



# 2020 VIRTUAL RESIDENT RESEARCH DAY

## DEPARTMENT OF SURGERY



UNIVERSITY OF  
SASKATCHEWAN



Saskatchewan  
Health Authority

*"The greater the ignorance the greater the dogmatism."*

**- William Osler, 1914**



## Dr. Ivar Mendez

Fred H. Wigmore  
Professor and  
Provincial Head

Department of Surgery

University of  
Saskatchewan  
and  
Saskatchewan Health  
Authority

COVID-19 has challenged our ability to balance our clinical service and academic mission. In the initial phases of the pandemic restrictions of formal teaching and research activities resulted in significant reduction of both basic and clinical research. With the reopening of university and hospital research facilities and thoughtful return to work guidelines research has been, to a greater extent, resumed.

It is precisely in a health crisis like the one we are living now that research and science can make their greatest contributions. The Department of Surgery is fully committed to the academic pathway, we firmly believe that research, teaching and clinical service are fundamental pillars for the provision of the best patient surgical care to the population of our Province

The Department has supported and promoted research at all levels and has particularly focused on advancing research by our residents, fellows and medical students. External research funding in the Department in 2019 reached an all-time high which is a testament of the research productivity of our members.

Our research committee has worked hard to prepare the first Resident Research Day on an interactive virtual format with an excellent program of presentations. Dr. Lloyd Mack from the University of Calgary is our keynote speaker. It promises to be an exiting day and hope to have you all attend.



## Dr. Daryl Fourney

Director of Research

Department of Surgery &  
Division of Neurosurgery

Professor

College of Medicine,  
University of Saskatchewan

The COVID-19 pandemic has had a significant impact on research in Canada and around the world. For months, scientists were unable to access their labs and equipment. Physical distancing measures limited in-person interaction with study participants. Funding agencies have been working to improve flexibility to prevent the loss of research staff and infrastructure. There have been many positive efforts to date, including supports from the Government of Canada and the Tri-Councils. I have had the privilege of collaborating with the Clinical and Population Health Committee, which is just one group at the College of Medicine working to help researchers bring their work back “online” with appropriate safety measures to limit the spread of the virus.

Clinical work has been challenging during this pandemic, with limited access to clinics and operating room time. However, research remain one of the key pillars of academic practice. The Department of Surgery has continued to work tirelessly to promote collaboration and foster excellence in surgical research through advocacy, education, and research infrastructure support.

Today’s program will be the first “virtual” Resident Research Day. It will showcase work across multiple specialties. I wish to thank all of the presenters, as well as the judges and session moderators for their valuable contributions. I want to thank Dr. Lloyd Mack for joining us as the Visiting Professor. I would also like to thank members of the Surgery Research Committee and the support staff within Department of Surgery Research and Communications for coordinating and promoting such an excellent program. Finally, I wish to thank all of you for attending, listening, and collaborating as we share today’s discoveries and look forward to tomorrow’s innovations.

# 2020

## DEPARTMENT OF SURGERY

### VIRTUAL RESIDENT RESEARCH DAY

October 8, 2020

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# INTRODUCTION

Royal University Hospital  
Mall Theatre

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08:00 - 08:15

## WELCOME AND INTRODUCTIONS

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

Dr. Daryl Fourney  
Director of Research,  
Department of Surgery & Division of Neurosurgery

# SESSION I

Department of Surgery  
Virtual Resident Research Day

Moderator: Dr. Stephen Gowing

08:15 - 09:30

The Loading of Gold Nanoparticles into Hepatocellular Carcinoma Cells for the Enhancement of Ablation Treatments

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## KEYNOTE SPEAKER

Department of Surgery  
Virtual Resident Research Day

09:30 - 10:30

# EVOLUTION OF CYTOREDUCTIVE SURGERY AND HEATED INTRAPERITONEAL CHEMOTHERAPY; IT ALL STARTS WITH THE APPENDIX

## Dr. Lloyd A. Mack

Professor of Surgery &  
Division of Oncology  
College of Medicine, University of Calgary  
Alberta Health Services





## Dr. Lloyd A. Mack

Professor in Surgery,  
Division of Oncology

University of Calgary  
and Alberta Health  
Services

Dr. Lloyd Mack obtained his medical degree at the University of Western Ontario going on to complete his residency in General Surgery in London as well. In Calgary, he completed a fellowship in General Surgical Oncology and stayed on as staff at the Tom Baker Cancer Centre and the University of Calgary. A Masters of Science was completed with a thesis involving the attitudes of family members of colorectal cancer patients to colorectal cancer screening.

