

Department of Surgery  
WESTERN UNIVERSITY

17<sup>TH</sup> ANNUAL  
DR. ROBERT ZHONG DEPARTMENT OF  
SURGERY RESEARCH DAY

Thursday, November 11, 2021  
1 PM  
Zoom Webinar

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## Program at a Glance

### **Research Day 2021**

### **Zoom Webinar**

### **November 11, 2021**

1:00-1:15 PM	Opening Remarks: Dr. Emil Schemitsch
1:15-2:04 PM	Award Winning Resident/Fellow Platform Presentations
2:11–2:20 PM	Break
2:20-2:27 PM	MSc in Surgery Award Winning Presentation
2:30-3:20 PM	KEYNOTE SPEAKER: Dr. Chad Ball
3:20-3:30 PM	Break
3:30-3:40 PM	Department of Surgery Research Update: Dr. Kelly Vogt
3:40-4:20 PM	Node Speakers- Presenting IRF Projects
3:40 PM	Dr. Adam Power (Fundamental Sciences & Surgical Innovation Node)
3:50 PM	Dr. Michael Ott (Surgical Education Node)
4:00 PM	Dr. Jeffrey Campbell (QI & Patient Centered Node)
4:10 PM	Dr. Sumit Dave (Big Data/ICES Node)
4:20-4:56 PM	Resident/Fellow Oral Poster Presentations
5:00-5:15 PM	Awards, Closing Remarks & Completion of On-Line Evaluations

## Biography of Dr. Robert Zhong



Named in honour of Dr. Robert Zhong, a brilliant scientist and colleague who passed away in London, Ontario on September 8, 2006. Dr. Robert Z. Zhong was born in Shanghai, China on January 16, 1946. He graduated from Shanghai No 1 Medical University and was then assigned by the government to work as a general surgeon in a community hospital. Dr. Zhong attended a seminar led by Dr. Sun Lee – considered to be the founding father of experimental microsurgery – and whom he would later credit to be one of the most important mentors of his life.<sup>1</sup> Dr. Zhong arrived in Canada first as a research fellow under the supervision of Drs. John Duff and Calvin Stiller in 1984. His persistence and vision led to a full-time appointment and microsurgical animal models that would be applied in human transplantation clinical practice. Recognizing that molecular biology and transplant immunology were critical to the future of transplantation, Dr. Zhong began his study of these fields in Canada to become one of the world's leading experts in transplantation and microsurgery. He went on to become a Tier One Canada Research Chair in Transplantation and Experimental Surgery in 2004 and was appointed a full Professor in the Departments of Surgery, Pathology, and Microbiology & Immunology at The University of Western Ontario. Dr. Zhong was a scientist at the Robarts Research Institute; Director of the Microsurgery Laboratory at LHSC; and a scientist at the Lawson Health Research Institute. Dr. Zhong's influence into the fields of transplantation and microsurgery were profound and far-reaching. He was Past President of the International Society of Experimental Microsurgery; a member of the Canadian Society of Transplantation, American Society of Transplantation; and the American Society of Transplant Surgeons. Dr. Zhong was awarded the Lifetime Achievement Award by the Canadian Society of Transplantation posthumously in 2007.

1. Zhong T. (2007), Dr. Robert Zhen Zhong: A tribute by his daughter. *Microsurgery*, 27:214-2

## Award Winning Resident/Fellow Presentations

**Presenter #1:** Dr. Oonagh Scallan

**Division:** Vascular Surgery

### Onyx versus coil embolization for the treatment of type II endoleaks

Oonagh Scallan, MD,<sup>1</sup> Stewart Kribs, MD,<sup>2</sup> Adam H. Power, MD, MPhil,<sup>1</sup> Guy DeRose, MD,<sup>1</sup> Audra Duncan, MD,<sup>1</sup> Luc Dubois, MD, MSc,<sup>1,3</sup>.

1. Division of Vascular Surgery, Western University, London, Ontario, Canada
2. Department of Interventional Radiology, Western University, London, Ontario Canada
3. Department of Epidemiology and Biostatistics, Western University, London, Ontario, Canada.

**Objective:** There is little evidence supporting the optimal treatment of type II endoleaks associated with aortic sac growth. Previous studies have lacked comparisons between treatment methods long-term follow up. The purpose of this study was to review our center's experience with the treatment of type II endoleaks comparing Onyx (a liquid embolization agent consisting of ethylene vinyl alcohol) embolization with coil embolization.

**Methods:** A retrospective review of a prospectively collected vascular surgery database was performed to identify all patients who underwent embolization of a type II endoleak for aortic sac growth after EVAR between 2005 and 2018. Onyx and coil embolization groups were compared using univariate statistics.

**Results:** In total, 58 patients underwent 77 embolizations for type II endoleaks with either Onyx (number of procedures =37) or coils (number of procedures =40). The average aneurysm size at the time of embolization was larger in the Onyx group (77.9mm) compared to coil embolization (73.4mm). Mean follow up was 57 months in the Onyx group and 74 months in the coil embolization group. Among the 27 patients undergoing Onyx embolization, two patients (7.4%) required graft explantation compared to five patients (16.1%) among the 31 patients undergoing coil embolization ( $p=.33$ ). Based on per-procedure analysis, the coil embolization group had a significantly higher rate of need for further reinterventions compared to the Onyx group (58% vs 19%,  $p<.01$ ). Two patients in each group presented with secondary rupture of the aneurysm sac following attempted embolization.

**Conclusions:** Type II endoleaks associated with sac growth treated with Onyx are less likely to require further reinterventions than with coil embolization, and there is a trend towards greater need for EVAR explant following coil embolization. With a high rate of further reintervention and potential for sac rupture, diligent follow-up is required after attempted type II embolization regardless of technique.

**Presenter #2:** Dr. George Pang

**Division:** General Surgery

**Why do surgeons teach? A narrative systematic review and thematic synthesis of qualitative studies.**

George Pang, Hannah Sy, Rajiv Tanwani, Julie Ann Van Koughnett

**Background:** The underlying motivation for surgeons and surgical residents to teach is not well established in the literature. Motivation is a known predictor of teaching effectiveness in the education literature, and this understanding can be useful in improving teaching effectiveness of surgery educators.

