

Calgary Orthopaedics 10th Annual Resident Research Day



University of Calgary

Thursday, May 11, 2023

0700 – 1800 hours

Please see Program for specific location of events



Adjudicators:

Dr. Robert O’Toole, University of Maryland School of Medicine, Baltimore

Dr. Braedon McDonald, University of Calgary, Calgary

Dr. Paul Duffy, University of Calgary, Calgary

Moderator: Dr. Prism Schneider, University of Calgary, Calgary

Residents:

R5s	R4s	R3s	R2s	R1s
Dr. Brent Benavides	Dr. Annalise Abbott	Dr. Laurel Collings	Dr. Manjot Birk	Dr. Stephanie Gibbon
Dr. Jayd Lukenchuk	Dr. Topher Flanagan	Dr. Erin Davison	Dr. Anna-Lee Policicchio	Dr. Timothy Lasswell
Dr. Murray Wong	Dr. Bryan Heard	Dr. Jarrett Moore	Dr. Brodie Ritchie	Dr. Michael Leslie
Dr. Daniel You	Dr. Chris Hewison	Dr. Laura Morrison	Dr. Gareth Ryan	Dr. Kaja Matovinovic
	Dr. Taryn Ludwig	Dr. Julian Rizos	Dr. Ethan Sanders	Dr. Meredith Stadnyk
		Dr. Logan Woods		

PROGRAM:

Time	Description / Location	Individuals
ACADEMIC SESSION		
0645-0800 hrs	Meet at Hotel Lobby at 0645 hrs Breakfast at Red’s Diner – Kensington (286 10 Street NW, Calgary)	Dr. P. Schneider Dr. R. O’Toole
0800-0825 hrs	Travel from Restaurant to Cumming School of Medicine	Dr. P. Schneider Dr. R. O’Toole
0825-0930 hrs	Tour of McCaig Institute for Bone and Joint Health ➤ Injury, Inflammation and Coagulopathy Lab (Dr. P. Schneider) 0830-0900 hrs ➤ Bone Lab (Mr. J. Tse) 0900-0915 hrs ➤ Biomechanics Lab (Dr. I Haider) 0915-0930 hrs	Dr. R. O’Toole Dr. P. Schneider Mr. J. Tse Dr. I. Haider
0930-0945 hrs	Group Photo by Hippocrates Statue	All Orthopaedic Residents Dr. R. O’Toole Dr. P. Schneider Dr. P. Duffy
0950-1115 hrs	Case Presentations – Dean’s Conference Room 7D19 CWPHB (formerly TRW building)	All Orthopaedic Residents Dr. R. O’Toole Dr. P. Schneider Dr. P. Duffy
1115-1215 hrs	Lunch – Dean’s Conference Room 7D19 CWPHB (formerly TRW building)	All Orthopaedic Residents Dr. R. O’Toole Dr. P. Schneider Dr. P. Duffy
1215-1230 hrs	Short Break and congregate in the Coombs Lecture Theatre, FMC	

SCIENTIFIC SESSION – PRESENTATIONS – COOMBS LECTURE THEATRE, FMC

Scientific Session is open to Adjudicators, Orthopaedic Residents, Faculty, Staff, Research Coordinators, the McCaig Institute, ABJIH, and Others

Types of Resident Presentations (total of twenty-one presentations)

Full Podium: 6 minutes for presentation/3 minutes Q&A/1 minute transition time (purple shading)

Abbreviated Podium: 3 minutes for presentation (maximum of 6 slides)/1 minute transition time/there will be three presented in a row followed by 5 minutes Q&A (orange shading)

3MT Presentations: 3 minutes for presentation (maximum of 1 slide)/1 minutes transition time/there will be three presented in a row followed by 5 minutes Q&A (blue shading)

1230-1235 hrs	Opening Remarks and Welcome		Dr. Prism Schneider
	Type	Title	Presenter
1235-1245 hrs	Full Abstract	The Association Between Plasma Leptin and Diaphyseal Femur Fracture Healing: A Pilot Study <i>Presentation Number: 2023-FP1</i>	Dr. Gareth Ryan
1245-1255 hrs	Full Abstract	Biomechanical Evaluation of Optimal Dual vs Single Plate Configuration for Humeral Diaphyseal Fracture Fixation <i>Presentation Number: 2023-FP2</i>	Dr. Laurel Collings
1255-1305 hrs	Full Abstract	Elective Surgical Management is a Cost-effective Treatment Pathway for Patients with Metastatic Bone Disease of the Femur <i>Presentation Number: 2023-FP3</i>	Dr. Annalise Abbott
1305-1309 hrs	Proposal Abstract	The Role of Thrombelastography in the Pediatric Trauma Patient: A Prospective Pilot Study <i>Presentation Number: 2023-3MT1</i>	Dr. Stephanie Gibbon
1309-1313 hrs	Proposal Abstract Gait	The “Bad Acting” Tibial Plateau Fracture: Relative Conversion Rate to Total Knee Arthroplasty of Fracture Dislocation Variants <i>Presentation Number: 2023-3MT2</i>	Dr. Meredith Stadnyk
1313-1317 hrs	Proposal Abstract	SPINE TRAC Study - Surveillance of a Population to Monitor the Incidence of New Deformity: Effects of Time and Recreation on Alignment in Calgary <i>Presentation Number: 2023-3MT3</i>	Dr. Taryn Ludwig
1317-1322 hrs	Q&A for Session One of 3MT Presentations		
1322-1342 hrs	Local Internal Adjudicator Presentation: “Dear Future, I’m Ready....”		Dr. Paul Duffy
1342-1352 hrs	Full Abstract	Defining Imminent Risk Using FRAX Score Multipliers for Patients with Recent Non-hip Fragility Fractures <i>Presentation Number: 2023-FP4</i>	Dr. Kaja Matovinovic
1352-1402 hrs	Full Abstract	Distal Radius Fracture Healing: A 12-month Follow-up Using HR-pQCT and Finite Element Analysis <i>Presentation Number: 2023-FP5</i>	Dr. Erin Davison
1402-1412 hrs	Full Abstract	Impact of Hand Dominance on Functional Recovery Following Upper Extremity Injuries <i>Presentation Number: 2023-FP6</i>	Calgary Orthopaedic Resident Research Group (CORRG) – presented by Dr. Topher Flanagan, Dr. Tim Lasswell, Dr. Laura Morrison, and Dr. Ethan Sanders
1412-1416 hrs	Full Abstract	CT-Verified Union Rate Following Arthrodesis of Ankle, Hindfoot, or Midfoot: A Systematic Review <i>Presentation Number: 2023-AP1</i>	Dr. Michael Leslie
1416-1420 hrs	Full Abstract	Inappropriate MRI Use in the Diagnosis of Acute Sciatica <i>Presentation Number: 2023-AP2</i>	Dr. Bryan Heard
1420-1424 hrs	Proposal Abstract	Optimal Construct for Fixation of Femoral Neck Fractures: A Biomechanical Analysis <i>Presentation Number: 2023-AP3</i>	Dr. Anna-Lee Policicchio