Dr. Mack is a Professor of Surgery and Oncology at the University of Calgary. He is the current Chair of the Residency Training Program in General Surgical Oncology at the University of Calgary, Medical Director of Cancer Surgery Alberta, as well as past President of the Canadian Society of Surgical Oncology. He is former Program Director for the General Surgery Residency Training Program at the University of Calgary and former lead of the provincial Sarcoma Tumor Group. His areas of clinical and research interest include the role of synoptic operative reports in quality improvement for cancer surgery, the treatment of peritoneal carcinomatosis, and the treatment of soft tissue sarcoma and related malignancies, among others.

## SESSION II

Department of Surgery  
Virtual Resident Research Day

Moderator: Dr. Paul Mick

10:30 - 11:45

Antibacterial Envelopes for Prevention of Infection in  
Neuromodulation Implantable Pulse Generators

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Prognosticating Outcome in Pancreatic Adenocarcinoma with  
the Use of a Machine Learning Algorithm

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Union Rate and Clinical Outcomes Following Four-Corner Arthrodesis  
With a Dorsal Locking PEEK Plate: A Retrospective Case Series

EMMITT HAYES 21

Laparoscopic Simultaneous Multi-Clip Applier in Vitro and  
in Vivo Study

STEPHANIE RUSCHEINSKY 22

Conformation-Specific Immunotherapy for Proteinopathies Based on  
Disease Specific Epitopes

KRISTIN MARCINIUK 23

## 2019 Award Recipients

### Surgery Resident Research Day

#### Platform Presentations:

Podium Presentation Award 1 <sup>st</sup> Place	Paul Kulyk
Podium Presentation Award 2 <sup>nd</sup> Place	Sarah McLaren
Podium Presentation Award 3 <sup>rd</sup> Place	Amit Persad
Kvinlaug Surgical Foundations Research Awards	
	Emily Chan

#### Undergraduate Medical Student Awards:

Dash-Reed Research Award	Julia Newton
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## 2018 Award Recipients

### Surgery, Pathology & Ophthalmology Resident Research Day

#### Platform Presentations:

Excellence in Research Award	Amit Persad
Best Podium Presentation Award	Sarah Schmid
Special Judges Award	Uzair Ahmed
Best Publication Award	Amit Persad & Laura Sims
Kvinlaug Surgical Foundations Research Awards	
1 <sup>st</sup> Place	Alexis Brassard
2 <sup>nd</sup> Place	Haven Roy

#### Pathology Research Awards:

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

#### Ophthalmology Research Award:

Best Podium Presentation Award	Vinay Kansal
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#### Undergraduate Medical Student Awards:

Dash-Reed Research Award	Kirsten Jewitt
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# ACKNOWLEDGMENTS

The Departments of Surgery would like to thank the following individuals for serving as judges and session moderators for the 2020 Virtual Resident Research Day.

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## JUDGES

### Dr. Lloyd Mack

Professor of Surgery  
Division of Oncology  
College of Medicine, University of Calgary

### Dr. Yigang Luo

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

### Dr. Silvana Papagerakis

Professor, Department of Surgery  
Basic Surgical Research & Otolaryngology  
College of Medicine, University of Saskatchewan

### Dr. Julia Radic

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

### Dr. Laura Sims

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

## MODERATORS

### Dr. Stephen Gowing

Assistant Professor, Department of Surgery  
Division of Thoracic Surgery  
College of Medicine, University of Saskatchewan

### Dr. Paul Mick

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

**2020**  
**DEPARTMENT OF SURGERY**  
**VIRTUAL RESIDENT RESEARCH DAY**  
**ABSTRACTS**

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# The Loading of Gold Nanoparticles into Hepatocellular Carcinoma Cells for the Enhancement of Ablation Treatments

Platform Presenter: Katlin Mallette

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

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## **Team Members/Affiliations:**

Deborah Michel (Pharmacy & Nutrition, University of Saskatchewan), Michael Moser (Department of Surgery, University of Saskatchewan), Ildiko Badea (Pharmacy & Nutrition, University of Saskatchewan).

