2019 RESIDENT RESEARCH DAY

DEPARTMENT OF SURGERY

University of Saskatchewan

Saskatchewan Health Authority

"Science knows no country,
because knowledge belongs to humanity,
and is the torch which illuminates the world."

- Louis Pasteur

Dr. Ivar Mendez

Fred H. Wigmore Professor and Provincial Head

Department of Surgery

University of Saskatchewan and Saskatchewan Health Authority

I am very pleased to inform that the research productivity of the Department of Surgery continues to improve with a strong grant capture and a record number of peer-reviewed publications this past academic year.

We have placed emphasis in resident research and have increased funding to the Resident Research Initiatives Program. This program provides incentive funding throughout the spectrum of a research project from the ethics application to travel funds for presentations and the publication of a manuscript. We have a program of Resident Research Workshops where faculty present and discuss common research themes. Ongoing mentorship for residents is also provided by networking lunches.

The internal seed funding support for faculty research programs has also been increased and has focused directly to new faculty. We have hired a statistician to provide support for faculty and residents and this past year the statistician was involved in data analysis of 123 projects and papers.

As the amalgamation of a Provincial Health Authority matures, a common approach to surgical services will open new and exciting opportunities for research collaboration. For the first time we will have the opportunity to establish province-wide quality improvement programs and enhance research and education across the province.

This year, our invited speaker is Dr. Cian O'Kelly, Associate professor and Site Lead in the Division of Neurosurgery at the University of Alberta.

We expect an exciting day of research presentations and look forward to seeing you all there!

Our Department of Surgery Resident Research Day this year will highlight surgery health care innovations and ongoing, impactful research within our department that exemplifies the diversity and growth of our surgery research programs, from clinical to translational health research. In the past year, the Department of Surgery has identified priority areas and opportunities to strengthen our research capacity, including investing funds to help support the research of our new surgeon researchers, basic scientists and residents. To date, we will have awarded nearly $50,000 for Resident Research Awards to recognize and engage more residents to do research at the lab bench and at the bedside. Additional investments, specifically the Resident Research Incentives Program, Resident Travel Awards, and the yearly Resident Research Publication Award, continue to support a solid research foundation necessary to attract the best surgical trainees.

I would like to acknowledge the strong commitment of our faculty to research by being generous with their time in providing mentorship and guidance for our resident and medical student researchers and also to congratulate all the trainees for submitting and presenting their abstracts today.

I would like to thank the members of the Surgery Research Committee, who have carefully chosen the excellent lineup of 14 podium presentations – all highlighting the research accomplishments of our junior researchers. I would also like to thank the judges, session moderators and surgery staff for being part of today's Resident Research Day.

Finally, Dr. Mendez and I look forward to welcoming our Keynote Speaker, Dr. Cian O'Kelly from the University of Alberta, and all of our participants to today's Resident Research Day celebration. We hope that you enjoy the scientific presentations at the Asher Auditorium throughout the day and the Awards Banquet tonight at the Sheraton Cavalier Hotel - Top of the Inn! I am very excited to be a part of this year's Resident Research Day and look forward to what promises to be a fantastic event.

Dr. Francisco Cayabyab

Director of Research

Leader, Neuroscience Research Cluster

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

2018 Award Recipients

Surgery, Pathology & Opthalmology Resident Research Day

Platform Presentations:

Excellence in Research Award	Amit Persad
Best Podium Presentation Award	Sarah Schmid
Special Judges Award	Uzair Ahmed
Best Publication Award	Amit Persad & Laura Sims

Kvinlaug Surgical Foundations Research Awards

1st Place	Alexis Brassard
2nd Place	Haven Roy

Pathology Research Awards:

Harry Emson Award - Senior Resident	Alicia Andrews
Jack Adolph Award - Junior Resident	Glenda Wright
Dr. Lorne Massey Award	Nick Baniak

Opthalmology Research Award:

Best Podium Presentation Award	Vinay Kansal

Undergraduate Medical Student Awards:

Dash-Reed Research Award	Kirsten Jewitt

2017 Award Recipients

Surgery & Pathology Resident Research Day

Platform Presentations:

Excellence in Research Award	Sanchea Wasyliv
Special Judges Award	Amanda Hall

Surgical Foundations Research Awards

1st Place	Michael Kindrachuk
2nd Place	Sam Ibrahim

Pathology Research Award:

First Prize	Hui Wang

Undergraduate Medical Student Awards:

