

Calgary Orthopaedic 9th Annual Resident Research Day



University of Calgary

Thursday, April 22, 2021
1330 – 1630 hours

Zoom Details:

Link information: <https://ucalgary.zoom.us/j/96255182815>

Meeting ID: 962 5518 2815 Passcode: 424012



Adjudicators:

Dr. Mary Brindle, University of Calgary

Dr. Andrew Dodd, University of Calgary

Moderator: Dr. Prism Schneider, University of Calgary

Residents:

R5s	R4s	R3s	R2s	R1s
Dr. Lee Fruson	Dr. Michael James	Dr. Annalise Abbott	Dr. Erin Davison	Dr. Laurel Collings
Dr. Joseph Kendal	Dr. Jennifer Purnell	Dr. Brent Benavides	Dr. Christopher Flanagan	Dr. Jarrett Moore
Dr. Madison Litkowski	Dr. Daniel You	Dr. Taryn Ludwig	Dr. Bryan Heard	Dr. Julian Rizos
Dr. Sarup Sridharan		Dr. Jayd Lukenchuk	Dr. Christopher Hewison	Dr. Logan Woods
		Dr. Murray Wong	Dr. Laura Morrison	

PROGRAM:

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1330-1335 hrs	Opening Remarks/Welcome/Introduction	Dr. P. Schneider
1335-1338 hrs	<i>Proposal 1: "In vivo cadaveric analysis of volar tilt correction using a kickstand screw technique in volar plate fixation for distal radius fractures"</i>	Dr. C. Hewison (R2) Topic: Biomechanics
1339-1342 hrs	<i>Proposal 2: "Biomechanical evaluation of optimal mini-fragment dual plate configuration for humerus diaphyseal fracture fixation"</i>	Dr. L. Collings (R1) Topic: Biomechanics
1343-1346 hrs	<i>Proposal 3: "Distal fibular fractures: A comparison of outcomes following posterolateral antiglide fixation to other fixation techniques"</i>	Dr. L. Woods (R1) Topic: Biomechanics
1347-1352 hrs	Questions	
1353-1359 hrs	<i>Full 1: "In-situ surgical fixation of slipped capital femoral epiphysis using simultaneous biplanar fluoroscopy"</i>	Dr. C. Flanagan (R2) Topic: Clinical
1359-1402 hrs	Questions	
1403-1409 hrs	<i>Full 2: "The bony apprehension test for identifying critical and sub-critical bone loss in patients with traumatic anterior shoulder instability"</i>	Dr. M. James (R4) Topic: Clinical
1409-1412 hrs	Questions	
1413-1419 hrs	<i>Full 3: "Establishing normative relationship of spinopelvic alignment to femoroacetabular orientation"</i>	Dr. T. Ludwig (R3) Topic: Clinical
1419-1422 hrs	Questions	
1422-1435 hrs	"How to Engage in Early Career Research"	Dr. Andrew Dodd

1435-1439 hrs	<i>Proposal 4: "Classification of heterotopic ossification about the elbow"</i>	Dr. B. Benevides (R3) Topic: Clinical
1440-1443 hrs	<i>Proposal 5: "Assessment of post-call motor function in Orthopaedic Surgery Residents: A comparison of the night float model and the standard call model"</i>	Dr. L. Morrison (R2) Topic: Medical Education
1444-1447 hrs	<i>Proposal 6: "Evaluation of radiographically persistent fracture lines as they relate to patient outcome: a retrospective radiographic assessment"</i>	Dr. J. Purnell (R4) Topic: Clinical
1447-1452 hrs	Questions	
1452-1458 hrs	<i>Full 4: "Synovial and cartilage responsiveness to peri-operative hyaluronic acid +/- dexamethasone administration following a limited injury to the rabbit stifle joint"</i>	Dr. B. Heard (R2) Topic: Basic Science
1458-1501 hrs	Questions	
1501-1507 hrs	<i>Full 5: "Topical vancomycin for the prevention of periprosthetic joint infection in hip and knee arthroplasty"</i>	Dr. M. Wong (R3) Topic: Clinical
1507-1510 hrs	Questions	
1511-1517 hrs	<i>Full 6: "Infectious brachial plexopathy and septic arthritis of the shoulder due to Lemierre's Syndrome: A case report and literature review"</i>	Dr. L. Morrison (R2) Topic: Clinical
1517-1520 hrs	Questions	
1521-1541 hrs	Keynote Address: "Surgical Leadership"	Dr. Mary Brindle
1542-1548 hrs	<i>Full 7: "Effectiveness of immune checkpoint inhibitors on bone metastases in non-small-cell lung cancer"</i>	Dr. A. Abbott (R3) Topic: Clinical
1548-1551 hrs	Questions	
1552-1558 hrs	<i>Full 8: "Patients with hip fractures treated with arthroplasty demonstrate prolonged hypercoagulability and increased venous thromboembolism risk"</i>	Dr. D. You (R4) Topic: Clinical
1558-1601 hrs	Questions	
1602-1608 hrs	<i>Full 9: "Clinical and functional outcomes of the Birmingham hip resurfacing system - A retrospective cohort study with a minimum ten-year follow-up"</i>	Dr. J. Lukenchuk (R3) Topic: Clinical
1608-1611 hrs	Questions	
1612-1618 hrs	<i>Calgary Orthopaedic Resident Research Group: "Which parameters predict delayed fracture displacement of distal radius fractures resulting in surgical treatment?"</i>	CORR-G (R1-R5) Topic: Medical Education / Clinical
1618-1621 hrs	Questions	
1623-1629 hrs	Awards	Drs. M. Brindle, A. Dodd and P. Schneider
1629-1630 hrs	Closing Remarks and Adjournment	Dr. P. Schneider

Biographies of Adjudicators and Moderator

Guest Adjudicator: Dr. Mary Brindle



Dr. Mary Brindle is a pediatric surgeon and health systems researcher. She is originally from St. Catharines, Ontario. She went to Yale University for her Undergraduate degree in Art, received her MD from Dalhousie University in Halifax, completed her general surgery residency in Vancouver and her pediatric surgery residency in Toronto. She completed an MPH at TH Chan Harvard School of Public Health. She has worked in Calgary for almost 14 years. She is currently the Scientific Director of the Alberta Surgery Strategic Clinical Network and the incoming Director of the Safe Surgery Safe Systems Program at Ariadne Labs, TH Chan Harvard School of Public Health in Boston. Dr. Brindle leads current international work to revisit and revise the WHO Surgical Safety Checklist and advance the rigor and scope of international ERAS guidelines.

Local Orthopaedic Adjudicator: Dr. Andrew Dodd



Dr. Dodd completed his medical school and Orthopaedic surgery residency training at the University of Calgary. He then traveled to Vancouver, British Columbia to complete a fellowship in Orthopaedic trauma surgery at the Vancouver General Hospital. Following that, he moved to Toronto, Ontario to pursue further training with a fellowship in Foot and Ankle Reconstructive surgery. He began his practice at the South Health Campus in Calgary, and subsequently moved to the Foothills Medical Centre. His interests include foot and ankle traumatic injuries and post-traumatic reconstruction. He leads the foot and ankle orthopaedic research group focusing on foot and ankle trauma, post-traumatic deformity, and arthritis.

