



2017 FACULTY RESEARCH DAY SURGERY



“People who have been privileged to contribute something to the advancement of science should not let arguments about priority becloud their joy over the fruits of common endeavor.”

- Albert Einstein, 1908



Dr. Ivar Mendez

Fred H. Wigmore
Professor and
Unified Head

University of
Saskatchewan
and
Saskatoon Health
Region

Welcome to the 2017 Department of Surgery Faculty Research Day !

Dr. Neal Shoman and his research committee have put a lot of effort in organizing this event. It is a unique opportunity to learn of the research being conducted by our faculty both in basic science and clinical research.

I am very pleased to report that research in the Department of Surgery is thriving. In 2016, the Department attracted over 1.5 million dollars in new research funding and 42 papers were published by our faculty. We have focused our efforts in enhancing resident research and have established a Resident Research Incentive Program Award as well as resident research workshops, research topics seminars and published a research manual that provides a roadmap for navigating research processes at the University of Saskatchewan and the Saskatoon Health Region. Our Faculty are supported in research administration processes by our research coordinator Karen Mosier and for research projects design by our statistician Dr. Osama Bataineh.

The Faculty Research Day promises to be exciting as twelve faculty members from most divisions of the Department will be presenting.

Faculty members of the Department of Surgery strive to achieve clinical and teaching excellence, and many are also actively involved in research endeavors. By nature of our relatively large size as a Department, and our busy clinical and teaching schedules, the research work of many individuals may not be known to a lot of us. Many of our faculty are doing great and exciting research but not everyone knows what type of research is being done and who is involved. I believe that the Faculty Research Day is a tremendous opportunity to highlight the research works of our members, learn about scientific progress in various disciplines, and help to continue building collaborative efforts to strengthen our academic foundation.

Most importantly, we want to take this time to thank and acknowledge, not only our faculty, but the residents, medical students, nurses, research scientists, clinical and post-doctoral fellows, graduate students, and research personnel who are actively involved in helping strengthen our research productivity. I am grateful for the incredible work that they do on a daily basis, despite the challenges often intertwined in clinical and basic science research. Collaborative effort is the foundation for promoting a vibrant research culture within our department.

I am very excited to be part of our Faculty Research Day, and I look forward to seeing many of my colleagues and mentors.



Dr. Nael Shoman

Director of Research

Department of Surgery

College of Medicine

University of

Saskatchewan

2017 FACULTY RESEARCH DAY

Surgery

April 4, 2017

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INTRODUCTION

Saskatoon City Hospital
Rependa Centre Auditorium

08:00 - 08:10

WELCOME AND INTRODUCTIONS

Dr. Ivar Mendez
Fred H. Wigmore Professor of Surgery

(Coffee & scones will be served)

SESSION I

Saskatoon City Hospital
Rependa Centre Auditorium

CHAIR: Dr. Annika Card

08:10 - 09:00

Geomapping of Traumatic Spinal Cord Injury in Canada and Factors Related to Triage Pattern

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Bivalirudin as an adjunctive anticoagulant to heparin in the treatment of heparin resistance during cardiopulmonary bypass-assisted cardiac surgery

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DR. ADAM WU 18

SESSION II

Saskatoon City Hospital
Rependa Centre Auditorium

CHAIR: Dr. Michael Kelly

09:00 - 9:50

Novel therapeutic approach to improve clinical outcomes in patients with head and neck cancer

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Remote Presence Robotic Technology: Narrowing the Gap of Inequality in Health Care Delivery

DR. IVAR MENDEZ 20

Persistent adenosine signaling promotes alpha-synuclein expression in a novel rat model of Parkinson's disease.

ELISABET JAKOVA 21

Shedding light on the ischemic penumbra in a photothrombotic stroke model using synchrotron-based X-ray fluorescence imaging.

DR. JAKE PUSHIE 22

Checklist Implementation in Saskatchewan for Lumbar Spine MRI reduces MRI requisitions

DR. GARY GROOT 23

Break 09:50 - 10:10

SESSION III

Saskatoon City Hospital
Rependa Centre Auditorium

CHAIR: Dr. Steven Bharadwaj

10:10 - 11:00

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DR. KOTOO MEGURO	28

SESSION IV

Saskatoon City Hospital
Rependa Centre Auditorium

CHAIR: Dr. Elke Mau

11:00 - 11:50

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CHANDA HETZEL	29
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Lunch

Foyer outside of Auditorium
Main Floor, Saskatoon City Hospital
12:00 - 13:00

ACKNOWLEDGEMENTS

The Department of Surgery would like to thank the following individuals for serving as judges and moderators for the 2017 Faculty Research Day.

JUDGES

Dr. Jose Tellez

Professor, Neurology,
Department of Medicine, College of Medicine,
University of Saskatchewan

Dr. Grant Miller

Professor, General Surgery,
Department of Surgery, College of Medicine,
University of Saskatchewan

Dr. Anthony King

Clinical Associate Professor, Orthopedic Surgery,
Department of Medicine, College of Medicine,
University of Saskatchewan

Dr. Renee Kennedy

Clinical Associate Professor, Thoracic Surgery,
Department of Surgery, College of Medicine,
University of Saskatchewan

Dr. Kylie Kvinlaug

Clinical Assistant Professor, Vascular Surgery,
Department of Surgery, College of Medicine,
University of Saskatchewan

SESSION CHAIRS

Dr. Michael Kelly

Professor, Program Director,
Neurosurgery Residency Training Program,
Department of Surgery, College of Medicine,
University of Saskatchewan

Dr. Steven Bharadwaj

Clinical Assistant Professor, Thoracic Surgery,
Department of Surgery, College of Medicine,
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Dr. Annika Card

Clinical Assistant Professor, Plastic Surgery,
Department of Surgery, College of Medicine,
University of Saskatchewan

Dr. Elke Mau

Clinical Assistant Professor, Urology,
Department of Surgery, College of Medicine,
University of Saskatchewan