Dash-Reed Research Award	Jenna Mann

2019
SURGERY RESIDENT RESEARCH DAY

May 16, 2019

Contents

Introduction

Saskatoon City Hospital
Asher Auditorium

08:00 - 08:25

BREAKFAST

08:25 - 08:30

WELCOME AND INTRODUCTIONS

Dr. Ivar Mendez
Provincial Head & Fred H. Wigmore Professor,
Department of Surgery

Session I

Saskatoon City Hospital
Asher Auditorium

CHAIR: Dr. David Sauder

08:30 - 09:45

Break 09:45 - 10:15

Session II

Saskatoon City Hospital
Asher Auditorium

CHAIR: Dr. Silvana Papagerakis

10:15 - 11:15

Keynote Speaker

Saskatoon City Hospital
Asher Auditorium

11:15 - 12:15

Transitioning to Competency Based Medical Education: Neurosurgery's Journey

Dr. Cian O'Kelly

Associate Professor of Surgery &
Chair, Competency By Design, Neurosurgery Residency Program
College of Medicine, University of Alberta

Site Lead, Division of Neurosurgery, Alberta Health Services

National Director, Canadian Neurosurgery Rookie Camp

Lunch
Foyer outside of Auditorium
Main Floor, Saskatoon City Hospital
12:15 - 13:00

Dr. O'Kelly is an academic neurosurgeon at the University of Alberta.

He attended medical school at the University of Alberta, graduating in 2001. This was followed by neurosurgical residency training at the University of Toronto. While in Toronto, Dr. O'Kelly also completed a Masters in Clinical Epidemiology with the Institute of Health Policy Management and Evaluation and further fellowship training in cerebrovascular and endovascular neurosurgery.

Dr. O'Kelly's current practice focuses on skull base and cerebrovascular surgery combined with endovascular neurointerventional surgery.

His interest and involvement in medical education has evolved through his tenure as program director at the University of Alberta and as specialty lead for Competency by Design at the Royal College Specialty committee in neurosurgery.

Dr. O'Kelly is currently the Neurosurgery Site Lead at the University of Alberta hospital, the Competency Committee Chair for the Neurosurgery Residency Program, and the National Director of the Canadian Neurosurgery Rookie camp. His research Interests include the epidemiology of subarachnoid hemorrhage, aneurysm treatment, and AVM treatment.

Dr. Cian O'Kelly

Associate Professor in Surgery &
Site Lead, Division of Neurosurgery

University of Alberta and Alberta Health Services

Session III

Saskatoon City Hospital
Asher Auditorium

CHAIR: Dr. Grant Miller

13:00 - 14:15

Closing Remarks 14:15 - 14:30

2019
SURGERY RESIDENT RESEARCH DAY
BANQUET

Sheraton Cavalier
Top of the Inn

Sheraton®

RECEPTION
18:00

DINNER
19:00

Presentation of prizes:
Drs. Ivar Mendez & Francisco Cayabyab

Acknowledgments

The Departments of Surgery would like to thank the following individuals for serving as judges and sessions chairs for the 2019 Resident Research Day.

Judges

Dr. Cian O'Kelly
Associate Professor of Surgery
Division of Neurosurgery
College of Medicine, University of Alberta

Dr. Daryl Fourney
Professor, Department of Surgery
Research Director, Division of Neurosurgery
College of Medicine, University of Saskatchewan

Dr. Gary Groot
Professor, Department of Surgery
Division of General Surgery
College of Medicine, University of Saskatchewan

Dr. Darrell Mousseau
Professor
Department of Psychiatry
College of Medicine, University of Saskatchewan

Dr. Marek Radomski
Vice Dean, Research
College of Medicine, University of Saskatchewan

Session Chairs

Dr. David Sauder
Assistant Professor, Department of Surgery
Division of Orthopedic Surgery
College of Medicine, University of Saskatchewan

Dr. Silvana Papagerakis
Associate Professor, Department of Surgery
Cancer Research Cluster
College of Medicine, University of Saskatchewan

Dr. Grant Miller
Professor, Department of Surgery
Pediatric Surgery
College of Medicine, University of Saskatchewan

2019

RESIDENT RESEARCH DAY ABSTRACTS

SURGERY

Mastectomy versus Breast Conservation Therapy: An Examination of How Individual, Clinicopathological, and Physician Factors Influence Decision Making

Platform Presenter: Jeff Gu

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

Team Members/Affiliations:
Megan Delisle (Department of Surgery, Manitoba University); Rachel Engler-Stringer (Department of Epidemiology and Community Health, University of Saskatchewan); Gary Groot (Department of Surgery, University of Saskatchewan).