Moderator: Dr. Prism Schneider



Dr. Prism Schneider is an Associate Professor of Orthopaedic Surgery and Community Health Sciences at the University of Calgary. She also holds the positions of Orthopaedic Trauma Research Lead and Resident and Fellow Research Director for Orthopaedic Surgery. Dr. Schneider spends 50% of her time as a traumatologist at the Foothills Medical Centre and the other 50% of her time is devoted to her research endeavours. She obtained her MD from the University of Calgary, and has completed post-graduate training including a PhD in Biomechanics and two Orthopaedic Trauma Fellowships at the University of Texas and the McGill University. Dr. Schneider's research interests involve understanding the cellular and systemic inflammatory response to injury, including trauma-induced coagulopathy and post-traumatic joint contractures, and using advanced imaging to determine fracture healing time.

Abstract Type: Proposal Abstract **Research Pillar:** Basic Science

Title: In Vivo Cadaveric Analysis of Volar Tilt Correction Using a Kickstand Screw Technique in Volar Plate Fixation for Distal Radius Fractures

Authors: Christopher Hewison, Eva Gusnowski, Spencer Montgomery and David Longino

Background: Distal radius fractures are one of the most common orthopedic injuries. Open reduction and internal fixation is a common procedure for injuries that fail to achieve appropriate closed reduction or subsequently lose reduction over time. Locked volar plating is the most common method of internal fixation. A technique wherein a locking screw is temporarily used as a “kickstand” to assist with volar tilt correction has gained popularity. However, there is no guidance regarding appropriate length or position of the screw in order to achieve a desired correction. Additionally, no studies to date have used human specimens to study the amount of achievable volar tilt correction with this technique.

Our main objective is to generate a reference table for kickstand screw length/position in a commonly used distal radius locking plate (LCP Distal Radius Volar System, DePuy Synthes). This will be verified with an *in vivo* analysis in a cadaveric model to determine the limits of volar tilt correction.

Methods: *Theoretical Volar Tilt Correction:* Digital calipers will be used to measure the length from the angle of inflection to the center point of the proximal locking screw holes. The expected degrees of correction achievable with the various screw lengths in various positions will be calculated.

In Vivo Analysis: Cadaveric specimens will be used to analyze the theoretical versus actual volar tilt correction. A sagittal saw will be used to create an osteotomy to simulate volar tilt. Initial radiographs will be performed. Volar plate fixation will then be performed using a standard modified Henry’s approach. Incremental screws from 6 mm to 16 mm will be locked into the various holes of the plate. Plates will be placed just proximal to the watershed line and subsequently fixed to the distal end segment using distal locking screws. The kickstand screw will then be removed and the plate will be levered down and fixed to the metaphyseal segment. Final radiographs will be taken of each specimen.

Results: N/A

Discussion: N/A

Conclusion: N/A

Acknowledgements: COREF Research Award.

Abstract Type: Proposal Abstract **Research Pillar:** Clinical Research

Title: Biomechanical Evaluation of Optimal Mini-Fragment Dual Plate Configuration for Humerus Diaphyseal Fracture Fixation

Authors: Laurel Collings, Ryan Martin, Robert Korley and Prism Schneider

Background: Single plate constructs currently are the traditional method for internal fixation of mid-diaphyseal humerus fractures. Dual small fragment locking plate constructs have been used as an alternative fixation method for smaller humerus size. Limited biomechanical data exist for comparison between single versus dual plating of mid-diaphyseal humeral fractures. The study aim is to compare single small-fragment plating to multiple dual humeral plate configurations for biomechanical non-inferiority testing and to determine if an optimal plate configuration can be identified, using a cadaveric model.

Methods: Cadaveric humeral shafts will be randomized to one of six groups based on CT scan assessment of Bone Mineral Content (BMC). We will compare six different plating configurations: posterior or anterolateral plating using a single 3.5-mm LC-DC plate with four cortices of fixation above and below the fracture and four different dual-plating constructs (3.5-mm LC-DC plate anterior and one-third tubular plate lateral, 3.5-mm LC-DC plate lateral and one-third tubular plate anterior, 2.7-mm LC-DC plate anterior and 3.5-mm LC-DC plate lateral, and 2.7-mm LC-DC plate lateral and 3.5-mm LC-DC plate anterior). The cadaveric models will be plated with a single plate, then osteotomized to create a straight transverse mid-diaphyseal fracture, followed by any additional plating required. Axial, torsional and bending (anterior-posterior, medial-lateral) stiffness will be determined through non-destructive cyclic testing using the MTS 858 Bionix system. This will be followed by torsional load-to-failure testing. Independent samples t-tests will be used to evaluate differences between stiffness and failure testing of each construct.

Results: This study will be the first to examine the biomechanical differences of multiple single and dual-plate constructs for fixation of mid-diaphyseal humeral fractures in cadaveric models. Given the increasing incidence of operative intervention for mid-diaphyseal humeral fractures, the results of this study will provide further biomechanical evidence to guide operative decision making.

Discussion: N/A

Conclusion: This new information will be used to help guide surgical pre-operative planning and decision-making.

Abstract Type: Proposal Abstract **Research Pillar:** Clinical Research

Title: Distal Fibular Fractures: A Comparison of Outcomes Following Posterolateral Antigliding Fixation to Other Fixation Techniques

Authors: Logan Woods, Daniel You and Prism Schneider

Background: Displaced distal fibular fractures are a common injury, which are often treated surgically by orthopaedic surgeons. Several surgical fixation techniques have been described, including intramedullary fixation, tension band wiring, lag screw fixation with a lateral neutralization plate, locked compression plating, and posterior/posterolateral antiglide plating. In biomechanical studies, antiglide plating has been shown to be superior to lateral plating; however, lateral plating remains the most commonly performed technique. Antiglide plating has been historically criticized for the potential to cause peroneal irritation; however, several clinical studies have found posterior and posterolateral antiglide plating to have equivalent post-operative functional outcome scores and implant removal rates compared to lateral plating. Antiglide plating also has the benefit of decreased patient-reported implant prominence. Currently, there have not been any studies comparing the outcomes of antiglide plating to all other forms of distal fibular fixation.

Methods: We first propose a systematic review of the literature to create a comprehensive summary of the literature regarding antiglide fixation of distal fibula fractures. We will then perform a retrospective observational study using data from Alberta Health Services analytics to identify all adult patients over the age of 18 who sustained a Danis-Weber B type distal fibula fracture over a five year period, treated with surgical fixation. Patients will then be grouped by the type of surgical fixation they received. Within these groups, we will compare rates of reoperation for failure of fixation, infection, wound complication, and symptomatic implants. In addition, we will investigate operative time, and perform a cost analysis of the various fixation techniques.