2017

**FACULTY RESEARCH DAY
ABSTRACTS**

SURGERY

Geomapping of Traumatic Spinal Cord Injury in Canada and Factors Related to Triage Pattern

Platform Presenter: Dr. Daryl R. Fourney

Department of Surgery, Division of Neurosurgery,
College of Medicine, University of Saskatchewan

TEAM MEMBERS

Christiana Cheng, Rick Hansen Institute; Vanessa Noonan, Rick Hansen Institute; Jayson Shurgold, Rick Hansen Institute; Jason Chen, Rick Hansen Institute; Carly Rivers, Rick Hansen Institute; Hamid Hamedani, Rick Hansen Institute; Suzanne Humphreys, Rick Hansen Institute; Christopher Bailey, Western University; Najmedden Attabib, Dalhousie University; Jean-Marc Mac-Thiong, CHU Sainte Justine; Michael Goytan, University of Manitoba; Jerome Paquet, University of Laval; Richard Fox, University of Alberta; Henry Ahn, University of Toronto; Brian Kwon, University of British Columbia

ABSTRACT

RATIONALE

More than half of traumatic spinal cord injury (TSCI) patients experience delays in transfer and receive surgery more than 24 hours post injury. The objectives of this study were to determine the geographic distribution of TSCI in Canada relative to specialized treatment centers, assess clinical and logistical factors at play for indirect admissions to those centers, and to explore differences in current time to admission and simulated scenarios in an attempt to assess the potential impact of changes to triage protocols.

METHODS

876 patients with TSCI enrolled in the prospectively collected acute Rick Hansen Spinal Cord Injury Registry (RHSCIR) between January 1, 2010 and December 31, 2013.

RESULTS

Patients transported directly to a RHSCIR acute facility were more likely to reach the facility within 1 h of injury while those transported indirectly were more likely to arrive 7 h later. Considering the injuries occurring within 40 km of a RHSCIR acute facility (n=323), 249 patients (77%) were directly admitted and 74 (23%) were indirectly admitted. In the multivariate regression analysis, only older age and longer road distance remained significantly associated with being indirectly admitted to a RHSCIR facility. Compared to the current status, the median time to admission decreased by 20% (3.5 h) in the 100% direct admission scenario; and increased by 102% (8.9 h) in the 100% indirect admission scenario.

CONCLUSION

The geographical patterns discovered in this study can inform province-specific resources allocation and triage protocol to optimize pre-hospital care of TSCI in Canada.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

Rick Hansen Foundation

Bivalirudin as an adjunctive anticoagulant to heparin in the treatment of heparin resistance during cardiopulmonary bypass-assisted cardiac surgery

Platform Presenter: Dr. Erick McNair

Department of Surgery, Division of Cardiac Surgery,
College of Medicine, University of Saskatchewan

TEAM MEMBERS

JoAnne Marcoux, Division of Cardiac Surgery; Dorothy Thomson, Division of Cardiac Surgery; Cara Bally, Department of Pathology and Laboratory Medicine; Jonathan Gamble, Department of Anesthesiology and Pain Management

ABSTRACT

RATIONALE

Heparin resistance (HR) is the inability to reach an acceptable activated clotting time following a calculated dose of heparin. Up to 20% of the patients undergoing cardiothoracic surgery with cardiopulmonary bypass using unfractionated heparin “gold standard” for anticoagulation experience HR. However, it is contraindicated in patients with heparin-induced thrombocytopenia and heparin or protamine allergy.

METHODS

The safety and efficacy of the use of the direct thrombin inhibitor bivalirudin for anticoagulation during cardiac surgery has been reported. However, there have been no reports on the treatment of HR with bivalirudin during CPB. In this review, we report the favorable outcome with the alternative use of bivalirudin in the management of anticoagulation of HR patients undergoing cardiac surgery.

RESULTS

The decreased venous drainage and suspected clot formation was likely due to (1) low AT levels; (2) soluble fibrin; and (3) fibrin absorbed on the surface of the CPB circuit. The bivalirudin solved the problem of heparin resistance, but the thrombosis was likely resolved by the fibrinolytic response during CPB. The high levels of d-dimer and low fibrinogen post-CPB are evidence of fibrin degradation from fibrinolysis. This report led to a change in practice in the Saskatoon Health Region. AT is now readily available and used routinely for the treatment of heparin resistance during cardiopulmonary bypass supported cardiothoracic surgery.

CONCLUSION

Although controversial, this novel strategy is useful in decreasing hemostatic activation during CPB in HR patients. AT should be available at all institutions performing cardiac surgery. Therefore, because the disadvantages outweigh the advantages noted earlier, we recommend that the treatment of HR with bivalirudin be used as a last resort.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

The authors acknowledge the support of Dr. Mendez, Head, Department of Surgery and Dr. Dalshaug, Head, Division of Cardiac Surgery. We would also like to thank Dr. Mycyck, and Victor Uppal for their contributions. We would also like to thank Sharon Wandzura for her time and effort

Imaging Glycogen and Lactate: Using FTIR Spectroscopy to Spatially Localize Metabolic Parameters of the Glial Response Following Brain Ischemia

Platform Presenter: Dr. Michael Kelly & Nicole Sylvain

Department of Surgery, Division of Neurosurgery,
College of Medicine, University of Saskatchewan

TEAM MEMBERS

Huishu Hou, Division of Neurosurgery; M. Jake Pushie, Division of Neurosurgery; Sally Caine, College of Pharmacy & Nutrition; Mariam Alaverdashvili, College of Pharmacy & Nutrition; Mark J. Hackett, Nanochemistry Research Institute, Department of Chemistry, Curtin University, Perth, Australia

ABSTRACT

RATIONALE

An ongoing challenge in the neuroscience field is imaging key metabolites associated with compromised cellular energy metabolism following brain injuries, like ischemia. Although glycogen can be semi quantitatively analyzed using stains such as periodic acid-Schiff (PAS) staining, these traditional staining methods suffer from typical histochemistry confounding factors, such as variable reagent penetration and binding. In addition, histochemical detection of glycogen does not reveal information on the metabolic fate of glycogen (i.e., lactate production).