Rationale:
Canada's interprovincial mastectomy rates vary from 25% to 68% with Saskatchewan reporting the nation's second highest mastectomy rate at 63%. The aim of our research was to better understand the factors that influence decision-making for women with ESBC.

Methods:
We created a survey based upon a previously developed framework that organizes the influencing factors into three constructs: clinicopathological, physician, and individual belief factors. All Saskatchewan women diagnosed and treated with ESBC in 2014-2015 inclusive were invited to participate in our survey.

Results:
276 participants completed our survey; 150 underwent mastectomy (54.3%) and 126 underwent BCT (45.7%). Treatment choice was influenced by disease stage and multiple individual belief factors. Women with stage two disease were significantly more likely to undergo mastectomy compared with stage one disease (OR, 7.48). Patients rating 'worry about cancer recurrence' (OR, 3.4) and 'total treatment time' (OR, 1.8) as more influential to their choice were also more likely to undergo mastectomy. Conversely, women rating 'wanting to keep own breast tissue' (OR, 0.17), 'tumor size' (OR, 0.66) and 'surgeon's opinion' (OR, 0.69) as influential to their choice were more likely to undergo BCT.

Conclusion:
Our study demonstrates treatment decision-making for Saskatchewan women with ESBC were primarily influenced by disease stage and individual belief factors. These findings would suggest that women are making their treatment choices predominantly based on individual values and preferences. Furthermore, when physician input is a factor, the direction of treatment influence is towards BCT. The use of mastectomy and BCT rates as an indicator of quality of care may be misleading. Instead, a shift in attention towards patient-centred care is more appropriate.

Funding Sources:
College of Medicine Resident Research Award

Multi-Modal Imaging Analysis to Evaluate Hyperoxygenation Therapy for Acute Cerebral Ischemia

Platform Presenter: S. Uzair Ahmed

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

Team Members/Affiliations:
Nicole J. Sylvain (Saskatchewan Cerebrovascular Center/Department of Surgery, College of Medicine, University of Saskatchewan); Huishu Hou (Saskatchewan Cerebrovascular Center/Department of Surgery, College of Medicine, University of Saskatchewan); M. Jake Pushie (Saskatchewan Cerebrovascular Center/Department of Surgery, College of Medicine, University of Saskatchewan), Lissa Peeling (Saskatchewan Cerebrovascular Center/Department of Surgery, College of Medicine, University of Saskatchewan), Michael E. Kelly (Saskatchewan Cerebrovascular Center/Department of Surgery, College of Medicine, University of Saskatchewan).

Rationale:
Stroke is a leading cause of morbidity and mortality worldwide. Hyperoxygenation at normal pressure has previously been studied as a therapeutic strategy in ischemic stroke, showing reduced stroke volume and functional recovery in animal models. However, this benefit has not proven to be translatable in human studies, and the exact mechanism of therapeutic benefit remains unknown. We employed hyperoxygenation as a treatment following ischemic stroke and used a multimodal imaging approach determine the effect on the size of the penumbra and on metabolic changes occurring in this region.

Methods:
Twenty-five C57 mice underwent photothrombotic stroke surgery. Hyperoxygenation therapy by means of a chamber with 100% 02 was provided in 5 groups: 1hr pre-stroke; both 1hr pre-stroke and 1hr post stroke; 1hr post stroke after 1hr delay; 2hr post stroke; and control. Animals were sacrificed at 72 h post-stroke. Whole brain sections were collected for Fourier-transform infra-red (FTIR) spectroscopy, and X-ray fluorescence imaging (XFI). Automated clustering algorithms allow identification of statistically distinct metabolic states in tissue.

Results:
Using FTIR spectroscopy, we detected changes in levels of proteins, aggregated proteins, lipid content, as well as glycogen and lactate levels in the infarct and penumbra. XRI maps elemental distributions, including mobile ions such as K and Ca, providing critically-important insight into changes in the underlying cellular state.

Conclusions:
Hyperoxygenation is an attractive therapeutic strategy for acute ischemic stroke. This work will provide biomolecular insights into the potential benefit and possible pitfalls of hyperoxygenation, as well as potential for translation to human studies.

Funding Sources:
Heart and Stroke Foundation; Saskatchewan Health Research Foundation; College of Medicine, University of Saskatchewan; Department of Surgery Resident Research Award; College of Medicine Resident Research Award; Research described here was performed at the Canadian Light Source, which is supported by the Canada Foundation for Innovation, Natural Sciences and Engineering Research Council of Canada, the University of Saskatchewan, the Government of Saskatchewan, Western Economic Diversification Canada, the National Research Council Canada, and the Canadian Institutes of Health Research.

