



# 2016 RESIDENT RESEARCH DAY SURGERY



*"Little progress in surgery could have been achieved without the countless laboratory investigations into the intricacy of surgical biology, and the pragmatism of surgeons urging them to pose and answer to clinical questions encounter at the bedside."*

- Harvey Cushing, 1939

American Neurosurgeon, considered the "father" of modern neurosurgery



## Andrew Wills

Interim President and  
Chief Executive Officer

Saskatoon Health  
Region

Born and educated in Saskatchewan, Andrew Will is currently the Interim President and CEO of Saskatoon Health Region and CEO of 3S Health.

Andrew's experience includes serving as the CEO of three health regions in Saskatchewan and Alberta and as Executive Vice President, Clinical Support Services for Alberta Health Services prior to joining 3S Health. Andrew has dedicated his career to providing executive leadership that builds a strong organizational culture that is focused on supporting individuals and teams to achieve their best for the people we serve.

The Department of Surgery has continued to expand its research activities at all levels. New research opportunities are available for our faculty, residents and students.

Major achievements in the past year have been the appointment of Karen Mosier as the Department's first research navigator and the hiring of a dedicated statistician to support research in the Department. We have established the first series of research workshops and seminars on research themes aimed at enhancing knowledge for grant writing and submission of research proposals by our residents and faculty.

Our Research Director Nael Shoman and the Research Committee have put together a comprehensive strategy to enhance research productivity in the Department by facilitating seed funding for projects and support for publication of papers and presentations at national and international meetings. This strategy is already bearing fruits as the Department had one of the highest number of successful applications for the recent College of Medicine Research Awards (CoMRAD). Our success rate on funding awards from regional and national research agencies is also steadily increasing which is a direct reflection of the Departmental emphasis and support of research.

This year the Resident Research Day promises to be an exciting event, our invited guest is Dr. Michael Chu, a cardiovascular surgeon from Western University in London, Ontario and an alumnus of our College of Medicine. I look forward to the presentations and seeing all of you at the Saskatoon City Hospital Rependa Theater.



## Dr. Ivar Mendez

Fred H. Wigmore  
Professor and  
Unified Head

University of  
Saskatchewan  
and  
Saskatoon Health  
Region



**Dr. Nael Shoman**  
Director of Research  
Department of Surgery  
College of Medicine  
University of  
Saskatchewan

Under the leadership of Dr. Mendez, the Department of Surgery has made research productivity a priority, and within a relatively short period of time a plan has been structured and resources established to turn this vision into a tangible reality. Over the past year, it has been a tremendous privilege to be part of this work as Director of Research.

Teamwork is the most important foundational aspect in promoting a research culture, and as such putting together a plan for advancing research at our institution has emphasized the need for involvement at all levels. Aside from continuing to make resources available, involving faculty and residents on a regular basis through planned events, workshops, incentive programs, mentorship recognition and acknowledgement of research accomplishments has been an integral component of a culture vision. The annual Resident Research Day is an example of such endeavors, whereby we celebrate the work of our trainees and recognize their research accomplishments. This year, we saw a large number of submitted abstracts across all Divisions, testimony to the work of the Department in continuing to support resident research, and recognize its tremendous value. Many individuals have collaborated to put together this year's event, and I am grateful for the incredible work they do on a daily basis, as without their efforts realization of a transformational culture change would not be possible. I would like to specifically thank my colleagues in the Research Committee, who continue to meet bimonthly to ensure that research remains a high priority within the objectives of the Department of Surgery and Karen Mosier, whose role as Research Facilitator has brought significant structural validity to our research vision.

I am very excited to be part of this year's Resident Research Day, and look forward to what promises to be a remarkable event.

## 2015 Award Recipients

### Platform Presentations:

First Prize (Kloppenburger Award)	Jason Shin
Second Prize	Farrukh Munshey
Third Prize	Laura Sims

### Poster Presentations:

First Prize	Amanda Hall
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### Undergraduate Medical Student Awards:

Platform Award Recipient: (Dash Reed Research Award)	Haven Roy
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Poster Award Recipient:	Jimmy Lam
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### Platform Presentations:

First Prize (Kloppenburger Award)	Amanda Hall
Second Prize	Zane Tymchak
Third Prize	Tanner Gurney Dunlop

### Poster Presentations:

First Prize	Peter Dust
Best Poster Display	Marla Mickleborough

MacRae Scholarship:	Amanda Hall Andrea Vasquez
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### Undergraduate Medical Student Awards:

Platform Award Recipient:	Chelsea Wilgenbusch
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## 2014 Award Recipients

# 2016 RESIDENT RESEARCH DAY

Surgery

May 13, 2016

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# INTRODUCTION

Saskatoon City Hospital  
Rependa Centre Auditorium

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09:00 - 09:30

## WELCOME AND INTRODUCTIONS

Dr. Ivar Mendez  
Fred H. Wigmore Professor of Surgery

## OPENING REMARKS

Andrew Wills  
Interim President and Chief Executive Officer  
Saskatoon Health Region

# SESSION I

Saskatoon City Hospital  
Rependa Centre Auditorium

CHAIR: Dr. Michael Kelly

09:30 - 10:30

A Novel Classification System for Distal Ulna Fractures  
Associated with Distal Radius Fractures

LAURA SIMS

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Salvage Total Mesorectal Excision after Transanal Endoscopic  
Microsurgery for Early Rectal Cancer: Is it Safe and Are  
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Therapeutic Nanoparticles for Cardiovascular Regenerative  
Medicine

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Subjective and Symtomatic Improvement of Graves'  
Ophthalmopathy after Thyroidectomy in the Treatment of  
Graves' Disease