Hypothesis: Based on early review of the current literature, we hypothesize that posterior and posterolateral antiglide plate fixation of Danis-Weber B distal fibula fractures to be equivalent to other surgical fixation techniques in all outcomes with a lower incidence of reoperation.

Discussion: With this study, we will compare our results to prior studies reporting on the use of posterior and posterolateral antiglide plating of distal fibula fractures. The results of this study will better inform orthopaedic surgeons in their approach to distal fibula fracture fixation and potentially reduce the need for reoperation and the associated costs to the health care system. In addition, we will use results from this study to design a patient questionnaire to identify reasons for implant removal, in order to better predict which patients may require implant removal. Developing an implant removal prediction score may be valuable, not only to surgeons and patients during surgical discussion, but also to other stakeholders including the Workers' Compensation Board and health care policy makers. Lastly, this study will inform the design of a prospective study comparing posterolateral antiglide plate fixation versus other fibular fixation techniques.

Conclusions: Distal fibula fractures are a common injury treated by orthopaedic surgeons. The antiglide technique, though less frequently used, may be equivalent, or by some metrics superior, to other forms of distal fibula fixation. This series of planned studies aim to answer this question.

Abstract Type: Full Abstract **Research Pillar:** Clinical Research

Title: In-situ Surgical Fixation of Slipped Capital Femoral Epiphysis using Simultaneous Biplanar Fluoroscopy

Authors: Christopher Flanagan, Courtney Bull, Lisa Phillips, Marcel Abouassaly, Simon Goldstein, Elaine Joughin, Gerhard Kiefer, David Parsons and Fabio Ferri-de-Barros

Background: The standard of care of slipped capital femoral epiphysis (SCFE) is surgical stabilization with in-situ fixation under fluoroscopic guidance to prevent slip progression. The use of two C-arms allows for simultaneous acquisition of images in two planes without the need to move the extremity or C-arm. Prior studies suggest advantages of using biplanar imaging, including improved accuracy of screw placement and shorter operating times. Our study aims to evaluate the differences in the amount and duration of radiation exposure for one versus two C-arms for in-situ pinning of SCFE.

Methods: A retrospective review was performed to compare uniplanar versus biplanar fluoroscopy in the surgical stabilization of SCFE. All patients were treated with in-situ fixation using a single cannulated screw. Data analysis was performed on 55 hips in 46 skeletally immature patients at our institution between 2006 and 2020. Demographic data, operating room set-up time, total surgical time, fluoroscopic screening time (seconds), and unit area radiation exposure (mGym²) was recorded and compared between techniques.

Results: No significant difference was found in total radiation output between uniplanar and biplanar fluoroscopic techniques. Total fluoroscopic time was significantly less using the biplanar technique, resulting in a significant difference in time adjusted radiation output. No significant difference was found in optimal screw position between the two groups.

Variable	Group 1: Uniplanar (N = 27)	Group 2: Biplanar (N = 28)	P-Value
Radiation Dose (mGy)	15.9	19.7	.228
Radiation Time (s)	116.2	93.1	.031
Mean OR Set-up Time (min)	14.4	22.9	.009
Mean Surgical Time (min)	47.4	45.0	.592
Mean Tip-to-Apex Distance (mm)	9.94	7.34	.004
Mean AP Screw Deviation (mm)	3.27	3.89	.411
Mean Lateral Screw Deviation (mm)	5.69	5.26	.726
Optimal Screw Placement	23 (85.2%)	25 (89.2%)	.656

Discussion: Simultaneous biplanar fluoroscopic technique for in-situ fixation of SCFE results in less intra-operative total fluoroscopic time. The failure to demonstrate a difference in total radiation exposure between uniplanar and biplanar techniques can be reconciled by the fact that the two fluoroscopy units were statistically different from each other in terms of how much radiation they were emitting.

Conclusion: By using a time adjusted analysis, this study suggests that a biplanar fluoroscopic technique using two identical C-arms would result in significantly lower intra-operative total radiation.

Acknowledgements: Alberta Children's Hospital; Fabio Ferri-de-Barros, MD, FRCSC; Lisa Phillips, MD, FRCSC; Marcel Abouassaly, MD, FRCSC; Simon Goldstein, MD, FRCSC; Elaine Joughin, MD, FRCSC; Gerhard Kiefer, MD, FRCSC; David Parsons, MD, FRCSC

Abstract Type: Full Abstract **Research Pillar:** Clinical Research

Title: The Bony Apprehension Test for Identifying Critical and Sub-Critical Bone Loss in Patients with Traumatic Anterior Shoulder Instability

Authors: Michael James, Cory Kwong, Ian Lo, Justin Leblanc and Aaron Bois

Background: The presence of critical bipolar bone loss has important implications when considering surgical management and outcomes of patients with recurrent shoulder instability. The bony apprehension test (BAT) is a physical examination maneuver that has been described for detecting critical bone loss that was designed to improve specificity from the standard apprehension test. The purpose of this study was to compare the BAT to the standard apprehension and relocation tests based on their abilities to predict significant bone loss. We utilized several well-described criteria to capture “significant bone loss” including critical ($\geq 25\%$) and sub-critical ($\geq 13.5\%$) glenoid defects, and Hill-Sachs defects $\geq 19\%$. We also assessed the ability of the BAT to predict significant bipolar bone loss as indicated by “engaging Hill-Sachs defects” and “off-track” lesions. We predicted that the BAT would have higher specificity and positive predictive value in predicting significant bony lesions than the traditional apprehension and relocation tests.

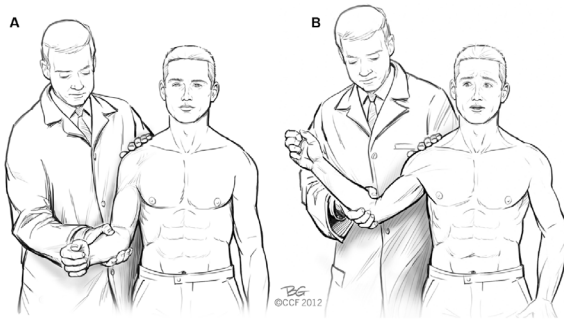


Figure 1: Demonstration of the Bony Apprehension Test

Methods: Our cohort included patients > 18 years of age who were scheduled to undergo arthroscopic stabilization for traumatic anterior shoulder instability. Notable exclusion criteria included multidirectional shoulder instability, connective tissue disorders, and worker’s compensation or litigation cases. Patients underwent physical examination immediately before surgery by the treating surgeon. Critical glenoid and humeral bone defects were measured on preoperative computed tomography scans. Hill-Sachs engagement was assessed arthroscopically and “on or off track” lesions were determined using a previously described glenoid track model.