The Prediction of Outcome after Shunting for Idiopathic Normal Pressure Hydrocephalus

Platform Presenter: Bashir Daud Shah

Undergraduate Medical Education
College of Medicine, University of Saskatchewan

Team Members/Affiliations:
Amit Persad (Department of Surgery, College of Medicine, University of Saskatchewan); Kotoo Meguro (Department of Surgery, College of Medicine, University of Saskatchewan)

Rationale:
Idiopathic normal pressure hydrocephalus (iNPH) is a triad of impaired gait, cognition and urinary control in the setting of normal pressure ventriculomegaly. Various options for shunt implantation exist, but there is limited ability to predict outcome.

Methods:
This study is a retrospective chart review of 82 shunted patients for iNPH between 2007 and 2018. Factors examined included age, sex, lumbar puncture results, use of laparoscopic approach, type of shunt used, Charlson Comorbidity Index and imaging (callosal angle and DESH). Patient outcome was assessed via modified Rankin Scale (mRS).

Results:
52 patients were male and 30 were female. Average age at surgery was 71.4 years. 58/62 (94%) improved following lumbar puncture. 41% of patients had VP shunt, and 59% of patients had LP shunt. 30/79 (38%) had laparoscopic placement of the distal catheter. 23/75 (31%) and 30/81 (36%) had a complication and required reoperation, respectively. Callosal angle showed statistically significant increase post-shunting (76 to 94 degrees, $p<0.005$). Presence of DESH did not change post-shunting. Average Charlson Comorbidity Index was 4.4. The mRS decreased from 3.84 to 2.66 post-operatively ($p<0.005$).

Conclusion:
In our centre, iNPH patients had clinicoradiologic improvement following shunting. We will perform regressional statistics to elucidate the factors influencing outcomes.

Epidemiological Trends of Meniscectomy in Saskatchewan

Platform Presenter: Emily Chan

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

Team Members/Affiliations:
Jason Shin (Department of Surgery, University of Saskatchewan; FH Wigmore Hospital, Moose Jaw); Richard Cohen Chaulk (Medical Student, College of Medicine, University of Saskatchewan).

Background:
Arthroscopic meniscectomy (ARM) for degenerative meniscal tear is one the most commonly performed procedures in orthopaedic surgery, despite increasing evidence demonstrating no benefit over conservative management. The current incidence and trends of ARM in Canada are not well-defined due to scarcity of epidemiological studies. As such, the purpose of this study is to determine the epidemiology and trends of ARM in Saskatchewan over the last 20 years.

Methods:
After obtaining institutional review board approval, physician billing codes were used to identify patients who underwent ARM in Saskatchewan between January 1, 1998 and December 31, 2017. Records were obtained from eHealth Saskatchewan, a provincial health database. Data was analyzed for overall incidence and age-specific trends of ARM during the study period.

Results:
Total number of meniscectomies decreased from 2003 to 2009, but increased again from 2010 to 2017. Overall, the highest incidence of surgery was observed in middle-aged patients (41-60 years old). During the 20-year study period, the incidence of ARM increased in the 51-60 and 61-70 year-old age groups, but decreased in the 31-40 and 41-50 year-old groups. Incidence of ARM increased significantly between the first and second decade of study for patients >50 years old (627 vs 1012, $P < 0.01$), but not for patients ≤50 years old (1025.5 vs 1054, $P = 0.68$).

Conclusion:
There has been an overall increase in the incidence of ARM in Saskatchewan over the last 20 years, particularly in patients older than 50.

The Diagnostic Value of the Nerve Root Sedimentation Sign for Symptomatic Lumbar Stenosis

Platform Presenter: Zachary Huschi

Undergraduate Medical Student
College of Medicine, University of Saskatchewan

Team Members/Affiliations:
Laura Neuburger (Medical Student, College of Medicine, University of Saskatchewan); Uzair Ahmed (Department of Surgery, College of Medicine, University of Saskatchewan); Yanzhao Cheng (School of Public Health, University of Saskatchewan); Daryl Fourney (Department of Surgery, College of Medicine, University of Saskatchewan)

Rationale:
Previous studies have shown varied results with respect to the diagnostic utility of a positive nerve root sedimentation sign (SedSign) on MRI for symptomatic lumbar stenosis. The objective of this study was to analyze the clinical characteristics of SedSign utilizing a validated classification for low back and leg pain (Saskatchewan Spine Pathway classification; SSPc).

