training (n=10), practice (n=10), and control (n=14) did not differ in age 62.2±9.2 yrs (mean±SD). Baseline biomechanical data were not different between groups for all variables except peak negative force. Following training, the intervention group improved push angle (+38.3°, $p<0.001$) and push frequency (-0.64 Hz, $p<0.01$) compared to the control group (-3.0° and 0 Hz, respectively). Furthermore, improvements were retained 2-weeks following training ($p<0.01$). There were no differences between practice and control groups ($p>0.50$).

Conclusions: Wheelchair propulsion training is effective in increasing push angle and decreasing push frequency among aging adults. The practice group, which received blocked practice did not significantly improve indicating that practice alone may not be sufficient for aging adults to optimize their wheeling biomechanics.

Podium Session Three:

1445 Abstract 10

E-textile Smart Knee Joint Movement Monitor Brace. William Geng, M.A.Sc Candidate ,SFU Research Assistant at MENRVA Laboratory.

Objective: Real-time monitoring of human joint movement is a prominent topic that finds many applications in clinical rehabilitation. However, there is a lack of affordable and light-weight devices capable of providing reliable data over an extended period. With E-textiles gaining popularity in recent years promising to integrate electronics into everyday life in a more natural and intimate manner, this study focus on the feasibility of using a polymer-based strain gauge to provide real-time angle measurement of the human knee by embedding the sensor in a compression knee brace.

Method: The polymer-based strain gauge sensor is a thin, conductive and stretchable shape memory polymer string that has a varying electrical resistance linearly proportional to the applied strain (the amount of extension/stretch). The sensor can be threaded into the woven fabric commonly found on compression knee braces, with the two ends secured by hammer on metal snap rings to provide electrical connection. Leg flexions will cause the fabric around the knee joint to stretch, hence increasing the resistance of the sensor. Readings from the sensor will be collected using a small textile-embeddable board and the data collected is stored with its corresponding knee angle data, which can be collected with a motion capture system or simply a goniometer. Together the readings and knee angle data form an idea training set for modern day machine learning algorithms. A model can be created to map the raw readings to an angle reading. The angle data can then be transferred to a phone app to monitor user knee joint movement in real time through an BLE (Bluetooth Low Energy) device that will also be embedded on the knee brace.

Current Result and Conclusion: In a sample trial for leg extensions and flexions, the data collected by the sensor and by a motion tracking system (reference angle) are as illustrated in Figure 3 and Figure 4. The similarities in the waveforms provide ground for further data processing using machine learning algorithms to create an model to convert sensor readings to angle readings. Creating and refining the model is currently the ongoing focus of the study, current model is accurate for flexions (lows in the waveform in Figure 5) but has considerable errors caused by polymer hysteresis for extensions.

1458 Abstract 11

Minocycline partially restores blood pressure regulation after experimental spinal cord injury. Ian Ruiz. Biomedical Physiology MD Student, UBC

Objective: Cardiovascular dysfunction (e.g. autonomic dysreflexia) is common after high-level spinal cord injury (SCI), and contributes to an increased risk of stroke and heart disease. The degree of dysfunction is thought to be proportional to the loss of descending sympatho-excitatory axons; hence, therapies targeting their preservation may improve cardiovascular function and reduce cardiovascular disease risk. As such, the purpose of this study was to investigate the effect of minocycline, an anti-inflammatory antibiotic, on both the motor and cardiovascular systems in a well-established animal model.

Design/methods 32 Male Wistar rats were randomized to either a treatment group (minocycline) or a control group (saline vehicle), and were followed for 2 months post-SCI. All rats received a T3 severe contusion. Treatment was administered at 1 hour post-injury, then twice daily for two weeks. Baseline hemodynamics and the severity of autonomic dysreflexia were assessed at 2 months post-injury. Baseline motor behaviour was also assessed pre-SCI and then weekly until study end-point.

Results We found that administration of minocycline significantly improves resting systolic blood pressure (107±1.5mmHg) compared to vehicle (98±2.2mmHg; $p=0.034$). Moreover, the severity of autonomic dysreflexia was remarkably reduced by 33% in animals treated with minocycline ($p=0.025$). In contrast to the cardiovascular improvements, there were no differences in motor function between the minocycline and vehicle groups (all $p>0.05$).

Conclusions These results provide the first evidence that minocycline is able to improve baseline hemodynamics. Furthermore, the diminished severity of autonomic dysreflexia following treatment may indicate a more robust preservation of cardiovascular autonomic function compared to those without treatment

1511 Abstract 12

Apps are our future: Developing a mobile self-management intervention for people with SCI. Gurkaran Singh. MSc Student, Rehabilitation Sciences, ICORD.

Objective: To describe stakeholder perspectives on the development of a functional mobile application (app) to facilitative self-management skills needed to prevent secondary complications following a spinal

cord injury (SCI) during inpatient rehabilitation, through an iterative design process involving key stakeholders.

