



# 2018 FACULTY RESEARCH DAY SURGERY



UNIVERSITY OF  
SASKATCHEWAN



Saskatchewan  
Health Authority



*“The knowledge of anything in medicine, since all things have causes, is not acquired or complete unless it is known by its causes.”*

**- Avicenna (980-1037 AD)**



## Dr. Ivar Mendez

Fred H. Wigmore  
Professor and  
Provincial Head of Surgery  
University of Saskatchewan  
and  
Saskatchewan Health  
Authority

Welcome to the 2018 Department of Surgery Faculty Research Day! This is an opportunity for our faculty members to share their research endeavors with the rest of the department. One of the objectives of this day is to encourage collaborations among faculty and specifically to engage our residents and fellows to become involved in research with faculty members across the surgical disciplines.

The Department of Surgery is fully committed to support research at all levels and especially to promote multi-disciplinary collaborative research programs within the College of Medicine and beyond. We are convinced that research is crucial not only in the continued development of our department but it is an essential component in the delivery of the best care possible to our patients.

Over the past few years, the department has almost quadrupled its research productivity both in the number of peer reviewed publications and peer reviewed grants. The Department of Surgery Research Committee has worked relentlessly in supporting research for both the residents and the faculty and I would like to take this opportunity to welcome our new Director of Research, Dr. Francisco Cayabyab.

I am proud of the performance of the department in research. Our faculty members are amongst the most successful researchers in the College of Medicine and we are quickly building bridges of collaborations with many basic scientists in the College of Medicine and other faculties within the University system.

This year, the Department of Surgery Faculty Research Day promises to be very exciting. A total of 19 presentations will be given in a wide range of research topics across all the surgical disciplines.

I look forward to seeing all of you at the Asher Auditorium.

We are leaders in improving the health and well-being of the people of Saskatchewan. We improve health through innovative and interdisciplinary research and education, leadership, community engagement, and the development of highly competent, skilled clinicians and scientists.

As Research Director, I am delighted to see our Department's research output growing leaps and bounds in the last few years, with substantial increases in Faculty peer-reviewed publications to communicate clinical and fundamental research findings and research funding to accelerate the development of new interventions to prevent and cure disease. Our Department's basic and clinical researchers are leveraging our regional premier resource opportunities, such as the Canadian Light Source, into national strengths. With the recent announcement of Federal Budget 2018 proposing the single largest investment in investigator-led fundamental research in Canadian history, the future looks bright! This major investment in science will hopefully stimulate the formation of more clinician-scientist led or clinician-basic scientist teams and translate into more successful grants to provide more research-based evidence to optimize clinical decision making and guide decision makers to craft policies that will deliver desired outcomes effectively.

As we gather in today's proceedings, you will be exposed to wide ranging research topics that highlight the vibrant research culture and the growing critical mass of researchers across all surgical divisions. I would urge all Faculty, residents, graduate students, postdoctoral Fellows and research associates to take advantage of ample opportunities to network and collaborate, share and learn about innovative scientific discoveries, and showcase new tools and technologies by our research Faculty.

Today's program features an exceptional assortment of basic and clinical platform presentations. I would like to thank all the judges and session chairs for being part of this year's second Annual Faculty Research Day, the Surgery Research Committee and Surgery Communications for putting together this exciting program, and finally all the Faculty and trainees presenting their groundbreaking results. It is an honour to be sharing in this spirit of collaboration, and I look forward to seeing everyone to celebrate our research accomplishments.



**Dr. Francisco  
Cayabyab**

**Director of Research  
Leader, Neuroscience  
Research Cluster**

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

# 2018 FACULTY RESEARCH DAY

Surgery

April 12, 2018

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# INTRODUCTION

Saskatoon City Hospital  
Asher Auditorium

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08:15

## WELCOME AND INTRODUCTIONS

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

(Coffee & scones will be served)

# SESSION I

Saskatoon City Hospital  
Asher Auditorium

CHAIR: Dr. Anthony King

08:30 - 09:20

- Does Soaking Synthetic Mesh in Vancomycin Solution Reduce Infections in Open Hernia Repairs?  
DR. ALI CADILI 15
- A Rigorous Examination into the Context of Indigenous Cultures on the Mechanisms of Trust and World View  
DR. GARY GROOT 16
- A Non-surgical Research Project That Arose Out of a Complication in One of my Patients: Research Questions are “Everywhere”  
DR. MIKE MOSER 17
- Non-invasive Treatment of Post-Stroke Depression with Low Field Magnetic Stimulation (LFMS) in a Small Vessel Animal Stroke Model  
JAY KIM [SUPERVISOR: DR. FRANCISCO CAYABYAB] 18
- The Saskatchewan Acute Stroke Pathway  
DR. MIKE KELLY 19

## SESSION II

Saskatoon City Hospital  
Asher Auditorium

CHAIR: Dr. Carolyn DuVal

09:20 - 10:00

The Utility of Early Postoperative Follow up and Radiographs in Surgically Treated Supracondylar Humerus Fractures in Children	DR. ALEXANDRA MORTIMER	20
Autologous Stem Cells for Brain Repair in Parkinson's Disease: Preclinical Studies	DR. IVAR MENDEZ	21
Sutureless Gastroschisis Closure Avoids the Potential Neurotoxicity of Volatile Anesthetics	DR. GRANT MILLER	22
Blood Conservation Techniques following Cardiopulmonary-bypass-supported Cardiac Surgery	DR. ERICK McNAIR	23

Break 10:00 - 10:30

## SESSION III

Saskatoon City Hospital  
Asher Auditorium

CHAIR: Dr. Francis Christian

10:30 - 11:20

Traumatic Spinal Cord Injuries among Aboriginal and Non-Aboriginal Populations of Saskatchewan: A Prospective Outcomes Study

DR. DARYL FOURNEY 24

Targeting HERG Potassium Channels for Breast Cancer Therapy

DR. FRANCISCO CAYABYAB 25

Radiographic, Clinical and Patient-rated Outcomes of Volar Locking Plate Fixation of Distal Radial Fractures in Adult Women and Related Implant-Specific Complications in 236 Adult Women