Methods:
This was a retrospective review of prospectively-collected data in 367 consecutive adult patients presenting to a spine surgeon with back and/or leg pain between January 1, 2012 and May 31, 2018. Baseline clinical characteristics included SSPc, Oswestry disability index (ODI), visual analogue pain scores for back and leg, and EuroQol Group 5-Dimension Self-Report (EQ5D). Inter- and intra-rater reliability for SedSign was 73% and 91%, respectively (3 examiners).

Results:
SedSign was positive in 111 (30.2%) and negative in 256 (69.8%) patients. On the univariate analysis, a positive SedSign was correlated with age, male sex, several components of ODI, EQ5D mobility, cross-sectional area (CSA) of stenosis, antero-posterior (AP) diameter of stenosis, and SSPc pattern 4 (intermittent leg dominant pain). On multivariate analysis, SedSign was associated with age, male sex, CSA stenosis and ODI walking distance. The sensitivity and specificity of SedSign for detecting neurogenic claudication was 50.3 and 82.9, respectively (ppv 65.8%, npv 71.9%).

Conclusion:
For every 1mm^2 reduction in CSA stenosis, the odds of SedSign positivity increased by 4%. For every one-unit decrease in ODI walking distance, the odds of SedSign positivity decreased by 26%. The SedSign has high specificity for neurogenic claudication, but the sensitivity is poor.

Funding Sources:
University of Saskatchewan College of Medicine Dean's Project

Fully Automatic Planning of Total Shoulder Arthroplasty: A Deep Learning Based Approach

Platform Presenter: Paul Kulyk

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

Team Members/Affiliations:
Guoyan Zheng (University of Bern, Institute for Surgical Technologies and Biomechanics); Matthias Zumstein (University of Bern, Inselspital)

Rationale:
In total shoulder arthroplasty (TSA) a humeral resection is performed along the articular marginal plane (AMP) or anatomic neck. The AMP defines the orientation, position, and size of the prosthetic humeral head. Current manual planning methods are time consuming and subject to error. We present a deep learning based method for automatically determining the AMP utilizing computer tomography (CT) images without segmentation or hand-crafted features.

Methods:
The process is broken down into a 3-stage fully convolutional neural network. Stage 1 determines a coarse estimation of the AMP center by sampling patches over the entire CT volume and combining the predictions with a novel kernel density estimation (KDE) method. Stage 2 utilizes the estimate from stage 1 to focus on a smaller sampling region at a higher resolution to obtain a refined prediction of the AMP center. Stage 3 focuses sampling at this location and regresses the tip of a vector normal to the AMP, defining the orientation.

Results:
The system was trained and evaluated on 27 upper arm CTs. In a 4-fold cross-validation the mean error in estimating the AMP center was 1.30 ± 0.65mm and the angular error for the normal was $4.68 \pm 2.84°$.

Conclusion:
Previous methods rely on traditional techniques which required manual feature definition. Our method applies a convolutional neural network which optimizes the parameters automatically and requires no segmentation or feature definition. We obtained state-of-the-art accuracy surpassing the previous published best results. Similar techniques to find the shaft axis would completely automate planning.

Funding Sources:
Data was provided by Dr. Lazaros Vlachopoulos and Dr. Philipp Fürnstahl of the Computer Assisted Research and Development Group, Balgrist University Hospital, University of Zurich, Zürich, Switzerland

Does Routine Real-Time Interdisciplinary Quality Care Evaluation Facilitated by a Cross-Platform Messaging System Reduce After-Hours Spine Surgery?

Platform Presenter: Rosalie Mercure-Cyr

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

Team Members/Affiliations
Persad AR (Department of Surgery, College of Medicine, University of Saskatchewan), Spiess MS (Department of Surgery, College of Medicine, University of Saskatchewan), Woo A (Department of Surgery, College of Medicine, University of Saskatchewan), Wu A (Department of Surgery, College of Medicine, University of Saskatchewan), Hnenny L (Department of Surgery, College of Medicine, University of Saskatchewan), Fourney DR (Department of Surgery, College of Medicine, University of Saskatchewan).

Background:
Although spine only accounts for 7.3% of after-hours surgery at Royal University Hospital (RUH), after-hours cases are controversial due to increased morbidity and mortality. The purpose of this study was to determine if routine use of a cross-platform messaging system (CPMS, WhatsApp Inc., Mountain View, California) affects the number or type of after-hour spine surgeries.