NIOMI SINGH

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Break 10:30 - 11:00

## SESSION II

Saskatoon City Hospital  
Rependa Centre Auditorium

CHAIR: Dr. Geoff Johnston

11:00 - 12:00

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KAYLEEN WINGERT	

## KEYNOTE SPEAKER

Saskatoon City Hospital  
Rependa Centre Auditorium

12:00 - 12:30

# EMBRACING MINIMALLY INVASIVE AND TRANSCATHETER TECHNIQUES - LESSONS FROM CARDIAC SURGERY

Dr. Michael Chu

Associate Professor of Surgery

London Health Centre and University of Western Ontario

Lunch

Foyer outside of Auditorium  
Main Floor, Saskatoon City Hospital

12:30 - 13:30

Michael studied medicine at the University of Saskatchewan, where he graduated with distinction in 2000. He then undertook a cardiac surgery residency at the University of Western Ontario and successfully completed his Royal College Examinations in June 2006. He also completed a Master's degree in Medical Education from the University of Toronto in November 2004. Following his residency, he undertook a fellowship with Dr. W.R. Chitwood, Jr. at East Carolina University in minimally invasive and robotic cardiac surgery, with a focus on complex mitral valve reconstruction. Then, he completed a fellowship in transcatheter aortic valve technology at the Herzzentrum in Leipzig, Germany with Professors F.W. Mohr and T. Walther. Michael has a clinical focus in minimally invasive mitral valve reconstruction, transcatheter valve technology and complex aortic reconstruction.

He is an active researcher and has investigated minimally invasive and robotic mitral surgery, augmented imaging in minimally invasive valve surgery, experimental transcatheter technology and complex aortic reconstruction.

Michael has also been awarded the MacEachern Award, prestigious international Francis Fontan Award and ISMICS Robert Emery Young Investigator Award for his research endeavours. He has active grants from the Heart and Stroke Foundation and Canadian Institutes of Health Research. He has over 80 peer reviewed publications, 3 textbook chapters and has delivered over 140 presentations at meetings nationally and internationally. He has been a visiting professor in many countries worldwide, where he has operated and taught minimally invasive and valve reconstructive techniques.

He is currently practicing as a consultant cardiac surgeon and Associate Professor of Surgery at the London Health Sciences Centre and University of Western Ontario.



## Dr. Michael Chu

Associate Professor of  
Surgery

London Health Centre  
and University of  
Western Ontario

# POSTER PRESENTATIONS

Saskatoon City Hospital  
Rependa Centre Auditorium

CHAIR: Dr. Carolyn DuVal

13:30 - 14:30

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Break 14:30 - 15:00

## SESSION III

Saskatoon City Hospital  
Rependa Centre Auditorium

CHAIR: Dr. Gary Groot

15:00 - 16:00

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**2016** RESIDENT RESEARCH DAY  
BANQUET

The Willows Golf and Country Club

RECEPTION

18:00

DINNER

19:00

Presentation of prizes:

Dr. Ivar Mendez and Dr. Nael Shoman



# ACKNOWLEDGEMENTS

The Department of Surgery would like to thank the following individuals for serving as judges and moderators for the 2016 Resident Research Day.

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## JUDGES

### Dr. Michael Chu

Associate Professor of Surgery  
London Health Centre and  
University of Western Ontario

### Dr. Marek Radomski

Vice Dean, Research  
College of Medicine  
University of Saskatchewan

### Dr. Nael Shoman

Clinical Assistant Professor, Division of Otolaryngology  
Director of Research  
Department of Surgery, College of Medicine  
University of Saskatchewan

## SESSION CHAIRS

### Dr. Michael Kelly

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

### Dr. Carolyn DuVal

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

### Dr. Geoff Johnston

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

### Dr. Gary Groot

Clinical Professor, Division of General Surgery  
Director of Oncology  
Department of Surgery, College of Medicine  
University of Saskatchewan



**2016**

**RESIDENT RESEARCH DAY  
ABSTRACTS**

**SURGERY**

# A Novel Classification System for Distal Ulna Fractures Associated with Distal Radius Fractures

Platform Presenter: Laura Sims

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

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Authors:

Laura Sims, Geoffrey Johnston

## **Rationale:**

Distal ulna fractures (DUF) are commonly associated with distal radius fractures (DRF). There is currently no standardized classification system for characterizing DUFs. Our purpose was to assess the utility of our newly created, inclusive classification system.

## **Methods:**

A classification system for DUFs was devised based on fracture pattern and location. Type 1 fractures are those in the ulnar styloid, with type 1a involving the apex and Type 1b in the body of the styloid; Type 2 fractures involve the ulnar fovea, with Type 2t adopting a transverse pattern and Type 2o an oblique pattern; Type 3 fractures involve the ulnar head; and Type 4 fractures were those proximal to the head, with Type 4n being through the neck and Type 4s involving the distal shaft. A questionnaire was distributed to all members of the Canadian Orthopedics Association, asking participants to evaluate 29 radiographic images of DUFs.

## **Results:**

The mean overall score from the 144 respondents was 83.39% ranging from 62.07% to 100%. In 21 out of 29 images, greater than 80% of raters agreed. Correct answers for each DUF type were: Type 1a 91.42%, Type 1b 81.81%, Type 2t 75.98%, Type 2o 97.56%, Type 4n 78.57%, and Type 4s 84.83%. A type 3 fracture occurred in combination with a type 2t fracture and was identified by 34.35%. Questions where fewer than 80% answered correctly were analyzed, revealing a common wrong answer was most often selected. For type 1b fractures, 82.5% of wrong answers selected were type 1a. For type 2t fractures, 91.1% of wrong answers were type 1b; for type 4n 89.6% of wrong answers selected were type 2o; and for type 4s fractures, 98.7% of wrong answers were type 4n.