DR. GEOFFREY JOHNSTON 26

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

DR. ADAM WU 27

Critical Care Neurophysiology

DR. JONATHAN NORTON 28

## SESSION IV

Saskatoon City Hospital  
Asher Auditorium

CHAIR: Dr. Kotoo Meguro

11:20 - 12:10

Laparoscopic Hepatectomy and Pancreatectomy DR. YIGANG LUO	29
Synchrotron Analysis of Clots from Acute Ischemic Stroke Patients VEDASHREE MEHER [SUPERVISORS: DR. KELLY & DR. PEELING]	30
Molecular Diagnostics and Radiomics to Improve Outcomes in Oropharyngeal Cancer DR. SILVANA PAPAGERAKIS	31
Aluminum Contamination of Parenteral Nutrition Causes Blunting of Bile Canalicular Microvilli DR. GRANT MILLER	32
Total Knee Arthroplasty Infections - The Saskatoon Experience DR. ANTHONY KING	33

Lunch

Foyer outside of Auditorium  
Main Floor, Saskatoon City Hospital  
12:10 - 13:00

**2018 FACULTY RESEARCH DAY**  
**BANQUET**

*Top of the Inn*



**Sheraton**  
CAVALIER SASKATOON HOTEL

RECEPTION

18:00

DINNER

19:00

Presentation of prizes:

Dr. Ivar Mendez and Dr. Francisco Cayabyab

# ACKNOWLEDGEMENTS

The Department of Surgery would like to thank the following individuals for serving as judges and moderators for the 2018 Faculty Research Day.

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## JUDGES

### Dr. Grant Miller, Head Judge

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

### Dr. Marilyn Baetz

Provincial Head  
Department of Psychiatry, College of Medicine,  
University of Saskatchewan

### Dr. Gavin Beck

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

### Dr. Marek Radomski

Vice Dean Research  
College of Medicine,  
University of Saskatchewan

### Dr. Renee Kennedy

Division Head of Thoracic Surgery  
Department of Surgery, College of Medicine,  
University of Saskatchewan

## SESSION CHAIRS

### Dr. Anthony King

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

### Dr. Carolyn DuVal

Division Head of Plastic Surgery  
Department of Surgery, College of Medicine,  
University of Saskatchewan

### Dr. Francis Christian

Director, Quality Improvement & Patient Safety  
Department of Surgery, College of Medicine,  
University of Saskatchewan

### Dr. Kotoo Meguro

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

**2018**

**FACULTY RESEARCH DAY  
ABSTRACTS**

**SURGERY**

# Does Soaking Synthetic Mesh in Vancomycin Solution Reduce Infections in Open Hernia Repairs?

Platform Presenter: Dr. Ali Cadili

General Surgery (Moose Jaw, SK), Department of Surgery,  
College of Medicine, University of Saskatchewan

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## TEAM MEMBERS

Megan Spafford, David Sereda, Sunita Ghosh

## ABSTRACT

### RATIONALE

Mesh infections following hernia repair surgery remain a significant problem and have been documented to occur in up to 13% of cases when the use of synthetic mesh is involved. Mesh infections or Surgical Site Infections are a significant predictor for the recurrence of hernias. Soaking meshes in antibiotic solutions in order to prevent potential infection and adhesion of the bacteria to the mesh, and as such prevent biofilm formation, is an idea that has long been contemplated and experimented with by General Surgeons. Although this practice today is not that uncommon, there remains a lack of solid data with human clinical trials to demonstrate its efficacy.

### METHODS

Both inguinal and ventral hernias performed via the open surgical approach were included in this study. All procedures were done under standard sterile field precautions and patients received weight-based Cefazolin intravenous injection within one hour of skin incision as a prophylactic measure. Patients who were allergic to Cephalosporins or Penicillin were given intravenous Clindamycin injection instead as a prophylactic antibiotic. Patients were randomized to one of two groups: Vancomycin group (where mesh is soaked in a 10mg/mL Vancomycin solution for 15 minutes prior to fixation within the body) and placebo group (where the mesh is soaked in a Normal Saline solution for 15 minutes prior to fixation within the body). This was done using the block randomization technique. Both the patient as well as the surgical team were blinded as to the patient's group assignment within the study. Both the surgeon and office staff remained blinded to the patient's group assignment on follow up which was uniformly arranged at 6 weeks after the operation.

### RESULTS

A total of 112 participants were recruited and randomized in this study. Of the 112 research subjects, 82% were over the age of 45 at the time of the surgery. The majority of the subjects were male (89 subjects or 79.6%) and 20.5% were female. There was no statistical difference in age between the male and female subjects. Overall, the rate of postoperative infection was very low patients undergoing open hernia repair in this study. Out of the 112 participants who underwent hernia repair surgery only three of them developed an infection (less than 3%). Although this outcome of roughly 2.7% was within the current normal range, it is not possible to infer the efficiency of soaking meshes in antibiotic solutions, as three infections is a small sample.

### CONCLUSION

This study has demonstrated the safety of soaking synthetic mesh with Vancomycin solution prior to use in hernia repair. Given the very low rate of infection, however, a significant effect of Vancomycin soaking on mesh infection could not be determined in this study. A higher powered trial with a larger sample size would be needed to adequately assess the effect of soaking mesh with antibiotic solution on infection risk.

# A Rigorous Examination into the Context of Indigenous Cultures on the Mechanisms of Trust and World View

Platform Presenter: Dr. Gary Groot

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

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## TEAM MEMBERS

Tamara Waldron (Community Health and Epidemiology), David Cochran (Community Health and Epidemiology), Tracey Carr (Community Health and Epidemiology), Vicky Duncan (College of Medicine) Linda McMullen (Department of Psychology) & Rose Roberts (Indigenous Engagement and Education) - University of Saskatchewan

## ABSTRACT

### RATIONALE

Shared Decision-making (SDM) was popularized in the late 1980s as a reactive model to paternalistic decision-making, aiming to better meet the needs of patients. Extensive research has been conducted internationally examining the benefits of SDM implementation; however, this literature has not been successful in exploring the nuances of Indigenous medical decision-making. It is known that trust and world view differ for Indigenous patients compared to Western counterparts. As such, we set out to address: "How, why, for whom and in what situations do the key mechanisms of trust and world view impact engagement in SDM for Indigenous patients?"