Methods:
We retrospectively compared the number, type and length of after-hours spine surgeries at RUH over three time periods: (A) June 1, 2016-May 31, 2017, baseline control; (B) June 1, 2017-May 31, 2018, implementation of quality care spine rounds to discuss after-hours surgery; (C) June 1, 2018-May 31, 2019, implementation of CPMS. A secondary outcome was analysis of surgeon discussions on CPMS, including rates of differences in opinion with respect to timing or type of surgery.

Results:
The mean number of after-hours spine surgeries/month over the three time periods (A, B, C) was 11.6, 10.25, and 9 ($p=0.14$); length of surgery was 41.8, 33.1, and 26.2 hours/month ($p<0.005$). From CPMS discussion, the type of procedure was challenged by at least 1 surgeon in 61.2% of cases; in 22.5%, controversy was not fully resolved. The emergency status was disputed in 29.2% of E3 cases versus 10.7% of E2 cases.

Conclusion:
This study suggests that real-time spine surgeon discussion of cases (prior to booking) via CPMS has more effect on the extent of after-hours surgery rather than the indication.

Improving the Achievement of Guideline Directed Surgical Care for Melanoma Patients: Application of Process Mapping and the Functional Resonance Analysis Method

Platform Presenter: Melissa Wood

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

Team Members/Affiliations
Gary Groot (Department of Surgery, College of Medicine, University of Saskatchewan); Raymond Deobald (Department of Surgery, College of Medicine, University of Saskatchewan); Lauren Morgan (Nuffield Department of Surgery, University of Oxford).

Rationale:
Saskatchewan cancer registry data from 2013-2015 reveals a substantial proportion of melanoma patients did not receive guideline directed surgical care, according to their cancer Tumour (T) stage. Thus, investigation into the delivery of melanoma care in the province is warranted and can be used to identify areas affecting the achievement of guideline directed care.

Methods:
Process maps, to map care trajectories melanoma patients undergo from diagnosis to treatment, were generated through an iterative multistep process; first an advisory panel meeting with key stakeholders, then revised in one-on-one interviews. Analysis of interview data allowed for identification of deviations in practice, sources of variability, and areas for improvement. The Functional Resonance Analysis Method (FRAM), a modelling method applied to complex systems, was then applied to further characterise issues threatening guideline directed care.

Results:
Process maps have been generated to depict the care trajectories of melanoma patients according to T-stage. Analysis of interview data, review of the process maps and FRAM application have identified areas contributing to variations in care; including diagnostic and treatment decisions for suspicious lesions, type of biopsy performed, management of a lesion after a diagnosis of melanoma on pathology report, and referral patterns.

Conclusion:
Generation of process maps and FRAM application have yielded valuable insights into sources of variation in melanoma care in Saskatchewan. These results lay the foundation for studying the impact of implementing a mandatory change to pathology reports and its impact on the attainment of guideline directed surgical care for melanoma patients in Saskatchewan.

Is a Positive Nerve Root Sedimentation Sign Associated with Better Outcomes after Lumbar Laminectomy?

Platform Presenter: Laura Neuburger

Undergraduate Medical Student
College of Medicine, University of Saskatchewan

Team Members/Affiliations:
Zachary Huschi (Medical Student, College of Medicine, University of Saskatchewan); Uzair Ahmed (Department of Surgery, College of Medicine, University of Saskatchewan); Yanzhao Cheng (School of Public Health, University of Saskatchewan); Daryl Fourney (Department of Surgery, College of Medicine, University of Saskatchewan).

Rationale:
The nerve root sedimentation sign (SedSign) has been correlated with clinically significant lumbar spinal stenosis (LSS) and promoted as a possible prognostic indicator. However, the methods used to distinguish LSS from non-specific low back pain were not clearly defined in prior reports. In this study, the clinically validated Saskatchewan Spine Pathway enabled diagnosis of neurogenic claudication due to LSS. The objective was to compare the outcome of lumbar laminectomy for neurogenic claudication with respect to SedSign.

Methods:
This was a retrospective analysis of prospectively-collected data in patients with neurogenic claudication who underwent elective lumbar laminectomy between January 2012 and March 2018. Outcomes included Oswestry Disability Index, Visual Analogue Scale (VAS) for back and leg pain, and EuroQol 5-Dimension questionnaire. Inter- and intra-rater reliability for SedSign was 73% and 91%, respectively.

Results:
Laminectomy was performed in 106 patients (discectomy in 57.6%; instrumentation in 36.8%; tubular-assisted in 36.8%), and 60 were SedSign positive. Outcomes did not differ with respect to SedSign for all outcome measures, in non-instrumented and instrumented cohorts. Improvement in walking distance was associated with dural cross sectional area of stenosis ($p=0.02$). VAS back and leg improvements were associated with back dominant ($p=0.038$) and leg dominant ($p=0.0036$) pain.