## **Conclusion:**

The Canadian orthopedic community has demonstrated that they can readily reproduce this new classification system with greater than 80% agreement. The results will guide further distinction between the definitions of Types 1b and 1a, 1b and 2t, and 4n and 4s, and Type 3 fractures. This provides treating physicians with a uniform way of describing DUFs, useful in predicting outcomes and conducting future research.

# Salvage Total Mesorectal Excision after Transanal Endoscopic Microsurgery for Early Rectal Cancer: Is it Safe and are Oncologic Principles Respected? A case-matched study

Platform Presenter: Suzie Harriman

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

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## Authors:

Francois Letarte, Suzanne Harriman, Ahmer Karimuddin, Terry Phang, Manoj Raval, Carl Brown

## Rationale:

Transanal Endoscopic Microsurgery (TEM) is now accepted as an alternative for conventional radical excision in cases of select early rectal cancers. If final histology demonstrates adverse features or positive margins or if recurrence develops, patients can still undergo salvage excision with total mesorectal excision (TME). However, these cases are technically challenging and it is not clear if oncologic quality of excision is similar to primary TME. The aim of this study is to evaluate the feasibility and safety of salvage TME after TEM.

## Methods:

At St. Paul's Hospital, a database of performed TEMs was prospectively collected since 2007. All consecutive patients treated with salvage TME after primary TEM (TEM-TME) were identified. A comparison cohort of primary TME (P-TME) treated patients were identified and matched for age, gender, ASA score, BMI, tumor height, neoadjuvant chemoradiation and tumor stage. Operative and surgical outcomes and surgical specimen quality were analyzed using student t-test, chi-square and fisher statistics.

## Results:

Between 2007 and 2015, 514 patients were treated by TEM. Thirty-four patients (6.6%) underwent salvage TME (TEM-TME group) and were matched to 34 patients in the P-TME cohort. Indications for salvage TME were adverse features (19 cases, 55.9%), positive margins (10 cases, 29.4%) and recurrence (5 cases, 14.7%). TEM-TME group was associated with lower rates of sphincter preservation (88.2% vs 52.9%,  $p = 0.007$ ) and increased operation duration (193 min vs 168 min,  $p = 0.038$ ). Estimated blood loss, peri-operative complication rates, length of stay, time to resume full diet and ileus rate were increased in the TEM-TME group but not statistically different. Anastomotic leak rate and overall complication rate was also similar between groups. There was no difference regarding oncologic quality of excision with similar rates of complete mesorectum, negative circumferential radial margin and clear margins.

## Conclusion:

Salvage TME after TEM had longer operating time and lower rates of sphincter preservation. However, quality of excised specimen and post-operative outcomes seem to indicate that it is safe and feasible.

# Therapeutic Nanoparticles for Cardiovascular Regenerative Medicine

Platform Presenter: Mohammad Izadifar

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

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Authors:

Mohammad Izadifar, Michael E. Kelly, Xiongbiao Chen

## **Rationale:**

Coronary artery disorders that result in myocardial infarction significantly destroy cardiac myocytes causing impairment in cardiac function that eventually lead to heart failure. Due to its intrinsic inability to re-grow, cardiac tissue is unable to repair itself when myocardial infarction/ischemia happens. Despite numerous achievements in cardiovascular treatments, existing therapies can only slow the downward progression of heart failure while unable to tackle the progressive loss of cardiomyocytes. Cardiovascular regenerative medicine aims to repair the ischemic/infarcted heart by implantation of cell-encapsulating cardiac scaffolds that are made of biomaterials to support cell proliferation and tissue regeneration at the damaged heart. However, vascularization of the implanted cardiac patch remains a challenge. A mature vascular network formation, which is typically driven by regulated actions of a number of angiogenic factors, is vital for the survival and growth of the implanted cells.

## **Methods:**

In this study, we have developed a biopolymeric nano-particulate delivery system capable of regulating the release of pro-angiogenic factors to stimulate angiogenesis in a cardiac patch matrix. Nanoparticles with different structural characteristics were fabricated using a modified double-emulsion solvent evaporation technique. The surface morphology of the nanoparticles was analyzed using electron scanning microscopy. Release kinetics of the nanoparticles was studied in-vitro over 70 days, and the structural integrity of the releasing protein was assessed using circular dichroism spectroscopy in triplicates. The angiogenic bioactivity of the nanoparticles was assessed by applying rat aortic ring bioassay to the cardiac patch matrix containing angiogenic factor-loaded nanoparticles. Sprouting angiogenesis in the cardiac patch matrix was quantitatively assessed and statistically compared to the control. Experiments were performed in six replications.

## **Results:**

The nanoparticles featured by smooth surface morphology and uniform size distribution and provided different release profiles including time-delayed release patterns. Circular dichroism spectroscopy indicated that the structural integrity of the loading protein was preserved during the release. Furthermore, angiogenesis bioassay revealed that the angiogenic factor-loaded nanoparticles significantly stimulated sprouting angiogenesis in the cardiac patch matrix.

## **Conclusion:**

The developed nano-particulate delivery system can be used for co-delivery and sequential release of angiogenic factors to promote angiogenesis in the cardiac patch.

# Subjective and Symptomatic Improvement of Graves' Ophthalmopathy After Thyroidectomy in the Treatment of Graves' Disease.

Platform Presenter: Niomi Singh

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

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Authors:

J. Gorka, N. Singh, F. Christian, G. Casper-Bell

## **Rationale:**

Graves' ophthalmopathy (GO) is an incapacitating eye disease that presents as a complication of Graves' disease. It results in debilitating ocular symptoms, marked changes in appearance, and, potentially, blindness. GO has a significant impact on health-related quality of life. Studies have failed to demonstrate significant objective improvement in clinical measures of GO after thyroidectomy for Graves' disease. However, subjective improvement parameters after thyroidectomy have not been well studied.