### METHODS

To achieve our study goals we conducted a six-step realist synthesis process, which included: (1) preliminary program theory development, (2) search strategy development, (3) selection and appraisal of literature in accordance with realist methodology (39, 44), (4) data extraction, (5) data analysis and synthesis, and (6) formation of a revised program theory with the input of stakeholders.

### RESULTS

Through our realist synthesis, we developed a refined program theory of SDM based on Indigenous trust and world view, including: demographics, Indigenous world view, reciprocal respect, culturally appropriate learning and education, and perception of world view acceptance.

### CONCLUSION

By examining trust and world view, we were able to form a clearer understanding of how these mechanisms impact Indigenous decision-making. Namely, we explored how trust and anxiety differ and moderate an individual's ability to engage in SDM. This will allow health care providers to adapt consultations to the needs of Indigenous patients.

## ACKNOWLEDGEMENTS/SOURCES OF FUNDING

University of Saskatchewan, College of Medicine

# A Non-Surgical Research Project that Arose out of a Complication in One of my Patients: Research Questions are “Everywhere”

Platform Presenter: Dr. Mike Moser

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

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## TEAM MEMBERS

Katherine Sawicka (College of Medicine), Noman Hassan (College of Medicine), Chance Dumaine (Department of Medicine), Allison Budd (Department of Medicine), June Lim (Department of Clinical Epidemiology and Biostatistics) & James Barton (Department of Medicine) - University of Saskatchewan; Chris Wall (Department of Radiology and Diagnostic Imaging) & Tama Banerjee (Department of Pathology and Lab Medicine) - Saskatchewan Health Authority

## ABSTRACT

### RATIONALE

A hemorrhagic complication prompted a review of local kidney biopsy outcomes and revealed a higher than expected number of complications. It was commonly taught that a kidney biopsy should be taken at an acute angle and directed at a pole, yet this is not uniformly practiced; furthermore, there was scant evidence in the literature to support doing biopsies this way. The purpose of our study was to improve safety and specimen adequacy and to identify technical factors, such as needle size, needle angle, and biopsy direction, associated with a safer kidney biopsy.

### METHODS

A multi-disciplinary research team was assembled. Charts, pathology reports, and ultrasounds were obtained for all patients who had renal biopsy between 2012 and 2015 (n=242). A Quality Improvement Intervention (QII) implemented March 1, 2014 consisted of education, reducing the number of radiologists performing renal biopsies and having a pathologist present.

### RESULTS

Biopsies directed at the pole, that avoided the medulla, and done at an angle < 60 degrees were all associated with a decrease in complications (p=0.014, p<0.001, and p<0.001 respectively). These same technical factors also resulted in fewer inadequate specimens (p=0.002, p=0.004, p=0.04). The QII was associated with a reduction in inadequate biopsies from 19% to 3% (p<0.001) and a reduction in repeat biopsies from 14% to 2% (p=0.002).

### CONCLUSION

Problems that arise in day-to-day practice, surgical or not, can be a source of research questions. A multi-disciplinary approach is essential in bringing about changes that will improve results for our patients.

# Non-invasive Treatment of Post-Stroke Depression with Low Field Magnetic Stimulation (LFMS) in a Small Vessel Animal Stroke Model

Platform Presenter: Jay Kim [Supervisor: Dr. Francisco Cayabyab]

Neuroscience Cluster, Department of Surgery,  
College of Medicine, University of Saskatchewan

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## TEAM MEMBERS

Michael Zaki (Health Sciences Graduate Program, Department of Surgery), Jocelyn Stockwell (Health Sciences Graduate Program, Department of Surgery), Yanbo Zhang (Department of Psychiatry) & Francisco S. Cayabyab (Department of Surgery) - University of Saskatchewan

## ABSTRACT

### RATIONALE

Stroke survivors often suffer from disability, including cognitive, motor and psychiatric disturbances. Early therapeutic intervention with the clot-busting agent TPA can indeed be effective, but few patients ever make it to the ER in time to receive this treatment. We propose that an alternative non-invasive stroke treatment involving low field magnetic stimulation (LFMS) could reduce the levels of neuronal damage in the hippocampus and other brain-sensitive regions.

### METHODS

Using an established focal cortical pial vessel disruption (PVD) stroke model in Sprague-Dawley rats, we studied the efficacy of LFMS in reducing hippocampal neuronal damage and associated behavioural deficits. Levels of anxiety, depressive and cognitive behavioural deficits were measured using the open field test (OFT), forced swim test (FST) and Y-maze, respectively. In vitro electrophysiological recordings were performed to correlate cognitive deficits with changes in hippocampal synaptic plasticity. Gamma burst stimulation (40 Hz, <0.1 Tesla) were used with LFMS.

### RESULTS

PVD treatments produced hippocampal-dependent spatial memory deficits, which were associated with decreased long term potentiation in hippocampal brain slices. Increased anxiety and depressive behaviours were observed in PVD-treated animals but not in sham animals (similar surgical procedures but with pial vessels left intact). Increased neuronal damage was confirmed using propidium iodide labeling and confocal imaging. In contrast, all animals that received daily LFMS (20min, 3d) showed significant improvements in cognitive, anxiety, and depressive function compared to PVD animals with sham LFMS treatments.

### CONCLUSION

The results showed that restoring gamma oscillations with LFMS counters the damaging effects of pro-neurotoxicity pathways after stroke.

## ACKNOWLEDGEMENTS/SOURCES OF FUNDING

Heart and Stroke Foundation of Canada, Saskatchewan Health Research Foundation Collaborative Innovation and Development Grant, CoMRAD, NSERC Discovery Grant.

# Saskatchewan Acute Stroke Pathway

Platform Presenter: Dr. Michael Kelly

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

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## TEAM MEMBERS

K. Ruth Whelan (Department of Surgery), Gary Hunter (Department of Medicine), Lissa Peeling (Department of Surgery) & Brett Graham (Department of Medicine) - University of Saskatchewan; Laura Schwartz, Jessica Hamilton & Vivian Onaemo - Saskatchewan Health Quality Council; Kim Davy, Kaisan Promotion Office, Saskatchewan Health Authority; Lori Latta, Saskatchewan Ministry of Health

## ABSTRACT

### RATIONALE

The Saskatchewan Acute Stroke Pathway was fully implemented in January of 2016. The pathway aimed to improve stroke systems and continuous performance review related to Canadian Best Practice Guidelines. This is an update of the pathway with 2017 data.