METHODS

We induced a stroke in adult mice using the photothrombotic stroke model, and produced serial sections of post-stroke brain tissue. We performed Fourier transform infrared (FTIR) imaging on the sections to map the distribution of lactate and glycogen.

Immunohistochemistry was also performed on these sections to provide a comparison with the glial distribution. The distribution of glycogen, revealed by FTIR imaging, has been further compared with histochemical detection of glycogen in the adjacent tissue sections using PAS staining.

RESULTS

We demonstrate the first application of FTIR spectroscopy for direct spectroscopic imaging of brain glycogen and lactate. The glycogen distribution revealed by FTIR is comparable to the distribution revealed by PAS staining, but with more accuracy and cellular detail. Astroglia distribution correlated with glycogen distribution, and both distributions increased with time in the penumbra.

CONCLUSION

We studied spatiotemporal disturbances in metabolism relative to glia and neuronal populations following ischemia using FTIR and traditional microscopy. Validation of a direct semiquantitative method to simultaneously image both brain glycogen and lactate in the same tissue section is of benefit in this research field.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

This work was supported by a Saskatchewan Health Research Foundation (SHRF) Establishment Grant awarded to M.E.K.; a Heart and Stroke Foundation (HSF), SHRF, and University of Saskatchewan Research Chair for Clinical Stroke Research awarded to M.E.K.; a joint Canadian Institutes of Health Research (CIHR)/Heart and Stroke Foundation of Canada (HSFC) Synchrotron Medical Imaging Team Grant #CIF 99472 awarded to Helen Nichol, M.E.K., and others. M.J.H. received scholarship support as a CIHR Postdoctoral Fellow and a Saskatchewan Health Research Foundation postdoctoral fellow. M.J.H. and S.C. received support as SMI postdoctoral fellows and CIHR-Training grant in Health Research Using Synchrotron Techniques (CIHR-THRUST) Fellows. Research described in this paper was performed in part at the Mid-IR beamline at the Canadian Light Source

Saskatchewan's surgical wait times: the last decade – good old days or good riddance?

Platform Presenter: Dr. Geoffrey Johnston

Department of Surgery, Division of Orthopedic Surgery,
College of Medicine, University of Saskatchewan

ABSTRACT

RATIONALE

Surgical wait times in the Province are on the rise again. Perhaps forgotten, or unknown, are the events that occurred in the Province over the last decade that may have influenced the drop in surgical waiting times. For surgical leaders of today it is important to be aware of these events, to learn from our history. This is especially relevant given the Government's adoption of a single health authority for the entire Province.

METHODS

Events of the last decade in Saskatchewan deemed to be of surgical significance were identified and placed onto a timeline. Superimposed on this were the patterns of change in surgical wait times for the two largest health regions, the Regina Qu'Appelle and Saskatoon Health Regions over that same decade. From this the authors had the means to speculate on the impact of interventions.

RESULTS

Surgical wait times have fallen substantially in the last decade, only to rise again in the last two years. Each of the interventions have had an impact, some more than others on the wait times. The introduction of third party private surgical services' delivery in both Regions was associated with the steepest drop in the number of patients waiting for surgery.

CONCLUSION

Surgical wait times are less than they were a decade ago. Efforts to decrease the wait time have been successful. Lessons learned should inform surgical leaders of strategies most apt to be effective. In the face of a single health authority in the Province, the more you know the better.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

None

A prospective comparison of outcome in patients undergoing surgery for low back and leg pain between patients referred first to a Clinical Spine Pathway Triage Clinic and patients referred directly to a spine surgeon

Platform Presenter: Dr. Adam Wu

Department of Surgery, Division of Neurosurgery,
College of Medicine, University of Saskatchewan

TEAM MEMBERS

Dr. Daryl Fourney, Division of Neurosurgery

ABSTRACT

RATIONALE

The Saskatchewan Spine Pathway (SSP) was developed as triage pathway to facilitate more appropriate and timely management and utilization of advanced imaging resources (such as MRI) for patients with low back pain and leg pain, by identifying at the level of primary care those patients who are unlikely to need or benefit from medical imaging and/or spine surgery consultation, and initiating appropriate non-surgical management earlier. While the main benefit of the SSP is for the majority of LBP patients who do not need surgery, this should not come at the cost of delayed treatment and/or worse satisfaction or outcome for the minority of patients who would benefit from surgery from the interpolation of a triage clinic referral prior to direct referral to a spine surgeon.

METHODS

In this study we prospectively compared patient satisfaction, utilization of resources, waiting time for treatment, and final outcome between patients undergoing spine surgery who were referred through the SSP with those who were referred directly to a spine surgeon.

RESULTS

We found that patients who went through the SSP had significantly shorter wait times for surgical consultation and MRI, and no difference in total waiting time to surgery. SSP patients also had significantly more conservative management for their symptoms, and greater satisfaction, prior to seeing the spine surgeon. There were no significant differences in the outcomes of surgery in Oswestry, VAS(back), and VAS(leg) scores up to 1 year after surgery, other than a trend towards a lower VAS(leg) score at 1 year in the SSP group.