Design: A user-centred design approach was used in the study. Setting: A Canadian in-patient rehabilitation centre. Participants: Three types of stakeholders were enrolled in the study: individuals admitted for rehabilitation following traumatic SCI (n=20) and informal (n=7) and formal caregivers (n=5 individual interviews; n=47 focus groups).

Intervention/Main Outcome Measure: On-going input and feedback was gathered from stakeholders via one-on-one interviews and three series of focus groups at the beginning, middle, and end of the study. Interventionists also recorded field notes about participants' perspectives and challenges with features of the app.

Results: A thematic analysis of interview and focus group data was performed (Braun and Clark, 2006). Our analysis identified three main themes: (1) being individualized and user friendly (i.e. designing an app that is simple and easy to use to facilitate universal uptake), (2) targeting goals to promote self-management (i.e. tracking self-management behaviors relative to personal goals and confidence), and (3) improving participation and gaining support to facilitate lifestyle change (i.e. incorporating leisure activities to facilitate community integration and promote overall wellbeing).

Conclusion: Incorporating key stakeholders into the design process enabled the creation of a self-management app that we will evaluate in future research.

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1524 Abstract 13

The ProacTive SCI Toolkit: Physiotherapists promoting physical activity to clients with spinal cord injury. Jasmin Ma. PhD Candidate, Behavior Change Science and Disability, UBC (Okanagan)

Objectives: One strategy to increase physical activity (PA) levels in people with spinal cord injury (SCI) may be to engage physiotherapists as key physical activity information deliverers. However, physiotherapists report that they do not currently possess the tools and resources to prescribe and promote PA to their clients with SCI. The purpose of this study was to use an integrated knowledge translation (IKT) process in designing a toolkit to facilitate physiotherapist-led prescription and promotion of PA to clients with SCI.

Design: Multiple stakeholders were engaged and an IKT process was used to inform the content and format of the toolkit. The following steps were conducted: 1) two systematic reviews; 2) a national online survey of physiotherapist training needs and preferences to effectively promote PA to their clients both with and without SCI (n=244); 3) semi-structured interviews targeting clients' perspectives on effective strategies for physiotherapist-led PA promotion with people with SCI (n=26); and 4) an expert panel consisting of physiotherapists, clients, and behaviour change specialists reviewed the evidence and provided final recommendations to inform the development of the toolkit (n=12).

Setting: Community

Participants: Physiotherapists and people with spinal cord injury

Results: A toolkit was formulated to assist physiotherapists in implementing the appropriate PA promotion strategy for their clients with SCI. This included three key strategies: education, referral, and tailored prescription.

Conclusion: This toolkit is the first evidence-based, IKT resource to target physiotherapists in leading PA promotion that is specifically tailored to clients with SCI.

1537 Abstract 14

The impact and evolution of acute SCI on autonomic cardiovascular control and susceptibility to cardiac arrhythmia. Vera-Ellen Lucci. PhD Student, Cardiovascular Physiology Lab, SFU.

After spinal cord injury (SCI) cardiovascular autonomic nerves can be injured, leading to cardiovascular dysfunction, particularly in high-level SCI. However, cardiovascular autonomic control and its evolution in the acute period after SCI are poorly characterised. We aimed to evaluate cardiovascular autonomic function over the first year after SCI and its relationship with markers of susceptibility to cardiac arrhythmia.

We tested 40 people <2 weeks, 1-, 3- and >6-months after acute SCI. Supine beat-to-beat blood pressure and heart rate variability, and electrocardiographic (ECG) markers of arrhythmia risk (QT variability index [QTVI] and P wave duration [PWD]) were determined at each visit. Low frequency variability of systolic arterial pressure (LFSAP) was used to determine sympathetic autonomic function.

LFSAP was reduced in all participants at <2 weeks. By 1-month post-injury two distinct groups emerged: autonomically-complete SCI with sustained low LFSAP (2.1±0.6mmHg2) and autonomically-incomplete SCI (11.19±3.6mmHg2), p=0.018) with higher LFSAP. These groups remained distinct at subsequent time-points. Those with autonomically complete lesions showed increased risk for ventricular

(QTVI >6-months: autonomically-complete SCI -0.75±0.3; autonomically incomplete SCI -2.0±0.4; p=0.01) and atrial (PWD >6-months: autonomically-complete SCI 141±9ms; autonomically incomplete SCI 120±11ms; p>0.05) arrhythmia that developed over time.

In order to develop treatments for cardiovascular dysfunction we must first understand the typical progression of changes in autonomic control after SCI. Assessment of autonomic function is most informative 1-month after injury and LFSAP may provide a simple measure to assess autonomic function non-invasively. Impaired autonomic function conveys an increased risk for cardiac arrhythmia after SCI.