### METHODS

A comprehensive provincial reporting system was established with all primary stroke centres reporting the data metrics. The metrics recorded were last seen normal time, door to CT time, door to needle time, number of patients receiving tissue plasminogen activator (tPA), total number of stroke alerts per month and cost savings. In Saskatoon, comprehensive metrics around all stroke patients and endovascular therapy were collected. The data was analyzed on an ongoing basis by the medical and epidemiology teams. Immediate action was taken when metric fell below expected standards.

### RESULTS

There have been significant improvements noted in all aspects of the metrics. This includes a door to need times below 60 minutes, a dramatic increase in patients receiving tPA rates, 96% utilization of advanced imaging using CT angiography and doubling of endovascular stroke volumes to 70 patients. Reductions in length of stay resulted in a savings of \$7,000,000. A complete overview of the improvements will be provided.

### CONCLUSION

The Saskatchewan Acute Stroke Pathway has dramatically improved stroke care in Saskatchewan. By engaging all providers, system leaders, ministry and other stakeholders effective change has been realized. The program has now expanded to include prevention, rehabilitation and community care effectively creating the Saskatchewan Stroke Strategy.

## ACKNOWLEDGEMENTS/SOURCES OF FUNDING

Funding for this project is provided by the Heart & Stroke Foundation, the Saskatchewan Health Research Foundation, as well as the University of Saskatchewan College of Medicine, for the Clinical Stroke Research Chair awarded to M.E.K. Funding was also provided by Penumbra Inc. to partially support a clinical nurse specialist.

# The Utility of Early Postoperative Follow up and Radiographs in Surgically Treated Supracondylar Humerus Fractures in Children

Platform Presenter: Dr. Alexandra Mortimer

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

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## TEAM MEMBERS

Anna M. Acosta, Yi-Ju Li, Viviana Bompadre & Suzanne Steinman - Seattle Children's Hospital, Department of Orthopaedics and Sports Medicine

## ABSTRACT

### RATIONALE

Evaluate the utility of early postoperative follow-up and radiographs at 7-10 days after closed reduction and percutaneous pinning (CRPP) of displaced supracondylar humerus fractures. We hypothesized that patients seen at 7-10 days versus 21-28 days (at time of pin removal) would have equivalent clinical outcomes and therefore could eliminate the need for early post-operative follow-up.

### METHODS

Retrospective review was performed at a single institution from 2014 to 2016. Inclusion criteria were patients under 14 years of age with a displaced supracondylar humerus fracture treated with CRPP. Exclusion criteria included open fractures, treatment with open reduction, intra-articular fractures, and patients without complete clinical or radiographic follow up. Primary endpoints included time to initial follow up, change in treatment plan after 1 week radiographs and complication rates.

### RESULTS

412 patients identified were divided into 2 groups based on time to initial follow up. 368 patients had an initial follow-up at 7-10 days (Group 1) and 44 patients at 21-28 days (Group 2). Statistically significant findings included time to initial follow up (Group 1 average at 7.66 days and group 2 at 23.45 days), days to pin removal (group 1 at 26.22 days and group 2 at 23.88 days), type of immobilization (group 1 with 5% circumferential casts and group 2 with 70% circumferential) and time to surgery (group 1 average of 26.24 hours and group 2 average of 62.9 hours). There was no significant difference in complication rates. Additionally, there was only a 0.5% rate of change in management after 1 week follow up in group 1.

### CONCLUSION

Early post-operative follow up and radiographs did not change patient clinical outcome in the treatment of displaced supracondylar humerus fractures. These findings suggest that the early follow-up appointment at 7-10 days may be eliminated for patients not requiring a change in immobilization.

# Autologous Stem Cells for Brain Repair in Parkinson's Disease: Preclinical Studies

Platform Presenter: Dr. Ivar Mendez

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

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## TEAM MEMBERS

Damaso Sadi, University of Saskatchewan; Jan-Eric Ahlfors, Fortuna Fix

## ABSTRACT

### RATIONALE

Parkinson's disease is characterized by the progressive degeneration of dopaminergic cells in the substantia nigra. As medical (L-Dopa) and surgical (Deep Brain Stimulation) approaches for the treatment of Parkinson's disease have limitations and do not address the loss of dopamine neurons, a cell replacement therapy to repair the brain makes sense. We have studied the potential of autologous reprogrammed stem cells to repair the brain in a rat model of Parkinson's disease.

### METHODS

Human Stem cells derived from the bone marrow were reprogrammed and differentiated into dopaminergic neurons using a self-contained automated manufacturing process. Dopaminergic cells were implanted into the substantia nigra and striatum of parkinsonian rats. Animals were analyzed for survival of transplants and improvement of function using rotational behavior. All animals received daily injections of cyclosporin to prevent rejection.

### RESULTS

Animals had surviving transplants in the substantia nigra and not the striatum. Cells maintained their dopaminergic phenotype after transplantation. Animals showed significant improvement in rotational behavior 4-6 weeks after transplantation.

### CONCLUSION

This study shows the feasibility of brain repair in Parkinson's disease using autologous stem cells. The use of an automated manufacturing process for the expansion and differentiation of clinical grade stem makes this approach eminently translatable to the clinic. The potential rejection of the transplant and the need of immunosuppression will be avoided by the autologous nature of the cells when translated into clinical trials.

## ACKNOWLEDGEMENTS/SOURCES OF FUNDING

CIHR-Industry Grant

# Sutureless Gastroschisis Closure Avoids the Potential Neurotoxicity of Volatile Anesthetics

Platform Presenter: Dr. Grant Miller

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

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## TEAM MEMBERS

Andrea Vasquez (Family Medicine) & Amanda Hall (General Surgery) - University of Saskatchewan; Saeed Awan, Pediatric Surgery, Children's Hospital of Orange County, CA

## ABSTRACT

### RATIONALE

Infants born with gastroschisis typically undergo general anesthesia for emergency reduction of the eviscerated bowel and suture closure of the abdominal wall defect. However, there is growing concern that volatile anesthetics may be neurotoxic to the developing brain. A bedside bowel reduction with an umbilical flap closure technique may be as effective and avoids the need for potential neurotoxic anesthetics. We reviewed our experience to determine if gastroschisis can be adequately treated without the use of volatile anesthesia agents.