**Objective:** This study aims to examine the motivational factors in surgical residents and surgeons.

**Methods:** A systematic review was undertaken according to PRISMA guidelines. Literature search of relevant articles in MEDLINE/PubMed, Embase, and PsychINFO was conducted. Additional studies were sought in reference list of retrieved articles, and grey literature was also searched. Two reviewers independently evaluated each article. Full texts of relevant studies were analyzed to determine eligibility for inclusion. Of the included studies, quality was assessed using the Critical Appraisal Skills Programme (CASP) tool for qualitative studies. Data was thematically synthesized using the Self Determination Theory as the theoretic framework

**Results:** From an initial screen of 1341 studies, 14 studies were included after full text analysis. Included studies were of mixed quality. Most studies used interview and questionnaire methodology. Most participants were surgeons and residents in academic teaching institutions. Motivational factors for teaching ranged from a spectrum of extrinsic motivation to intrinsic motivation. After thematic synthesis, intrinsically motivated factors were the most prevalent, and educators consistently identified interest, enjoyment, and satisfaction as main motivators. Extrinsic motivation factors (rewards, career obligations) were less frequently identified as motivators. Commonly identified barriers to teaching were mostly extrinsic (lack of time, clinical duty, and lack of incentives).

**Conclusion:** Surgical educators identified themselves as being intrinsically motivated to teach, but feel hindered by extrinsic factors. Teaching effectiveness may be enhanced by continuing to foster existing intrinsic motivators, while providing extrinsic motivators and removing extrinsic barriers to teaching.

**Presenter #3:** Dr. Carolyn MacLeod

**Division:** Urology

**Decision aids for patients with lower urinary tract dysfunctions: A systematic review**

**C. MacLeod, B. Welk, Z. Chuang, Z. MacNeily**

**Background:** Lower urinary tract symptoms (LUTS) may be due to benign prostatic hyperplasia (BPH), overactive bladder, neurologic disease, and stress or urge incontinence. There are many treatment options available, including medical and surgical management, and these treatments vary in their intensity, functional outcomes, risks, and effects on patient's quality of life. Patient decision aids can be used to increase patients' knowledge of their health condition and help guide treatment decisions. The aim of this review is to examine the use of patient decision aids in adult patients making decisions about the management of their LUTS.

**Methods:** MEDLINE, Embase, and CINAHL were searched from inception through June 2021. We followed the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA). This systematic review was registered with PROSPERO (#220534). Two reviewers independently screened abstracts for inclusion and extracted data from those studies that met the inclusion criteria. Studies reporting on patient decision aids used in lower urinary tract dysfunctions were included in the review. Journal reviews, conference abstracts, studies of pediatric populations, and studies published in languages other than English were excluded. Quality of individual studies were compared in accordance with Standards for Universal reporting of a patient Decision Aid Evaluations (SUNDAE).

**Results:** Overall 2,096 abstracts were reviewed, and 33 full text articles were analyzed resulting in 18 papers fully meeting inclusion criteria. Of these papers, thirteen examined decision aids used in men with BPH, two looked at decision aids used in patients with stress incontinence, one examined a decision aid in men with urethral strictures, and two papers looked at a decision aid used in the treatment of overactive bladder. Thirteen of the papers reviewed the use of patient decision aids whereas five examined the development of patient decision aids for patients with LUTS. Main outcomes highlighted in these studies support the idea that decision aids used in patients with lower urinary tract dysfunctions increase patients' knowledge of their health condition (3/13), decrease decisional conflict (6/13) and improve patient satisfaction with their treatment choice (8/13).

**Conclusions:** This systematic review reveals that there is limited data published on patient decision aids used in patients with LUTS. Given the increasing management options available for patients with LUTS, the fact that LUTS are generally a quality of life issue, and the evidence supporting the use of patient decision aids, further studies would be beneficial in this area.



**Presenter #4:** Dr. Joseph Cavanagh

**Division:** Orthopaedic Surgery

### **Navigation and Patient Specific Instrumentation in Shoulder Arthroplasty**

**Joseph Cavanagh, G Athwal, J Johnson, D Langohr, J Lockhart**

**Background:** The rates of shoulder arthroplasty are increasing, and projected to continue to do so. Both anatomic and reverse shoulder arthroplasty rely on replacement of the proximal humerus. The humeral head osteotomy influences the humeral component height, its version and neck shaft angle. These parameters all influence outcomes of shoulder replacement. Little, however, has been done to evaluate these humeral head osteotomies. The purpose of this study is to develop a navigation technique for the proximal humerus and use real time navigation to execute the humeral head osteotomy.

**Methods:** 3D printed models of 10 humeral specimen were created. These models were used to mark anatomic points and tracings in development of a proximal humerus navigation technique. These same models were then used to execute preoperatively planned humeral head osteotomies. Four different cut methods were trialed; free hand, fixed angle guide, patient specific guides, and real time navigation. The cut height, neck shaft angle and version were recorded for all. A series of paired, two-tailed T-tests were used for statistical analysis of the comparisons of the error of each cut method. For the analysis of the healthy vs. OA groups, a series of unpaired (unequal variance), two-tailed T-tests were performed. Statistical significance was defined as  $p < 0.05$ .

**Results:** Navigated osteotomies had significantly less neck shaft angle error than the free hand ( $p=0.025$ ), fixed angle guide ( $p=0.003$ ), and the patient specific guide ( $p=0.023$ ). The patient specific guide was also significantly better than the fixed angle guide ( $p=0.007$ ). There was no statistical difference between the free hand and fixed angle groups. The version angle error of the navigated cut was significantly less than the error of both the free hand ( $p=0.014$ ) and fixed angle guide ( $p=0.003$ ) cuts. The patient specific guide was not significantly better than the free hand or the fixed angle guide ( $p=0.77$ ,  $p=0.32$ ), and no significant difference was detected between the patient specific guide and navigation ( $p=0.059$ ). There was no difference in cut heights between all four groups.