Conclusion:
This is the largest analysis of SedSign with respect to operative outcomes, and the only study with validated clinical criteria for defining neurogenic claudication. Although several clinical and radiological factors are associated with improvements, SedSign did not correlate with laminectomy outcome.

Funding Sources:
Dean's Research Project, College of Medicine

Pedicle Screw Resistance: A Crucial Component for Intraoperative EMG Neuromonitoring

Platform Presenter: Michael Kindrachuk

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

Team Members/Affiliations:
Dr. Jonathan Norton (Department of Surgery, College of Medicine, University of Saskatchewan);
Dr. Daryl Fourney (Department of Surgery, College of Medicine, University of Saskatchewan).

Rationale:
Evoked electromyographic (EMG) monitoring of pedicle screws is an effective adjuvant to image guidance or direct visualization of pedicle screw placement. Electrical stimulation is delivered to the pedicle screw at various intensities until a compound muscle action potential is evoked. The electrical resistance of modern manufactured pedicle screws and stimulation devices has not been studied. The objective of this study was to determine if pedicle screw resistances allows for triggered EMG to be a useful test.

Methods:
Samples of the most commonly implanted pedicle screws in Canada were obtained, with diameters ranging from 4.5 to 7 mm. The resistance between the screw head and thread and core at the mid point and tip of the screw was recorded using a Fluke Multimeter in accordance with IEEE standards. For screws with variable threads, the mid point was considered the point at which the thread pitch changed. We also tested 5 types of pedicle probes, including the associated cables. The average of five measurements was used to determine the resistance in Ohms.

Results:
All screws had low impedances when tested at the point of the screw, but much higher when the cup is tested. The resistance of different manufactures' screws was significantly different, ranging from 0.514 to 2156 Ohms. The probes and cables also have some resistance, each tested low (about 0.01 Ohms) and differences were not significant.

Conclusions:
Despite differences in resistance, most screws had resistances in ranges that allow for triggered EMG pedicle integrity testing.

Arteriovenous Fistula Remains the Best Hemodialysis Access Choice for Some Elderly Patients

Platform Presenter: Chris Pastor

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

Team Members/Affiliations:
David Kopriva (Department of Surgery, College of Medicine, University of Saskatchewan)

Rationale:
The goal was to determine hemodialysis dependent life-expectancy by age of the patient at dialysis initiation, and compare this to the durability of the various hemodialysis access options.

Methods:
We abstracted data from our center's hemodialysis electronic database over a ten-year period to determine patient survival on hemodialysis, stratified by decade of life at dialysis initiation. We collected data on each dialysis access to determine primary and secondary patency of access types by age subgroup.

Results:
794 patients started hemodialysis for chronic renal replacement therapy. Patients in the ninth decade of life (80-89 years) had a median survival of 1.5 +/- 0.5 years on dialysis but this represented two divergent patient groups. Patients aged 80-89 years who were selected for arteriovenous fistula (AVF) creation and utilized this access survived a median of 3.0 +/- 0.9 years, while those patients who were deemed fit for an AVF, but did not utilize their AVF had a median life expectancy of 1.5 years (Table 1). There were no age-related differences in AVF patency (median secondary patency 5.3 +/- 0.4 years). The secondary patency of AVF was superior to both arteriovenous grafts (1.9 +/- 0.8 years) and CVC (1.5 +/- 0.4 years).

Conclusions:
Clinical gestalt can be used to select patients in the 9th decade of life for hemodialysis through an AVF. Patients that are selected and use the AVF have an increased median life expectancy. These patients have a life expectancy that exceeds the secondary patency of AVG and CVC.

The Effect of Patient Resilience and Pain Catastrophizing on Outcomes Following Carpal Tunnel Release

Platform Presenter: Sarah McLaren

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

Team Members/Affiliations:
Laura Sims (Department of Surgery, College of Medicine, University of Saskatchewan); Raymond Khan (Division of Surgery, College of Medicine, University of Saskatchewan); David Sauder (Department of Surgery, College of Medicine, University of Saskatchewan).

Purpose:
Outcomes following carpal tunnel release are generally favorable. Understanding factors that contribute to inferior outcomes may allow for strategies targeted at improving results in these patients. Our purpose was to determine if patients' underlying personality traits, specifically resiliency and catastrophization, impact their post-operative outcomes following carpal tunnel release.