## **Methods:**

In this study, we examine the subjective quality of life (QoL) outcomes in patients with GO to determine if there is an improvement in GO-related and overall quality of life after thyroidectomy. Patients with GO treated with thyroidectomy at our institution from 2009 to 2014 were selected for participation. Questionnaires were distributed to patients meeting inclusion criteria. Retrospective chart review was used to document indication for thyroidectomy, severity of GO as defined by an Ophthalmologist, and thyroid stimulating hormone receptor antibody (TRAb) levels. Differences between the pre- and post-thyroidectomy groups were evaluated using paired t-tests for questionnaire results and t-test on log differences for TRAb levels.

## **Results:**

Forty-one percent of the questionnaires were returned and included in the statistical analysis. All symptoms of GO showed improvement post-thyroidectomy, with statistically significant improvement in bulging eyes ( $p=0.044$ ) and orbital pressure ( $p=0.011$ ). There was also a trend toward improvement in general well-being post thyroidectomy, however this did not reach significance ( $p=0.073$ ). TRAb levels were significantly decreased post-thyroidectomy ( $p=0.008$ ).

## **Conclusion:**

Our results indicate improvement of GO-specific symptoms and general well-being in patients with GO treated with thyroidectomy. This observation may be related to the significant decrease in post-thyroidectomy TRAb levels observed in our study, as presence of the thyroid-stimulating hormone receptors in orbital tissue plays a role in the pathophysiology of GO.

# Multi-modal Synchrotron Imaging Techniques to Quantify Elemental and Molecular Changes after Stroke

Platform Presenter: Uzair Ahmed

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

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## Authors:

S.U. Ahmed, S. Caine, H. Hou, M.J. Hackett, N.J. Sylvain, S. Weese Maley, M.E. Kelly

## Rationale:

Effects of stroke at the cellular and sub-cellular level remain poorly understood by conventional techniques. We use synchrotron-based imaging techniques to study elemental and biochemical changes in the ischemic infarct and peri-infarct zone (also called the penumbra) after stroke in an experimental mouse model.

## Methods:

Ischemic stroke is induced in mice using the previously validated photothrombotic model. Animals are sacrificed at pre-determined time-points after stroke (1h, 24h, 48h and 72h). Fourier transform infrared spectroscopic imaging (FTIRI) is used to gather sub-cellular imaging data of lipid oxidation and protein aggregation in the areas of interest. X-ray fluorescence (XRF) imaging is used to image the distribution of bio-important elements at cellular and sub-cellular spatial resolutions. Routine histology and immunohistochemistry, identifying astrocytes, macrophage, myelin and other cells, are used to co-localize cell-types to areas of interest and biochemical changes.

## Results:

XRF results indicate a significant reduction in the concentration of multiple elements in the infarct, compared to the penumbra, at day 1 post-stroke. Preliminary results at 3 days post-stroke show that some elements begin to return to normal concentration in the penumbra. FTIRI data at 1 day post-stroke shows that lipid and total protein levels are decreased, while aggregate protein levels are increased in the penumbra. Astrocytes accumulate in the penumbra starting at 1 day post stroke, and macrophage start accumulating in the penumbra and the lesion at 2 days post-stroke.

## Conclusion:

Multi-modality synchrotron imaging can be used to map elements as well as bio-molecules in a stroke model, which, when used with immunohistochemistry and histology, will aid in the elucidation of mechanisms involved in cell death following cerebral ischemia. A better understanding of post-stroke changes will help guide therapeutic interventions after stroke.



# Understanding Saskatchewan Women's Choice of Mastectomy Versus Breast Conserving Therapy in Early Stage Breast Cancer

Platform Presenter: Jeffrey Gu

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

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## Authors:

Jeffrey Gu, Gary Groot, Lorraine Holtslander, Rachel Engler-Stringer

## Rationale:

Between 2007 and 2010 65% of all newly diagnosed breast cancer patients in Saskatchewan had a mastectomy, the second highest mastectomy rate in Canada. Although there are quantitative studies looking at factors that influence mastectomy choice, this literature is fairly limited, largely retrospective, and mostly conducted in counties outside Canada. It is not known if the same factors apply in Saskatchewan, especially given its large rural population. The purpose of this study is to identify factors that influence Saskatchewan women's choice between BCT or mastectomy in ESBC and to compare and contrast underlying reasons behind choice of BCT versus mastectomy.

## Methods:

Saskatchewan REB ethical approval was obtained. A qualitative approach using Interpretive Description was used. Purposeful sampling was aimed at capturing diversity and variation of the phenomenon under the study. 13 mastectomy and 12 BCT patient semi-structured interviews were conducted. Data was analyzed using thematic analysis and presented in thematic maps.

## Results:

Women chose mastectomy because of one of three main themes: worry about cancer recurrence, perceived consequences of BCT treatment, or breast-tumor size perception. In contrast, women chose BCT because of three different themes: mastectomy being too radical, surgeon influence, and feminine identity.

## Conclusion:

Although the individual reasons found in this study have been seen in the literature before, choice of mastectomy or BCT has not previously been understood as having different reasons underlying each choice of therapy. These results are also novel in identifying interdependent subthemes or secondary reasons for each choice. Furthermore, the thematic maps created are useful additions to the literature in providing a visual depiction of decision-making factors for patients and health care workers.

# Sealing Security of a Harmonic Scalpel

Platform Presenter: Reed Gillanders

Undergraduate Medical Student

College of Medicine, University of Saskatchewan

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## Authors:

R. Gillanders, K. Hundseth, M. Rosin, B. Ambros, R. Black, C. Cartwright, R. Petracek, Q. Zhou, M. Moser, J. Shaw, G. Beck, Y. Luo

## Rationale:

The Harmonic Scalpel is an ultrasound-powered surgical instrument used often in abdominal surgery; however, its sealing security on different tissue types has been questioned clinically and in the literature. The purpose of this study is to evaluate its sealing security through animal and human clinical studies.