1424-1429 hrs	Q&A for Session One of Abbreviated Podium Presentations	
1429-1454 hrs	Local External Adjudicator Presentation: "When Good Bugs Go Bad – The Microbiome and Infections in the ICU"	Dr. Braedon McDonald
1454-1525 hrs	Break	
1525-1535 hrs	Full Abstract	Fluoroscopic Assisted Digital Navigation During Anterior Approach Total Hip Replacement Improves Patient Outcomes <i>Presentation Number: 2023-FP7</i>
1535-1545 hrs	Full Abstract	Evaluating Venous Thromboembolism in Patients with Metastatic Bone Disease: Are We Treating Patients with Appropriate Thromboprophylaxis? <i>Presentation Number: 2023-FP8</i>
1545-1555 hrs	Full Abstract	An Early Coagulation Factor Dominant Hypercoagulability is Followed by a Prolonged Platelet-dominant Hypercoagulability in Patients with Hip Fracture <i>Presentation Number: 2023-FP9</i>
1555-1559 hrs	Full Abstract	Distal Fibular Fractures: A Comparison of Outcomes Following Posterolateral Antiglidle Fixation to Other Fixation Techniques <i>Presentation Number: 2023-AP4</i>
1559-1603 hrs	Proposal Abstract	External Validation of a Machine Learning Algorithm for Predicting Concurrent Posterior Malleolar Fractures in Patients with Diaphyseal Tibial Fractures <i>Presentation Number: 2023-AP5</i>
1603-1608 hrs	Q&A for Session Two of Abbreviated Podium Presentations	
1608--1612	Proposal Abstract	Venous Thromboembolism Rates Following Multi-ligamentous Knee Reconstruction and Current Thromboprophylaxis Practices: A Systematic and Retrospective Review <i>3MT Presentation Number: 2023-3MT4</i>
1612-1616 hrs	Proposal Abstract	Prospective Evaluation of the Effects of Traumatic Brain Injury on Long Bone Fracture Healing <i>3MT Presentation Number: 2023-3MT5</i>
1616-1620 hrs	Proposal Abstract	Weight Bearing CT in Scapholunate Interosseous Ligament Instability <i>3MT Presentation Number: 2023-3MT6</i>
1620-1624 hrs	Proposal Abstract	Development of a Pediatric-specific Anterior Cruciate Ligament (ACL) Quality of Life (QoL) Outcome Measure <i>3MT Presentation Number: 2023-3MT7</i>
1624-1629 hrs	Q&A for Session Two of 3MT Presentations	
1629-1715 hrs	Keynote Address: "The VANCO Trial: What Could We Have Done Better?"	Dr. Robert O'Toole
1715-1720 hrs	Closing Remarks	Dr. Prism Schneider
1720-1730 hrs	Deliberation Time for Judges	
1730-1800 hrs	Travel to Dinner Location	Dr. P. Schneider to drive Dr. R. O'Toole
1800 hrs	Dinner (by invitation only) at Model Milk (Model Citizen Private Room)	

Biographies of Adjudicators and Moderator

Guest Adjudicator: **Dr. Robert O'Toole**



Dr. O'Toole is the Hansjörg Wyss Medical Foundation Endowed Professor in Orthopaedic Trauma; Division Head, Orthopaedic Traumatology; Chief of Orthopaedics, R Adams Cowley Shock Trauma Center; Program Director, Orthopaedic Traumatology Fellowship Program; and Vice-Chair of Research, Department of Orthopaedics at the University of Maryland School of Medicine. Dr. O'Toole received his Bachelor of Science in Mechanical Engineering from Carnegie Mellon University, an MS in Mechanical Engineering from Stanford University, and an MD degree from Harvard Medical School. He completed his residency at the Harvard Combined Orthopaedic Program and his fellowship in Orthopaedic Traumatology at the R Adams Cowley Shock Trauma Center. In addition to Dr. O'Toole's clinical and educational work as an orthopaedic trauma surgeon, he is an active clinical researcher in the field of orthopaedic trauma. Much of his funded work entails the study of techniques to reduce complications of high energy trauma, particular infection and blood clots. Much of this work is performed in close collaboration with the Major Extremity Trauma Research Consortium (METRC).