## **Rationale:**

Most patients with hepatocellular carcinoma have progressed beyond surgical resectability on diagnosis. One non-surgical option for the treatment of such tumors is the use of radiofrequency ablation (RFA), utilizing high-frequency alternating current, ionic agitation, production of heat and, cell destruction. Unfortunately, ablation is limited to tumors under 5 cm. Nanoparticles have been proposed to overcome this limitation. Gold nanoparticles accumulate in the liver due to its blood supply and within HCC cells due to their high vascularity and permeability. It's postulated that gold nanoparticles can enhance the effect of ablation by increasing the ability to destroy tumor cells over a broader area, without damaging surrounding tissue. The objective of this study is to assess the feasibility of loading gold nanoparticles into HCC cells, while maintaining their viability.

## **Methods:**

A monolayer of HepG2 cell model was used and gold nanoparticles of 20nm and 50nm diameter were assessed at several concentrations. The cellular viability after exposure to the gold nanoparticles was assessed utilizing a colorimetric MTT assay and the cellular uptake was evaluated by flow cytometry.

## **Results:**

MTT assay demonstrates high cell viability after incorporation with gold nanoparticles of both 20nm and 50nm diameters. The internalization of the gold nanoparticles was concentration-dependent.

## **Conclusion:**

The loading gold nanoparticles into HepG2 cells is feasible and uptake is concentration-dependent. Studies examining the effect of poly-L-lysine, on uptake of the gold nanoparticles are ongoing. Future studies will evaluate the use of gold nanoparticles with ablation in 3D cell cultures and animal models.

## **Funding Sources:**

None

# Patient Productivity Losses for Surgical Clinic Appointments and Initial Experiences with Telemedicine as a Method of Follow-up Care

Platform Presenter: Mitchell Thatcher

Undergraduate Medical Education  
College of Medicine, University of Saskatchewan

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## Team Members/Affiliations:

McKinley Smith (College of Medicine, University of Saskatchewan), Michelle McCarron (Research Scientist, Department of Psychology, University of Regina), Megan Dash (Department of Family Medicine, University of Saskatchewan), Jeremy Reed (Department of Surgery, University of Saskatchewan).

## Rationale:

Telemedicine has been rapidly implemented in orthopedics during the COVID-19 pandemic. These changes prompted the researchers to investigate the productivity losses that patients face when attending in-person appointments as well as quantify patient experiences with telemedicine.

## Methods:

We developed a telephone survey for patients who have had elective orthopedic surgery and have also attended at least one in-person and one phone call appointment. The survey assessed productivity losses with in-person appointments, experience with telemedicine, and preferred type of appointment in the future.

## Results:

41 subjects completed the survey. Median travel distance to the clinic was 108.0 km and time spent in the clinic was 60 minutes. Subjects responded “yes” to various forms of productivity losses associated with attending in-person appointments, including missed work (46.3%), recreational activities (26.8%), home or yard care (14.6%), socializing with friends or family (12.2%), school (2.4%), childcare (2.4%), and lost income (34.1%). Average ratings, from 0-10, of various aspects of their telemedicine appointment included convenience (8.4), ease of use (9.2), confidence in the doctor’s diagnostic ability (8.2), likelihood of using services in the future (6.4), and overall satisfaction (8.2). Finally, preferred type of appointment for future follow-up care included in-person (36.6%), first visit in-person and the rest over the phone (61.0%), and unsure (2.4%).

## Conclusions:

Our research supports that patients have a favourable view towards telemedicine and are supportive of a blended in-person and telemedicine approach for follow-up care.

## Funding Sources:

None.

# Mutism after Posterior Fossa Surgery

Platform Presenter: Bryan Renne

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

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## Team Members/Affiliations:

Julia Radic (Department of Surgery, University of Saskatchewan), Brittany Albrecht (College of Medicine, University of Saskatchewan), Taylor Davis (College of Medicine, University of Saskatchewan), Spencer Lindsay (College of Medicine, University of Saskatchewan), Aleksander Vitali (Department of Surgery, University of Saskatchewan).