## Methods:

This study was approved by the University of Saskatchewan's Biomedical (#15-130) and Animal (AUP 2015-0034) Research Ethics Boards. Our study included two parts. Part I animal study: various intra-abdominal structures were transected in 5 pigs. Part II human clinical study: 8 surgeries were performed at RUH. The following data was collected: the type, diameter, and sealing rate of transected structures. Statistical analysis with one-tail binomial test was performed. The Harmonic Scalpel power was set to 5 for cutting and 3 for coagulating.

## Results:

In part I all veins (2.8mm [range 1-10mm]; N=41), all arteries (1.9mm [range 1-4mm]; N=27), all bile ducts (10.4mm [range 10-12mm]; N=5), all ureters (4.3mm [range 4-5mm]; N=8) and all liver parenchyma (N=2) were sealed immediately and remained sealed until the end of surgery (at least 30 minutes). Only 25% of small bowel (28.1mm [range 20-30mm]; N=16) remained sealed. In part II 99% of veins (1.3mm [range 1-3mm]; N=82), all arteries (1.1mm [range 1-2mm]; N=62), and 67% of bile ducts (2.3mm [range 1-4mm]; N=3) remained sealed. There were no postoperative complications. Compared to a test proportion of 95%, the Harmonic Scalpel safely sealed veins with statistical significance with part I and II data combined ( $p=0.014$ ), and arteries with part I and II data combined ( $p=0.010$ ) and part II data alone ( $p=0.042$ ). The Harmonic Scalpel did not safely seal small bowel (only part I reported small bowel data;  $p<0.001$ ). No statistical significance was reached for bile duct, ureter, or liver parenchyma.

## Conclusion:

The Harmonic Scalpel can securely seal small veins and arteries up to 4mm and arteries but not small bowel. The amount of tissue transected and the extent of tissue manipulation while cutting are important for sealing effectiveness. Further study with larger sample size and longer postoperative observation on a living swine model is warranted.

# Interactions Between Oscillations in the Nervous System and Peripheral Stimulation

Platform Presenter: Kayleen Wingert

Undergraduate Medical Student  
College of Medicine, University of Saskatchewan

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Authors:

Kayleen Wingert, Jonathan Norton

## **Rationale:**

The cortico-spinal tract mediates coherence in the beta band(15-35Hz), which represents common cortical drive to skeletal muscle. The frequency of exogenous stimulation required to induce a similar contraction in skeletal muscle is 20-40Hz. The objective of this study was to determine the extent to which the naturally occurring waveforms of the brain interact with exogenous electrical stimulation of the nerves, and to determine if the natural frequencies sent by the brain are altered in the presence of electrical stimulation.

## **Methods:**

For each of 20 subjects (10 upper limb; 10 lower limb), surface electromyographic activity was recorded from the muscle being stimulated and an agonist during a functional task; from this intermuscular coherence was calculated. The stimulation was applied at sensory threshold, twice sensory threshold, motor threshold, and twice motor threshold. Stimulation was applied at the frequency that had the largest coherence in the beta band (20Hz) as well as 10% of that frequency.

## **Results:**

Stimulation below twice sensory threshold had no effect on patterns of coherence.

Above twice sensory threshold, if the stimulation was at the same frequency as the coherence peak, the coherence peak frequency moved to a new, but close frequency.

## **Conclusion:**

Sensory stimulation plays a critical role in motor control, including affecting the intrinsic oscillation frequencies in the motor control pathways. Coherence may be a viable control signal in future neural prostheses.

# Variability in Outcome Reporting for Operatively Managed Anterior Glenohumeral Instability

Poster Presenter: Laura Sims

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

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## Authors:

Jayd Lukenchuck, Laura Sims, Jason Shin

## Rationale:

The purpose of this study was to quantify the degree of variability in outcomes assessed following surgery for anterior shoulder instability in recent high impact literature.

## Methods:

An extensive review of the literature during a five-year period from Jan 2011 through December 2015 was performed across six orthopaedic journals with high impact factors to identify all studies investigating outcomes following anterior shoulder instability. Studies reporting clinical outcomes for patients with anterior glenohumeral instability after surgical treatment with at least 1 year follow-up were included. Several metrics were collected from each manuscript: (1) range of motion (ROM), (2) quantitative strength, (3) physical examination testing, (4) patient reported outcomes (PROs), (5) complications (including recurrent instability), (6) patient satisfaction, (7) return to pre-injury level of activity or sport. Variability in outcome measures was then qualitatively assessed.

## Results:

Sixty-nine studies were included for final analysis ranging from level 4 -1 evidence. Fifty-eight percent reported ROM and 17% measured strength. Other clinical exam maneuvers were assessed in 44%, with 39% assessing apprehension. Imaging was used in 61%, including x-rays, MRI, and CT scans. On average, 2.25 PRO tools were assessed. In total, 28 different PRO's were used to assess outcomes. The three most commonly reported PRO's were the Rowe scale at 45%, the Western Ontario Shoulder Instability Index (WOSI) at 30%, and the Constant Shoulder Score at 26%. Twenty-five percent included patient satisfaction in their assessment of outcomes. Recurrence was assessed by 58% and return to pre-injury level of activity by 36%.

## Conclusion:

There is substantial variability in outcome reporting for high impact anterior shoulder instability literature with 28 different outcome tools used, making it difficult to compare outcomes between studies. Agreeing upon a uniform measure to assess outcomes would allow for clearer interpretation of the literature as well as the potential to draw conclusions from pooled data.