Local External Adjudicator: **Dr. Braedon McDonald**



Dr. McDonald is an Assistant Professor in the Department of Critical Care Medicine and Department of Medicine in the Cumming School of Medicine. Originally from Crossfield, Alberta, Dr. McDonald trained in microbiology and immunology at McGill University in Montreal, followed by MD as well as PhD training in immunology at the University of Calgary. He completed his Internal Medicine residency at the University of British Columbia, followed by a fellowship in adult Critical Care Medicine at the Cumming School of Medicine. Dr. McDonald completed a CIHR- and AIHS-funded postdoctoral fellowship in microbiome research at the University of Calgary's International Microbiome Centre. Dr. McDonald is a clinician-scientist in the Snyder Institute for Chronic Diseases and International Microbiome Centre, where he leads a translational and basic science research program on microbiome-immune interactions in infection and critical illness. Dr. McDonald's clinical practice focuses on multi-systems intensive care, and he is an attending intensivist in the ICU at Foothills Medical Centre, Rockyview General Hospital, and South Health Campus.

Local Internal Adjudicator: Dr. Paul Duffy



Dr. Paul Duffy is an Orthopaedic Trauma Surgeon in the Section of Orthopaedic Surgery in the Cumming School of Medicine at the University of Calgary and Alberta Health Services. He is the Head of the Division of Orthopaedic Trauma, and was a previous Fellowship Director, and previous Royal College Examiner. He is a Clinician, Educator and Researcher. Dr. Duffy has been the recipient of many awards including of Educator of the Year and Surgical Citizenship Award. He is a member of the OTA, as well as being a Kandahar Afghanistan Trauma Surgeon Veteran. Dr. Duffy did his Orthopaedic Residency Training a Memorial University in St. John's Newfoundland, as well as doing several Fellowships: Pelvic and Acetabular Trauma in the United Kingdom in London; Trauma/Arthroplasty at Dalhousie University in Halifax; and Orthopedic Trauma and Clinical Research Fellowship at the Royal Infirmary of Edinburgh in Scotland.

Moderator: Dr. Prism Schneider



Dr. Prism Schneider is an Associate Professor of Orthopaedic Surgery in the Departments of Surgery and Community Health Sciences, at the University of Calgary. She also holds the positions of Orthopaedic Trauma Research Lead and the Faculty, Resident and Fellow Research Director for Orthopaedic Surgery. 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 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, clinical trials for optimizing surgical outcomes, and using advanced imaging to study the micro-architecture of fracture healing. She

also has a particular interest in identifying and assisting patients who are injured due to violence in the home. Dr. Schneider has completed several multi-centre randomized controlled trials in collaboration with the Canadian Orthopaedic Trauma Society, in order to define surgical indications following injury and to determine the optimal surgical techniques to help improve patient outcomes. Dr. Schneider's trauma-induced coagulopathy research program aims to use a precision medicine approach to prevention of venous thromboembolism and is funded by the Orthopaedic Research and Education Foundation, the Canadian Institutes for Health Research, and the Canadian Foundation for Innovation.

Abstract Type: Full Abstract

Research Pillar: Clinical Research

Title: The Association Between Plasma Leptin and Diaphyseal Femur Fracture Healing: A Pilot Study

Authors: Gareth Ryan, Haiyan Hou, Jessica Duong, Kim Rondeau and Prism Schneider

Background: Fracture healing is an intricate process that is dependent on stability and biology. Animal studies have shown that leptin, a hormone that aids in regulating energy storage, may facilitate fracture healing. Furthermore, leptin is hypothesized to be related to the higher rates of union and heterotopic ossification seen in patients with head injury. The aim of this pilot study is to determine the relationship between plasma leptin and femur fracture healing, as well as to assess feasibility outcomes to inform a full-scale study designed to evaluate the effects of brain injury on leptin levels and fracture healing. We hypothesize that patients with higher plasma leptin levels will exhibit faster fracture healing.

Methods: This is a prospective, single-centre cohort study of adult patients with operatively treated diaphyseal femur fractures. Radiographs and plasma were obtained at 2- and 6-weeks post-operatively. Leptin levels were measured using a single-analyte immunoassay electrochemiluminescence measurement (Meso Scale Discovery, Rockville MD). Radiographs were classified as "healed", "partially healed," or "not healed" and were also scored according to the Radiographic Union Score for Tibial fractures (RUST) by two reviewers. A paired t-test was used to compare leptin levels at the 2-week and 6-week follow-up, and a linear regression model for evaluating leptin levels compared to RUST scores.

Results: Twenty patients with operatively treated diaphyseal femur fractures were included, with a mean age of 52 years (SD=22). A total of 65% of patients were male and the mean body mass index (BMI) was 25.6 (SD=4.2). No patients achieved partial or complete union or a RUST score >5 at the 2-week follow-up. At the 6-week follow-up, 40% had achieved partial union, with 35% achieving a RUST score of 6, 15% achieving a RUST score of 7, 20% achieving a RUST score of 8, and 5% achieving a RUST score of 9. Mean leptin levels were greater at the 6-week follow-up (mean=14,997; SD=24,409) compared with the 2-week-follow-up (mean=13,009; SD=25,259); however, this was not statistically significant (p=0.8). There was a significant increase in RUST score between 2-week (mean=4.10; SD=0.31) and 6-week follow-up timepoints (mean=6.35; SD=1.39; p<0.0001). The linear regression analysis did not demonstrate a correlation between leptin levels and RUST scores in this pilot cohort.

Discussion: This pilot study did not demonstrate a significant association between plasma leptin levels and radiographic fracture healing; however, the short duration of follow up and the small sample size likely contributed to this finding. Executing this study has facilitated us learning techniques for measuring biomarkers of interest.

Conclusion: Although we did not demonstrate a significant relationship between leptin and fracture healing, future trials with a larger sample size and longer follow-up are still warranted and this study has informed longer planned follow-up.