**Conclusion:** Navigation and patient specific guides resulted in improvement in humeral head osteotomy parameters compared to fixed angle guides and free hand executed osteotomies. Further research and utilization of navigation and patient specific guides may further improve shoulder arthroplasty.



**Presenter #5:** Dr. Spencer Chambers

**Division:** Plastic & Reconstructive Surgery

**Interfascicular Anatomy of the Motor Branch of the Ulnar Nerve: A Cadaveric Study**

**Spencer B Chambers, Kitty Wu, Corey Smith, Robert Potra, Louis M Ferreira, Joshua Gillis**

**Introduction/Purpose:** The motor branch of the ulnar nerve contains fascicles that innervate the intrinsic musculature of the hand. The internal topography within the motor branch has yet to be reported.

**Methods:** Five fresh frozen cadaveric specimens with an average age of 74 years were dissected. The ulnar nerve was exposed and transfixed to underlying tissues to maintain its orientation throughout dissection. The fascicle to the first dorsal interosseus (FDI), flexor pollicis brevis (FPB), and abductor digiti mini (ADM) were identified as they entered respective muscles. Internal neurolysis was performed to identify the interfascicular arrangement of these fascicles. The insertion and take off of specific motor fascicles was measured using a 3D surface scanner with 0.05mm accuracy and recorded relative to the pisiform.

**Results:** The internal topography of the motor branch was consistent among all specimens. Proximal to the pisiform, the arrangement from radial to ulnar was volar sensory branch (VSB), FPB, FDI/intrinsic muscles, ADM, dorsal cutaneous branch (DCB). The position of these branches remained consistent as the deep motor branch curved radially within the palm and travelled to terminal musculature (**Figure 1**). The location of the average branch points of the FDI, ADM, and DCB with respect to the pisiform were as follows; FDI: 4.6cm distal (range: 4.1-4.9 cm), 4.5cm radial (range: 4.1-4.9 cm). ADM 0.65cm distal (range: 0.3-1.1 cm), 0.7cm radial (range: 0.3-1.1 cm). DCB 7.7cm proximal (range: 4.2-10.1 cm), 0.4 cm ulnar (range: 0.3-0.8 cm).

**Conclusions:** The internal topography of the ulnar nerve motor branch was consistent among specimens studied. This work may inform clinical interventions targeting specific muscular branches during nerve transfers.

**Presenter #6:** Dr. Noah Stern

**Division:** Paediatrics (Representing)

**A CUSUM analysis of operative times and complications for a surgeon initiating robot assisted pyeloplasty- a predictable decrease in operative time is possible by case 30**

**Noah Stern, Yilong Li, Peter Wang, Sumit Dave**

**Introduction:** The transition from laparoscopic and open surgery to robot assisted procedures in paediatric urology leads to an increase in operative times and added health care costs. Cumulative sum (CUSUM) analysis can be used to study inflection points to detect changes in operative timing and complication rates. This analysis can be used to define a procedure's learning curve and to monitor for unacceptable complication rates when adopting a new approach. The objectives of this study are to investigate the learning curve of a single surgeon transitioning to robot assisted pyeloplasty (RAP) in the Canadian healthcare system.

**Methods:** Demographic and surgical data from 50 consecutive RAP performed between 2013 and 2019 were prospectively collected. Operative time was recorded by an independent operative room personnel. The CUSUM of RAP operative times (CUSUM<sub>OT</sub>) was plotted against the number of operations ( $\text{CUSUM}_{OT} = \sum_{i=1}^n (x_i - \mu)$ ). The mean operative time (OT) from each phase of CUSUM<sub>OT</sub> were compared using one-way analysis of variance (ANOVA) and post-hoc Tukey test on SPSS 26. Non-risk-adjusted cumulative observed minus expected failure chart with 80% (alert) and 95% (alarm) boundary lines was constructed using 5% acceptable and 10% unacceptable complication rates.

**Results:** The mean OT for RAP was  $157.1 \pm 39.4$  min for all 50 cases. One-way ANOVA analysis showed that the 3 phases of the learning curve had significantly different mean OT ( $p < 0.001$ ). Post-hoc Tukey test showed that the mean OT of Phase 1 ( $207.3 \pm 34.7$  min, the initial 12 cases), Phase 2 ( $161 \pm 17.5$  min, the middle 16 cases), and Phase 3 ( $127 \pm 19.3$  min, the last 22 cases) were all significantly different ( $p < 0.001$ ) [Fig. 1]. The complication rate for RAP stabilized around the acceptable level of 5% up to case 41 before it finalized at 8% overall [Fig. 2].

**Conclusion:** CUSUM analysis can be used to monitor surgeon progression along the learning curve, and safety when adopting a new approach. In our study, OT showed an inflection point by case 12, and another at case 28. We propose that by case 30 a surgeon transitioning to RAP can achieve a significant decrease in OT. Complication rates remained within acceptable limits throughout, indicating that RAP can be safely adopted, even at low volume centers (8-10 RAP/year). Future studies can work to establish reference values against which surgeons can monitor competence.

**Presenter #7:** Dr. Alexander Ednie

**Division:** Thoracic Surgery

**Does pre-operative SABR increase the risk of complications from lung cancer resection? A secondary analysis of the MISSILE trial**

**Alexander Ednie**

**Background:** Stereotactic ablative radiotherapy (SABR) plays an important role in the management of early NSCLC in patients who are poor operative candidates, or more recently during the COVID-19 Pandemic, as a bridge to surgery, when operating room access is limited. The impact of preoperative SABR on surgical resection has not been extensively explored in terms of length of hospital stay (LOS) and difficulty of surgical resection (DSR).

**Methods:** LOS and perioperative outcomes were assessed for patients with stage I NSCLC who received preoperative SABR and subsequent surgical resection (RS), and compared to a similar cohort who underwent surgery alone (S) from 2014 to 2017 using a propensity-score matched analysis. DSR was assessed based on: operative time, blood transfusions, conversion rates (CR), and increased sub-lobar to lobar resection (SL).