Results: Fifty-two patients were included in the study. In cases of subcritical glenoid bone loss (i.e., $\geq 13.5\%$) and critical Hill-Sachs defects in the setting of bipolar bone loss (i.e., $\geq 19\%$), the BAT had ‘good’ to ‘fair’ specificity (82% and 72%, respectively), but poor sensitivity. The BAT also had poor sensitivity, specificity and predictive value for higher percentages of glenoid bone loss (i.e., $> 25\%$). When assessing for engaging Hill-Sachs lesions, the BAT had excellent specificity (94%) and positive predictive value (94%), but poor sensitivity and negative predictive value (43% and 44%, respectively). Furthermore, the BAT performed poorly at predicting off-track humeral lesions.

Conclusion: Overall, the BAT performed poorly at identifying subcritical and critical bone loss (i.e., low sensitivity [$\leq 50\%$] and variable specificity). Notably, the BAT seemed to best predict engaging Hill-Sachs lesions. Future work is needed to identify patients with critical bone loss in a non-invasive manner that could eliminate the need for or compliment computed tomography scans for preoperative planning.

Acknowledgements: WCB Grant - \$17,233.25

Abstract Type: Full Abstract **Research Pillar:** Clinical Research

Title: Establishing Normative Relationship of Spinopelvic Alignment to Femoroacetabular Orientation

Authors: Taryn Ludwig, Jonathan Bourget-Murray, Sarup Sridharan, Ariana Frederick, Kelly Johnston, Brent Edwards and Fred Nicholls

Background: Determining the native alignment of the acetabulum in patients with concomitant degenerative hip and spine pathology is challenging. In operative cases, postural changes following one surgery can influence the success of the other, and there is debate as to which procedure should be performed first. Normative data describing the relationship between hip orientation and spinopelvic alignment is not described in the literature. Our goal is to obtain 3D renderings of the spine, pelvis, and hip to evaluate spinopelvic and femoroacetabular parameters in healthy young adults. We hypothesize that native femoroacetabular alignment is predictable and can be determined based on measurement of spinopelvic parameters.

Methods: This is a cross-sectional study of healthy volunteers age 20-39 with no known hip or spine pathology. Full body EOS scans will be used to obtain 3D reconstructions of participants' acetabulum and proximal femur. Pelvic parameters will be measured (acetabular version and inclination, femoral version, and neck shaft angle) and correlated to spinopelvic parameters (pelvic incidence, pelvic tilt, sacral slope, lumbar lordosis, lumbopelvic morphotype). A total of 450 patients have been imaged, and image processing is ongoing. Preliminary data for a subset of patients are presented here, along with descriptive statistics. Further analysis will include a predictive model of femoroacetabular alignment based on spinopelvic measurements.

Results: Three hundred seventy-two participants are included for this abstract. Average age is 28.3 ± 5.1 years, 58% are female, average BMI 24.9 ± 4.3 . Average spinopelvic and femoroacetabular parameters are presented in the table below.

Parameter	Average (°)	Standard deviation (°)
Pelvic incidence	47.9	11.6
Sacral slope	38.9	8.6
Pelvic tilt	9.0	7.6
Lumbar Lordosis	-53.7	11.2
Acetabular Version	14.5	4.2
Acetabular inclination	55.7	3.4
Femoral version	15.0	9.3
Femoral neck-shaft angle	129.3	4.5

Conclusion: By correlating normative hip, pelvis and spine alignment, orthopaedic surgeons will be able to more accurately position hip implants in patients also awaiting spinal arthrodesis, decreasing the need for revision and improving overall patient outcomes.

Acknowledgements: Thanks to Victoria Smith, PhD, University of Calgary Spine Program Research Coordinator for assistance with data acquisition and organization; COREF Research Award.

Abstract Type: Proposal Abstract **Research Pillar:** Clinical Research

Title: Classification of Heterotopic Ossification about the Elbow

Authors: Brent Benavides, Dave Cornell, Kevin Hildebrand, Richard Walker and Prism Schneider

Background: Heterotopic ossification (HO) is a well-known complication of injury to the elbow. Rates of HO from simple elbow dislocation approach 3%, while fracture dislocation patterns are associated with up to 90% incidence of HO formation. This can lead to ongoing pain and functional deficits long after a fracture or injury. It has been previously demonstrated that for activities of daily living, a range of motion (ROM) arc of 130 degrees is needed; HO has the potential to severely restrict elbow ROM, and therefore one's overall function and ability to be a productive member of society. The Hastings and Graham classification published in 1994 describes only the functional limitation associated with HO formation. It does not describe location, size, or maturity of the lesion. To our knowledge, this classification system has never been validated or used to describe a large cohort of patients. The goal of our study is to use an existing large database of post injury elbow x-rays coupled with patient reported outcomes and ROM values to validate the existing classification and potentially develop a novel or modified classification system to better characterize elbow HO.

Methods: Retrospective review of an image database by 4 independent reviewers

Results: Awaiting final data collection and data analysis.

Discussion: The Hastings and Graham classification was based on expert opinion and observations. Our study is the first to evaluate elbow HO in a large cohort of patients with radiographic follow up for up to 24 months post elbow injury. Our study will seek to validate the Hastings and Graham classification by having multiple reviewers analyze our cohort of patients at multiple time points.

Conclusion: Final conclusions pending data review and analysis. Aim to validate the existing Hastings and Graham elbow HO classification and potentially develop a novel classification system based on anatomic location and maturity.

Acknowledgements: COREF Research Award.

Abstract Type: Proposal Abstract **Research Pillar:** Clinical Research

Title: Assessment of Post-Call Motor Function in Orthopaedic Surgery Residents: A Comparison of the Night Float Model and the Standard Call Model

Authors: Laura Morrison¹, Faizal Kassam², Steve Scott², Sean Dukelow¹, Fred Nicholls¹ and Prism Schneider¹

¹ University of Calgary | ² Queen's University

Background: Sleep deprivation (SD) can negatively affect cognitive reasoning, complex decision-making, and motor function – all of which are necessary skills for surgical residents. The available literature has yet to outline the best strategy for mitigating the negative effects of SD in resident trainees. One approach to attempt to minimize call-effects, is the introduction of a night float model (NFM), in place of the standard call model (SCM). The implications of the NFM on physical measures of motor function are unknown.

The WHOOP (WHOOP) sleep tracker is a validated, wearable device that uses photoplethysmology to quantify and analyze sleep patterns. The Kinesiological Instrument for Normal and Altered Reaching Movements (KINARM) is a robotic tool that has been used to measure disturbances in sensory, motor, and cognitive domains in patients with neurological dysfunction. While the KINARM test captures gross motor function, the Purdue Pegboard Test (PPBT) is a validated tool to assess fine motor skills such as finger and hand dexterity. These physical domains are applicable to surgical performance and could be valuable as surrogate measures of operating room readiness following overnight call on the trauma service. Therefore, this study will use both robotic assessment and wearable technology to examine the difference in post-call motor functioning in orthopaedic residents working in a SCM or an NFM.

Methods: This is a prospective cohort study involving orthopaedic surgery residents from the University of Calgary (using the SCM) and Queen's University (using the NFM). Residents will wear a portable sleep-tracking device for 14 days. On days 1-7, baseline data will be recorded and on days 8-14 intervention data will be recorded. Each group of residents will undergo five rounds of testing including the KSTs and Purdue Peg Board Test in the study period. Subgroup analyses will aim to determine if differences exist between call models with respect to baseline characteristics, sleep quality and quantity, and KST scores.