Methods:
A prospective case series was performed. Based on our power analysis, 102 patients were recruited. Patients completed written consent, the Boston Carpal Tunnel Questionnaire (BCTQ), the Pain Catastrophizing Scale (PCS) and the Brief Resiliency Scale (BRS). A single surgeon, or his resident under supervision, then performed an open carpal release under local anaesthetic. Our primary outcome measure was a repeat BCTQ at three- and six-months. Univariate and multivariate analysis was performed to assess the correlation between PCS and BRS scores and final BCTQ scores.

Results:
Forty-three and sixty-three participants completed the BCTQ at three and six months respectively. All patients showed improvement in their symptoms ($p = 0.001$). There was no correlation between patients PCS or BRS and the amount of improvement. There was also no correlation between PCS or BRS and the patients' raw scores at baseline. Subgroup analysis showed non-diabetic patients had greater improvement in their BCTQ.

Conclusion:
Patients self-assessed resiliency and degree of pain catastrophization has no correlation with the amount of improvement they have three or six months post-operatively. Most patients improved following carpal tunnel release, and patients with low resiliency and high levels of pain catastrophization should expect comparable outcomes to patients without these features.

The "7/20 EMG Protocol" in Combination with O-arm Imaging for Accurate Lumbar Pedicle Placement While Minimizing Diagnostic Radiation Exposure

Platform Presenter: Amit Persad

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

Team Members/Affiliations:
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Rationale:
With the advent of O-arm-guided stereotactic pedicle screw navigation, any centers have abandoned electromyography (EMG), but radiation exposure for a 3D lumbar O-arm scan is equivalent to about 25 plain chest x-rays. The objective of this study was to validate a standardized intraoperative EMG protocol to reduce diagnostic radiation exposure.

Methodology:
We conducted a prospective cohort analysis of all patients undergoing elective lumbar instrumentation. Inclusion criteria included age >18, elective procedure, and degenerative spinal etiology. All screws were placed using a standard "7/20 EMG protocol", O-arm guided navigation, and "final check" O-arm assessment of screw placement. The primary outcome is prediction of potentially clinically relevant pedicle breach at any stage of the procedure.

Results:
Information on 31 patients and 194 screws has been collected, including 8 revision procedures (48 revised screws). A total of 14 screws across 8 cases had breech issues. Five screws were revised; four because of abnormal 7mA stim in the setting of revision surgery, and one due to screw depth on fluoro. Sensitivity of 7mA stimulation is 0.8, with specificity of 0.96, and false positive rate 64%. Mann-Whitney U test found p=0.03 for 7mA stim in prediction of screw breakthrough.

Conclusions:
7mA stimulation was the most common reason for intraoperative screw revision. O-arm imaging and 20mA stim had equal results in the setting of false positive 7mA stimulation. These findings suggest that O-arm guided navigation supplemented with EMG may render "final check" O-arm imaging of screws unnecessary.

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Assessing the Risk of Gadolinium-Based Contrast Agents in Post-Stroke Brain Tissue

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Rationale:
Gadolinium-based contrast agents (GBCAs) are used to enhance MRI, however, they may pose risk to those with a compromised blood-brain barrier (BBB) after stroke. Gadolinium is toxic to biological systems, therefore GBCAs are used clinically in a chelated form that is either macrocyclic or linear and charge-neutral or anionic. The permeability of the BBB is increased following ischemic stroke and GBCAs can penetrate the brain. If the gadolinium ion dissociates from the chelate, it could potentially accumulate in the tissue. The EU has banned linear GBCAs due to concerns of lesser stability, while Health Canada has issued cautions for use. This project compares the stability of six GBCAs, varying in charge and structure, in ischemic brain tissue. Comparisons were made using MRI, electrospray-ionization mass spectroscopy (ESI-MS), and synchrotron imaging.

Methods:
Photothrombotic ischemic stroke was induced in adult male mice. At three days, contrast was injected via tail vein 30 minutes prior to euthanization. Mice were euthanized by cervical dislocation and prepared for MRI. The images were analyzed with ImageJ to quantify the intensity of the lesion and contralateral tissue. Other tissue sections were frozen in liquid nitrogen and sectioned using a cryostat at -20C for synchrotron imaging. The six GBCAs were analyzed in-vitro for stability, using ESI-MS.

Results:
All contrast agents were detectable in the stroke lesion with MRI imaging, including Dotarem, ProHance, MultiHance, Optimark, Magnevist, and Gadovist. Magnevist appears to have the largest penetrance through the BBB.

Conclusion:
In this preliminary pilot work, we were able to detect all gadolinium based contrast agents. Further work will expand animal numbers to allow for statistical analysis.

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