**Results:** Forty patients in the RS cohort were compared to 168 patients in the S cohort. Univariable and multivariable logistic regression models were generated as a comparison for all patients ( $n = 208$ ). Mean  $\pm$  SD LOS was similar between the cohorts ( $5.2 \pm 4.7$  vs  $4.3 \pm 2.2$  days,  $p = 0.897$ ). There were no differences between cohorts for blood transfusions (0% vs 0%), mean  $\pm$  SD operative time ( $2.4 \pm 1.0$  vs  $2.5 \pm 1.2$  hours,  $p = 0.596$ ), conversion rates (21.9% vs 18.8,  $p = 0.756$ ), or increased SL (9.4% vs 0%,  $p = 0.238$ ). Three patients who received radiotherapy did not proceed to surgery, 1 due to concerns of radiation pneumonitis.

**Conclusion:** Preoperative SABR in patients with stage I NSCLC does not have a significant impact on the DSR and LOS.

**Presenter #8:** Dr. Fadi Hage

**Division:** Cardiac Surgery

## **Does Adding An Aortic Root Procedure During Aortic Arch Repair Increase Post-Operative Mortality? Evidence from the Canadian Thoracic Aortic Collaborative**

**Fadi Hage, MD, MPH<sup>1</sup>; Ali Hage, MD, MPH<sup>1</sup>; Francois Dagenais, MD<sup>2</sup>; Maral Ouzounian, MD, PhD<sup>3</sup>; Ismail El-Hamamsy, MD, PhD<sup>4</sup>; Mark Peterson, MD, PhD<sup>3</sup>; Kevin Lachapelle, MD<sup>5</sup>; Munir Boodhwani, MD, MMSc<sup>6</sup>; John Bozinovski, MD, MSc<sup>7</sup>; Michael C. Moon, MD<sup>8</sup>; Michael Yamashita, MDCM, MPH<sup>9</sup>; Rony Atoui, MD<sup>10</sup>; Darrin Payne, MD<sup>11</sup>; Michael W. A. Chu, MD, MEd<sup>1</sup>; on behalf of the Canadian Thoracic Aortic Collaborative**

<sup>1</sup>Western University, London, ON, Canada, <sup>2</sup>Laval University, Quebec City, QC, Canada, <sup>3</sup>University of Toronto, Toronto, ON, Canada, <sup>4</sup>University of Montreal, Montreal, QC, Canada, <sup>5</sup>McGill University, Montreal, QC, Canada, <sup>6</sup>University of Ottawa, Ottawa, ON, Canada, <sup>7</sup>Ohio State University Wexner Medical Center, Columbus, OH, <sup>8</sup>University of Alberta, Edmonton, AB, Canada, <sup>9</sup>University of Manitoba, Winnipeg, MB, Canada, <sup>10</sup>Health Sciences North, Sudbury, ON, Canada, <sup>11</sup>Queen's University, Kingston, ON, Canada

**Background:** Continuous debate exists regarding the extent of proximal aortic repair in patients presenting with an index aortic arch procedure. Aortic arch repairs are known to be associated with high mortality and morbidity, and it could be argued that the addition of an aortic root procedure, with increased surgical complexity, could result in worsened outcomes. A recent study by the International Aortic Arch Surgery Study Group reported no increased postoperative mortality when adding an aortic root operation to an aortic arch procedure, however this study was limited to elective cases and did not report outcomes of patients presenting with aortic dissection. Therefore, we set out to evaluate the effect of adding an aortic root procedure on mortality and morbidity during aortic arch repair in patients undergoing elective and non-elective surgery.

**Methods:** 2472 patients underwent aortic arch repair with hypothermic circulatory arrest between 2002 and 2018 at 12 Canadian centers. Multivariable logistic regressions (MV) and propensity-score with inverse probability of treatment weighting (PS-IPTW) analyses were performed for each of the four primary outcomes (mortality, stroke, reoperation for bleeding, dialysis-dependent renal-failure).

**Results:** A total of 1099 (44.5%) patients had additional aortic root procedures. Those with aortic root interventions were younger (61±13 vs. 64±13 years,  $p<0.001$ ), had less females (23% vs. 35%,  $p<0.001$ ), less dissection (31% vs. 36%,  $p=0.004$ ), less urgent cases (35% vs. 39%,  $p=0.047$ ), more connective tissue disease (7% vs. 3%,  $p<0.001$ ), and less total arch replacements (14% vs. 22%,  $p<0.001$ ). On adjusted analyses, the addition of aortic root procedure was associated with increased mortality (MV: OR 1.41, 95% CI 1.03-1.92; PS-IPTW: risk increased by 3.7%, 95% CI 1.2% to 6.3%,  $p=0.004$ ). Reoperation for bleeding was also increased with the addition of aortic root intervention (MV: OR 1.48, 95% 1.10-1.99; PS-IPTW: risk increased by 3.2%, 95% CI 0.8% to 5.6%,  $p=0.009$ ). The risks of stroke and dialysis-dependent renal failure were similar. When looking only at non-elective cases, the increased risk of mortality was more pronounced (MV: OR:1.60, 95% CI 1.11-2.32,  $p=0.013$ ; PS-IPTW: risk increased by

6.8%, 95 CI 1.7% to 11.8% , $p=0.008$ , and a number need to harm of 15 patients to cause 1 additional death).

**Conclusions:** The addition of aortic root procedure during aortic arch repair is associated with increased post-operative mortality, particularly in non-elective cases.

**MSc in Surgery Presentation:** Dr. Renan Rodrigues Fernandes

**Biomechanical comparison between patient-specific and non-patient-specific PLIF cages.**

**Renan Fernandes, Aaron Gee, Andrew Kanawati, Parham Rasoulinejad, Radovan Zdero, Chris Bailey**

**Objectives:** Instrumented lumbar spinal fusion procedures have grown over the last century, and the use of interbody fusion devices is well established. Among several techniques, posterior lumbar interbody fusion (PLIF) has become one of the most popular. Biomechanical studies comparing cage shapes and sizes have found significant differences when increasing the surface of contact with larger devices. Still, none of them specifically focused on the effect of a patient-specific intervertebral disc device. Thus far, no biomechanical studies are comparing the stiffness and loading distribution parameters using PLIF implants that match the endplate bone geometry compared to flat surface commercial PLIF cages.