1550 Abstract 15

Multi-domain assessment of autonomic function in spinal cord injury using an autonomic reflex screen. Michael Berger. Resident, Physical Medicine and Rehabilitation, UBC

The purpose of this study was to characterize autonomic lesions in participants with spinal cord injury (SCI; n=10) using an autonomic reflex screen, incorporating sudomotor, cardiovagal and sympathetic adrenergic tests, as well as hemodynamic responses to head-up tilt (HUT).Hemodynamic responses were compared to healthy controls (n=20) and previously published normative cutoffs in order better identify autonomic impairments. Sympathetic skin responses (SSRs), heart rate response to deep breathing (HRDB) and heart rate and beat-to-beat blood pressure responses to Valsalva maneuver (VM) and HUT were measured. SCI participants demonstrated impairment in at least one domain, with 7/10 demonstrating autonomic impairment across all domains. No single test was concordant with orthostatic hypotension on HUT, in all participants. Measures of cardiovagal function including, HRDB (SCI=7.7±3.8 beats/min vs. controls=17.6±8.1 beats/min) and Valsalva ratio (SCI=1.53±0.29 vs. controls=1.85±0.37) were significantly reduced in SCI participants, compared to controls ($p<0.05$). These findings suggest that an autonomic reflex screen, which includes standardized testing protocol and normative data for comparison, is useful for determining the autonomic domains affected by the neurological injury in SCI. We also demonstrated significant cardiovagal impairment in SCI participants compared to controls, which warrants further investigation to determine whether cardiovagal dysfunction is associated with the negative cardiovascular outcomes, which are known to occur in SCI.

Poster Presentations:

1. Sympathetic stimulation increases susceptibility to cardiac arrhythmia in rodents with high-thoracic spinal cord injury. Vera-Ellen Lucci, PhD Student, Cardiovascular Physiology Lab, SFU

In addition to motor and sensory deficits, high-level spinal cord injury (SCI) causes injury to spinal sympathetic pathways, abnormal control of blood pressure and heart rate, and increases susceptibility to cardiac arrhythmia (particularly with sympathetic stimulation i.e. autonomic dysreflexia). Dobutamine (DOB) is a cardiac inotrope that mimics cardiac sympathetic stimulation. We evaluated the effects of DOB on susceptibility to cardiac arrhythmia over time in a rodent model of T2-SCI with severe cardiac autonomic injury.

Wistar rats underwent 400Kdyn (5s dwell) contusive SCI at T2 (n=7) and were compared to sham-injured controls (n=7). Electrocardiogram (ECG) data were evaluated pre-SCI, 1- and 6-weeks post-SCI. At each time point, animals were infused with 30μg/min/kg of DOB. We evaluated autonomic cardiovascular control from heart rate variability (HRV) analyses at low (LF), high (HF), and very low (VLF) frequencies. Indices of arrhythmia risk (Tpeak-Tend mean and variability, transmural dispersion of repolarisation; QTc, overall duration of repolarisation) were determined from ECG at baseline and during DOB.

LF HRV was maintained in T2-SCI, indicating increased vagal tone with sympathetic injury. VLF HRV (index of cardiovascular mortality) decreased 6-weeks after T2-SCI. Heart rate increased with DOB at all time points in both groups ($p<0.001$). Tpeak-Tend and Tpeak-Tend variability were larger in T2-SCI than sham 1-week after injury. Tpeak-Tend and QTc increased with DOB 1-week after SCI; which was larger in T2–SCI than sham ($p=0.049$). Tpeak-Tend variability increased with DOB 1-week post SCI in T2-SCI ($p=0.035$).

Cardiac sympathetic stimulation aggravates the cardiac consequences of autonomic injury, with an increased risk of ventricular arrhythmia.

2. Use of a potential compression therapy device improves orthostatic responses in healthy individuals: a randomized, placebo controlled trial. Hadi Moein, Ph.D. Candidate, School of Engineering Science, SFU

Purpose. Orthostatic intolerance can occur secondary to concomitant venous pooling and enhanced capillary filtration when upright, and is one of the principle causes of syncope or fainting. Syncope affects approximately 6.2% of the population. Compression therapy is commonly recommended for the

management of syncope based on the assumption that it would increase venous return. We evaluated an innovative portable active compression brace (ACB), which can produce variant compression, as a potential compression therapy device for orthostatic intolerance.

Methods. We evaluated the efficacy of an active compression brace (ACB) on the prevention of blood pooling and the improvement of venous return in 14 healthy volunteers in a randomized, cross-over, double-blind fashion. The ACB, actuated by shape memory alloy wires, was designed, and prototyped for potentially being used in future clinical studies. The test protocol consisted of head-upright tilting and walking on a treadmill. Each participant completed testing on two consecutive days with a pair of ACBs wrapped around both legs. The ACB was not actuated on one testing (placebo), and it was actuated on the other testing. The wearability, comfort, and ambulatory use of the ACB were assessed using a questionnaire-based method.