Results: N/A

Discussion: N/A

Conclusion: The KINARM robot has been used clinically to assess disturbances of motor control in patients with stroke, traumatic brain injuries, and neurodegenerative diseases; however, the application of its use in post-call surgical residents is novel. The new knowledge generated from this study will help to inform the discussion regarding fatigue management tactics in orthopaedic surgery training programs, and may elucidate the implications of using a night float model as a proposed strategy for minimizing the negative effects of call-related fatigue.

Acknowledgements: COREF Research Award



Figure: KINARM robot assessment set-up

Abstract Type: Proposal Abstract **Research Pillar:** Clinical Research

Title: Evaluation of Radiographically Persistent Fracture Lines as They Relate to Patient Outcome: A Retrospective Radiographic Assessment

Authors: Jennifer Purnell, Kevin Hildebrand, Prism Schneider, Richard Walker and Dave Cornell

Background: To date, there is a paucity of literature around persistent fracture lines about the elbow in trauma patients and how these persistent radiographic lucencies correlate to patient clinical outcome in such a way that helps guide patient management. Additionally, we do not know how reliable we are at determining radiographic union of fractures about the elbow. Our primary aim is to evaluate inter-rater agreement of 'persistent fracture lines' around the elbow. Secondly, we aim to correlate radiographically persistent fracture lines with ROM and patient reported outcome measures using the quickDASH.

Methods: This is a retrospective radiographic review of a large prospective cohort of elbow fractures. The staff orthopedic surgeon, one staff radiologist, one orthopedic resident, and one radiology resident will independently evaluate the 2, 6, 12, 26, and 52 week post-injury radiographs of 133 de-identified patients with fractures or fracture-dislocations about the elbow. Each of the four evaluators assess the radiographs at random. Each patient has completed serial reported outcome measure questionnaires and these will be assessed in conjunction with their radiographs.

Results: Results are currently in the process of being obtained. We hypothesize that inter-observer reliability will be poor. We also believe that persistent fracture lines on post-operative radiographs will correlate with poorer patient reported outcomes and range of motion (ROM).

Discussion: This is a novel study that, to our knowledge, there is no previously published literature assessing the ability of surgeons to reliably assess elbow fracture unions radiographically, let alone how persistent fracture lines correlate to clinical patient outcomes. Additionally, this study will provide valuable knowledge about the ability of a surgeon to reliably assess elbow fracture radiographs and this information may stem further development of elbow radiographic assessment tools.

Conclusion: We are awaiting the finalized results of this study. This study stands to provide trauma surgeons with the ability to tailor elbow fracture management in a way that is individualized to the patient and their specific healing pattern as assessed radiographically.

Acknowledgements: Funding via COREF Research Award (2019)

Abstract Type: Full Abstract **Research Pillar:** Basic Science

Title: Synovial and Cartilage Responsiveness to Peri-Operative Hyaluronic Acid +/- Dexamethasone Administration Following a Limited Injury to the Rabbit Stifle Joint

Authors: Bryan Heard, Kristen Barton, Saleem Abubacker, May Chung, Ryan Martin, Tannin Schmidt, Nigel Shrive and David Hart

Background: Post-traumatic osteoarthritis (PTOA) can develop after an injury to the knee. Previous studies have suggested that an intra-articular (IA) injection of the potent glucocorticoid dexamethasone (DEX) administered at the time of surgical injury may significantly prevent induction of PTOA. The aim of the present study was to investigate the effectiveness of a single IA injection of hyaluronic acid (HA), alone and in combination with DEX following a localized intra-articular injury as a PTOA-preventing treatment option.

Methods: An established rabbit model of surgical injury consisting of dual intra-articular (IA) drill holes in a non-cartilaginous area of the femoral notch near the origin of the anterior cruciate ligament (ACL) to allow for bleeding into the joint space was used. Immediately following surgery, subjects were treated with HA, HA+DEX, or received no treatment. An uninjured control group was used for comparison (N=5/group). Rabbits were sacrificed and investigated at 9 weeks post-injury.

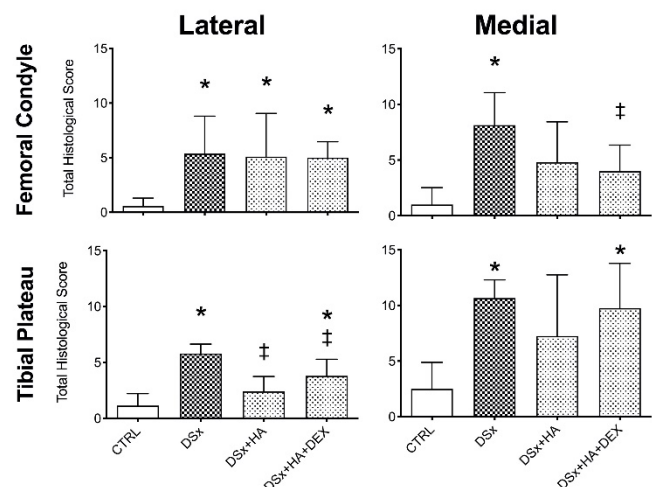
Results: At 9 weeks post-injury, there was a significant protective capacity of the single IA treatment of DEX + HA on the histological grade of the synovial tissue, and some variable location-specific effects of HA alone and HA + DEX interactions on cartilage damage. Thus, it is possible that co-treatment with HA may interfere with the effectiveness of the DEX. In vitro friction testing indicated that DEX did not interfere with the lubricating ability of HA or synovial fluid on cartilage.

Discussion: Previous studies in this model have shown that DEX alone is sufficient to protect cartilage from the onset of PTOA. However, the results presented in this study indicate that the effective inhibition of changes to the synovium after an injury by HA + DEX does not translate into a consistent positive effect on preventing development of PTOA. This conclusion was based on the variable effectiveness of HA + DEX in some cartilage locations. Therefore, these results suggest that suppression of synovial responses to injury are not sufficient to prevent development of PTOA in this model.

Conclusion: These results suggest that a single IA administration of HA in combination with DEX following an IA injury is not recommended for inhibition of PTOA progression in this model.

Acknowledgements: The authors would like to acknowledge Dr. Cy Frank for his input and direction during the early days of this project. The authors would also like to acknowledge the efforts of Trish Lindsey for her technical help through the duration of this study. Funding from by the Canadian Arthritis Network, the Osteoarthritis Team Grant – through Alberta Innovates Health Solutions and the Strategic Clinical Networks Program.