**Method:** After obtaining CT scan images of the lumbar spine of cadaveric specimens, a 3D volumetric reconstruction sequence was performed. From the vertebrae's 3D model, PLIF cages matching the endplate geometry were obtained through a Boolean operation. The cages were printed using a resin with properties similar to PEEK. Biomechanical testing was performed on the cadaveric lumbar vertebrae comparing the patient-specific (PS) cages to two commercially available cages. The force required for mechanical failure in Newtons(N) and stiffness in (N/mm) were compared among the groups.

**Results:** In the first comparison group, PS cages were compared to Fuse cages. The mean force to failure was 1399N for PS cage and 852N for Fuse cage( $p<0.001$ ). The mean stiffness was 1274N/mm and 431N/mm( $p<0.001$ ). In the second comparison group, PS cages were compared to Capstone cages. The mean force to failure was 1381N for PS cage and 1164N for Capstone cage( $p=0.086$ ). The mean stiffness was 1382N/mm and 867N/mm( $p=0.009$ ).

**Conclusion:** Interbody fusion implants matching the endplate surface can help prevent subsidence since they require a higher force to subside, and they present a significantly higher stiffness than commercially available cages.

## THE DR. ROBERT ZHONG LECTURE: Dr. Chad Ball, MD, MSc, FRCSC, FACS



Dr. Chad Ball is an associate professor of surgery and oncology at the University of Calgary. He currently practices Hepatobiliary, Pancreas, Trauma and Acute Care Surgery at the Foothills Medical Centre (quaternary care regional referral facility).

He completed his undergraduate degree at the University of Alberta (physiology), graduate degree at the University of British Columbia (MSc), medical school at the University of Toronto, general surgery residency at the University of Calgary, trauma and surgical critical care fellowships at Emory University, and his hepato-pancreato-biliary fellowship at Indiana University.

He has over 250 peer-reviewed publications, 35 book chapters, and is an international speaker on a broad range of surgical and resuscitation topics. His research areas of interest include clinical injury care, hybrid operating environments, parabolic spaceflight surgery, randomized controlled trials within HPB surgery, and national surgical manpower analyses. He is on a broad range of surgical society executive committees, as well as peer-reviewed journal editorial boards. He also remains the director for both the HPB and acute care surgery fellowship programs.



## DEPARTMENT OF SURGERY RESEARCH UPDATE & NODE PRESENTATIONS

**Department of Surgery Research Update:** Dr. Kelly Vogt, Research Committee Chair

**FUNDAMENTAL SCIENCES & SURGICAL INNOVATION NODE SPEAKER:** Dr. Adam Power

**Talk Title:** Introducing a New Concept of Fixed-Volume Aortic Occlusion for Fluoroscopy-Free Resuscitative Endovascular Balloon Occlusion

**SURGICAL EDUCATION NODE SPEAKER:** Dr. Michael Ott

**Talk Title:** Unintended Consequences: Translation of CBME Theory into Practice

**QUALITY IMPROVEMENT & PATIENT CENTERED NODE SPEAKER:** Dr. Jeffrey Campbell

**Talk Title:** Reducing Opioid Use After Minor Urologic Surgery

**BIG DATA/ICES NODE SPEAKER:** Dr. Sumit Dave

**Talk Title:** Big Data: Does (Sample) Size Matter? ICES Research in Pediatric Urology



## Resident/Fellow Oral Poster Presentations

**Presenter #1:** Dr. Lukas Hashem

**Division:** Orthopaedic Surgery

### Kienbock's Disease – Long Term Surgical Outcomes

**L. Hashem, N. Suh, R. Grewal**

**Purpose:** Kienbock's Disease is uncommon but can cause significant wrist dysfunction. There is a paucity of data on the natural history of Kienbock's disease and long-term results of surgical intervention. We wanted to assess the long-term clinical and radiographic outcomes of Kienbock's disease treated surgically at our centre.

**Hypothesis:** Clinical differences will be found between the groups depending on stage and procedure.

**Methods:** An operating room database was used to identify subjects who had surgery for Kienbocks from 1998-2017. Fifty two patients were identified and had retrospective reviews of the health record. Patients were then invited for clinical assessments. Specifically we collected patient reported outcome measures (PROMs), range of motion, grip strength, and radiographic measurements. Our primary outcome was the Patient Rated Wrist Evaluation (PRWE). Secondary outcomes were quickDASH, ROM, grip strength, radiographic disease progression, re-operation rates, & complications.

**Results:** Thirty patients agreed to return for followup. To date 19 have completed a full assessment and 3 completed the PROMs by telephone. Operative procedures included: Radius shortening osteotomy (RSO) (n=33), proximal row carpectomy (PRC) (n=11), wrist arthrodesis (n=7). Average time since OR for RSO, PRC & arthrodesis were  $10.9 \pm 3.5$ ,  $9.0 \pm 4.3$ , &  $10.7 \pm 4.4$  respectively. PRWE scores for RSO, PRC, and arthrodesis were:  $22.5 \pm 16.5$ ,  $27.9 \pm 20.7$ , &  $47.2 \pm 20.0$ . QuickDASH scores for RSO, PRC, and arthrodesis were:  $16.4 \pm 12.6$ ,  $19.3 \pm 20.3$ , &  $33.3 \pm 23.1$ . ROM arc for RSO and PRC were  $95.8 \pm 24.7$  &  $70.4 \pm 24.8$  respectively. Grip strength for RSO, PRC, and arthrodesis were  $69.2 \pm 14.0$ ,  $63.5 \pm 21.5$ , &  $50 \pm 0.0$ . Complications included 7 removal of hardware, 1 carpal tunnel release, 5 further salvage procedures, and 2 CRPS.

**Conclusion:** RSO and PRC showed excellent long-term function on PRWE and quickDASH at an average of ~10 years followup.