Results. The average pressure exerted by the ACB on the calf was 46.3±2.2 mmHg and the actuation pressure was 20.7±1.7 mmHg. The stroke volume was greater with the ACB activated during tilt after supine rest (+5.20±2.34 %) and after walking (+2.94±3.93 %). The heart rate was lower with the ACB activated during tilt after supine rest (-5.12±2.41 %) and after walking (-4.81±3.68 %). The magnitude of the decrease in stroke volume after ten minutes of tilting was positively correlated with the height:calf circumference ratio ($r=0.464$; $p=0.029$; $n=22$; both conditions combined). The magnitude of the increase in heart rate after ten minutes of tilting was negatively correlated with the height:calf circumference ratio ($r=-0.485$; $p=0.022$; $n=22$; both conditions combined) and was positively correlated with the average calf circumference ($r=0.539$; $p=0.009$; $n=22$; both conditions combined).

Conclusions. These data verify that the ACB increased stroke volume during tilting in healthy controls. The questionnaire-based evaluation results provide evidence of wearablity and comfort of the ACB during its ambulatory use.

3. A Triple Combination Approach Involving Nerve Transplantation, Glial Scar Digestion and Passive Exercise Promotes Cardiovascular Recovery after Spinal Cord Injury. Rahul Sachdeva, Postdoctoral Fellow, Autonomic Research laboratory, ICORD

Introduction: SCI causes debilitating cardiovascular (CV) dysfunction primarily by (a) loss of medullary control of sympathetic pre-ganglionic neurons and, (b) the aberrant sprouting of nociceptive afferent fibers within the spinal cord. We used a triple combination approach to simultaneously enhance supraspinal axon regeneration and to reduce nociceptive sprouting to promote CV recovery after SCI.

Methods: Male Wistar rats (n=40) received a T3 spinal transection. The treatment included peripheral nerve grafts (PNGs) spanning the lesion, intrathecal chondroitinase enzyme and cycling exercise (1 hr/day, 5 days/week). Resting blood pressure (BP), heart rate and pressor response to colorectal distension (CRD) was assessed terminally using radiotelemetry. Functional regeneration across PNGs was determined using stimulus-driven units below the lesion upon electrical stimulation at cervical level. **Results:** The PNG and chondroitinase combination led to significant CV recovery compared to the untreated group. Specifically during CRD, the PNG+chondroitinase group showed 51.2% reduction in systolic BP elevation (66.5 vs. 32.4mmHg, $p<0.0001$), 45.7% reduction in diastolic BP elevation (37.4 vs. 20.3mmHg, $p<0.001$), 48.2% reduction in mean arterial pressure elevation (47.1 vs. 24.4mmHg, $p<0.001$) and abolishment of bradycardia (-86.3 vs. +5.4bpm, $p<0.01$). Stimulus-driven neuronal activity across PNGs confirmed the functional re-connection of regenerating axons. Surprisingly, no effect of exercise was seen in any of the groups. Ongoing histological studies will investigate the mechanisms underlying recovery.

Conclusion: The combination approach leads to significant recovery of CV function after SCI, which is likely mediated by vasomotor regeneration.

Supported by the Rick Hansen Foundation and the Heart and Stroke Foundation of Canada (AVK).

4. Understanding the burden experienced by caregivers of older adults who use power mobility. Delphine Labbé, Postdoctoral Fellow, GF Strong Rehabilitation Research Centre

Background: Power wheelchairs (PWCs) are commonly used to support the mobility of older adults with significant mobility disability. Despite their benefits, the PWCs users often require assistance from informal caregivers to get around. Few studies have focused on the impact of PWCs on caregivers, with mixed results. While PWCs may increase caregivers' sense of freedom and independence and decrease their physical burden, they may also limit their participation in community activities.

Objective: To describe the association between PWCs, overall caregiver burden and other caregiver outcomes.

Method: This cross-sectional study used the Power Mobility Caregiver Assistive Technology Outcome Measure (PM-CATOM) to assess caregivers' wheelchair-specific and overall burden. We also measured the caregiver's wheelchair skills (WST-Q),

frequency of and perceived limitations in their life activity (LLDI), anxiety and depression (HADS) and social support (ISEL) and then correlated it with the burden scores.
Results: Participants were 35 caregivers, mostly women, ranging in age from 32 to 85 years old and providing at least 1 hour of care/week for a PWC user aged 50 years or older. Both the wheelchair-related and overall burden scores were positively and strongly correlated with perceived limitations in daily activities, and negatively moderately with anxiety and depression scores. The overall score was positively and moderately associated with perceived social support.
Conclusion: These results show that the caregivers' PWC-related and overall burden is associated with mental health as well as participation issues. These results have implications for the type of resources required to support informal caregivers.