CONCLUSION

Initial assessment through a triage pathway resulted in improved utilization of conservative management and patient satisfaction with care prior to surgery and no significant differences in surgical outcomes.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

RUH Foundation

Novel therapeutic approach to improve clinical outcomes in patients with head and neck cancer

Platform Presenter: Dr. Silvana Papagerakis

Department of Surgery,
College of Medicine, University of Saskatchewan

TEAM MEMBERS

Laboratory of the Oral, Head and Neck Cancer, Personalized Diagnostics and Therapeutics within the Cancer Cluster, University of Saskatchewan; Laboratory of Head and Neck Cancer Invasion and Metastasis, University of Michigan Ann Arbor

ABSTRACT

RATIONALE

In addition to contributing to the complications post radio- or chemo-therapies, there is evidence that pathological acid production and reflux may play a role in the etiology of head and neck squamous carcinoma (HNSCC). Acidity contributes to both tumor progression and resistance to chemotherapy. Antacid medications are commonly and chronically used in patients with HNSCC based on their ability to decrease and/or inhibit the acid production. They consist in two classes: histamine receptor-2 antagonists (H2 blockers) and proton pump inhibitors (PPIs).

METHODS

The overall goal of my research project is to determine the potential therapeutic benefit of such agents in patients with head and neck cancer and explore the mechanisms by which these drugs can protect against cancer progression and mortality.

RESULTS

We have solid evidence, which demonstrate that HNSCC patients might benefit from antacids medications as part of their cancer treatment. Our molecular epidemiological study is the first to unveil a significant survival benefit of antacids in HNSCC patients. The outcome of the proposed research will result in a series of focused clinical trials to further evaluate these novel therapeutic concepts.

CONCLUSION

This research has the potential to guide novel chemopreventive interventions for the HNSCC treatment. Determining agents that are effective in the prevention/treatment of HNSCC is of significant importance because to date the chemopreventive armamentarium is not large. While the research model is HNSCC, findings likely can be applied to other types of cancer.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

American Cancer Society RSG-13-103-01-CCE

Remote Presence Robotic Technology: Narrowing the Gap of Inequality in HealthCare Delivery

Platform Presenter: Dr. Ivar Mendez

Department of Surgery, Division of Neurosurgery,
College of Medicine, University of Saskatchewan

TEAM MEMBERS

Tanya Holt, Pediatric Critical Care; Veronica McKinney, Northern Medical Services; Scott J. Adams, College of Medicine; Brent E. Burbridge, Medical Imaging; Paul S. Babyn, Medical Imaging; Nazmi Sari, Economics

ABSTRACT

RATIONALE

Access to specialized medical care in remote communities in Canada and particularly in Saskatchewan is a substantial challenge. We evaluated the use of remote presence robotic technology to assess, manage, and triage acutely ill pediatric patients and determine the need for inter-facility transport. The hypothesis was that robotic technology would expedite initiation of treatment, support triaging, and reduce the need for transport. We also compared the accuracy of a novel robotic ultrasound system with conventional ultrasonography.

METHODS

Thirty-eight acutely ill children from a remote clinic were prospectively recruited. They were assessed, managed and triaged using a remote presence robot. The primary end point was the number of transports required. The secondary end points included the number of patients transported to a regional center and hospital length of stay (LOS). Eighteen patients prospectively underwent a conventional sonography examination followed by a telerobotic sonography examination and these two exams were compared for diagnostic accuracy.

RESULTS

Fourteen of 38 (37%) cases required transport; whereas all (100%) control patients were transported. Six (42.8%) of transported cases were directed to a regional care hospital. None of the control patients were regionalized. The differences in transportation and regionalization between the cases and controls were statistically significant ($p < 0.05$). The hospital LOS beyond 24 hours were significantly greater in the control group when compared to the intervention non transported group ($p < 0.001$). There was no significant difference in diagnostic accuracy between the two modalities of ultrasonography. All patients responded that they would be willing to have another telerobotic examination.

CONCLUSION

Using these new technologies we were able to effectively assess, manage, and triage acutely ill pediatric patients prior to inter-facility transport. The use of a telerobotic ultrasound system is feasible for performing abdominal ultrasound examinations at a distant location with minimal training and set-up requirements.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

Ministry of Health, Province of Saskatchewan

Persistent adenosine signaling promotes alpha-synuclein expression in a novel rat model of Parkinson's disease.

Platform Presenter: Elisabet Jakova

Department of Surgery, Division of Neurosurgery,
College of Medicine, University of Saskatchewan

TEAM MEMBERS

Jocelyn Stockwell, Division of Neurosurgery; Siddarth Nosib, Division of Neurosurgery; Francisco Cayabyab, Division of Neurosurgery; Jeremy S. Lee, Department of Biochemistry

ABSTRACT

RATIONALE

Destruction of dopaminergic neurons in substantia nigra pars compacta (SNc) underlies the motor deficits observed in Parkinson's disease (PD).

METHODS

Although various therapeutic strategies are available to alleviate the symptoms of PD, including dopamine replacement therapy and monoamine oxidase inhibitors, none of these therapies slows progression of the disease. Since we recently reported that adenosine contributes to neuronal damage in *in vivo* and *in vitro* stroke models, we now hypothesize that aging-related elevation of cerebral adenosine leads to dopaminergic neuron damage in SNc. Using Sprague-Dawley rats, we developed a new PD model by chronic *i.p.* injection of the adenosine A1 receptor (A1R) agonist N(6) cyclopentyladenosine (CPA), and tested the effects of novel neuroprotective agents in this new Parkinson's model.

RESULTS

Compared to vehicle controls, systemic administration of 3mg/kg CPA for 7 days caused hippocampal-dependent learning deficits (Y-maze test), consistent with increased neurodegeneration of hippocampal neurons (FluoroJade B staining and NeuN labelling). CPA-treated rats also showed significant motor impairment and increased depressive behavior (forced swim test), which was prevented by A1R antagonist DPCPX, 1-aminoindan (a metabolite of Rasagiline), or caffeine-1-aminoindan dimer. In contrast, the amphetamine metabolite 2-aminoindan, which is structurally similar to 1-aminoindan, did not prevent the CPA-mediated behavioral deficits.