**Presenter #2:** Dr. Yousif Atwan

**Division:** Orthopaedic Surgery

**Indomethacin for heterotopic ossification prophylaxis following surgical treatment of elbow trauma: a randomized controlled trial**

Y. Atwan, I. Abdulla, R. Grewal, K. Faber, G. King, G. Athwal

**Introduction:** Heterotopic ossification is a frequent complication following surgical treatment of elbow trauma. The use of indomethacin to prevent heterotopic ossification is reported in the literature, however, its effectiveness is controversial. As such, the purpose of this randomized, double blind, placebo-controlled study was to determine if indomethacin is effective in reducing the incidence and severity of heterotopic ossification after surgical management of elbow trauma.

**Hypothesis:** Prophylactic indomethacin use would reduce the incidence of heterotopic ossification and result in improved functional outcomes.

**Materials and Methods:** Between February 2013 and April 2018, 164 eligible patients were randomized to receive postoperative indomethacin and pantoprazole or placebo medications. The primary outcome was to determine the incidence of heterotopic ossification on elbow radiographs at one year follow-up. Functional outcome scores were also collected including the Patient Rated Elbow Evaluation (PREE), the Mayo Elbow Performance Index (MEPI) and the Disabilities of the Arm, Shoulder and Hand (DASH).

**Results:** At one year follow-up there was no significant difference in the incidence of heterotopic ossification in the indomethacin group (49%) compared to the control (55%) group (relative risk = 0.89;  $p = 0.52$ ). There were no significant differences in post-operative PREE, MEPI, DASH scores and range of motion ( $p = 0.16$ ). There was a 17% complication rate in both the treatment and control groups ( $p = 1$ ). There were no non-unions in either group.

**Conclusion/Discussion:** This level 1 study demonstrated that indomethacin prophylaxis against heterotopic ossification in surgically treated elbow trauma was not significantly different than placebo.

**Presenter #3:** Dr. Robin Wigen

**Division:** General Surgery

**Reducing revisit to hospital rates among pediatric post-appendectomy patients:  
A quality improvement project**

R. Wigen, E. Pitre, J. Davidson, L. Muszynski, M. Dorward, J. Lam

**Introduction:** Acute appendicitis is the most common abdominal surgical emergency in pediatric patients. Failure to provide accurate information upon discharge can lead to unnecessary visits to emergency department due to post-operative concerns, leading to an undue burden on our health care system. Recent data from the National Surgical Quality Improvement Project (NSQIP) indicates that Children's Hospital at London Health Sciences Centre has a high rate of return to hospital for these patients. At our centre, post-appendectomy patients have an odds ratio of 1.68 for re-visits compared to the NSQIP average.

**Hypothesis:** A quality improvement initiative comprised of a bundle of interventions will decrease the rate of re-visit to hospital in post-operative appendectomy patients.

**Materials and Methods:** Beginning July 2021, our team implemented a set of interventions targeting post-appendectomy re-visit rates that included: increased education to the patient and nursing staff, revised discharge pamphlets for patients/families, and a post-discharge phone call from our nurse practitioner to confirm receipt of discharge materials and to elucidate common complaints. Progress of this intervention was tracked on a bimonthly basis using a run chart generated from NSQIP data.

**Results:** Previous NSQIP data prior to intervention demonstrated a re-visit rate of 16.5% (21/127 patients). The expected rate at our institution would be 7.6% (risk-adjusted, considering patient variables) based on the average NSQIP hospital. Preliminary data post-intervention demonstrated a total number of appendectomies of 38 with 3 patients re-presenting to hospital between July 1st and Sept 9th, 2021, giving a re-visit rate of 7.9%.

**Conclusion/Discussion:** There is a clear area for improvement at our institution in reducing re-visit rate among post-appendectomy patients. Preliminary data from our quality improvement project infers there is a declining rate of re-visit to hospital.

**Presenter #4:** Dr. Brendan Wallace

**Division:** Urology

**Postoperative Opioid Use Following Transurethral Surgery: An Institutional Audit and Development of an Opioid Reduction Strategy**

B. Wallace, S. Sami, H. Abed, M. Pignanelli, H. Razvi, J. Bjazevic

**Introduction:** The use of postoperative opioid analgesia has come under increasing scrutiny in all surgical disciplines. Providing patients with adequate analgesia while decreasing the risk of opioid overdose or addiction has encouraged urologists to re-examine postoperative pain control strategies. Previous data demonstrates high rates of persistent opioid use postoperatively for both major open surgeries and minimally invasive or endoscopic procedures.

**Hypothesis:** Our prescribing habits for transurethral surgery has over utilized opiates and there is opportunity at our centre to develop an effective non-opioid based postoperative analgesic protocol.

**Methods:** This study reports on a single institutional audit of postoperative opioid use in patients undergoing endoscopic transurethral surgery including transurethral prostatectomy (TURP) and transurethral bladder tumour resection (TURBT) between January 2016 and December 2018. Patient demographics and the type of postoperative analgesia received were recorded. The primary outcome was the utilization of any opioids. The secondary outcome was aimed at determining potential predictors of postoperative opioid use.

**Results:** Two hundred and sixty patients were identified and 67.3% of them received postoperative opiates. Gender, co-morbidities, length of procedure, and catheter size were not predictors of postoperative opioid usage. Age, concomitant use of anticholinergic medication, prolonged hospital length of stay, and preoperative analgesia use prior to TURBT were associated with opiate use.

**Conclusions:** Anticholinergics should be a mainstay of treatment in these patients due to bladder related discomfort. Anticholinergics and non-opioid analgesia were incorporated into our electronic medical record (EMR) postoperative patient care plan to eliminate the use of opioid analgesics. We plan to look at the prospective results of our patient care plan to see the change in opiate use over time.

**Presenter #5:** Dr. Khalifa AlGhanim

**Division:** Plastic & Reconstructive Surgery

### **The effect of Hyaluronan on cutaneous squamous cell carcinoma**

K. AlGhanim, A.Simpson, E.Turley

**Introduction:** Cutaneous squamous cell carcinoma (cSCC) is a form of non-melanotic skin cancer (NMSC) and its incidence is increasing by 4% annually, accounting for 28% of new cancer cases in Canada. Therapeutic approaches that prevent or curtail progression and recurrence are needed to reduce the impact of this under-recognized cancer. Hyaluronan (HA) is enriched in young skin but fragmented into pro-inflammatory and oncogenic sizes with age by generation of ROS by UVB/carcinogen exposure and by age-related increases in hyaluronidases.