Figure 1: Histological grading of articular cartilage
 CTRL = Control; DSx = drill surgery no treatment;
 HA = Hyaluronic Acid; DEX = Dexamethasone.
 * = Significantly different from CTRL ($p \leq 0.05$)
 ‡ = Significantly different from DSx ($p \leq 0.05$)



Abstract Type: Full Abstract **Research Pillar:** Clinical Research

Title: Topical Vancomycin for the Prevention of Periprosthetic Joint Infection in Hip and Knee Arthroplasty

Authors: Murray Wong, Sarup Sridharan, Erin Davison, Richard Ng and Nicholas Desy

Background: Total hip and knee arthroplasty (THA and TKA) are the third and second most performed inpatient surgeries, respectively, with a lifetime risk greater than 11% in the general population. Unfortunately, periprosthetic joint infection (PJI) occurs in 0.2-2% of primary hip and knee arthroplasty and is a leading cause of revision surgery, impaired function, and increased morbidity and mortality. Topical, intrawound vancomycin administration is a simple and promising treatment to prevent infection following hip and knee arthroplasty that allows for high local drug concentrations at the surgical site. It has demonstrated good results in prevention of surgical site infection after spinal surgery. However, concerns including increased non-infectious complications and antibiotic resistance remain. We sought to answer: (1) Does topical vancomycin reduce the rate of PJI in hip and knee arthroplasty? (2) Does topical vancomycin lead to increased complications in hip and knee arthroplasty?

Methods: A search of Embase, MEDLINE, and PubMed databases as of June 2020 was performed according to PRISMA guidelines. Studies comparing topical vancomycin to standard care in primary hip and knee arthroplasty with a minimum of three months follow-up were identified. Study quality was assessed using the Newcastle Ottawa scale. Rates of PJI and overall complication rates were analyzed. The results from applicable studies were meta-analyzed to determine the impact of topical vancomycin on PJI rates as well as wound-related and overall complications. Results were expressed as odds ratios (ORs) and 95% confidence intervals.

Results: We screened 2408 studies, resulting in nine eligible studies reviewing 3371 patients with topical vancomycin administration and 2884 patients without. Existing evidence is observational and predominantly retrospective. Only one of nine studies found a significantly lower rate of PJI after primary THA or TKA (OR 0.09-1.97), though meta-analysis showed a significant reduction in PJI with vancomycin (OR 0.47, p=0.02, Figure 1). In seven studies which reported complication rates other than PJI, there were no significant differences in overall complication rates with vancomycin administration (OR 0.48-290.94), nor was there any significant difference in meta-analysis (OR 0.97, p=0.45).

Discussion: PJI is a devastating and difficult to treat complication after THA and TKA. Topical vancomycin powder has theoretical potential to reduce the rate of PJI but may also lead to serious side-effects and harm. Existing studies consist of low levels of evidence and have methodological flaws, and thus meta-analysis should be interpreted with caution. The single positive study was low-quality and retrospective. Individual studies were also underpowered to detect differences in overall medical or wound related complications and varied in complication reporting. Theoretical concerns of nephrotoxicity, ototoxicity, anaphylactic reactions, development of vancomycin resistant organisms, or increased component wear have been raised with topical vancomycin, warranting appropriate study prior to widespread adoption of the practice.

Conclusion: The limited evidence summarized here indicates topical vancomycin may be a promising modality to decrease PJI in primary THA and TKA, but there is insufficient evidence thus far to conclusively show a decrease in PJI or to demonstrate safety. High quality, prospective studies with adequate power are required before definitive treatment recommendations can be made.

Acknowledgements: No funding was received for this study.

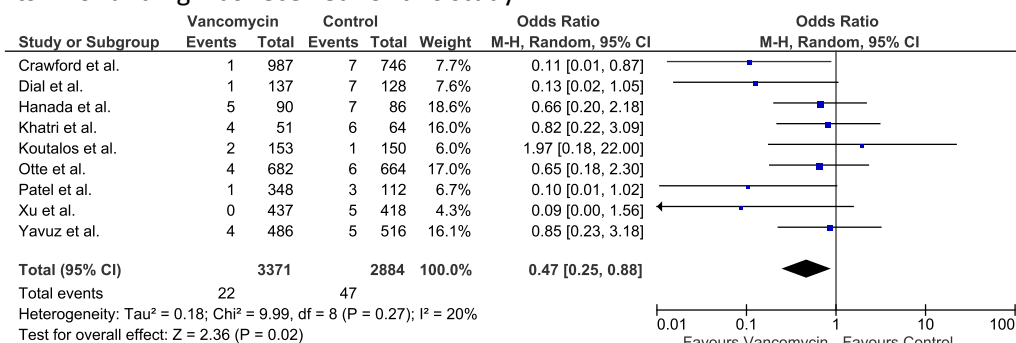


Figure 1: Forest plot of PJI rates after primary THA and TKA.

Abstract Type: Full Abstract **Research Pillar:** Clinical Research

Title: Infectious Brachial Plexopathy and Septic Arthritis of the Shoulder due to Lemierre's Syndrome: A Case Report and Literature Review

Authors: Laura Morrison, Eva Gusnowski and Aaron Bois

Background & Case Report: Lemierre's syndrome is a well-established disease making a modern resurgence. The classical definition of Lemierre's syndrome includes thrombophlebitis of the internal jugular (IJ) vein, secondary to a primary nasopharyngeal infection, followed by septic metastases to distant sites. Musculoskeletal metastases are present in up to 27% of Lemierre's cases making its recognition an important aspect of care. We present a 20-year-old female with Lemierre's syndrome, an infectious brachial plexopathy and missed septic shoulder arthritis. She subsequently presented with advanced post-infectious glenohumeral joint arthritis. In an attempt to improve the patient's shoulder pain and function, an arthroscopic irrigation and debridement and capsular release was performed. At the final twelve-month follow-up, substantial shoulder pain and dysfunction persisted.

Methods: A systematic review of the literature was performed following the Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines to identify cases of Lemierre's syndrome with upper extremity septic metastases. Full-text studies were included if Lemierre's syndrome was clearly documented with evidence of (1) an IJ thrombus and/or bacteremia, (2) an oropharyngeal/nasopharyngeal infectious source, and (3) upper extremity septic metastasis. The "upper extremity" was defined as any structure extending between the sternoclavicular (SC) joint and the hand.

Results: A total of 1,337 studies were screened and 16 articles (17 patients) met final inclusion/exclusion criteria. Of the 24 distal metastases documented, the most common site included joints (n=9, 37.5%), followed by soft-tissue(s) (n=7, 29.1%) and bone (n=6, 25%). Skin was the least common metastatic site (n=2, 8.3%, Fig. 8). Multiple diagnostic tests (total of 28) were used to evaluate the metastatic site; culture from fluid aspirate or biopsy was the most common (n=9, 32.1%) and WBC scan (n=2, 7.1%) the least commonly performed diagnostic test. *Fusobacterium necrophorum* was the most commonly associated bacteria (n=13, 76.5%), followed by the *Streptococcus* species (n=2, 11.8%), Methicillin-resistant *Staphylococcus aureus* (n=1, 5.9%), and a gram-negative bacillus not further specified (n=1, 5.9%). Interventions included surgical debridement (n=10, 58.8%), medical management only (n=5, 29.4%) and image-guided abscess drainage (n=2, 11.8%). Most of the 17 patients had positive outcomes, with 12 'full' recoveries (70.6%), 3 'partial' recoveries (17.6%) and 1 death (5.9%). One study did not report patient outcome.