### METHODS

We did a retrospective cohort analysis of the health records of all patients with gastroschisis over 7 years and evaluated the technique of closure, anesthetics used, and outcomes.

### RESULTS

All 42 patients were treated with bedside bowel reduction with or without a silastic silo. Twenty-eight infants had primary suture fascia & skin closure under general (volatile) anesthesia (Sutured Group). Seventeen were treated an umbilical cord flap sutureless closure technique (Sutureless Group). None of the infants in the Sutureless Group received a volatile anesthesia agent. The groups were otherwise comparable. The mean number of days before herniated bowel could be reduced to the abdominal cavity was significantly longer in the Sutured Group (3.7 versus 0.9 days). At 6 weeks followup post treatment an abdominal wall hernia was 3.5 times more prevalent in the Sutureless Group.

### CONCLUSION

Gastroschisis can be effectively treated without the use of potentially neurotoxic anesthetics by a bedside sutureless closure technique with an increased incidence of abdominal wall hernia.

# Blood Conservation Techniques following Cardiopulmonary-bypass-supported Cardiac Surgery

Platform Presenter: Dr. Erick McNair

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

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## TEAM MEMBERS

Dorothy Thomson (Division of Cardiac Surgery), Taras Mycyk (Division of Cardiac Surgery), Greg Dalshaug (Cardiac Surgery), William McKay (Department of Anesthesiology and Pain Management) Sharon Wandzura (Department of Surgery), Victor Uppal, (Department of Surgery), Jo-Anne Marcoux (Department of Surgery) Jennifer Bezaire (Department of Surgery) & Marnie Olson (Department of Surgery) - University of Saskatchewan

## ABSTRACT

### RATIONALE

According to the Canadian Blood Services red blood cell transfusion rates are continuing to rise. During the 2015-2016 year 740,000 units of blood at an average cost of \$411/ unit were transfused into patients in Canada. Over the past 10 years the percentage of patients that underwent cardiac surgery, that received a transfusion doubled from 12-24%. During cardiac surgery, with cardiopulmonary bypass, small, elderly patients have increased risk for receiving a transfusion due to dilutional anemia. Transfusions are independently associated with increased hospital mortality. Various techniques are available to attenuate transfusions following cardiac surgery. However, there is no clear-cut data comparing these techniques in smaller patients regarding postoperative outcomes.

### METHODS

Our research sought to determine which of 3 blood conservation techniques was best at decreasing postoperative cardiac surgical blood transfusions and identify which techniques will allow enhanced clinical outcomes during the postoperative period. We hypothesized that patients who undergo the Online-MUF (n=35) technique will have higher hemoglobin levels at the 12-hour postoperative interval, and enhanced clinical/biochemical parameters as compared to the Offline-MUF (n=30) and centrifugation methods (n=34).

### RESULTS

Upon arrival in ICU the patients that received Online-MUF had significantly higher hemoglobin levels compared to the other two groups. However, after 12-hours in ICU the patients that received centrifugation had significantly higher levels of hemoglobin compared to the other 2 groups.

### CONCLUSION

Although the Online-MUF technique provides initially higher hemoglobin levels following cardiac surgery, the levels decreased significantly over the 12-hour postoperative period and provided no enhancement of clinical outcomes from the intervention.

## ACKNOWLEDGEMENTS/SOURCES OF FUNDING

Research Services, College of Medicine, University of Saskatchewan

# Traumatic Spinal Cord Injuries among Aboriginal and non-Aboriginal Populations of Saskatchewan: A Prospective Outcomes Study

Platform Presenter: Dr. Daryl Fourney

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

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## TEAM MEMBERS

Lucy Liu, Adam Wu, Allan Woo, Michael Spiess, Luke Hnenny, Kotoo Yong-Hing, Aleksander Vitali, Kotoo Meguro, Michael Kelly, Lissa Peeling, Gary Linassi, Katherine Knox & Suzanne Hattingh - University of Saskatchewan, Suzanne Humphreys - Rick Hansen Institute

## ABSTRACT

### RATIONALE

People of Aboriginal ancestry are more likely to suffer traumatic spinal cord injury (TSCI) compared to other Canadians; however, outcome studies are limited to qualitative (interview) methods. The objectives of this study were to, for the first time, compare Aboriginal and non-Aboriginal populations with acute TSCI with respect to: (1) baseline demographics, comorbidities, mechanism and severity of injury; (2) time to surgery, neurological outcomes, morbidity/mortality, and length of stay in acute care and rehabilitation; and (3) time to discharge to community and outcomes at one-year after discharge (functional independence measures, quality of life scores, secondary health conditions, compensation type, employment status).

### METHODS

159 patients with TSCI enrolled in the prospective Rick Hansen Spinal Cord Injury Registry (RHSCIR), Saskatoon site between February 13, 2010 and December 17, 2016.

### RESULTS & CONCLUSION

62 patients consented to the full dataset, which includes ethnic background: 21 Aboriginal (33.9%); 41 non-Aboriginal (66.1%). Transport injuries were the most common mechanism of injury among Aboriginal peoples, followed by assault. For whites, falls and transport injuries were equally common. Aboriginal patients were younger, had fewer medical comorbidities and had similar severity of neurological injury and similar outcomes compared to non-Aboriginal patients. However, the time to discharge to the community from acute care or inpatient rehabilitation was significantly longer (median 104.0 days versus 38.5 days,  $p=0.021$ ). While 35% of whites were discharged home from acute care, all patients of Aboriginal ancestry were transferred from the acute care site to another hospital (inpatient rehabilitation or local hospital).