## Rationale:

This study aimed (1) to determine the incidence and severity of pediatric cerebellar mutism (CM) and cerebellar mutism syndrome (CMS) after midline posterior (PF) tumor resection in children treated at these centers and (2) to identify modifiable factors related to surgical management (rather than tumor biology) that correlate with the incidence of CM/CMS.

## Methods:

Attending pediatric neurosurgeons and former fellows of British Columbia's Children's Hospital provided retrospective data on children <18 years old who underwent initial midline PF tumor resection within a center-selected 2-year period. Modifiable surgical factors assessed included pre-resection surgical hydrocephalus treatment, surgical positioning, ultrasonic aspirator use, intraoperative external ventricular drain (EVD) use, surgical access route to the tumor, and extent of resection. CM was defined as decreased or absent speech output postoperatively and CMS as CM plus new or worsened irritability.

## Results:

There were 263 patients from 11 centers in 6 countries (Canada, Germany, the Netherlands, India, Indonesia, and the USA). Median age was 6 years (range < 1 to 17 years). The overall incidence of CM was 23.5% (range 14.7–47.6% for centers with  $\geq 20$  patients) and of CMS was 6.5% (range 0–10.3% for same). A multivariate logistic regression on the full data set showed no association between pre-resection surgical hydrocephalus treatment, prone position, ultrasonic aspirator use, EVD use, telovelar approach, complete or near total resection, or treating center and either postoperative CM or CMS.

## Conclusion:

While there was variation in surgical management of midline PF tumors, the factors in management we examined did not predict CM or CMS.

## Funding Sources:

None.



# Comparing Superficial vs. Deep Local Anesthetic Infiltration to Improve Patient Experience During Carpal Tunnel Release

Platform Presenter: Kristi Billard

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

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## Team Members/Affiliations:

David Sauder (Department of Surgery, University of Saskatchewan), Laura Sims (Department of Surgery, University of Saskatchewan), Yanzhao Cheng (Department of Surgery, University of Saskatchewan), Anne Sperling (Clinical Trial Support Unit, University of Saskatchewan).

## Rationale:

Carpal tunnel syndrome is a common clinical problem that can be reliably treated with surgical carpal tunnel release (CTR). This procedure is generally performed with the patient wide-awake using local anesthetic (LA). While most patients tolerate this type of procedure, there is a possibility of some discomfort or pain. We compared two LA infiltration techniques to determine which is best to provide the least amount of pain or discomfort during a CTR. The two methods are subcutaneous infiltration alone (superficial) and subcutaneous infiltration with infiltration into the carpal tunnel (deep).

## Methods:

On the morning of their procedure, 74 participants (n=80 cases) were recruited and randomized to either deep or superficial LA infiltration. There were 38 in the deep group and 42 in the superficial group. The primary outcomes were presence and severity of pain during the LA infiltration and the procedure.

## Results:

Average age of participants was  $63.04 \pm 12.92$  (n=40 females and n=34 males). In the deep group, 21% experienced pain during freezing compared to 9.5% in the superficial group ( $p=0.149$ ), while 13.2% of the deep group and 11.0% of the superficial group experienced pain during the procedure ( $p=0.866$ ).

## Conclusion:

In this randomized clinical trial comparing deep vs. superficial LA infiltration techniques for CTR, we found that there was no statistically significant difference in the pain experienced during the administration of the LA or during the procedure. Given these findings, we recommend using superficial infiltration for CTR as it is technically easier and reduces the risk of potential median nerve injury.

## Funding Sources:

Department of Surgery Resident Research Award.

# What Information are Patients Receiving from the Internet about the Operative and Non-Operative Management of Acute Appendicitis?

Platform Presenter: Zarrukh Baig

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

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## Team Members/Affiliations:

Mike Moser (Department of Surgery, University of Saskatchewan), Luke Conlon (Royal College of Surgeons Ireland).

## Rationale:

Operative appendectomy (OA) has remained the gold standard in the treatment of acute appendicitis for the past century. Recent studies suggest that non-operative management with antibiotics (NOMA) may be a reasonable option for managing uncomplicated acute appendicitis. We examined the information currently available online to determine if patients are likely to find the information they need to make an informed decision between the two options.