CONCLUSION

Using nanopore and imaging analyses, we determined that the neuroprotective compounds exerted their effects by preventing A1R-mediated increase in alpha-synuclein expression and aggregation. Taken together, these data suggest that chronic A1R signaling plays a major role in the early stages of PD pathogenesis, and that A1R-alpha-synuclein interaction represents a novel therapeutic target for PD.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

College of Medicine Graduate Student Award (CoMGRAD) to EJ; NSERC Discovery Grant, Heart and Stroke Foundation of Canada Grant-in-Aid (GIA); Saskatchewan Health Research Foundation CID Grant; Canada Foundation for Innovation to FSC

Shedding light on the ischemic penumbra in a photothrombotic stroke model using synchrotron-based X-ray fluorescence imaging.

Platform Presenter: Jake Pushie

Department of Surgery, Division of Neurosurgery,
College of Medicine, University of Saskatchewan

TEAM MEMBERS

Nicole J. Sylvain, Division of Neurosurgery; Huishu Hou, Division of Neurosurgery; Andrew M. Crawford, Department of Geological Sciences; Graham N. George, Department of Geological Sciences; Michael E. Kelly, Division of Neurosurgery; Mark J. Hackett, Nanochemistry Research Institute, Department of Chemistry, Curtin University, Perth, Australia

ABSTRACT

RATIONALE

Our team employs a suite of spectroscopic imaging techniques to visualize the elemental and metabolic changes in brain tissue following an ischemic stroke. We have need of an automated, unbiased method for characterizing populations of cells based on their elemental and metabolic characteristics. Our goal is to track changes to the infarct and penumbra following treatments in future studies.

METHODS

We employ a photothrombotic mouse model of stroke which produces a highly focal thrombus. Post-mortem brain sections, collected 1 day post-stroke, are mapped using synchrotron-based X-ray fluorescence imaging (XFI). Images are analyzed with a Gaussian clustering method using expectation maximization to separate the tissue into discrete regions of interest.

RESULTS

We have implemented a data analysis algorithm which differentiates statistically different regions within and surrounding the stroke lesion. The method separates the core of the infarct from healthy tissue, and also demarcates a discrete penumbra. These regions of interest can be combined with elemental and metabolic data from XFI experiments, as well as with conventional histological and immunohistochemical techniques performed on the same or adjacent tissue sections.

CONCLUSION

The XFI experiments provide an indicator of metabolic status as well as severity of depolarization and we hypothesize that the cell populations demarcated by the clustering algorithm provide a reproducible means of visualizing the size and extent of the penumbra at the level of the single cell. This method provides our team with the critically-needed tool to track changes in metabolic status and penumbra size in new animal models and treatments.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

Saskatchewan Health Research Foundation (SHRF); Heart and Stroke Foundation; College of Medicine Dean's Summer Research Award; Canadian Institute of Health Research (CIHR)

Checklist Implementation in Saskatchewan for Lumbar Spine MRI reduces MRI requisitions

Platform Presenter: Dr. Gary Groot

Department of Surgery, Division of General Surgery,
College of Medicine, University of Saskatchewan

TEAM MEMBERS

Dr. Kopriva, Division of Vascular Surgery; Deb Gudmondson, Ministry of Health

ABSTRACT

RATIONALE

Improving Appropriateness of Care (AC) is a key priority for the Saskatchewan health system. In early 2015, MRI of the lumbar spine (L-Spine) was selected as a prototype project to test the provincial AC framework. The goal of this project was to improve appropriate ordering of MRI L-Spine.

METHODS

Drs Groot and Kopriva led a group of clinicians (orthopedic surgeons, neurosurgeons, radiologists, a family physician, and chiropractor) and patient advisors in addressing the question of how to improve the ordering of MRI's of the Lumbar Spine based on available evidence. They developed a MRI L-Spine Checklist based on best practice guidelines, as a decision support tool for ordering physicians, that was successfully piloted in the Saskatoon Health Region and the Regina Qu'Appelle Health Region in the fall of 2015. A pre- post analysis of the number of requisitions received was conducted as well as measuring checklist compliance.

RESULTS

Physician compliance for use of the checklist was above 90% by the end of the pilot, indicating that the checklist has become part of daily work for many physicians. The checklist resulted in a significant reduction in the volumes of MRI lumbar spine requisitions in RQHR and SHR since the checklist was implemented. The key factor that contributed to the successful implementation was effective engagement and involvement of physicians, health system leaders/providers and patients in this project.

CONCLUSION

An evidence-based checklist added to the MRI requisition form for Lumbar Spine MRI's resulted in a significant reduction in MRI requisitions in Saskatchewan.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

We would like to acknowledge the support and funding received from the Ministry of Health Appropriateness of Care Program and the Saskatchewan Health Quality Council

Functional MRI and Diffusion Tensor Imaging in Clinical Practice

Platform Presenter: Dr. Layla Gould

Department of Surgery, Division of Neurosurgery,
College of Medicine, University of Saskatchewan

TEAM MEMBERS

Michael Kelly, Division of Neurosurgery; Marla Mickleborough, Department of Psychology; Chelsea Ekstrand, Department of Psychology; Ron Borowsky, Department of Psychology; Tasha Ellchuk, Department of Medical Imaging; Hamid Dabirzadeh, Department of Medical Imaging

ABSTRACT

RATIONALE

Functional magnetic resonance imaging (fMRI) is a neuroimaging technique that detects changes in cerebral blood flow in order to map brain activity. The clinical fMRI team at RUH uses fMRI to localize functional brain regions near the surgical resection plane in patients undergoing surgery for various conditions, including temporal lobe epilepsy, tumours, cortical and vascular malformations, and other lesions in order to avoid disrupting cognitive processes as much as possible. Given that each patient type presents unique challenges with respect to developing cognitive tasks that will activate regions near the planned surgical margins, our work involves designing individualized fMRI paradigms to suit each patient's specific needs.

METHODS

We have created paradigms for mapping speech production, attention, perception of objects, faces, and places, semantic memory, emotion, as well as motor and sensory functions. Our team also uses Diffusion Tensor Imaging (i.e., fiber tracking) to visualize specific white matter tracts, which can help to identify changes in the tracts that may be due to tumours or other malfunctions.