5. Serum albumin predicts long-term neurological outcomes after acute spinal cord injury. Bobo Tong, Research Assistant, ICORD, Kramer Lab
Importance. There is a need to identify reliable biomarkers of spinal cord injury recovery for clinical practice and clinical trials.
Objective: To correlate serum albumin levels with spinal cord injury neurological outcomes.
Design: Longitudinal cohort study of historical clinical trial data (secondary analysis).
Setting: Historical multi-centre clinical trial.
Participants: 591 adult patients with traumatic spinal cord injury who participated in the multi-centre Sygen clinical trial.
Exposures, Main Outcomes, and Measures: Serum albumin concentrations were obtained as part of routine blood chemistry analysis, at trial entry (24 to 72 hours), 1, 2, and 4 weeks after injury. The primary outcomes were 'marked recovery' and lower extremity motor scores, derived from the International Standards for the Neurological Classification of Spinal Cord Injury. Data were analyzed with multivariable logistic and linear regression to adjust for potential confounders.
Results. Serum albumin was significantly associated with spinal cord injury neurological outcomes. Higher serum albumin concentrations at 1, 2, and 4 weeks were associated with higher 52-week lower extremity motor score (Beta=2.2 [95% CI 0.56, 3.8]; Beta=2.7 [95%CI 0.99, 4.4]; Beta=4.8 [95% CI 2.7, 6.9], respectively). Similarly, the odds of achieving 'marked neurological recovery' was greater for individuals with higher serum albumin concentrations.
Conclusions and Relevance. In spinal cord injury, serum albumin is an independent marker of long-term neurological outcomes. Serum albumin could serve as a feasible biomarker for prognosis at the time of injury and stratification in clinical trials.

6. The feasibility of evaluating a self-management mobile app for SCI in the inpatient and early community settings, Megan MacGillivray, PhD Candidate, UBC Rehabilitation Science
Objectives: To determine the feasibility of evaluating a newly developed self-management mobile app for spinal cord injury (SCI) in the inpatient rehabilitation and early community settings.
Design: Feasibility study.
Setting: Local inpatient rehabilitation hospital and community.
Participants: 20 individuals from the local inpatient rehabilitation hospital following their first SCI.
Intervention: A newly developed self-management mobile app for SCI consisting of 18 tools focusing on various areas of health and prevention of secondary conditions related to SCI.
Outcomes: Feasibility indicators including recruitment, retention, respondent burden, adherence, and app usage. A Likert scale was used to evaluate confidence in managing various areas of self-management related to SCI.
Results: 45% of eligible inpatients enrolled in the study over a 10-month period and did not differ from those who chose not to participate (mean age of 41 18 yrs, 85% male). Participants' average Spinal Cord Independence Measure-III score was 33.1 (range: 7-84) and did not relate to app usage. Retention from admission to discharge was 85% and from discharge to 3-mos post discharge was 70%. Those who remained in the study saved data to the app an average of 1.7x/day in rehabilitation (n=17), and 0.5x/day in the community (n=7). Participants' bowel self-management confidence improved between admission and discharge ($p<0.01$).
Conclusions: The study design was feasible and inpatient rehabilitation appeared to be an appropriate time to introduce the app. The transition between inpatient rehabilitation to community may not be a feasible time to evaluate this type of intervention because of the associated challenges with housing and internet access.

7. Cardiovascular responses to ballroom dancing with spinal cord injury, Amanda Lee, MSc student (Experimental Medicine), Autonomic Research Laboratory, ICORD

Objectives: To determine if cardiovascular responses and energy expenditure differs between able-bodied dancers and wheelchair dancers.
Design and setting: Wheelchair dancers (n = 8) and able-bodied stand-up partners (n = 9) performed a slow dance (rumba) and a fast dance (swing). Each dance routine was two minutes long. Participants were given an hour-long lesson and at least 10 minutes of seated rest before data collection. During the dance routine, participants wore heart rate monitors and Actical accelerometers on their wrists and ankles (for able-bodied) or wheelchair.
Participants: Able-bodied control participants were paired with wheelchair dancers. Of the wheelchair dancers, 5 had sustained a traumatic spinal cord injury (SCI), 2 had non-traumatic SCI, 1 had a sustained polio as a child and 1 had spina bifida.
Main Outcome Measures: During baseline rest and after the dance session, we collected heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP). During the dance, we collected HR and activity counts.
Results: Activity counts from accelerometers were taken; energy expenditure and average intensity was extrapolated. Despite having equal levels of energy expenditure, peak HR was significantly elevated in able-bodied dancers throughout dance, but not for wheelchair dancers ($p < 0.05$). Both dances significantly elevated SBP and MAP.
Conclusions: Ballroom dance is an excellent form of recreational exercise for individuals in wheelchairs that results in elevated HR and blood pressure and energy expenditure comparable to that of able-bodied dancers. Attenuated peak HR response in wheelchair dancers (particularly with SCI) is likely due to a combination of deconditioning and deficient autonomic control over the cardiovascular system.