Discussion: Bone and joint involvement occur in 8% to 27% of confirmed Lemierre's cases. Our reported case and literature review suggest that most upper extremity septic metastases involve the glenohumeral joint (4 of 17 cases, 23.5%). However, referred pain to the upper extremity from the IJ vein thrombosis or intrathoracic involvement can make diagnosis and recognition of upper extremity metastases difficult.

In our review, plain radiographs were of little diagnostic utility. Eventually, advanced imaging studies or laboratory interventions were frequently obtained which often led to a diagnosis and prompted intervention, suggesting that earlier use of advanced diagnostic techniques may be beneficial for early recognition and treatment of such infections. Furthermore, in early case reports (1994 or earlier) medical management was the sole treatment (4 of 5 cases, 80%). A strong trend towards surgical/procedural intervention was established in the years to follow (12 of 12 cases, 100%); however, the long-term effects of surgical intervention are difficult to discern given the variability in reporting of patient outcomes.

Conclusion: Lemierre's syndrome is a potentially lethal complication of pharyngeal and otolaryngeal infections and may not be as uncommon as previously thought. Successful management requires an awareness of the condition and a multidisciplinary approach. Patients with orthopaedic complaints require a thorough assessment to rule out musculoskeletal involvement. This will aid in the rapid identification of patients that may require surgical intervention to prevent severe sequelae of missed metastatic sites of infection.

Abstract Type: Full Abstract **Research Pillar:** Clinical Research

Title: Effectiveness of Immune Checkpoint Inhibitors on Bone Metastases in Non-small-cell Lung Cancer

Authors: Annalise Abbott, Daniel Meyers, Don Morris, Winson Cheung, Shannon Puloski and Michael Monument

Background: Immune checkpoint inhibitors (ICI) are revolutionizing cancer care and becoming standard first line therapy for patients with metastatic non-small-cell lung cancer (NSCLC). The presence of metastatic bone disease (MBD) is common in patients with advanced NSCLC and remains a poor prognostic factor. Patients who have radiological response to ICI demonstrate unprecedented and durable survival improvements yet, there is no data detailing how bone lesions respond to this line of therapy as bone lesions are often considered unmeasurable by the Response Evaluation Criteria in Solid Tumours (RECIST). Additionally, it is unclear how these novel treatments should influence surgical decisions for patients with MBD. The aim of this study was to compare the imaging-based therapeutic response of metastatic bone lesions against visceral lesions in patients with NSCLC treated with ICI.

Methods: We have conducted a retrospective cohort study of patients with NSCLC treated with ICI in Alberta. Patients were identified using the Alberta Cancer Registry and the Alberta Pharmaceutical Information Network from January 2015 to January 2020. The search identified 713 patients with metastatic NSCLC treated with ICI for potential inclusion. The primary endpoint was the response rate to ICI in bone versus visceral organs measured with serial CT scans or PET scans. RECIST version 1.1 was used to assess visceral lesions and the MD Anderson Criteria (MDA) was used to assess bone lesions. Secondary outcomes included the progression free survival (PFS) and overall survival (OS) amongst patients with and without MBD.

Results: A total of 573 patients met the inclusion criteria and were included in analysis. ICI was prescribed as first line therapy in 282 patients (49.6%). All 573 patients had visceral metastases and 240 patients (41.9%) also had bone metastases. The rate of skeletal related events was 38.7% (95%CI: 32.5-45) and 28 patients (4.9%) underwent orthopaedic surgery for MBD. Median OS was 7.3 months (95%CI: 6.4-8.4) and median PFS was 4.8 months (95%CI: 4.0-5.5). The response rate of bone metastases was 21.69% (95%CI: 16.0-28.3%), significantly lower than the response rate of visceral metastases (31.4%, 95%CI 27.2-36.0, [p=0.01]). Patients with MBD had a significantly shorter OS than patients without (5.8 months, 95%CI 4.5-6.5 versus 10.0 months, 95%CI: 7.5-13.4 [p<0.001]) and a significantly shorter PFS (2.5 months, 95%CI 2.0-3.1 versus 4.4 months, 95%CI: 3.0-5.9 [p<0.001]).

Discussion: This is the first study to evaluate the response of metastatic bone lesions to immunotherapies. Bone lesions had a significantly lower response rate to ICI and patients with MBD had significantly worse clinical outcomes. Operative and non-operative decision making requires a comprehensive understanding of anticipated bone healing responses to systemic cancer therapies. Bone lesions that are unlikely to heal can be strategically treated with radiation or surgical stabilization to prevent progressive immobility, pain crises, acute fractures and interruptions in systemic therapy schedules. As the indications for ICI continue to increase, understanding how these new therapies affect metastatic bone lesions is of critical importance to the multi-disciplinary care and surgical decision-making of these patients.

Conclusion: MBD is a significant source of patient morbidity, and as many of these patients require surgery or radiation, it is imperative to understand how metastatic bone lesions respond to ICI. Such information will improve the understanding of the biology of bone metastases treated with immunotherapies for both surgeons and oncologists and will reform modern operative and non-operative decision-making for these patients.

Abstract Type: Full Abstract **Research Pillar:** Clinical Research

Title: Patients with Hip Fractures Treated with Arthroplasty Demonstrate Prolonged Hypercoagulability and Increased Venous Thromboembolism Risk

Authors: Daniel You, Robert Korley, Richard Buckley, Paul Duffy, Ryan Martin, Andrea Soo and Prism Schneider

Background: The venous thromboembolism (VTE) risk after hip fracture surgery (HFS) is among the highest for all procedures. Recent clinical studies have demonstrated an increased VTE rate following surgical treatment of hip fractures with arthroplasty compared to surgical fixation. Thrombelastography (TEG) is a whole-blood viscoelastic assay capable of providing real-time hemostasis analysis. An elevated TEG maximal amplitude (MA) value >65 (measure of maximal clot strength) is indicative of a hypercoagulable state. This study's objective was to perform serial TEG analysis in patients with hip fracture, in order to: i) compare hypercoagulability between patients treated with arthroplasty compared to fixation and; ii) to determine the duration of post-operative hypercoagulability.

Methods: Consecutive patients >50 years of age with a hip fracture amenable to surgical treatment (AO 31A1-3 & 31B1-3) were recruited at a Level 1 trauma centre. Whole blood was collected every 24-hours from admission until 5-days post-operatively, and in follow-up at 2-, 4-, and 6-weeks for TEG analysis. All patients received 28 days of pharmacological thromboprophylaxis. Results were summarized using descriptive statistics. Logistic regression analysis was performed using the presence or absence of MA >65 for patient and surgical factors associated with hypercoagulability.