Acknowledgements: Foothills Orthopaedic Trauma Research Team, Rick Buckley, Paul Duffy, Rob Korley, Ryan Martin, Andrew Dodd for their assistance with recruiting patients

COREF Funded: No

Abstract Type: Full Abstract
Research Pillar: Basic Science

Title: Biomechanical Evaluation of Optimal Dual vs Single Plate Configuration for Humeral Diaphyseal Fracture Fixation

Authors: Laurel Collings, Helena Greene, Paul Sharplin, Ryan Martin, Robert Korley, Ifaz Haider and Prism Schneider

Background: Single plate constructs are the traditional method for internal fixation of mid-diaphyseal humerus fractures. Dual small fragment plate constructs have been used as an alternative fixation method for smaller humerus diameters. Given increasing awareness of soft tissue preservation for improving fracture healing, dual plating constructs may allow for smaller surgical incisions and decreased plate lengths. Limited biomechanical data exist for comparison between single versus dual plating of mid-diaphyseal humerus fractures. The study aim is to compare biomechanical performance of single small fragment plating compared with multiple dual humeral plating configurations. We hypothesize that dual plate constructs will demonstrate higher stiffness compared with single plate constructs for humeral diaphyseal fracture fixation.

Methods: Six cadaveric full-length humerus specimens were randomized to one of three groups based on CT scan assessment of Bone Mineral Content (BMC). We compared three different plating configurations: a single plate construct (anterolateral plating using a single 3.5-mm limited-contact plate [LCP]) and two different dual-plating constructs (anterior 3.5-mm LCP and lateral 2.7mm LCP, or an anterior 3.5-mm LCP and a lateral one-third tubular plate).

All cadaveric models were stabilized using a custom potting jig and PMMA cement. A straight transverse 5mm osteotomy was created using a hand saw at the mid-point between the greater tuberosity and the olecranon fossa, to simulate a rotationally unstable mid-diaphyseal humerus fracture. This was followed by plating with a single plate anteriorly, then any additional plating required laterally. All cadaveric models had eight cortices of fixation above and below the level of the osteotomy in both single and dual plating constructs. Axial compressive stiffness was determined through non-destructive quasi-static loading (up to 100N) using an MTS 858 Bionix system. One-way ANOVA and Tukey's honestly significant difference (HSD) tests will be used to evaluate differences between stiffness and failure testing of each construct.

Results: A one-way ANOVA revealed that there was a statistically significant difference in compressive stiffness between at least two groups ($F = 14.27$, $p = 0.029$). Post-hoc analysis with Tukey's HSD Test for multiple comparisons found that the mean value of compressive stiffness was significantly different between single 3.5mm LCP and both dual plating constructs ($p = 0.029$).

TABLE 1 Stiffness results from compression testing of all plating constructs

Construct	Compressive Stiffness (N/mm)
3.5mm LCP	2014 ± 509.12
3.5mm LCP + 2.7mm LCP	3096 ± 127.28 *
3.5mm LCP + 1/3 tubular	3672.50 ± 150.61 *

Note: Mean ± standard deviation; n = 2 for all groups; LCP = limited-contact plate.

** indicates statistically significant difference compared to single plate construct, $p < 0.05$.*

Discussion: These preliminary data support the hypothesis that dual plate constructs have higher stiffness compared to single plate constructs for humeral diaphyseal fracture fixation. Next steps for this project will be to complete testing on 20 cadaveric specimens, including a third dual-plating construct (dual 2.7mm LCP plates anterior and lateral), to assess if smaller dual plates demonstrate superiority to a single plate construct. Additionally, we plan to determine bending (anterior-posterior, medial-lateral) and torsional stiffness with non-destructive testing, followed by torsional load-to-failure testing.

Conclusion: This study is the first to examine the biomechanical differences of multiple single and dual plate constructs for fixation of mid-diaphyseal humerus fractures using cadaveric models. Given the increasing indications for operative intervention for mid-diaphyseal humerus fractures, the results of this study will provide further biomechanical evidence to guide operative decision making and may be used to inform a future clinical trial.

Acknowledgements: Brent Edwards and Kent Paulson from the Biomechanics Lab in the McCaig Institute for Bone and Joint Health, the Foothills Orthopaedic Trauma Research Team, especially Jessica Duong

COREF Funded: Yes

Abstract Type: Full Abstract

Research Pillar: Health Services Research

Title: Elective Surgical Management is a Cost-effective Treatment Pathway for Patients with Metastatic Bone Disease of the Femur.

Authors: Annalise Abbott, Joseph Kendal, Benjamin Wajda, Shannon Puloski and Michael Monument

Background: Metastatic bone disease (MBD) of the femur carries a substantial burden to both patients and the healthcare system. Currently, patients with MBD enter surgical care through either emergent or electively scheduled care pathways. The purpose of this study was to determine the survival benefits and healthcare costs associated with elective versus emergent surgical care pathways for patients with MBD of the femur in a Canadian healthcare system.

Methods: A decision analytic model and probabilistic sensitivity analysis were used to perform a cost effectiveness analysis of MBD surgical care pathways. Treatment effectiveness was determined from the post-operative survival of patients with MBD of the femur included in the Southern Alberta Metastatic Cancer To Bone (SMART Bone) database. Elective surgeries were defined by patients seen by an orthopaedic surgeon at least once prior to surgery, and booked for a scheduled, urgent, yet elective procedure. Emergent surgeries were defined by patients admitted to hospital via urgent care mechanisms and managed on the on-call trauma list. The decision analytic model was developed with clinical experts to compare surgical care pathways and included the use of post-operative radiation therapy as well as the probability of acute, 30-day hospital readmission. A six-month time horizon was used, and the analysis was considered using a public payer perspective. Direct and indirect healthcare costs associated with surgery, post-operative care, and hospital readmissions were estimated using micro-costing data from Alberta Health Services and converted to 2021 Canadian Dollars.