## Methods:

An exhaustive list of 29 search terms were established by a focus group and then entered into Google resulting in 49 unique webpages. Each webpage was reviewed by three reviewers and consensus was obtained for bias (OA, NOMA, or balanced), webpage type, JAMA score, reading grade, and DISCERN score.

## Results:

30/49 websites (61%) favored surgery, while 13/49 (27%) favored NOMA, and 7/49 (14%) provided balanced information. 12/49 websites (24%) had no information about NOMA at all. 11/12 (92%) patient-directed and 7/9 (78%) physician-directed webpages favored surgery whereas academic webpages presented a more balanced picture. Only 8/49 (16%) sites mentioned that the presence of a fecalith predicts the failure of NOMA. Only 2/49 webpages had reading grades at or below the recommended grade 8 level for patient information. The mean DISCERN score was 48.5 out of 80 ("fair") with academic webpages having the highest DISCERN score (60).

## Conclusion:

Most of the webpages available on the internet do not provide sufficient information, nor are they understandable to most patients to make an informed decision about the current options for the management of acute appendicitis.

## Funding Sources:

None.

# Use of Antibacterial Envelopes for Prevention of Infection in Neuromodulation Implantable Pulse Generators

Platform Presenter: Amit Persad

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

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## Team Members/Affiliations:

Syed Uzair Ahmed (Department of Surgery, University of Saskatchewan), Rosalie Mercure-Cyr (Department of Surgery, University of Saskatchewan), Karen Waterhouse (Department of Surgery, University of Saskatchewan), Aleksander M. Vitali (Department of Surgery, University of Saskatchewan).

## Rationale:

Neuromodulation carries a historic infection rate as high as 12%. Treatment requires surgical removal and systemic antibiotics. TYRX antibacterial envelopes (Medtronic Inc., Minneapolis, MN), absorbable mesh envelopes that elute minocycline and rifampin, have been used in cardiac devices with substantial infection reduction. At our center, one surgeon uses these envelopes with all implanted neuromodulation units.

## Methods:

We conducted a retrospective cohort study of consecutive implantable pulse generator (IPG) unit implantation with a TYRX antibacterial envelope© between October 2014 and December 2019. We collected demographic data, including postoperative infections, reoperations, and complications associated with the IPGs. This cohort was then compared to a historical cohort of consecutive patients undergoing IPG placement or revision prior to the use of the envelopes (between October 2007 and April 2015).

## Results:

In the pre-envelope cohort of 151 IPGs placed in 116 patients, there was a culture-confirmed infection rate of 18/151 (11.9%). In the antibacterial envelope cohort of 233 IPGs placed in 185 patients, there were 5 cases of culture-confirmed infection (2.1%). The absolute risk reduction with the use of the antibacterial envelope was 4.6% (95% CI, 0.045-0.048), with a relative risk reduced by 77% (odds ratio, 0.23; 95% CI 0.05-1.08; P=0.065). The NNT was 21 (95% CI 20.8-22.4) envelope uses to prevent one IPG infection.

## Conclusion:

Usage of an antibacterial envelope with IPG placement for neuromodulation therapy has resulted in a lower infection rate at our center. Based on these results, we can recommend the use of envelopes for infection prophylaxis.

## Funding Sources:

None.

# Prognosticating Outcome in Pancreatic Adenocarcinoma with the Use of a Machine Learning Algorithm

Platform Presenter: Nawaf Abu-Omar

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

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## Team Members/Affiliations

Dr. Zarrukh Baig (Department of Surgery, University of Saskatchewan), Rayyan Khan (College of Engineering, University of Saskatchewan), Carlos Verdiales Castro (Department of Surgery, University of Saskatchewan), Ryan Frehlick (Department of Surgery, University of Saskatchewan), Dr. Fangxiang Wu (College of Engineering, University of Saskatchewan), Dr. Yigang Luo (Department of Surgery, University of Saskatchewan).

## Rationale:

Pancreatic cancer is a lethal condition with a poor prognosis. Pancreaticoduodenectomy, also known as the Whipple procedure, is the treatment of choice in patients who have a resectable tumour, which is associated with severe morbidity. The purpose of this project was to identify prognostic features in resectable pancreatic head adenocarcinoma and use these features to develop a machine learning algorithm that prognosticates survival post-Whipples.