8. Interim results of implentation of the Spinal Cord Independence Measure (SCIM III) into clinical practice in spinal cord injury rehabilitation programs across Canada. Anne Harris, National Clinical Liaison, Rick Hansen Institute
Objective. The Spinal Cord Independence Measure III (SCIM) is a validated measure of function recommended internationally but is not widely used in Canada. In 2014, the SCIM was added to the Rick Hansen SCI Registry data set to facilitate the implementation of this measure into spinal cord injury programs across Canada. The objective was to describe the interim results of implementing the SCIM in 15 rehabilitation programs.
Design . A knowledge translation framework [Consolidated Framework for Implementation Research (CFIR)] informed the implementation of the SCIM into clinical practice (Implementation Science 2009;4:50) (Fig. 1).
Setting/Participants: 15 rehabilitation programs in Canada.
Interventions: Individualized strategies were provided throughout the implementation process to address program-identified barriers.
Main Outcome Measure: Number of rehabilitation programs using the SCIM in clinical practice.
Results. As of December 2016, 6 of 15 rehabilitation programs were using the SCIM in clinical practice. Surveys completed by 44 clinicians identified they 'agree' or 'strongly agree' that the following were anticipated barriers to SCIM implementation in their program: time (61%), staff turnover (48%), and training (36%).
Conclusions. The CFIR framework identified facilitators and barriers to implementing the SCIM in rehabilitation programs. A multi-level approach involving continuing to facilitate the implementation at the remaining 9 rehabilitation programs and working to include the SCIM as part of the National Rehabilitation System data set are being pursued.

9. Effects of Injury Severity on miRNA Expression Profile in CSF and Serum Samples from Human Patients with SCI. Seth Tigchelaar, PhD Candidate, ICORD (Kwon Lab)
Purpose: With no real treatment options currently available to clinicians, there is an urgent need for non-invasive biomarkers to aid in the scientific development and clinical validation of novel therapies for acute spinal cord injury (SCI). MicroRNAs are small regulatory noncoding RNA molecules that mediate protein translation. Many miRNAs are highly enriched in the nervous system and are also directly implicated in the pathogenesis of various neurodegenerative diseases including traumatic TBI, and SCI.
Methods:We compared the miRNA expression profiles of serum and cerebrospinal fluid (CSF) collected from human patients with SCI. CSF and blood samples were collected every 8h for 5 days in order to compare CSF and serum miRNA profiles following injury. Additionally, control ''non-injury'' CSF samples were collected via a single lumbar puncture from patients undergoing hip or knee surgery during their spinal anesthetics. Next-generation sequencing was used to compare effects of injury severity on miRNA levels. Extracellular miRNAs were isolated and sequenced using the Illumina HiSeq 2500 system. Generated data was processed using the Mayo Clinic's Comprehensive Analysis Pipeline for miRNA Sequencing Data (CAP-miRSeq), and aligned miRNA reads were used to compare differential expression.

Results and Conclusions: Here, we present miRNA profiles in CSF and serum clinical samples during acute stages after SCI. This analysis was done in parallel to the investigation of miRNA in the serum of pigs following SCI. This characterization is important to establish whether biomarkers of SCI found in pigs can be transferred to humans and vice-versa.

10. Blurred lines: The liminality of mobility scooters. Sharon Jang, MSc Candidate, Rehabilitation Sciences, Rehabilitation Research Lab

Background: The use of mobility scooters is becoming more popular, due to their social acceptability and their fair cost. A variety of associated benefits have been reported with scooter use, such as increased confidence, increased sense of autonomy and independence, and increased social participation. However, scooter users are still facing a variety of barriers in their communities. Objective: To explore the everyday experiences of scooter users within the context of their physical and social environments. **Design:** Semi-structured interviews were conducted with 20 participants.

Setting: Interviews were conducted at the GF Strong Rehab Research Lab.

Results: Our preliminary analysis revealed three main themes. Accidents and incidents examined the different physical mishaps experienced by participants (such as bumps and falls). Participants also discussed factors they perceived to have contributed to their accidents, and discussed accident prevention strategies. Dealing with environmental challenges examined the barriers encountered by scooter users in the natural, built, and social environments, and techniques used to overcome them. Liminal devices revealed the ambiguous status of scooters as both disability signifiers and mobility devices (e.g., whether scooter users are treated as vehicles or pedestrians).

Conclusion: This study provides insight to the issues and barriers faced by scooter users in their everyday experience; many of which related to the liminality of mobility scooters. Possible improvements are suggested to decrease the barriers and stigmas while facilitating social participation and community integration.

11. Testing a wearable suppression device on individuals with tremor. Gil Herrnstadt, PhD Candidate, MENRVA Research Group, SFU.

Background: Tremor is an involuntary rhythmic oscillation of a body part [1]. Pathological tremor can be highly debilitating for activities of daily living and can limit social participation [2], [3]. Essential Tremor (ET) and Parkinson's Disease (PD) are the most common pathologic tremor disorders. Hands and other body parts can be affected [3]. Standard therapy is not always effective [4].