Results: The probabilistic sensitivity analysis demonstrated superior expected overall survival of the elective surgery group at 15.5 months with a corresponding lower overall cost of \$26,579 per patient. The emergent surgery group had an overall survival of 5.9 months and an overall cost of \$44,931 per patient. The results were consistent across two-way sensitivity analysis. Incremental cost effectiveness ratios were not calculated due to the superiority of the elective care pathway. Minimal difference was found in the operating room and implant costs between the two groups, with elective surgery costing an average of \$6,805 (SE: \$665) per patient and emergent surgery costing \$5,694 (SE: \$551). Increased hospital length of stay (LOS) was the primary driver of increased healthcare costs in the emergent group. The average LOS in the elective group was 5 days (95%CI: 5-6) compared to 14 days (95%CI: 13-16) in the emergent group ($p < 0.001$).

Discussion: Elective surgical management is a superior treatment pathway for MBD of the femur with longer post-operative survival and lower healthcare costs. These findings demonstrate clinical and economic value in refining the current care delivery model for surgical MBD in southern Alberta to reduce the use of emergent surgery when possible.

Conclusion: The burden of MBD is significant and increasing. In the face of rising healthcare costs, interventions capable of reducing the economic burden of MBD surgery will have positive impacts on patient care and provide opportunity for health economic efficiencies.

Acknowledgements: Eldon Spackman, Elissa Rennert-May, Alberta Innovates

COREF Funding: Yes

Abstract Type: Proposal

Research Pillar: Clinical Research

Title: The Role of Thrombelastography in the Pediatric Trauma Patient: A Prospective Pilot Study

Authors: Stephanie Gibbon, Annalise Abbott, Lisa Phillips and Prism Schneider

Background: Trauma remains the leading cause of morbidity and mortality in pediatric patients. Trauma induced coagulopathy (TIC) is a consequence of orthopaedic trauma and a poor prognostic factor for patients presenting with secondary hemorrhagic shock. In pediatric populations, coagulopathy is an independent predictor of mortality after trauma: however, pediatric patients are proposed to have reduced systemic inflammatory and coagulopathy responses. Despite the established role for thromboelastography (TEG)-informed balanced resuscitation in adult patients, there is a lack of high-quality prospective research describing inflammatory response and coagulopathy in the pediatric trauma population. There is also limited data to determine hypercoagulability and the need for thromboprophylaxis in the pediatric population.

This study aims to characterize the inflammatory response to orthopaedic trauma in pediatric patients with a femur fracture and to quantify TIC in pediatric patients with a femur fracture using TEG. We hypothesize that children who have sustained a femur fracture will exhibit abnormal coagulation profiles and pro-inflammatory response, but duration of hypercoagulability and elevated pro-inflammatory cytokines will be less pronounced and for a shorter duration of time compared to their adult counterparts.

Methods: This is a pilot prospective case-control study. The proposed research will examine pediatric patients (n = 15) at a single academic tertiary pediatric trauma centre presenting with a femur fracture requiring operative intervention with internal fixation, including plate and screw constructs and flexible or locked intramedullary nails (IMN). The control group will be selected from an ongoing prospective study evaluating TIC in adults with femur fractures. Clinical and biochemical data will be obtained through prospective collection of patient data including demographics, injury severity score, conventional labs (i.e., lactate, base excess, hemoglobin), fracture pattern, treatment strategies and resuscitation efforts, and surgical fixation technique. Cohort will be matched based on sex and surgical treatment type (open reduction and internal fixation or IMN).

Blood specimens will be obtained preoperatively, intraoperatively, and two-weeks postoperatively. Blood specimen data collection will include TEG analysis (Global Citrated and Platelet Mapping cartridges, Haemonetics Corp, Braintree, MA) and inflammatory marker analysis (Meso Scale Discovery). Feasibility outcomes will include number of patients who provide consent, number who decline study participation and reason for their decline, number of injuries missed due to injury pattern including time of day or multiple injuries, and study retention.

Descriptive statistics will include t-tests and Chi square analysis to compare between groups. Serial TEG and inflammatory cytokine levels will be compared between adult and pediatric patients using t-tests at each time period. Hypercoagulability will be defined using the maximal amplitude parameter from TEG analysis (MA; a measure of clot strength), with MA ≥ 65 mm defining hypercoagulability, and will be compared between groups and over time.

Results: N/A

Discussion: It is proposed that coagulopathy and systemic inflammatory response are dampened in pediatric patients who sustained an orthopaedic injury; however, there is a scarcity of literature to confirm this and the extent and duration of TIC in this population is under evaluated. Novel data from this study will help define the patient- and injury-specific TIC response and the temporal trends associated with coagulopathy and systemic inflammatory response in pediatric trauma patients. This will be used to inform the feasibility and study design for a larger clinical study.

Conclusion: Given the continued morbidity and mortality associated with pediatric trauma, addressing the knowledge gaps in pediatric response to trauma will be valuable to stakeholders including patients, families, and healthcare providers.

Acknowledgements: Foothills Orthopaedic Trauma Research Team

COREF Funded: Yes

Abstract Type: Proposal

Research Pillar: Clinical Research

Title: The “Bad Acting” Tibial Plateau Fracture: Relative Conversion Rate to Total Knee Arthroplasty of Fracture Dislocation Variants

Authors: Meredith Stadnyk, Helena Greene, Ryan Martin and Prism Schneider

Background: Patients who sustain tibial plateau fractures are at an increased risk of post-traumatic osteoarthritis (PTOA). Despite operative fixation of tibial plateau fractures, residual incongruity of the articular surface, damage to the chondral surface sustained during the injury itself, as well as malalignment of the mechanical axis of the knee post-operatively, all increase the risk of developing PTOA. A proportion of patients who develop PTOA after an operatively treated tibial plateau fracture will progress to requiring a TKA; however, the tibial plateau injury patterns at highest risk for this progression have not been previously investigated.