# Decreasing Length of Hospital Stay and Intravenous Calcium Requirements with Standardized Postoperative Orders for Dialysis Patients with Secondary Hyperparathyroidism who have Undergone a Parathyroidectomy

Poster Presenter: Kelsey Hinthner

Undergraduate Medical Student

College of Medicine, University of Saskatchewan

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## Authors:

Kelsey Hinthner, Suzie Harriman, Gary Groot, Judith Klassen

## Rationale:

The purpose of this study is to assess if administering a post-operative standardized order set for intravenous calcium treatment for dialysis patients with secondary hyperparathyroidism who have undergone a parathyroidectomy will decrease hospital stay.

## Methods:

The medical records of dialysis patients who underwent subtotal PTX for symptomatic secondary hyperparathyroidism were reviewed prior to and after the introduction of a standard postoperative order set. The gender, duration of hospital stay as well as readmission rates of all patients were analyzed.

## Results:

The study population included 50 patients, with a mean age of 49 years. 25 patients were administered the standardized order set of intravenous calcium treatment following a subtotal PTX. There was no statistical difference ( $p = 0.7063$ ) between the length of hospital stay in the group of the patients that received the post-operative standardized order set of intravenous calcium and the group that did not. Only 1 patient was readmitted during the study period.

## Conclusion:

There was no statistical difference in the length of hospital stay between the dialysis patients with secondary hyperparathyroidism who received the standardized order set of intravenous calcium and the patients who did not following a PTX. This could have been largely due to limitations of the study, including a small sample size and a non-randomized study design, and not examining other metrics, including the number of inpatient episodes of significant hypocalcaemia and nursing time. Thus, further studies are warranted.

# Development of a New App for iPhone and Android for M&M Data Collection/Retrieval and Results of Initial Field Testing

Poster Presenter: Crystal Burant

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College of Medicine, University of Saskatchewan

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## Authors:

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## Rationale:

Morbidity and Mortality (M&M) rounds are a cornerstone of the continuous drive toward Quality Improvement (QI) in departments of surgery. However, a key impediment to meaningful M&M rounds is the difficulties encountered in contemporaneous collection of important M&M data that can then be readily retrieved for the rounds. Another consideration is the secure storage of data respecting privacy principles and laws.

## Methods:

We describe a new, M&M app which we have developed from scratch, in order to address these shortcomings. This is a joint collaboration between the departments of Surgery and Computer Science of the University of Saskatchewan. Smartphones are now a constant and ubiquitous piece of equipment with residents and surgeons and it was decided to develop a new M&M app for both iPhone and android operating systems.

The guiding principles of design of the App were simplicity and ease of use; "always available" data entry capability (data in your pocket); speed and convenience of data entry; targeted capture of essential data useful for M&M rounds and QI; and secure storage and retrieval of data.

During development, there was frequent collaboration between the computer and clinical teams. The computer languages and code used to develop the apps included PHP, HTML, CSS, Json, Ajax, Phonegap and mysql database.

## Results:

Once the app was internally tested, the next stage in its development was a period of 3 months of field testing in actual clinical situations by surgeons of the Department of Urology. The latter have provided feedback and suggestions for improvement which will be incorporated in the next iteration of the App - following which, the App will be released for further and wider field testing.

## Conclusion:

We describe the development from scratch a new App for iPhone and Android for the recording and retrieval of M&M data.

# The Value in Prolonged Intubation in Laryngotracheal Separation

Poster Presenter: Joel Howlett

Undergraduate Medical Student  
College of Medicine, University of Saskatchewan

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## Authors:

J. Howlett, A. Sharma, R. Bigsby

## Objective:

To report a case of complete laryngotracheal separation (LTS) with bilateral vocal cord paralysis (BVCP) after a clothesline injury. This case highlights the value of prolonged intubation and delayed tracheostomy in improving longterm outcomes.

## Background:

The survival from LTS is rare. For those who survive the management of LTS has traditionally been primary repair and the insertion of a tracheostomy tube +/- laryngeal stent.

## Clinical Case:

A 25 year old male suffered complete LTS and BVCP. Intraoperative decision was made to leave the patient intubated and delay the insertion of a tracheostomy tube. The patient was successfully decanulated 2 months post injury with adequate voice and swallow in the context of bilateral vocal cord paralysis.

## Conclusion:

For patients who survive LTS with BVCP there may be value in prolonged intubation and delayed tracheostomy post repair. Prolonged intubation may allow for healing at the primary repair site, act as a laryngeal stent to prevent subglottic stenosis, and additionally allow for paramedian fixation of the vocal cords. All of which may increase the chance of decanulation and maximize swallow and voice outcomes.

# Preoperative Prognostic Features of Pancreatic Head Adenocarcinoma

Poster Presenter: Kelsey Hinthner

Undergraduate Medical Student

College of Medicine, University of Saskatchewan

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## Authors:

Sanji Ali, Kelsey Hinthner, Jack Spiers, Bill Taylor, Roman Bacchus, Ismail Peer, Mahmoud Soliman, Yigang Luo

## Rationale:

The purpose of this study was to define the preoperative prognostic features in pancreatic cancer patients following Whipple procedure.

## Methods:

Twenty-two Whipple procedures performed by a single surgeon in Windsor, ON between March 2004 and October 2012 were pathology- confirmed pancreatic head adenocarcinoma. The cases were retrogradely analyzed in 2 groups: group 1 comprised of 9 patients who lived more than 3 years, and group 2 comprised of 13 patients who died within 1 year following the surgery. Clinical data were collected by chart review, including demographic, histopathologic, preoperative, perioperative, and postoperative findings. The primary variable analyzed in this study was survival time after surgery.