## ACKNOWLEDGEMENTS/SOURCES OF FUNDING

Rick Hansen Foundation

# Targeting HERG Potassium Channels for Breast Cancer Therapy

Platform Presenter: Dr. Francisco Cayabyab

Neuroscience Cluster, Department of Surgery,  
College of Medicine, University of Saskatchewan

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## TEAM MEMBERS

Kevin Jung (Department of Physiology Graduate Program), Le Gui (Department of Surgery), Zhicheng Chen, (Department of Physiology Graduate Program), Ingrid Wirth (Department of Physiology Undergraduate Program), Cherry Xiong (Department of Physiology Undergraduate Program), Dengpei Tang, (Department of Biochemistry Undergraduate Program) & Veronica Campanucci (Department of Physiology) - University of Saskatchewan; Mohan Babu, Department of Chemistry and Biochemistry, University of Regina; Chaoke Tang, University of South China, PR of China

## ABSTRACT

### RATIONALE

Estrogen receptor positive (ER+) breast cancer accounts for ~70 % of all breast cancer incidence. The human ether-a-go-go-related gene (HERG) channel is a voltage-gated potassium channel which promotes growth of various cancers, including breast cancers. Signal Transducer and Activator of Transcription 1 (STAT1) is a transcription factor which is also implicated in breast cancer. We hypothesize that HERG and STAT1 interaction regulates breast cancer cell proliferation under the influence of estrogen.

### METHODS

We investigated the biochemical and functional interactions of HERG potassium channel and STAT1 in absence or presence of ER stimulation of human breast cancer cell lines using confocal imaging microscopy, co-immunoprecipitation, cell surface biotinylation, proliferation assay and patch-clamp electrophysiology.

### RESULTS

Increased interaction of overexpressed HERG and STAT1 was observed in pathology-certified breast cancer tissue, ER+ (MCF-7, T47D) and ER- (MDA-MB-231, BT-20) human breast cancer cell lines. Relative to ER- breast cancer cell lines, HERG and STAT1 colocalization after estrogen treatment was greater in ER+ breast cancer cells. Cell surface biotinylation revealed an increase in surface expression of HERG channels after ER stimulation of ER+ breast cancer cell lines, suggesting that estrogen promotes expression and interaction of HERG and STAT1. In cell proliferation studies, inhibition of HERG channels, STAT1 or ERs all prevented estrogen-induced cell proliferation. A peptide inhibitor which disrupts HERG-STAT1 interaction also reduced HERG currents and cell proliferation.

### CONCLUSION

An ER-mediated signaling pathway involving STAT1 and HERG interaction, is critical for upregulation of surface trafficking of HERG for increased cell proliferation of human breast cancer cells.

## ACKNOWLEDGEMENTS/SOURCES OF FUNDING

Canadian Breast Cancer Foundation, CFI, and NSERC Discovery Grant.

# **Radiographic, Clinical and Patient-rated Outcomes of Volar Locking Plate Fixation of Distal Radial Fractures in Adult Women and Related Implant-specific Complications in 236 Adult Women**

Platform Presenter: Dr. Geoff Johnston

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

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## **TEAM MEMBERS**

Saskatoon Orthopedic Surgeons

## **ABSTRACT**

### **RATIONALE**

The study objectives were to evaluate radiographic and clinical outcomes of volar locking plate (VLP) fixation of distal radius fractures (DRFs) in adult women at our institution, and to identify implant-specific complications.

### **METHODS**

Retrospectively assessed outcomes of DRF-VLP fixation in adult women were radiographic (radial inclination (RI), ulnar variance (UV) and radial tilt (RT) at 9-12 weeks post-fracture) and clinical (restoration of range of motion, strength, and patient rated wrist evaluation (PRWE) scores at nine, 12, 26 and 52 weeks post-fracture). Additionally, hardware-specific complications were recorded.

### **RESULTS**

A cohort of 236 women was identified. Mean RI was 22 degrees, UV +2.0 mm, and RT 6.9 degrees volar. Implant complications included screw penetration into adjacent joints (7.2%), and at-risk for penetration (24%); and unnecessarily long screws (13.5%). At the four time points 67%, 67%, 54% and 40% of the cohort was assessed. Respective restoration (percentages) of wrist extension were 56, 69, 81 and 86; flexion 53, 65, 78 and 85; forearm supination 71, 81, 91 and 94; and pronation 91, 93, 94 and 94; of grip strength 35, 51, 68 and 81. Mean PRWE scores were 65, 48, 31, and 27, respectively.

### **CONCLUSION**

By one year post DRF VLP fixation women had regained the majority of their motion and strength, and symptoms, although diminished, had not disappeared. VLP fixation can restore distal radial alignment, but fracture location and pattern, fragment instability and plate technology facilitate inadvertent screw penetration of adjacent joints and soft tissues. Intra-operative strategies to minimize these complications should be regularly used.

# 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

Division of Neurosurgery, Department of Surgery,  
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## TEAM MEMBERS

Daryl Fourney, Division of Neurosurgery, University of Saskatchewan

## ABSTRACT

### RATIONALE

Triage pathways like the Saskatchewan Spine Pathway (SSP) pathway facilitate more appropriate and timely management and utilization of advanced imaging resources (such as MRI) by identifying at the level of primary care those patients with low back and leg pain who are unlikely to need or benefit from medical imaging and/or spine surgery consultation. It is important, however, that the interpolation of a triage clinic referral not negatively impact treatment and outcome for the subset of patients who would benefit from surgery. The objective of this study was to compare satisfaction, utilization of resources, waiting time for treatment, and final outcome between patients undergoing spine surgery referred through the SSP with those referred directly to a spine surgeon.

### METHODS

We prospectively compared 75 patients referred through the SSP with 75 patients referred directly to the spine surgeon.

### RESULTS & CONCLUSIONS

Patients who went through the SSP had shorter wait times for surgical consultation (48.7 vs 100.3 days) and MRI (16.8 vs 63.0 days), and no difference in total waiting time to surgery. A significantly greater proportion of SSP patients received guideline concordant conservative management, such as physiotherapy ( $p=0.03$ ), for their symptoms, and greater satisfaction, prior to seeing the spine surgeon ( $p=0.03$ ). No significant differences in the outcomes of surgery in Oswestry, VAS(back), and VAS(leg) scores up to 1 year after surgery were observed between groups.