We hypothesize that there are specific tibial plateau fracture-dislocation variants that are “bad acting” and are more likely to progress to ipsilateral TKA in the future. The aim of this study is to identify patients who have undergone a TKA following an operatively treated ipsilateral tibial plateau fracture and compare the rates of progression to TKA between those which possess “bad-acting” fracture-dislocation variant characteristics, and those that do not.

Methods: This study will be a retrospective chart review using the province-wide Alberta Bone and Joint Health Institute database (ABJHI). Inclusion criteria will be patients who received a TKA and previously had an operatively treated ipsilateral tibial plateau fracture. The cohort will be identified using database definitions developed with our collaborating ABJHI data analyst. The tibial plateau fracture imaging of these patients will be reviewed for specific fracture-dislocation variant characteristics, such as posterolateral depression, tibial eminence fracture or depression, Segond fracture, meniscal root fracture, or medial plateau translation. Patient demographics, including age at time of tibial plateau fracture, age at time of TKA, sex, and co-morbidities will be collected. The rate of progression of operatively treated tibial plateau fracture to TKA will be compared between a group of patients who either exhibited the specific imaging-defined fracture-dislocation variants, and those who do not fit these injury patterns. Additionally, patient demographics and co-morbidities will be used to identify other clinical risk factors for progression to TKA.

Demographic data will be reported and compared using t-tests and Chi-square analysis. Cox proportional hazards regression analysis will be used to identify risk factors for future TKA following tibial plateau fracture.

Results: Not yet available.

Discussion: This study may help to identify tibial plateau fracture patterns that are at a higher risk of progression to TKA. With this information, injury-specific counselling between patients with tibial plateau fractures and their surgeons will be better informed and will include large provincial data regarding prognosis following tibial plateau fractures and the risk of TKA in the future. This novel data will also help guide future research on tibial plateau fracture-dislocation variants.

Conclusion: Not yet available.

Acknowledgements: The Foothills Medical Centre Orthopaedic Research Team, ABJHI, Kim Rondeau.

COREF Funded: No

Abstract type: Proposal

Research Pillar: Clinical Research

Title: SPINE TRAC Study - Surveillance of a Population to monitor the Incidence of New Deformity: Effects of Time and Recreation on Alignment in Calgary

Authors: Taryn Ludwig, Fred Nicholls, Michael Asmussen, Brent Edwards and Nathan Evaniew

Background: Adult spinal deformity (ASD), by radiographic criteria, affects 32-68% of the population over age 65. Impact on quality of life is profound- pain and changes in postural alignment impact mobility, self-image, and ability to work and participate in recreational activities. Physical function and patient reported outcomes for patients with symptomatic adult spinal deformity are similar to that of patients with advanced cancer, diabetes, and heart disease. Twenty-seven to 38% of ASD patients have comorbid mental health disorders. Disability increases with worsening deformity, and correction of deformity can improve health related quality of life. The cost to our healthcare system of treating ASD is significant, with non-surgical treatment estimated to cost \$5,000 per year, and surgical treatment estimated to cost over \$43,000 USD as of 2018. Furthermore, surgical treatment has a high complication rate. Major complications (neurologic deficit, pulmonary embolus, cardiovascular/cerebrovascular events, or requiring revision surgery) occur in as many as 40% of cases, significantly adding to direct and indirect costs and decreasing overall surgical efficacy. The underlying etiology and risk factors for adult spinal deformity are poorly understood; while general recommendations to maintain paraspinal and core muscle strength are frequently made to patients suffering with ASD, it is not clear if alterations in strength are contributing factors or because of ASD. It is likewise unclear whether maintaining baseline core fitness is at all an effective preventative strategy. The SPINE TRAC study (Surveillance of a Population to monitor the Incidence of New deformity: Effects of Time and Recreation on Alignment in Calgary) is a longitudinal study with the overarching goal of monitoring for development of spinal deformity, and to investigate the underlying etiology by assessing level of activity of participants. The **objectives** are three-fold, as outlined below.

Methods:

1. **Establish patterns of normal spinal alignment:** Extending from our previous work investigating relationships between cervical and lumbosacral alignment, we will use machine learning methods to establish evidence-based patterns of spinal alignment extending up to the cervical spine.
2. **Monitor the effects of aging on development of spinal deformity.**
 - a. We will recall our previous 500 study participants for repeat whole body EOS imaging at 10-year intervals to monitor the effects of aging on the incidence of spinal deformity.
 - b. Comparison to another North American cohort will allow us to determine what, if any additional benefit can be gained from longitudinal follow-up of the same cohort compared to concurrent cross-sections of older populations.
3. **Activity monitoring and functional assessment to elucidate contribution of activity and muscle strength.**
 - a. We will collect activity data from participants smart phone devices to quantify overall activity level and relate this to periodic quality of life assessments.
 - b. We will perform functional assessment of a subset of 50 healthy and 50 ASD participants to evaluate and compare spine muscle strength. Surface EMG and dynamometry will quantify muscle activity and strength. Ultrasound assessment of paraspinal muscle cross sectional area will be obtained at rest and during contraction to determine size and function.

Results: None yet.

Discussion: Contributing to understanding of the etiology of ASD will improve patient care by possible prevention of ASD and enhanced recovery after surgery with greater understanding of muscular contributions. This study will also provide improved understanding of surgical targets for alignment in deformity correction surgery; this will subsequently lead to decreased cost to the health care system by decreasing revision surgery.