**Hypothesis:** The depletion of HA over time could represent a possible target to inhibit the progression and development of cSCC by promoting apoptosis of tumor initiating cells and suppressing field inflammation.

**Methods:** Human tissue samples of cutaneous squamous cell carcinoma (cSCC) will be collected from patients who have been referred to the plastic surgery clinic at Victoria hospital. These patients have already had a biopsy proven cSCC and referred to our clinic for a wider surgical excision. Analyses will quantify HA content, polymer size, and expression of HA synthases (HAS1-3), hyaluronidases (HYAL2.4) and HA receptors (CD44, HMMR, TLR4) in healthy skin and cSCC tumors of varying differentiation. The aim is to assess if changes in the amount of hyaluronan and associated proteins are linked to the severity of cSCC.

**Expected Results:** The reduced availability of HA and correlated decrease in the associated metabolic activity in cSCC compared to the surrounding normal skin could demonstrate a possible therapeutic target. A previous HA based cream from our laboratory has previously demonstrated significant results with cutaneous basal cell carcinoma in an animal model.

**Conclusion:** HA is a relatively novel therapeutic target with significant clinical potential. The ability to demonstrate that HA is more depleted in cancerous skin gives us the potential in the future to assess whether replenishing HA can treat cSCC.

**Presenter #6:** Dr. Olawale Sogbein

**Division:** Orthopaedic Surgery

**Effects of Quadriceps Insult on Patient-Reported Outcomes Following Total Knee Arthroplasty: A Pilot Randomized Clinical Trial**

O. Sogbein, B. Zomar, D. Bryant, J.Howard, J.Marsh, B. Lanting

**Introduction:** Various surgical approaches have been investigated in the hopes of improving outcomes and reducing length of stay following TKA. Two such approaches include the medial parapatellar and midvastus. As the midvastus approach does not disrupt the extensor mechanism, it may be advantageous for functional recovery in the early postoperative period, however length of stay and long-term functional outcomes were similar. Therefore, both techniques are viewed as reliable and safe. Tourniquet use during TKA is still controversial with conflicting results in the literature and practices.

**Hypothesis:** We hypothesized that a future RCT comparing outpatient versus standard TKA could use either surgical approach with or without a tourniquet. The objective of this pilot RCT was to compare postoperative patient-reported pain, function, and quality of life between the medial parapatellar or midvastus approach with and without a tourniquet.

**Materials and Methods:** We conducted a randomized trial with a two-by-two factorial design to compare the medial parapatellar to the midvastus surgical approach for TKA with and without a tourniquet. The SF-12, WOMAC, and KSS were collected at baseline, and postoperatively at two, six, 12 weeks, and one year.

**Results:** Eighty-three patients were analyzed. Postoperative WOMAC scores were statistically but not clinically higher at six weeks and three months in favour of no tourniquet use. There were no differences in postoperative WOMAC scores between approaches. Short Form-12 and KSS scores increased in both groups with no significant differences at any time points ( $p > 0.05$ ).

**Conclusion/Discussion:** There were no clinically significant differences in postoperative WOMAC, SF-12, or KSS scores between surgical approaches or tourniquet use. As such, we believe a future larger RCT investigating outpatient TKA could likely incorporate either approach or tourniquet preferences without significant impact on patient reported outcomes.

**Presenter #7:** Dr. Eric Mitchell

**Division:** Plastic & Reconstructive Surgery

### **Strength of Upper Extremity Peripheral Nerve Coaptations: An In-vitro Study**

E. Mitchell, M. Haddara, K. Wu, S. Chambers, L. Ferreira, J. Gillis

**Introduction:** Many techniques exist in the field of peripheral nerve surgery to perform coaptations following nerve grafts or transfers. Historically, suture neuroorrhaphy has been the mainstay, however tissue adhesives have become increasingly utilized. The purpose of this study was to compare the in-vitro failure loads of nerve coaptations using fibrin glue alone, suture alone, and a combination of fibrin glue and suture.

**Hypothesis:** Coaptation strength will increase sequentially from use of fibrin glue alone, to suture alone, to combined use.

**Material and Methods:** The median, radial and ulnar nerves from fifteen fresh-frozen cadaveric upper extremity specimens (forty-five nerves in total) were dissected in-vitro and transected 5 cm proximal to the wrist crease to simulate an injury requiring coaptation. Three coaptation techniques were used: fibrin glue alone, suture alone, and suture augmented with fibrin glue. Repair load to failure was measured using a linear-servo actuator with an in-line force sensor. Results were analyzed using two-way repeated measures ANOVA tests and pairwise comparisons with Bonferroni correction.

**Results:** The nerve coaptation technique and the specific nerve that was repaired both had a significant effect on failure load. Suture-glue repair had the highest load to failure of  $11.2 \pm 2.9$  N and significantly increased load to failure by  $2.9 \pm 1.7$  N compared to glue repair alone. There was no significant difference between suture-glue repair and suture repair or between glue repair alone and suture repair.

**Conclusion:** In this in-vitro cadaveric model, nerve coaptation using both suture and fibrin glue resulted in the strongest repair. The addition of fibrin glue may provide some benefit when used to augment suture repair, but in isolation is inferior to combined suture and glue constructs. Combined coaptations may be useful in the early post-operative period to increase nerve repair strength and potentially reduce rupture rates.



**Presenter #8:** Dr. Fernanda Gabrigna Berto

**Division:** Urology

### **Shockwave Lithotripsy for Distal Ureteric Stones – Results from an International Research Initiative**

F. Gabrigna Berto, H. Razvi, J. Bjazevic, V. Wong, L. Nott, M. Hossny, R. Dasgupta, P. Osther, B. Turney, B. Chew

**Introduction:** Shock wave lithotripsy's (SWL) role in the management of distal ureteral stones is controversial with discordance between the American Urological Association and European Association of Urology guideline recommendations. Stone free rates (SFR) have been reported to be lower with SWL than ureteroscopy (URS).