## Results:

There was a statistical difference in preoperative weight loss and the number of poorly differentiated tumors. A greater number of patients showed preoperative weight loss and had poorly differentiated tumors. Both groups showed patients died due to metastatic disease. Some trends were concluded, however they were not statistically significant, such as gender, age, comorbidities, abdomen and back pain, ASA, high CA 19-9, SMA and SMV involvement, perineural invasion, TNM staging, number of positive margins, OR time, hospital stay, whether the patients received chemotherapy or radiation, and presence of dilated pancreatic duct.

## Conclusion:

Pancreatic adenocarcinoma is not a homogeneous disease. It is possible to find preoperative prognostic features for more adequate patient management. With better preoperative stratification, our care for these patients could be more individualized, and lead to better outcome. Moreover, they could be more economically beneficial, reduce procedural wait times, and spare select patients from futile surgery. This could have been due to the small sample size. Thus, future studies with a larger sample size may elucidate important information. Most pancreatic patients died due to metastatic disease. Therefore, early systemic cancer control might be important to achieve long-term survival.



# Fabrication and Optimal-Design of Biodegradable Stents for the Treatment of Aneurysms

Poster Presenter: Xia Wu

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

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Authors:

X. Han, M. Kelly, X.B. Chen

## **Introduction:**

Biodegradable stent-assisted coiling is expected to be the ideal treatment of wide-neck complex aneurysms. A number of biodegradable stents are promising, but also with issues and/or several limitations to be addressed. From the design point of view, biodegradable stents are typically designed without structure optimization. The drawbacks of these stents often cause weaker mechanical properties than native arterial vessels. From the fabrication point of view, the conventional methods of the fabricating stent are time-consuming and expensive, and also lack precise control over the stent microstructure. As an emerging fabrication technique, dispensing-based rapid prototyping (DBRP) allows for more accurate control over the scaffold microstructure, thus facilitating the fabrication of stents as designed.

## **Methods:**

For aneurysm treatment, biodegradable stents should possess appropriate mechanical properties featured by the sufficient radial stiffness and flexibility. For this, Polycaprolactone (PCL) was chosen and dissolved in chloroform, and the DBRP technique is creatively utilized to dispense the 70% w/v PCL solution out of a needle (with a diameter of 410  $\mu\text{m}$ ), depositing on the mandrel and thus forming the stents of tubular structure (Figure 1). Furthermore, a parametric optimization method based on finite element analysis was performed for optimizing the stents structure (Figure 2). The goal here is to determine the parameters of the biodegradable stent that offer the minimum radial deformations under the given force.

## **Results:**

Stents fabricated with varying patterns are shown in Figure 3, in which the overall size of stents is 2 mm in diameter and 20 mm in length. Moreover, the results of optimization present that the total deformation can be decreased by 35.83% by modifying the parameters of the geometry.

## **Conclusion:**

The results illustrated that DBRP is a promising technique for fabricating biodegradable stents, with the good control over their structure. Stents with proper mechanical properties for aneurysms treatment can be directly fabricated from polymer powders through DBRP technique, which would not be possible by means of conventional methods. Thus, the DBRP technique can contribute to accelerating the stent development. Additionally, a finite element analysis could help in designing new structure of stents or analyzing actual stents to ensure enough radial stiffness.

# Parenteral Nutrition Associated Liver Disease: The Effects of Aluminum Contamination and Lipid Composition on Bile Acid Transporters

Platform Presenter: Amanda Hall

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

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## Authors:

A. Hall, G.A. Zello, C.J. Arnold, J. Alcorn, R. Bertolo, J.A. Brunton, G.G. Miller

## Rationale:

Parenteral nutrition (PN) is a lifesaving therapy for newborn infants, but it causes parenteral nutrition associated liver disease (PNALD). While the pathophysiology of PNALD is unclear, it is likely multifactorial with aluminum (Al) contamination and pro-inflammatory lipids contributing. The objective of this study was to assess the impact of these factors on bile acids transporters in an effort to better understand PNALD.

## Methods:

A Yucatan piglet parenteral nutrition model was used, with newborn piglets placed into 4 groups of 7-8 animals each. The piglets were given PN with either high Al (62 $\mu$ g/kg/day) or low Al (26 $\mu$ g/kg/day) contamination and either an omega-6 based lipid or an omega 3 and 6 mixed lipid. Serum and liver samples were collected for analysis. This work was approved by the University of Saskatchewan and Memorial University's Animal Research Ethics Board, and adhered to the Canadian Council on Animal Care guidelines for humane animal use. We chose four bile acid transporters (Mrp2, Bsep, Ntcp, and Oatp), a stabilizer protein (radixin), and a nuclear receptor (FXR) as targets important in bile flow. The serum was analyzed for bile acids and C-reactive protein. The bile acid transporter analysis will include qPCR, immunofluorescence confocal microscopy, and Western blot. In addition, transmission electron microscopy is being performed.

## Results:

No significant difference in serum bile acids was found between the groups. When comparing the two groups with mixed lipids, the high Al group had a greater rise in C-reactive protein as compared to the low Al group ( $p=0.03$ ). In groups with omega-6 lipids only, qPCR demonstrated a significant fold difference in favour of low Al vs high Al for Mrp2, Bsep, and Ntcp. Fold differences were 1.8 (SD 0.8), 3.1 (SD 2.4), and 1.4 (SD 1.1) respectively. In the mixed lipid groups, the low Al demonstrated a significant fold difference for only Ntcp (1.6, SD 0.9). FXR and radixin were not significant for any of the comparisons. Further analysis is ongoing.

## Conclusion:

Aluminum has a negative effect on the bile acid transporters Mrp2, Bsep, and Ntcp but this effect may be mitigated with a mixture of lipids as opposed to only omega-6 lipids.