Objective: Test the proposed tremor suppression approach and elbow suppression device with individuals with tremor. The device was previously tested with a robotically simulated input [5]. Participants: Seven participants with mild to severe Essential Tremor (ET) or Parkinson's disease (PD) were recruited.

Interventions: The participants performed computer target pursuit tracking tasks. All the participants performed the tasks with and without the tremor suppression orthosis while their movements were recorded. The participants' movements were translated via the wearable device to a cursor movement on the screen.

Main Outcome Measure: Two outcome measures were considered; the first is the tremor signal power reduction. The second measure is the tracking error for the position and velocity signals. Results: The mean tremor power reduction for all the participants was above 90%. The mean position tracking errors without the suppression device and with the suppression device were 6.82 and 7.62 deg respectively, which translates to about 0.9% error increase. The mean velocity tracking errors without the suppression device and with the suppression device were 0.384 and 0.394 rad/s respectively, which translates to about 0.5% error increase.

Conclusions: The results obtained with the suggested approach and orthosis demonstrate a significant tremor reduction of approximately (>90%). Importantly, there's little obstruction to the voluntary motion as demonstrated by the small changes (<1%) to the tracking errors obtained with and without the suppressions orthosis. The study outcomes suggest a wearable device can offer an effective treatment for tremor suppression and can potentially assist individual with tremor in their daily activities.

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12. Wearable optical sensing technologies that can bring rehabilitation from the clinic to the home. Jordan Lui. MASc Candidate, MENRVA Research Group, SFU

Studies show that monitoring rehabilitation exercises can improve recovery of the patient. Some technologies exist to track user movements but they are often large, expensive, or require multiple units to be attached to the user in different locations. In this paper, we propose design of wearable device which incorporates inertial measurement units (IMUs) and infrared sensors to determine orientation of the arm in various exercises. A novel optical wearable was created for detection of arm movements in three dimensions. A study of 5 participants yields high accuracies of 98% across participants, without any normalization of results to participant body sizes. These findings indicate a strong inter-patient similarity in arm movement patterns. This could allow development of an accurate yet general predictive machine learning model; demonstrating feasibility for commercial off-the-shelf (COTS) product which can be brought into the home to help a user track their rehabilitation exercise.

13. **Utilization and Impact of a Computerized International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) Algorithm.** Tova Plashkes, Rick Hansen Institute

Objectives : Challenges in accurately classifying the severity and motor level of a spinal cord injury (SCI) with the International Standards for Neurological Classification of SCI (ISNCSCI) have identified the need for computerized algorithms. Developed in 2012, the Rick Hansen Institute (RHI)-ISNCSCI Algorithm is a freely available website with a downloadable open source-code. The study objective was to evaluate the utilization and impact of the Algorithm in clinical care, research, and education since its release.

Design and Main Outcome Measures: Utilization was measured by the number of website visits, global user representation, source-code downloads, and translation into other languages. Education impact was evaluated by examining feedback from the Algorithm website and from participants during ISNCSCI training. Clinical impact was evaluated by the number of electronic medical records (EMRs) using it. Research impact evaluation included impact on 2 studies hosted on RHI's Global Research Platform.

Results: As of March 2017, utilization of the Algorithm included: website access from 159 countries (65,488 visits), 9739 downloads, and translation into Chinese. Impact included: 1) Education-Incorporation into ISNCSCI training at 14 Canadian SCI centres and obtaining feedback. 2) Clinical–Algorithm inclusion requests for 4 EMRs. 3) Research–3 SCI registries [US, Canada and Australia] have incorporated the Algorithm to improve data quality. The Algorithm corrected classification for 16% of Rick Hansen SCI Registry ISNCSCI exams (1850/11357) and supported clinical trial eligibility screening for 382 patients.

Conclusions: The Algorithm is being used globally to support clinical care, education, and research. Evaluation is ongoing with a focus on clinical impact. Information obtained will guide future development.

14. **New insights into sensorimotor recovery after spinal trauma – a translational study.** Catherine Jutzeler, Post-doctoral fellow, ICORD

Introduction: Among changes in the central nervous system induced by traumatic spinal cord injury (SCI), adaptations in primary sensorimotor areas in the brain representing intact regions of the body have been reported. Currently missing from our understanding in humans is how changes in the brain emerge over time in response to SCI.

Aims: The primary aim of this study was to investigate the progression of changes in the brain in response to SCI in humans from acute to chronic stages. Utilizing common neurophysiological techniques, observations in humans were then reverse translated in a pig model of thoracic SCI. The fundamental goal here was to determine if changes in the brain of pigs in response to SCI was similar to what we observed in humans.

Methods: A total of 262 patients with SCI underwent neurophysiological assessments to assess trauma-induced changes in the sensory and motor cortex using somatosensory (SSEP) and motor evoked potentials (MEP), respectively, at 1, 3, 6, and 12 months post injury. Moreover, the same assessments were performed in 12 Yucatan pigs prior to a thoracic contusion injury (i.e., baseline), as well as 10min, 3hrs, and 12 weeks post injury.