Conclusions: None yet

Acknowledgements: Andy van der Raadt, Victoria Smith

COREF Funding: for baseline imaging of patients/previous study, not for this study directly

Abstract Type: Full

Research Pillar: Clinical Research

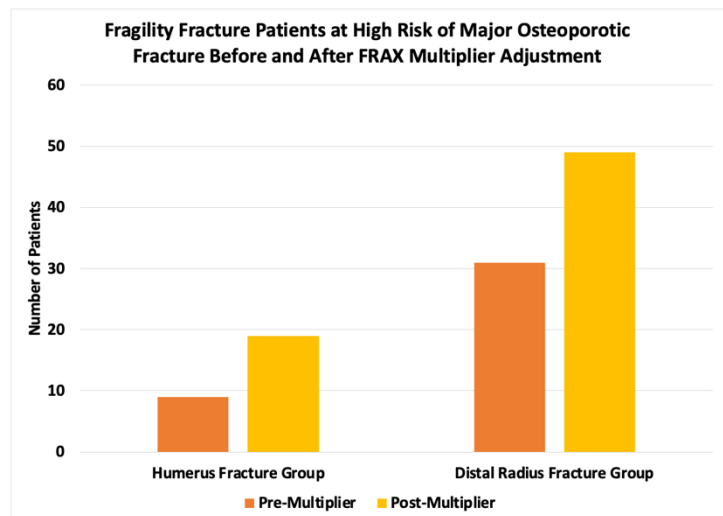
Title: Defining Imminent Risk Using FRAX Score Multipliers for Patients with Recent Non-hip Fragility Fractures

Authors: Kaja Matovinovic, Scott Willms, Leah Kennedy, Stephanie Yee, Emma Billington and Prism Schneider

Background: The Fracture Risk Assessment Tool (FRAX) estimates a 10-year probability of major osteoporotic fracture (MOF) using age, sex, body mass index, and seven clinical risk factors, including prior fracture history. Prior fracture is binary in FRAX, despite knowledge that prior fractures affect future MOF risk differently depending on fracture recency and site. Risk of MOF is highest in the first two years following a fracture – this is defined as imminent risk. Therefore, the FRAX tool may underestimate true fracture risk, resulting in missed opportunities for earlier osteoporosis management. To address this, multipliers based on age, sex, and fracture type may be applied to baseline FRAX scores for patients with recent fractures. Adjusted FRAX estimates may enable earlier pharmacologic treatment and other risk reduction strategies. This study aimed to report the effect of multipliers on conventional FRAX scores in patients with recent non-hip and non-vertebral fragility fractures.

Methods: Both standard and multiplier-adjusted FRAX scores were calculated for patients included in our outpatient Fracture Liaison Service who were 50 years of age or older and had experienced a distal radius or proximal humerus fracture between June 2020 and May 2022. Exclusion criteria consisted of patients under 50 years old, hip and vertebral fractures. Age- and sex-based FRAX multipliers for recent distal radius and proximal humerus fractures described by McCloskey et al. (2021) were applied to conventional FRAX scores. Low, intermediate, and high-risk of MOF was defined as less than 10%, 10-20%, and greater than 20%, respectively. Data are reported as mean for continuous variables and as proportions for categorical variables. Paired samples t-tests were used to compare FRAX scores pre- and post-modifier adjustment.

Results: A total of 142 patients with a median age of 65 years (range = 50-97) were included. The majority of patients were female (90.1%), with 75.4% sustaining distal radius fractures and 24.6% sustaining proximal humerus fractures. In the distal radius group, the average MOF risk significantly increased from pre-multiplier (17.2) to post-multiplier adjustment (21.0; $p < 0.05$; Figure 1). Seventeen percent of patients in the distal radius group moved from intermediate to high 10-year fracture risk after multiplier adjustment. Average FRAX scores significantly increased in the humerus group from before (16.1) to after multiplier adjustment (23.0; $p < 0.01$), with 28.6% of patients moving from an intermediate risk to a high-risk score.



Discussion: Multiplier adjustment produces a clinically significant increase in conventional FRAX scores in some patients with recent non-hip and non-vertebral fragility fractures. A significant number of patients in both the distal radius and humerus fracture group moved from intermediate to high-risk of MOF after multiplier adjustment, now meeting criteria for pharmacologic management.

Conclusion: Using the modified FRAX score as a clinical decision-making tool in patients with recent fragility fractures may guide earlier initiation of first-line osteoporosis therapies and reduce the risk of future osteoporotic fractures. These novel findings in a large prospective cohort warrants further investigation to reduce the morbidity and cost associated with increasing fragility fractures.

Acknowledgements: Foothills Orthopaedic Trauma Research Team, POWER Program Fracture Liaison Service

COREF Funded: No

Abstract Type: Full

Research Pillar: Clinical Research

Title: Distal Radius Fracture Healing: A 12-month Follow-up Using HR-pQCT and Finite Element Analysis

Authors: Erin Davison, Phillip Spanswick, Ifaz Haider, Jolene Allan, Stephanie Yee, Robert Korley, Paul Duffy, Ryan Martin, Andrew Dodd, Steven Boyd and Prism Schneider

Background: Distal radius fractures are one of the most common injuries treated by orthopaedic surgeons. The majority of these fractures are treated non-operatively with closed reduction and cast immobilization. Despite the prevalence, both duration of immobilization and criteria to define fracture union lack consensus. Early fracture healing is characterized by rapid bony healing and remodeling which provides fracture stability allowing for cast removal. Fractures continue to remodel, restoring biomechanical properties and strength. Previous studies have reported partial recovery in bone density, architecture, and strength in these first few months after injury. These studies demonstrate considerable recovery in the first six weeks, followed by a slower recovery, up to six months. Despite these findings, little is known about the progression of bone density and stiffness longer-term. Therefore, this study aimed to follow our previous cohort to assess distal radius fracture healing through stiffness, bone density, and bone microarchitecture in comparison to the contralateral, uninjured side up to 12-months post fracture.