## Methods:

A retrospective chart review of 93 patients who underwent a Whipples procedure was performed. The patients were analyzed in 2 groups: Group 1 (n=38) comprised of patients who survived < 2 years and Group 2 (n=55) comprised of patients who survived > 2 years.

## Results:

Using a student's t-test, chi-squared analysis, and a recursive feature elimination test 10 categorical features and 2 continuous features (12 total) were selected from 50 to be statistically significantly ( $p < 0.05$ ) in prognosticating survival < 2 years. These include: 1) presence of type 2 diabetes, 2) family history of any type of cancer, 3) number of family members with cancer, 4) bile duct stricturing, 5) perineural involvement of tumor, 6) positive margins on resection, 7) resection of portal tissue, 8) tumor size on MRI, 9) tumor size on pathology, 10) neoadjuvant chemotherapy, 11) adjuvant chemotherapy and 12) recurrence of cancer. These 12 features were used to train a Support Vector Model (SVM) algorithm. The algorithm was created using 90% of the data and validated using 10% testing data. The algorithm obtained 78% accuracy, 56.83% sensitivity, and 91.94% specificity in predicting survival < 2 years using the 12 prognosticating factors.

## Conclusion:

A machine learning algorithm that prognosticates survival can be a useful tool to individualize treatment plans for patients with pancreatic cancer and prevent futile surgery.

## Funding Sources:

Department of Surgery Resident Research Award.

# Union Rate and Clinical Outcomes Following Four-Corner Arthrodesis With a Dorsal Locking PEEK Plate: A Retrospective Case Series

Platform Presenter: Emmitt Hayes

Undergraduate Medical Student  
College of Medicine, University of Saskatchewan

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## Team Members/Affiliations

Haron Obaid (Department of Medical Imaging, University of Saskatchewan), David Leswick (Department of Medical Imaging, University of Saskatchewan), David Sauder (Department of Surgery, University of Saskatchewan).

## Rationale:

Four-corner arthrodesis (FCA) is a salvage procedure for advanced SLAC and SNAC wrist arthritis. A novel locking polyether ether ketone (PEEK) plate has been introduced for use in this procedure. While early series have shown good results at short follow up periods, there is a paucity of evidence exploring results with this plate at longer follow up periods. Our objective was to evaluate the radiographic union rate and clinical outcomes in a series of patients who received FCA with this plate.

## Methods:

We re-examined 39 wrists in 37 patients at a mean follow up of 50 months. Range of motion and grip strength were assessed. AP, lateral, and oblique radiographs of the operative wrist were obtained at follow up and analyzed by two fellowship-trained musculoskeletal radiologists. We defined union as the consolidation of bridging bone between the lunate and capitate or hamate.

## Results:

87% of wrists achieved union; 8% had non-union; 5% had indeterminate union. Average pain decreased from 83.4/100 preoperatively to 35.1/100 postoperatively. Mean satisfaction was 81.5/100. The mean QuickDASH score was 24.4, and the mean PRWE score was 26.5. Mean grip strength was 31.5 kg or 81% of the nonoperative hand. Mean flexion was 37.2 degrees and mean extension was 28.9 degrees.

## Conclusion:

FCA with a locking PEEK plate has reliable clinical and radiographic outcomes comparable with other fusion methods. This is the largest series with the longest mean follow-up period examining results with this plate, suggesting that its use leads to reliable medium-term outcomes.

## Funding Sources:

University of Saskatchewan Dean's Project Bursary.

# Laparoscopic Simultaneous Multi-Clip Applier in Vitro and In Vivo Study

Platform Presenter: Stephanie Ruscheinsky

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

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## Team Members/Affiliations:

Yigang Luo (Department of General Surgery, University of Saskatchewan), Chris Zhang (College of Engineering, University of Saskatchewan), Yanzhao Cheng (Department of Surgery, University of Saskatchewan), Shaoqing Du (College of Engineering, University of Saskatchewan), Chenwang Yuan (College of Engineering, University of Saskatchewan), Robert Bigsby (Department of Medicine, University of Saskatchewan).