RESULTS

This presentation will discuss specific cases in which presurgical fMRI helped neurosurgeons select their surgical approach, thus highlighting the utility of presurgical planning in localizing cognitive processes in order to maximize surgical outcomes on a case-by-case basis.

CONCLUSION

Overall, the presentation should serve to educate clinicians about the value and implications of presurgical fMRI, as well as how to identify candidates for this procedure.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

Saskatchewan Health Research Foundation

Early Surgical and Clinical Outcomes with an Active Transcutaneous Bone Conduction Implant

Platform Presenter: Dr. Nael Shoman

Department of Surgery, Division of Otolaryngology,
College of Medicine, University of Saskatchewan

TEAM MEMBERS

Lynne Brewster, Saskatchewan Pediatric Auditory Rehabilitation Center (SPARC); Uta Stewart, Audiology, Saskatoon Health Region; Natalie Morog, Audiology, Saskatoon Health Region

ABSTRACT

RATIONALE

Bone conduction implants (BCI) are indicated in the management of conductive and mixed hearing loss as well as single sided deafness. Although percutaneous coupling has achieved consistent and powerful outputs, they suffer concerns of soft tissue complications and cosmetic considerations. The BONEBRIDGE (BB) is an active transcutaneous BCI that received clinical approval from Health Canada for adults in 2013, and for children in 2015. This study describes early surgical and clinical experiences with the BB. Research design: A retrospective analysis at a tertiary academic center.

METHODS

Clinical variables included patient demographics, surgical indications, operative details, immediate and short term complications, and patient comments on hearing ability and device design. Audiometric outcomes included audiometric thresholds, speech performance as well as qualitative measures. Outcomes were recorded from the 1 to 12 month follow up appointments. Statistical analysis was undertaken to assess pre- and post-operative measures.

RESULTS

Eleven adults (age 22 – 62) and 6 children (age 5 – 14) were implanted. Patients had erythema at the magnet site and this resolved with downgrading the magnet strength. No other perioperative complications were reported. Audiometric outcomes showed significant improvement in speech perception performance. Qualitative measures indicated all children tolerated the device well and parents reported higher usage compliance than with Softbands.

CONCLUSION

The BB is safe in children and adults with a low surgical complication rate. The device provides significant objective improvements in audiological outcomes as well as subjective benefit in everyday situations and is associated with a high acceptance rate by patients.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

None

Synchrotron speckle-based X-ray phase-contrast imaging for mapping intra-aneurysmal blood flow without contrast agent

Platform Presenter: Dr. Lissa Peeling

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TEAM MEMBERS

Dr. Michael Kelly, Division of Neurosurgery

ABSTRACT

RATIONALE

This study aims to assess the performance of the synchrotron speckle-based X-ray phase contrast particle imaging velocimetry (PIV) to map the velocity fields of a pulsatile blood flow in an in-vitro aneurysm model without usage of contrast agents.

METHODS

Fresh heparinized porcine blood was used in a blood circulation loop driven by a peristaltic pump. The silicone aneurysm model was imaged using the synchrotron X-ray phase contrast imaging (PCI). X-ray images were processed, speckle characteristics were assessed, and the best PCI parameters were determined for X-ray PIV. A computational fluid dynamic (CFD) model was developed for simulation of intra-aneurysmal blood flow and compared to the X-ray PCI-PIV measurements for interpretation of the blood flow patterns.

RESULTS

Image processing significantly improved X-ray speckle characteristics suitable for PIV analysis. X-ray PIV measurements of blood cell sedimentation velocity and laminar flow velocity profile had a good agreement with theoretical models. The X-ray PIV measurement of the cyclic intra-aneurysmal blood flow was consistent with the actual frequency of the peristaltic pump. The CFD model and X-ray PIV measurements showed similar intra-aneurysmal blood flow structures but the velocity magnitudes were generally higher in CFD model. Contrary to CFD model, X-ray PIV measurements showed a blood cell sedimentation layer cushioning upon the blood flow shear force at the wall. The discrepancies between CFD simulations and X-ray PIV measurements of the flow patterns can be potentially associated with the blood cell sedimentation layer, mostly at the aneurysm dome, which is widely neglected in CFD models.

CONCLUSION

Synchrotron speckle-based X-ray PCI-PIV technique was technically successful for visualization of blood flow in an in-vitro aneurysm model. The X-ray PCI-PIV measurements are useful not only for the characterization of intra-aneurysmal blood flow but also for the refinement of our interpretation of CFD simulations. Findings from this study pave the road toward PCI-PIV based hemodynamic analysis for geometrically different patient specific aneurysm models without the usage of contrast agents.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

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Prevalence of Osteoporosis, Low and Normal Bone Density in Women \geq 50 years with a recent Distal Radius Fracture and Relationship to Clinical Features and Radiographic Outcomes

Platform Presenter: Dr. Geoffrey Johnston & Alexander Perreault

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ABSTRACT

RATIONALE

Although osteoporosis increases a patient's predisposition to secondary fragility fracture up to sevenfold, the identification and treatment of these patients at risk typically is less than 10%. We sought to determine the prevalence and distribution of osteoporosis, low, and normal bone density (OP/LBD/NBD) in women \geq 50 years referred to our DRF clinic, and to identify the impact of osteoporosis on the radiographic and clinical outcomes of treatment.

METHODS

The prevalence and distribution of OP, LBD and NBD was determined in women \geq 50 years who had both a DRF and DEXA bone densitometry (BMD). Secondly, radiographic, clinical and patient-reported outcomes were stratified according to bone density and contrasted.