Results: In total, 121 patients (81 female) with a median age of 81 (IQR 71-87) were included. Sixty-four patients had intertrochanteric fractures (AO 31A) and 57 patients had femoral neck fractures (AO 31B). Patients treated with arthroplasty were significantly more hypercoagulable on post-operative day (POD) 3 (OR = 7.08, 95% CI = 2.00-34.09; $p = 0.005$), at two weeks post-operative (OR = 2.84, 95% CI = 1.10-7.68, $p = 0.034$), and at six weeks post-operative (OR = 5.14, 95% CI = 1.73-17.16) compared to patients treated with surgical fixation. All three patients (2.5%) who developed symptomatic VTE following hip fracture were treated with arthroplasty procedures. At 6-weeks, the majority of patients remained above the MA>65 hypercoagulable threshold (mean MA=65.9 SD=4.0 $p<0.04$).

Discussion: This study demonstrates for the first time that patients with hip fracture treated with arthroplasty were significantly more hypercoagulable post-operatively (based on MA >65) than patients treated with surgical fixation. The increased VTE risk may be associated with more invasive surgical approaches and leg manipulation during arthroplasty, leading to increased activation of the coagulation cascade. Additionally, blood flow has been shown to be reduced in the operated leg following arthroplasty up to 6-weeks post-operatively coinciding with our findings.

Conclusion: Risk stratification with TEG and TEG-guided thromboprophylaxis regimens may reduce VTE risk in patients with hip fracture requiring arthroplasty and with prolonged hypercoagulability.

Acknowledgements: COREF Research Award.

Abstract Type: Full Abstract **Research Pillar:** Clinical Research

Title: Clinical and Functional Outcomes of the Birmingham Hip Resurfacing System - A Retrospective Cohort Study with a Minimum Ten-year Follow-up

Authors: Jayd Lukenchuk, Jonathan Bourget-Murray, Scott Watt Kearns, Sophie Piroozfar, Kelly Johnston and Jason Werle

Background: The focus of this study was the survivorship, functional, and clinical outcomes at a minimum of ten years of 243 consecutive Birmingham hip resurfacing arthroplasties in 211 patients. All procedures were performed by a single non-designer surgeon between 2003 and 2009. All patients were followed-up clinically and radiologically in June 2019.

Methods: This is a retrospective cohort study of patients who underwent Birmingham Hip Resurfacing for osteoarthritis of hip between 2003 and 2009 with a minimum 10-year follow-up. Revision surgery was considered the end point of survivorship and was analyzed using the Kaplan-Meier method. Hip range of motion (hip flexion, abduction, and internal rotation) and patient reported outcome measures were prospectively captured. These included the Harris Hip Score (HHS), the University of California, Los Angeles (UCLA), and a 10-point visual analog scale (VAS).

Results: The results are based on 211 patients (243 hips) who received a Birmingham hip resurfacing for osteoarthritis of the hip. In terms of gender, survivorship in males was 97.1% while in females it was 92.5%. Of this original cohort, 107 patients (127 hips) were available for long-term clinical follow-up. We report prospectively collected functional and clinical outcomes of 24 females and 83 males (127 hips) with a mean follow-up of 12.4 ± 1.4 years. Comparing pre- and post-operative function, the mean difference in hip flexion was 29.6° ($p < 0.001$), the mean difference in internal rotation was 11.5° ($p < 0.001$), and the mean difference in abduction was 11.4° ($p < 0.001$). Upon final follow-up, the mean Harris Hip Score was 93.93 in males and 93.59 in females ($p = 0.2711$); mean University of Los Angeles Activity Score was 8.20 for males and 7.22 in females ($p < 0.001$), and mean Visual Analog Scale was 81.9 for males and 81.3 for females ($p = 0.3541$).

Discussion: The results of this study agree with previous studies reporting an implant survivorship of approximately 96% beyond 10-years. Our results corroborate the long-term efficacy of Birmingham hip resurfacing in young male patients with osteoarthritis, by demonstrating good implant survival, improvements in patient reported outcomes, and sustained improvements in functional range of motion.

Conclusion: This study confirms that hip resurfacing using the BHR system provides good to excellent functional outcome, including ROM, and durability for active men, at a mean follow-up of twelve years. Our experience with resurfacing in women confirms that outcomes are inferior to men. BHR continues to be a valid procedure as an alternative to total hip arthroplasty within the younger, more active population who have an underlying diagnosis of osteoarthritis.

Abstract Type: Full Abstract **Research Pillar:** Clinical Research

Title: Which Parameters Predict Delayed Fracture Displacement of Distal Radius Fractures Resulting in Surgical Treatment?

Authors: Calgary Orthopaedic Resident Research Group (CORRG), Kim Rondeau and Prism Schneider

Background: Distal radius fractures (DRFs) are common injuries which represent 17% of all adult upper extremity fractures. Some fractures deemed appropriate for nonsurgical management following closed reduction and casting exhibit delayed secondary displacement (greater than two weeks from injury) and require late surgical intervention. This can lead to delayed rehabilitation and suboptimal functional outcomes. This retrospective study aimed to determine demographic and radiographic features which can reliably predict delayed fracture displacement following closed reduction and casting of distal radius fractures.

Methods: This is a multicentre retrospective case-control study using radiographs extracted from the Analytics Data Integration, Measurement and Reporting (DIMR) database, using diagnostic and therapeutic codes. Skeletally mature patients aged 18 years of age or older with an isolated DRF treated with surgical intervention between two and four weeks from initial injury, with two or more follow-up visits prior to surgical intervention, were included. Exclusion criteria were polytrauma patients with multiple musculoskeletal injuries, surgical treatment with fewer than two clinical assessments by an orthopaedic surgeon prior to surgical treatment, or surgical treatment within two weeks of injury. The proportion of patients with delayed fracture displacement requiring surgical treatment will be reported as a percentage of all identified DRFs within the study period. A multivariable conditional logistic regression analysis will be used to assess case-control comparisons, in order to determine the parameters that are mostly likely to predict delayed fracture displacement leading to surgical treatment. Intra- and inter-rater reliability for each radiographic parameter will also be calculated.

Results: A total of 210 case-controlled pairs were identified, with 81.0% being female and a mean age of 50.2 (standard deviation = 14.1) years. Variables assessed in the model included pre-reduction and post-reduction radial height, radial inclination, radial tilt on the lateral x-ray, volar cortical displacement, injury classification, intra-articular step or gap, ulnar variance, radiocarpal alignment, and cast index. We will report the significant predictors of delayed fracture displacement beyond a minimum of 2-week follow-up.

Discussion: Cast immobilization is not without risks and delayed surgical treatment can result in delayed rehabilitation and recovery. Therefore, if reliable and reproducible pre-reduction and immediate post-reduction parameters can be identified that predict delayed fracture displacement, this information will aid in counseling patients with distal radius fractures, and may lead to earlier surgical intervention, when indicated.

Conclusion: Early reliable prediction of factors which lead to delayed fracture displacement following closed reduction of distal radius fracture will aid in treatment discussion between surgeons and patients to optimize patient outcomes.

Acknowledgements: COREF Research Award.