## Rationale:

More than 50% of abdominal surgeries are done laparoscopically. A common maneuver is applying clips to vessels/cystic duct. Complications of poorly placed clips can lead to bleeding or bile leaks resulting in open surgery, poor outcomes, and longer hospital stays. Also, repeated insertion of instruments increases risk of intra-abdominal injury, and about 30% of operative time is spent on changing instruments. Therefore, a multi-clip applier was developed and tested in-vitro prior to in-vivo experiments, to achieve more efficient and safe laparoscopic surgery.

## Methods:

In vitro trials with 2 prototypes were conducted to optimize the multi-clip applier. Trials were done by testing the clip applier on IV catheters, assessing functionality and accuracy. The applier was then trialed on 3 pig models vs a control, 3 single clips applied.

## Results:

Thirty-one trials were completed, 20 multi-clip applier and 11 control trials. There was no significant difference (P-value 0.535) between the leak rate in the multi-clip applier (3 minimal, trickling leaks) vs the control (none). The multi-clip device mean application time was 28.5 +/- 23.1 seconds, while the control mean application time was 100.1 +/- 76.7 seconds. The Wilcoxon Rank test (P-value 0.0001) and the T-test (P-value <0.0001) showed the multi-clip applier use was significantly less time than the control.

## Conclusion:

The Concept of a novel multi-clip applier has been demonstrated. It uses significantly less time than the single clip applier, and there is no statistical difference between the leaks rates, even with the minor leaks record. Overall, further optimization in design is warranted.

## Funding Sources:

College of Medicine Resident Research Award.

# Conformation-Specific Immunotherapy for Proteinopathies Based on Disease Specific Epitopes

Platform Presenter: Kristin Marciniuk

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

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## Team Members/Affiliations:

Pekka Maattanen (VIDO INTERVAC, University of Saskatchewan), Ryan Taschuk (School of Public Health/VIDO INTERVAC, University of Saskatchewan), Beibei Zhou (Djavad Mowafaghian Centre for Brain Health, UBC), Brett Trost (Computer Science, University of Saskatchewan), Erin Scruten (VIDO INTERVAC, University of Saskatchewan), Kim Doig (VIDO INTERVAC, University of Saskatchewan), Andrew Potter (VIDO INTERVAC, University of Saskatchewan), Philip Griebel (School of Public Health/VIDO INTERVAC, University of Saskatchewan), Neil Cashman (Djavad Mowafaghian Centre for Brain Health, UBC), Scott Napper (Biochemistry, Microbiology and Immunology/VIDO INTERVAC, University of Saskatchewan).

## Rationale:

Many neurodegenerative disorders, such as Amyotrophic Lateral Sclerosis (ALS), Alzheimer's Disease, Parkinson's Disease, and Huntington's Disease are proteinopathies, characterized by the misfolding of a self-protein into an aggregate structure. These misfolded protein aggregates are not only a pathological hallmark of these diseases, but also a key player in disease initiation and progression. Parallels have been drawn between the pathogenic mechanisms in these neurodegenerative diseases and the unique propagation of protein misfolding observed in prion diseases. Vaccine development efforts are now focusing on neutralization of these pathogenic misfolded species as a method for delaying or halting disease progression.

## Methods:

Our lab developed a pipeline for generating conformation-specific vaccines for proteinopathies. This platform translates epitopes that are selectively exposed in the pathogenic misfolded conformation, referred to as disease specific epitopes (DSEs), into highly immunogenic constructs suitable for vaccine applications.

## Results:

This project involved further optimization of this pipeline through development of an in silico method for enhancing peptide epitope immunogenicity for vaccine applications. This pipeline was utilized to generate conformation-specific immunotherapy for prion diseases and ALS. Hypothesis-based and thermodynamic computational approaches were used to identify DSEs specifically exposed in misfolded pathogenic SOD1 conformers, the proposed causative agent of a subset of ALS, as well as epitopes uniquely exposed in PrP-Sc, the misfolded and infectious species in prion diseases. Candidate vaccines based on DSEs were generated as recombinant fusions with proprietary proteins and characterized in terms of immunogenicity, specificity, safety and efficacy.

## Conclusions:

These investigations demonstrated the therapeutic potential of conformation-specific immunotherapy for neurodegenerative disease.

## Funding Sources:

CIHR, SHRF, PREVENT, APRI, PrioNet, University of Saskatchewan, and VIDO-InterVac.



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Department of Surgery