RESULTS

Of 523 eligible women 41%, 51% and 8% had OP, LBD and NBD, respectively. Significant findings included: radiographically, the initial correction of radial inclination was less in patients with OP, final ulnar variance was more positive in patients with OP, and initial correction of radial tilt was greatest in NBD, least in OP; grip strength was lower in patients with OP; patients with OP reported greater dysfunction at 6 and 12 months post-fracture.

CONCLUSION

A DRF in a woman \geq 50 years is a "sentinel event", indicative of weakened underlying bone structure. The prevalence of osteoporosis in these women is double the quoted norm for the same group without a DRF. Osteoporosis negatively influences radiographic, grip strength and PRWE outcomes. Physicians treating these fragility DRFs should order BMD measurement and relay the results to primary care practitioner.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

None

Epidemiology of spinal infections: retrospective review of the patients with osteomyelitis, discitis, and epidural abscesses

Platform Presenter: Dr. Kotoo Meguro

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TEAM MEMBERS

Brittany Pirlot, Division of Neurosurgery; Tasha Ellchuk, Department of Medical Imaging

ABSTRACT

RATIONALE

Spinal infections are one of the most difficult, complex, and multi-disciplinary health conditions. The purpose of this paper was to gather demographic information of the patients with spinal infections and to identify factors that would influence their management.

METHODS

Retrospective chart review of 176 adult patients with osteomyelitis, discitis or epidural abscesses admitted to the Royal University Hospital, Saskatchewan, from 2007-2014. This study included 176 adults, of whom 60% were male and 40% were female. The mean age was 54 years old. 69% had osteomyelitis, 45% had an epidural abscess, and 41% had discitis. 45% of patients were intravenous drug users, 40% were Hepatitis C positive, and 12% were HIV positive. 36% of patients underwent surgery.

RESULTS

Presence of an epidural abscess, presence of a neurological deficit on admission, older age, higher white blood cell count, shorter duration between onset of symptoms and admission, longer duration of admission in hospital, and increased T2-weighted signal on MRI were identified as statistically significant in relation to poor outcome. Presence of an epidural abscess, presence of a neurological deficit on admission, higher white blood cell count and longer duration of admission in hospital were identified as statistically significant in relation to need for surgery.

CONCLUSION

We were able to identify high-risk patients as to the need for surgery and poor outcome. Based on this information, we can better tailor our management strategy of this difficult condition.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

2015 Dean's summer student project

Decision Making Process of Cancer Treatment for Indigenous Women with Breast Cancer

Platform Presenter: Chanda Hetzel

Department of Surgery, Division of General Surgery,
College of Medicine, University of Saskatchewan

TEAM MEMBERS

Dr. Gary Groot, Division of General Surgery; Dr. Jennifer Poudrier, Department of Sociology; Dr. Rose Roberts, Department of Community Health and Epidemiology; Dr. Tracey Carr, Department of Community Health and Epidemiology; Dr. Linda McMullen, Department of Psychology; Dr. Mary Hampton, Department of Psychology, University of Regina; Tania Lafontaine, Saskatoon Health Region; Lorna Arcand, First Nations and Metis Health Services; Shelley May Neufeld, Department of Community Health and Epidemiology

ABSTRACT

RATIONALE

This qualitative project focuses on the decision making process that Indigenous women undergo when receiving breast cancer treatment.

METHODS

One-on-one, open-ended interviews were completed with 12 Indigenous women from the Saskatchewan region. Two-eyed seeing was the theoretical framework that developed the data collection and analysis phases. Two-eyed seeing integrates Western science and Indigenous knowledge together. This lens was chosen as we anticipated that participants may view health and healing by either a Traditional or a Western perspective, or a combination of the two. A methodological approach of inductive thematic analysis was conducted to conclude the main findings.

RESULTS

There were four main findings which were: the importance of support especially through holistic healing, the importance of worldview, the impacts of colonization, and the amount of accessibility to health care services.

CONCLUSION

The results from this study suggest that Indigenous women are still facing barriers in the health care system when going for breast cancer treatment. These barriers include: differing understandings of health and healing between patients and physicians, distrust in health care professionals and the health care system as a result of colonial influences, as well as the lack of accessibility and education on breast cancer especially for Northern communities. This situation could be improved upon by further integration of culturally appropriate services, and better education around screening and preventative practices for Indigenous women with breast cancer within Saskatchewan's health care system.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

Dr. Gary Groot, Department of Surgery, Division of General Surgery - Principal Investigator; Dr. Jennifer Poudrier, Department of Sociology, College of Arts and Science - Supervisor; Dr. Rose Roberts, Department of Community Health and Epidemiology, College of Medicine - Interviewer; Saskatchewan Health Research Foundation; Collaborative Innovation Development Grant

Lateral nigrostriatal lesioning with an adenosine A1 receptor agonist produces parkinsonian symptoms in rats

Platform Presenter: Jocelyn Stockwell

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TEAM MEMBERS

Damaso Sadi, Division of Neurosurgery; Dr. Ivar Mendez, Division of Neurosurgery; Dr. Francisco Cayabyab, Department of Surgery

ABSTRACT

RATIONALE

Parkinson's disease is characterized by loss of dopaminergic neurons in the substantia nigra pars compacta (SNc), resulting in progressive motor dysfunction. Traditional animal models for Parkinson's disease include lesioning of the SNc or nigro-striatal pathway using substances toxic to dopaminergic neurons, such as 6-hydroxydopamine (6-OHDA) or rotenone. Although these substances produce robust parkinsonian symptoms in rats, these models are not necessarily translational to the human disease and do not allow us to investigate the progressive early stages of the disease. Adenosine signaling has been implicated in multiple aging-related neurodegenerative disorders including stroke, Alzheimer's disease, and Parkinson's disease. Our lab has recently shown evidence of prolonged adenosine A1 receptor (A1R) activation causing neurodegeneration, demonstrated by significant neuronal death in the hippocampus. We investigated the role of adenosine signaling in a new rat model of Parkinson's disease (PD).