**Hypothesis:** We aimed to evaluate SFR and identify factors predictive of treatment failure in patients undergoing SWL for distal ureteric stones in a real-world setting among centers participating in the Team of Worldwide Endourological Researchers (TOWER) initiative.

**Methods:** Between October 2011 and November 2020, patients who underwent SWL with the Storz SLX-F2 lithotripter for distal ureteric calculi at four institutions (England, Oman and two in Canada) were retrospectively reviewed. SFR, defined as the treated stone clearance, was assessed by post-operative imaging (computerized tomography, plain film x-ray or ultrasound). Descriptive statistics and logistic regression were used to analyze patients' characteristics and assess for predictors of treatment failure.

**Results:** Our series comprised 384 patients with a mean age of 51.24 years ( $\pm 15.75$ ). Mean body mass index (BMI) was 28.03 Kg/m<sup>2</sup> ( $\pm 5.05$ ) and 67.7% were male. Mean stone size was 6.51mm ( $\pm 2.54$ ) and 64.8% were treated in supine position. After one SWL, 236 patients were stone free. Retreatment rate was 10.9%. Treatment success was not known in 106 patients who were assumed as treatment failure (intent to treat). Patients who failed SWL had larger stones (OR 1.092,  $p=0.042$ , 95% CI) which were, on average, 0.58mm larger ( $p=0.048$ ). BMI, age, sex, total energy, number, and frequency of shocks were not predictors of failure on univariate or multivariate analysis.

**Conclusion:** SWL for distal ureteral stones SFR was 69.6%. Larger stone size was predictive of treatment failure. SWL should be considered in patients who fail conservative therapy and wish to avoid URS, especially for stones 6mm.

**Presenter #9:** Dr. Ge Shi

**Division:** General/Thoracic Surgery

### **The Development and Validation of a Mixed Reality Thoracic Surgery Anatomy Atlas**

G. Shi, E. Ho, A. Kokavec, R. Waterman, E. Wang, K. Harnden

**Introduction:** New extended reality (XR) technologies (Augmented, Mixed, and Virtual Realities) are increasingly utilized to enhance surgical education. We describe the development and validation of the first interactive MR Thoracic Surgical Anatomy Atlas.

**Hypothesis:** We hypothesize learners will feel increased motivation to study using our XR application when compared to conventional study methods.

**Materials and Methods:** We obtained a de-identified computer tomography of the thorax from The Cancer Imaging Archive and used segmentation and development software to create our application for Microsoft's HoloLens 2™, an MR platform. Medical students and residents were recruited and guided through a 20-minute session. An anonymous modified Michigan Standard Simulation Experience Scale questionnaire (5-point Likert scale) assessing the application was administered. Parametric and nonparametric statistical analyses were performed.

**Results:** Thirty-seven volunteers were included (ages 23-34 years; M/F=16/21). The device was felt to be safe (100%), did not cause nausea (92%) or eye strain (92%). Nearly all would recommend the application (97%). Eighty-four percent felt increased motivation to study with XR compared to conventional methods and 94% thought it was an asset for learning anatomy. MR was the second preferred approach to learning anatomy after cadaveric dissection. Pre-graduate learners enjoyed more the application (5.0 vs 4.7,  $p=0.023$ ) and felt it was an asset for teaching (5.0 vs 4.5,  $p=0.005$ ) compared to post-graduate learners. Surgical residents felt the device more comfortable (4.7 vs 3.7,  $p=0.018$ ) and were more likely to use it >15 min (4.8 vs 3.5,  $p=0.01$ ) compared to non-surgical residents.

**Conclusion/Discussion:** We demonstrate the successful development and validation of an MR Thoracic Surgical Anatomy Atlas as a comfortable and desirable modality for learning thoracic anatomy.

**Presenter #10:** Dr. Linda Chang Qu

**Division:** General Surgery

**NSQIP 5-Factor Modified Frailty Index Predicts Morbidity but not Mortality after Esophagectomy**

L.C. Qu, M. Qiabi, R. Nayak, R.A. Malthaner

**Introduction:** Patient selection is crucial for an esophagectomy – a complex surgery that is integral to the treatment of esophageal cancer. Previously, the National Surgical Quality Improvement Program (NSQIP) 11-factor Modified Frailty Index (mFI) demonstrated correlation between frailty and adverse esophagectomy outcomes. Whether the new simplified 5-factor mFI (mFI-5) retains the same predictive value is unclear.

**Hypothesis:** mFI-5 score correlates with 30-day complications and mortality.

**Methods:** Esophagectomy patients from 2016-2018 were identified using the targeted NSQIP Participant User File. An mFI-5 score was generated, and multivariate logistic regression analyses were applied.

**Results:** 3274 patients were included in the final analysis. No patients had an mFI-5 score higher than 3/5. Mortality rates for mFI-5 scores of 0, 1, 2, and 3 were 1.5%, 3%, 3.6%, and 5.2%, respectively. Clavien-Dindo grade 4 complication rates for mFI-5 scores of 0, 1, 2, and 3 were 11.3%, 16.5%, 20.6%, and 25.9%, respectively. Multivariate logistic regression analyses, controlling for age, sex, body mass index, American Society of Anesthesiologists classification, operative time, pathology, and neoadjuvant therapy, showed increasing frailty score was significantly associated with Clavien-Dindo grade 4 complications ( $p=0.01$ ), but not mortality ( $p=0.13$ ). Associations were also noted between frailty score and hospital stay  $>30$  days, reoperation, and sepsis. Increasing frailty score was particularly associated with pulmonary complications, including reintubation, prolonged ventilation  $>48$ hr, and pneumonia.

**Conclusion:** The simplified 5-factor mFI is significantly associated with 30-day morbidity but not mortality after an esophagectomy. Unlike its 11-factor predecessor, the mFI-5 may not be nuanced enough in the frailty assessment specific to this patient population. Care should be taken when applying mFI-5 for the purposes of patient selection for esophageal resection.