Results: Corresponding with observations in humans, the afferent responses (i.e., SSEP) in pigs progressively increased to 12 weeks post injury. In contrast to changes in somatosensory processing, motor responses (i.e., MEP) increased immediately after injury and remained elevated at 12 weeks.

Conclusion: Despite many obvious differences between experimental models of SCI and the human condition, changes in the brain following damage in the spinal cord share remarkable similarities across species. Taken together with the stark similarities with

humans in terms of size, general systems physiology (e.g., cardiac), and genetic traits, our findings highlight the utility of Yucatan pigs in translational research and development of spinal cord repair strategies.

15. The Spinal Cord Injury Research Evidence SCIRE Project: Progress to Date. Matthew Queree, M.App. Psych, B.A (Hons) SCIRE Research Coordinator

The Spinal Cord Injury Research Evidence (SCIRE) project is an international collaboration between scientists, clinicians and consumers headquartered in Vancouver, British Columbia and London, Ontario. This free resource eliminates your need to search and screen individual databases, and informs health professionals and other stakeholders of best and most up to date rehabilitation practices following SCI. As of February 2017, the SCIRE Project has had 1,038,359 website hits, from 817,376 unique users, and a total of 2,588,677 page views.

The most accessed pages continue to be Outcome Measures, in particular the ASIA/ISNCSCI page. Most recently, we went through a massive website upgrade; our site is now responsive (will adapt no matter what device you use to access it) and is Level 2 Accessible (text size can be enlarged, transcripts for videos, alt-text for images, etc.). We have made content improvements including better Clinical Summaries, and more graphics, clinical resources and instructional videos. Improvements to come include: Chapter Summaries, Gaps Analyses, and Forest Plots to graph Effect sizes of RCTs.

16. Incidence and natural progression of neurogenic shock following traumatic spinal cord injury. Ian Ruiz, BSc. (Hons) Biomedical Physiology MD Class of 2019 University of British Columbia

Objective: Neurogenic shock, a distributive type of circulatory shock following spinal cord injury (SCI), results in profound hypotension. The consequent hemodynamic instability complicates clinical management, delays surgical intervention, and impacts neurological outcome. Moreover, the reported incidence of this condition varies significantly. Here, we establish the incidence of neurogenic shock by comparing the most common clinical definitions used to diagnose the condition. Further, we characterize the acute progression and recovery of neurogenic shock.

Design/methods: Daily blood pressure, heart rate, and fluid management, as well as vasopressor therapy and neurologic status were collected over 30 days from 84 adults admitted to our tertiary trauma centre following cervical (n=56) and thoracic (n=28) SCI.

Results: We found that the reported incidence of neurogenic shock varied greatly depending on which clinical definition was applied. By using a novel combination of hemodynamic and lab criteria to define neurogenic shock, the calculated incidence (29% cervical SCI) in our sample most appropriately reflects the true incidence, finding that hypovolemia was a primary factor responsible for the inconsistency in incidence reports between studies. Additionally, we found a characteristic decline in blood pressure following the first week post-injury and that fluid management is not currently an integral aspect of clinical management (all individuals were managed at a net fluid intake < zero).

Conclusions: The results demonstrate the need for accurate identification of neurogenic shock through consistent and appropriate criteria which is not only important from a clinical point of view, but also in establishing accurate epidemiology to responsibly allocate resources to its management.

17. The Chicken or the Egg: Neuropathic Pain Causes Changes in the Temporal Summation of Pain after Spinal Cord Injury. Paulina Scheuren, ICORD

Neuropathic pain (NP) after spinal cord injury (SCI) is a common and debilitating problem often presenting early after injury and persisting into chronic stages. Unfortunately, our understanding of the underlying mechanisms of NP remains limited. Temporal summation of pain (TSP) is the normal amplification of noxious C-fibre activity in the spinal dorsal horn. (i.e., clinical correlate of windup). Studies have suggested that impaired TSP accompanies central sensitization in patients with NP. However, few studies have addressed whether TSP precedes the development of NP (or vice versa) - a classic case of which came first, the chicken or the egg? Our study investigated the relationship between the development of NP and TSP after SCI. Eighteen individuals underwent tonic heat testing at admission and discharge. Preliminary analysis revealed 3 distinct response groups at admission: 1) 56% presented with a "normal progression" (i.e. a gradual decrease (adaptation) and subsequent increase (TSP) in pain rating) 2) 17% presented with progressive TSP throughout the examination, and 3) 27% presented with no TSP. At admission, NP was present in all 3 groups. By discharge, the majority of individuals with persistent NP presented with a TSPonly profile. Patients in whom NP had resolved presented with a normal profile. These observations are consistent with the notion that TSP failure does not cause NP, but rather the persistence of NP is altering TSP. Continued progress in assessing sensory physiology early after

injury may help clarify the mechanisms of NP and allow for a more effective mechanism based therapeutic approach.