METHODS

Recently, we showed that 48 hour or 7 day intraperitoneal (i.p.) injection of rats with the A1R agonist N6-cyclopentyladenosine (CPA) produced significant motor and cognitive deficits in Sprague-Dawley rats. Alternatively, female Wistar rats were laterally lesioned with CPA in the nigro-striatal pathway. Both 3 and 6 weeks following lesioning, a battery of testing was performed to characterize motor function. Post-mortem analysis of the SNc using immunohistochemistry was then performed to explore the effects of lesioning on the dopaminergic neuron population.

RESULTS

Lesioned rats showed motor deficits in motor behavioural tests and immunohistochemistry assays showed significantly reduced tyrosine hydroxylase staining on the lesioned side of the SNc.

CONCLUSION

Taken together, these results indicate that lesioning the nigro-striatal pathway with CPA induces parkinsonian symptoms which may give us further insight into the role of adenosine in the development of Parkinson's disease.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

Heart and Stroke Foundation of Canada Grant-in-Aid; Saskatchewan Health Research Foundation; NSERC Discovery Grant and CFI awarded to FSC; Graduate Program in Health Science Scholarship Support to JS

Patient-Rated Outcomes of Fragility Distal Radial Fractures No Less Than 5 Years Post Fracture in Women 50 Years and Older

Platform Presenter: Dr. Geoff Johnston

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ABSTRACT

RATIONALE

We know the one-year patient-reported outcomes in women ≥ 50 years who have experienced distal radial fractures (DRFs) – they remain mildly symptomatic. In order to better inform best treatment we sought to learn of longer term outcomes in these same women, and to speculate on the influence that the first year radiographic and clinical outcomes might have had on the 5-year PRWE score.

METHODS

From a cohort of women ≥ 50 years treated for an isolated DRF for one year, all who were at least five years post-fracture were invited by telephone to participate by completing a patient rated wrist evaluation (PRWE) questionnaire. The differences between first and 5-year scores were analyzed.

RESULTS

143/250 women eligible for the study were available to participate, and of these 141 agreed to participate. 128 completed questionnaires were received. The average follow-up was 6.1 years. For the whole cohort (250) the average PRWE score at one year post-fracture was 23. The average PRWE score of the study participants at 5 years was 12. 95/128 (74%) recorded lower PRWE scores, ten (8%) no change, and 24 (19%) higher PRWE scores. Final ulnar variance was correlated with a higher late PRWE score. There was a trend towards an association of a high 9-week PRWE to a higher 5+ year PRWE score.

CONCLUSION

The majority of women ≥ 50 years with a DRF at a minimum of five years post-fracture reported further improvement in their symptoms over their first year post-fracture score.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

None

A realist synthesis of the Shared Decision Making Literature

Platform Presenter: Dr. Gary Groot

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TEAM MEMBERS

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ABSTRACT

RATIONALE

Shared Decision Making (SDM) is a method of medical decision making that involves a balanced relationship between patients, physicians, and other key players. SDM is purported to improve patient and system outcomes but there are gaps in the current literature between theory and implementation.

METHODS

We conducted a realist synthesis of the SDM literature to identify “in which situations, how, why, and for whom does SDM between patients and health care providers contribute to improved decision making?” A six step iterative process was used that included: preliminary theory development, establishment of a search strategy, selection and appraisal of literature, data extraction, analysis and synthesis of extracted results from literature, and formation of a revised program theory with the input of patient, physician, nurse navigators, and policy maker from a stakeholder session.

RESULTS

A complex mix of interrelated mechanisms in three domains (health care provider, patient and system support) was identified that interacts with the context of the degree of difficulty of a given decision to result in an intermediate outcome of ability to engage in the SDM process which in turn represents the primary mechanism responsible for a patient having a successful patient informed health decision outcome.

CONCLUSION

Our realist synthesis resulted a program theory for SDM through the identification of mechanisms which shape the characteristics of when, how, and why SDM will, and will not, work that will be tested empirically in a variety of contexts, the first of which will be the Saskatchewan Indigenous context.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

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The Saskatchewan Acute Stroke Pathway

Platform Presenter: Dr. Michael Kelly

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TEAM MEMBERS

Laura Schwartz, Saskatchewan Health Quality Council; Jessica Hamilton, Saskatchewan Health Quality Council; K. Ruth Whelan, Saskatoon Health Region; Kim Davy, Saskatoon Health Region; Lori Latta, Saskatchewan Ministry of Health

ABSTRACT

RATIONALE

Prior to 2014, there was no comprehensive acute stroke program in the province of Saskatchewan. This changed with the development of the Saskatchewan Acute Stroke Pathway. The pathway is a Saskatchewan Ministry of Health led initiative to get acute stroke patients to either regional or tertiary centres. The pathway implementation and process will be reviewed along with targeted data regarding outcomes.

METHODS

The Saskatchewan Acute Stroke Pathway implemented Canadian Best Practice Guidelines in 2016. Process changes included 1) changes to EMS bypass protocols and air services, 2) emergency department stroke protocols and 3) emergency imaging protocols using computerized tomography and angiography. A provincial plan to provide endovascular services for patients with large vessel occlusions was implemented with centralization at Royal University Hospital. Robust data collection with continuous quality improvement initiatives were undertaken in collaboration with the Ministry of Health, regional health authorities, and the Saskatchewan Health Quality Council.

RESULTS

There have been significant stroke system process improvements noted. This includes a reduction in door to administration of tPA times, improved utilization of CT angiography, improved access to endovascular stroke therapy, the use of standard order sets provincially and overall reduction in length of stay on acute stroke units.

CONCLUSION

The acute stroke pathway has improved system processes, and allowed for ongoing quality improvement initiative. The movement of acutely ill patients has been streamlined across Saskatchewan. The pathway has improved a patient's access to acute stroke care and reduced the overall burden of stroke on the healthcare system.

ACKNOWLEDGEMENTS/SOURCES OF FUNDING

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