## ACKNOWLEDGEMENTS/SOURCES OF FUNDING

RUH Foundation

# Critical Care Neurophysiology

Platform Presenter: Dr. Jonathan Norton

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

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## TEAM MEMBERS

Michael Kelly (Department of Surgery), Lissa Peeling (Department of Surgery), Allan Woo (Department of Surgery) & Francis Bui (Department of Electrical Engineering) - University of Saskatchewan

## ABSTRACT

### RATIONALE

Stroke is undergoing a revolution in therapy, both in acute management and in rehabilitation. Endovascular treatment of large vessel occlusion is the new standard, and although the time window for efficacy is expanding, the earlier intervention is applied the better the outcome. Mobile CT scanners are expensive and will always be a limited resource. EEG is being tested in some centres for acute diagnosis. In addition to EEG changes, strokes also affect SSEPs. We are testing a novel device for remote assessment of SSEPs in the diagnosis of stroke, spinal cord injury and status epilepticus.

Many patients with cervical spine issues present with multi-level degenerative changes. Limiting surgery to the most symptomatic levels is advantageous for patients and the health care system. Many patients have nerve root innervations that are more complex than the classical textbook models.

### METHODS

The device is a handheld nerve stimulator and amplifier unit controlled through a blue tooth link to a smart phone. The device also records 4 channels of EEG activity, with amplification and filters and stimulus-locked averaging. To evaluate the device we are testing it in a rat model of stroke with a middle cerebral artery filament occlusion.

We have developed a novel magnetic coil to activate cervical nerve roots. This will allow the identification of the most symptomatic level in terms of nerve root compression.

### RESULTS & CONCLUSIONS

Both projects remain in the testing phase, but show the potential of novel neurophysiology to answer clinical questions.

## ACKNOWLEDGEMENTS/SOURCES OF FUNDING

Funded by the College of Medicine and donations from surgeons. Additional donation from the Neufeld Family Trust.

# Laparoscopic Hepatectomy and Pancreatectomy

Platform Presenter: Dr. Yigang Luo

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

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## TEAM MEMBERS

John Shaw, Mike Moser, Gavin Beck & Maurice Ogaick, Hepatobiliary Pancreatic Surgery - University of Saskatchewan

## ABSTRACT

### RATIONALE

To improve our patient care with the advanced techniques, in 2013, we started laparoscopic liver and pancreas resections at Saskatoon. Over the last few years, more than 50 cases were performed.

### METHODS

A retrograde review was conducted. Patient information, intra-operative data and postoperative mortality/morbidity were recorded and analyzed in comparison with the published results.

### RESULTS

Excluding minor liver wedge biopsies and cystic fenestrations, 48 cases of liver lobectomies and segmentectomies (n=37) and distal pancreatectomies (n=11) were reviewed, including combined cases of laparoscopic liver resection and colon-rectum resection, as well as laparoscopic associated liver partition and portal vein branch ligation with staged liver resection (lap-ALPPS), male/female ratio: 25/23; average age: 61.54 (29 - 86); average surgical time: 270 min (85-479min); average blood transfusion: 0.48 units with no blood transfusion in 84% of cases; 10 cases (20.8%) were switched to open surgery mostly due to intra-operative ablation; postoperative hospital stay was averagely 7.42 days, ranging 3 - 27 days, there were 3 Clavien-Dindo IIIb complications, but no mortality. We did not use special instruments but those for regular laparoscopic surgery. Intra-operative U/S was performed with a regular U/S probe through a hand-port. Cases of multiple former surgeries with extensive intra-abdominal adhesions were not considered as contraindication because we used a hand port in surgery.

### CONCLUSION

Laparoscopic liver and pancreatic resection can be successfully done in Saskatoon with safe and excellent results comparable to the current published results in the literature.

# Synchrotron Analysis of Clots from Acute Ischemic Stroke Patients

Platform Presenter: Vadashree Meher [Supervisors: Dr. Kelly & Dr. Peeling]

Neuroscience Cluster, Department of Surgery,  
College of Medicine, University of Saskatchewan

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## TEAM MEMBERS

Roland Auer (Department of Pathology and Laboratory Medicine), Michael Kelly (Department of Surgery), Lisa Peeling (Department of Surgery), Jake Pushie (Department of Surgery), Sharleen Weese Maley (Clinical Trial Support Unit and Saskatchewan Cerebrovascular Centre), Nicole Sylvain, (Department of Surgery) & Huishu Hou (Department of Surgery) - University of Saskatchewan.

## ABSTRACT

### RATIONALE

With the recent technological advances in mechanical thrombectomy, and evidence that clearly demonstrates the need for fast and effective thrombus retrieval, it remains unclear as to which device and technique combination is most effective. Defining detailed thrombus morphology with advanced synchrotron based imaging techniques, may help us better understand the biochemical composition of clots.

Histological evaluations have characterized the presence of several biological components in thrombi including platelets, leukocytes, neutrophils, erythrocytes, and fibrin. We hypothesize that endothelialization and trapped biological elements result in denser and harder thrombi, making it difficult to retrieve them and restore complete intracranial flow. To characterize endothelialization and distribution of trapped elements, we are combining conventional histology with advanced imaging techniques.

### METHODS

Freshly retrieved blood clots from acute ischemic stroke patients will be analyzed using Fourier Transform Infrared (FTIR) spectroscopy and X-ray fluorescence imaging (XRF) to map the distribution of metabolites and elements, respectively in combination with conventional histology.

### RESULTS

XRF analysis of the thrombus samples exhibited increased distribution of Cl, Zn, S, P and Fe. FTIR analysis demonstrated an increased distribution of lipids and glycogen. Histological analysis demonstrated that endothelial cells (CD31) were spread on the periphery of the thrombus while macrophages (CD68) were scattered throughout the thrombus.

### CONCLUSION

Characterizing thrombus composition, identifying appropriate targets, and correlating these findings with clinical information are key steps in improving our understanding of stroke treatment outcomes.

## ACKNOWLEDGEMENTS/SOURCES OF FUNDING

Funding for this project is provided by the Heart & Stroke Foundation, Saskatchewan Health Research Foundation, UoS CoM Clinical Stroke Research Chair (M.E.K.), UofS CoM Research Award (L.P.), Health Sciences Scholarship, CoM Health Sciences Graduate Program (V.M.)