# Burnout Levels Among General Surgical Residents in Canada

Platform Presenter: Simon Adams

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

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## Authors:

S.T. Adams, R. Zeeshan, F. Christian

## Rationale:

Burnout is increasingly recognized as an important condition involving excessive physical and psychological exhaustion, coupled with cynicism and disengagement. Evidence exists to suggest that affected physicians not only suffer considerable consequences themselves but also that patient safety and clinical outcomes are negatively affected. This study is intended to identify potentially remediable risk factors for burnout among residents enrolled in general surgery programs across Canada.

## Methods:

An online questionnaire was distributed to every general surgery resident in the 15 general surgery residency programs consenting to take part. Questions were asked pertaining to 5 broad domains: resident demographics, working patterns, attitudes towards residency, life experiences and lifestyle/outlook. Respondents' risks of burnout were assessed using the Maslach Burnout Inventory™ (MBI). The responses and MBI scores were analysed first using univariate analysis and then multiple logistic regression (MLR) with  $p \leq 0.05$  being considered significant.

## Results:

114 completed questionnaires were received (22%). Of these residents, 39 (34%) met the criteria for high risk of clinical burnout. MLR analysis showed that inadequate family time, a personal history of mental health or substance abuse related issues, and moderately to poorly approachable staff were all significantly associated with a high burnout score (OR 4.3 ( $p=0.003$ ), OR 6.0 ( $p=0.007$ ) and OR 4.6 ( $p=0.003$ ) respectively). From the predicted probabilities, residents with none of the above factors have a 10% probability of being at risk of clinical burnout. This increases to up to 40%, 75% and 93% with 1, 2 or all of these risk factors being present.

## Conclusion:

Fully one-third of general surgery residents in Canada are at a high risk of clinical burnout. Residency programs have potentially direct influence over the specific, identifiable risk factors associated with this outcome. Addressing these remediable causes of burnout could benefit residents, staff and importantly, our patients.

# Quitting Surgical Specialty Residencies - Attitudes and Factors in Canada

Platform Presenter: Simon Adams

Department of Surgery, Division of General Surgery  
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## Authors:

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## Background:

This study sought to determine how many residents in Canadian surgical specialty programs are considering leaving and why.

## Methods:

An anonymous survey was administered to all residents enrolled in nine Canadian surgical disciplines. Association between potential factors and serious consideration of leaving one's program was determined using Pearson's chi-squared test. The response rate was calculated using data from the CAPER website.

## Results:

523 responses were received (27.6% response rate). 140 (26.8%) were either somewhat or seriously considering leaving their program, with general surgery reporting the highest rate (32.7%). PGY status, specialty, age, gender, relationship status and the possession of/ desire to obtain a postgraduate degree were not associated with a desire to change specialty. Residents intending to pursue fellowship training or an academic career were less likely to harbour thoughts of leaving their specialty ( $p = 0.003$  and  $0.005$  respectively). Poor work/ life balance and fear of unemployment/ underemployment were the top two reasons why residents would consider changing specialty (55.5% and 40.8% respectively), although the reasons cited did not differ between the groups ( $p = 0.644$ ). Those residents considering changing specialty were less likely to enjoy their work but reported that they persisted as they felt they had already invested too much time to change careers ( $p < 0.001$ ).

## Conclusion:

Over a quarter of residents in surgical training programs in Canada harbour genuine desires to abandon their surgical careers primarily for fear of ending up with a poor work/ life balance or being unable to find satisfactory employment. Many of the dissatisfied residents appear not to enjoy their work but persist because they feel they have travelled too far to turn back. Efforts to educate prospective residents about the reality of the surgical lifestyle and to optimise employment prospects may improve completion rates.

# Towards Synchrotron Radiation-based Hemodynamic Analysis of Cerebral Aneurysms

Platform Presenter: Mohammad Izadifar

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

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Authors:

Mohammad Izadifar, Michael Kelly, Lissa Peeling

## **Rationale:**

Subarachnoid haemorrhage secondary to aneurysm rupture is a hemorrhagic stroke with a mortality rate of ~40%, despite the most aggressive hospital care. Owing to numerous clinical observations, an interaction between high-flow hemodynamic forces and arterial wall is believed to be involved in the formation, progression and rupture of cerebral aneurysms. A better understanding of the risk of aneurysm growth and rupture greatly contributes to a better decision on the treatment options including endovascular surgery. As such, the study of aneurysm hemodynamics is crucially important; however, precise measurement of blood velocity field in the aneurysms remains a challenge. Conventional medical imaging modalities such suffer from poor spatial and/or time resolution to track blood cells, particularly for turbulent flows. Thus, development of a medical imaging technique to provide precise measurements of blood flow characteristics in aneurysms without using contrast agent is crucial.

## **Methods:**

Loaded with heparinised porcine blood, a microvessel silicon tube model and a syringe pump were set up at the imaging stage in Biomedical Imaging and Therapy (BMIT) beamline at the Canadian synchrotron facility. Vertically oriented, an area of 4.5 mm<sup>2</sup> of the microvessel model was exposed to the beam at two levels of x-ray photon energy, three sample-to-detector distances, and two spatial and time resolutions. Phase contrast imaging parameters were optimized and then applied to visualize different blood flow patterns based on tracking red blood cells (RBCs) without using contrast agent. Water was used as the control sample for experiments.

## **Results:**

X-ray speckles of RBCs were successfully detected with white beam in the bending magnet at an optimum sample-to-detector distance of 150 cm and effective pixel size of 2 mm. Natural and forced convections of red blood cells in the microvessel silicon model were successfully visualized. Cross-correlation analysis resulted in mapping blood velocity vectors corresponding to red blood cell trajectories in-situ.

## **Conclusion:**

Preliminary results reveal that synchrotron x-ray phase contrast imaging at BMIT can be successfully used for visualizing blood flow patterns and mapping velocity field in a microvessel silicon tube model, paving the road for blood flow characterization in patient specific aneurysm models.







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