# Molecular Diagnostics and Radiomics to Improve Outcomes in Oropharyngeal Cancer

Platform Presenter: Dr. Silvana Papagerakis

Cancer Research Cluster, Department of Surgery,  
College of Medicine, University of Saskatchewan

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## TEAM MEMBERS

Lubomir Hadjiyski, Professor of Radiology, University of Michigan; Henry Adeola, Oral Pathologist; Paul Babyn (Department of Medical Imaging), Petros Kechagioglou (Department of Surgery) & Andrea Badea (Department of Medical Imaging) - University of Saskatchewan

## ABSTRACT

Precision oncology promises to tailor the full spectrum of cancer care to an individual patient, notably in terms of personalization of cancer prevention, screening, risk stratification, therapy and response assessment. The projects goal is to design and validate combined molecular and radiographic biomarkers to provide foundation for precision patient-specific diagnosis and treatment of oropharyngeal cancer (OPC).

## RATIONALE

For high-stage OPC patients, the identification of biomarkers such as high-risk human papillomavirus (HPV) that impact patient survival, have led to less aggressive treatment protocols decreasing the risk of treatment-related toxicities while optimizing outcome. In contrast, a significant number of early-stage (Stages I-II) patients with HPV-negative OPC develop recurrence and/or metastasis following single modality treatment protocols, thus failing to benefit from the standard of care with worse outcome and survival. Therefore, there is a clinical need for a more refined approach able to identify biomarkers that can differentiate high and low risk neoplasms, allowing for a more accurate pre-treatment staging and post-treatment progression prediction based on in-depth multi-parametric analysis of the tumor biology.

## METHODS

To identify molecular biomarkers and to develop radiomics biomarkers based on multimodality imaging (PET/CT and CT) for accurate tumor staging and progression prediction of OPC that will allow for early patient stratification into prognostic groups.

## EXPECTED RESULTS

The combination of molecular and radiomics biomarkers is expected to increase the sensitivity and specificity of the pre-treatment staging and tumor progression prediction of HPV-negative OPC.

## CONCLUSION

This will assist clinicians in utilizing the multimodality information efficiently and effectively for OPC patients.

## ACKNOWLEDGEMENTS/SOURCES OF FUNDING

Start up Funds (SP)

# Aluminum Contamination of Parenteral Nutrition Causes Blunting of Bile Canalicular Microvilli

Platform Presenter: Dr. Grant Miller

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

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## TEAM MEMBERS

Amanda Hall (General Surgery) & Gord Zello (College of Pharmacy & Nutrition) - University of Saskatchewan; Janet Brunton & Robert Bertollo, Biochemistry - Memorial University of Newfoundland; Consolato Sergi, Laboratory Medicine & Pathology, University of Alberta

## ABSTRACT

### RATIONALE

Infants on long-term parenteral nutrition (PN) are susceptible to parenteral nutrition-associated liver disease (PNALD). Aluminum (Al) is a known contaminant of PN, and we hypothesize that it contributes to PNALD. In this pilot study, we aimed to assess the impact of Al on hepatocytes in a piglet model.

### METHODS

Yucatan miniature piglets, aged 3-6 days, were randomized into two groups. A high Al group (HiAL) (n=8) received PN with 63µg/kg/day of Al, while a low Al group (LoAL) (n=7) received PN with 24µg/kg/day of Al. Serum total bile acids were collected over two weeks, and liver tissue was obtained at the end of the experiment. Bile canaliculus morphometry was studied by transmission electron microscopy (TEM) and Image-J software analysis.

### RESULTS

The canalicular microvilli were significantly shorter in the HiAL group. There was no difference in the total serum bile acids between the groups.

### CONCLUSION

Aluminum causes ultrastructural changes in the hepatocytes with blunting of the canalicular microvilli. The lack of difference in serum bile acids may indicate the ultrastructural changes are an early sign of PNALD.

## ACKNOWLEDGEMENTS/SOURCES OF FUNDING

Hospital of Saskatchewan Foundation, the Janeway Children's Hospital Foundation. Dr. Sergi has received funding from the Women and Children Research Institute, Tyrolean Cancer Research, Saudi Cultural Bureau, and the Canadian Foundation for Women's Health (CFWH).

# Total Knee Arthroplasty Infections - The Saskatoon Experience

Platform Presenter: Dr. Anthony King

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

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## TEAM MEMBERS

Alex Lei (Medical Student) & Matthew Mastel (Orthopedic Surgery Resident) - University of Saskatchewan

## ABSTRACT

### RATIONALE

Infection is one of the most undesired post-operative complications after Total Knee Arthroplasty (TKA). Our research aims were to quantify the post-operative TKA infection rate for patients undergoing primary TKA within the Saskatoon Health Region (SHR), to elucidate patient risk factors for TKA infections, to characterize clinical and microbiological patterns for TKA infections and to analyze costs of diagnosing and treating TKA infections for the Saskatoon Health Region.

### METHODS

Retrospective chart review was performed on 231 patients who were admitted with a clinically diagnosed post-TKA infection in the Saskatoon Health Region between January 2006 and January 2016. SHR archived procedural data of the total number of TKA surgeries performed per year was used to calculate the joint infection rate. Billing codes for diagnostic, medical and surgical treatment modalities were used to perform cost analysis.

### RESULTS

An average of 0.37% of SHR TKA patients had an early (< 6 weeks post surgery) joint infection. There was no increase in the number of early infections per year. There was a trend of an increasing number of late (> 6 weeks post surgery) infections presenting to the SHR. Notable risk factors included BMI>30 (65.5%), smoking (39.6%), diabetes (37.0%). Causative organisms of joint infections were as follows: Staphylococcus (67.0%), Streptococcus (30.4%), other gram positives (26.1%), gram negatives (10.9%), none isolated (8.7%). An estimated \$5.81 million was spent diagnosing and treating post-TKA infections between 2006 and 2016 with an estimated \$25.2 thousand per patient.

### CONCLUSION

The early post-TKA infection rate has not increased in the SHR over the ten years reviewed. However, there was a trend of treating an increasing number of late post-TKA infections. Numerous organisms were identified. The cost of treating TKA infections is high. Further efforts to minimize infection rates should continue.

## ACKNOWLEDGEMENTS/SOURCES OF FUNDING

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