Methods: Skeletally mature adults with stable distal radius fractures treated with closed reduction and casting were followed at 2-, 4-, 6-, 8-, 12-, 26- and 52-weeks post-fracture. All participants underwent a baseline high-resolution peripheral computed tomography (HR-pQCT) scan of the contralateral, uninjured distal radius. At each follow-up timepoint, participants underwent radiographic, clinical, and functional assessments. Radiographic assessment included x-rays and HR-pQCT scans and functional assessments included the Patient Rated Wrist Evaluation and Quick Disability of the Arm, Shoulder, and Hand. Bone stiffness was assessed through finite element (FE) analysis, and bone density and bone microarchitecture were assessed by HR-pQCT image analysis. Bone parameters from 12-months were compared to the uninjured side using pairwise comparison.

Results: A total of 57 patients (50.5 yrs \pm 16.0 yrs) are being followed, 20 patients (51.2 yrs \pm 16.0 yrs) have undergone analysis of their 12-month follow-up HR-pQCT scans. The majority were female participants (80.7%) with fractures of their non-dominant side (57.9%). The majority were extra articular fractures (45.6%), while the remainder were complete articular (43.9%), and partial articular fractures (10.5%), respectively. Preliminary 12-month analysis found that the fractured side had 14.3% higher torsional strength ($p = 0.01$) and 17.0% higher compressive stiffness ($p = 0.02$) when compared to the contralateral, uninjured side. There was no significant difference in bone mineral density between the injured and uninjured wrists at 12-months post-injury ($p = 0.114$).

Discussion: Preliminary data show that by 12-months post-distal radius fracture, bone mineral density was comparable to the uninjured contralateral side and was significantly stronger than the uninjured side. Complete results from the 12-month follow-up timepoint are currently being collected and will undergo final data analysis when completed.

Conclusion: By 12-months post distal radius fracture, bone mineral density and bone strength recovered to that of the uninjured contralateral side. This novel data can be used when informing patients and healthcare stakeholders regarding expected recovery from injury.

Acknowledgements: Workers Compensation Board of Alberta, University of Calgary Department of Surgery Clinical Research Fund, and McCaig Institute for Bone and Joint Health.

COREF Funded: Yes

Abstract Type: Full Abstract**Research Pillar:** Clinical Research**Title:** Impact of Hand Dominance on Functional Recovery Following Upper Extremity Injuries**Authors:** Calgary Orthopaedic Resident Research Group (CORRG), Kim Rondeau and Prism Schneider

Background: Hand dominance is a commonly obtained demographic when evaluating upper extremity injuries; however, its influence on outcome is unclear. In addition to hand dominance, clinical and patient-reported outcomes are impacted by factors such as age, sex, and operative versus nonoperative management. This study seeks to determine the influence of hand dominance on clinical and patient-reported outcomes following operative and non-operative management of upper extremity injuries.

Methods: A retrospective subgroup analysis of four multi-centre prospective randomized controlled trials involving patients with upper extremity trauma was performed [Humeral Diaphyseal RCT, PERK-1 (elbow fractures and dislocations), Ulnar Diaphyseal RCT, and distal radius RCT]. Patient and injury characteristics including age, sex, fracture classification, and management strategy (operative versus non-operative) were collected. Clinical and patient-reported outcomes, including the Disabilities of the Arm, Shoulder, and Hand (DASH) were also collected. A multivariable regression analysis model was used to determine which variables were predictive of patient-reported outcome scores.

Results: A total of 582 patients met inclusion criteria from the four trials. The dominant upper extremity was injured in 56%, 50%, 46%, and 55% of patients in the trials, respectively. At 2-week follow-up, the DASH scores were significantly worse if the dominant extremity was injured (53 ± 21 versus 59 ± 21 ; $p=0.023$). Additionally, on regression analysis, injury of the dominant upper extremity was a significant predictor of a worse DASH score at 2-weeks post-injury. There was an 8.5-point further impairment (CI = 1.0–15.9; $p=0.026$), if the dominant upper extremity was injured. There were no significant differences in DASH scores between the sides at subsequent follow-up visits.

	Distal Radius ¹	Humeral Shaft ²	PERK 1 ¹	Ulnar Shaft ¹	p-value ²
Age	54 (16)	44 (17)	45 (16)	41 (15)	<0.001
Missing	0	4	1	2	
Sex					<0.001
Female	148 / 201 (74%)	66 / 171 (39%)	73 / 149 (49%)	27 / 99 (27%)	
Male	53 / 201 (26%)	105 / 171 (61%)	76 / 149 (51%)	72 / 99 (73%)	
Missing	0	1	0	2	
Dominant Side Injured					0.3
no	89 / 198 (45%)	80 / 159 (50%)	79 / 145 (54%)	14 / 32 (44%)	
yes	109 / 198 (55%)	79 / 159 (50%)	66 / 145 (46%)	18 / 32 (56%)	
Handedness					0.4
Ambidextrous	1 / 199 (0.5%)	4 / 165 (2.4%)	0 / 145 (0%)	0 / 32 (0%)	
Left	18 / 199 (9.0%)	13 / 165 (7.9%)	16 / 145 (11%)	4 / 32 (12%)	
Right	180 / 199 (90%)	148 / 165 (90%)	129 / 145 (89%)	28 / 32 (88%)	
Missing	2	7	4	69	

¹ Mean (SD); n / N (%)² Kruskal-Wallis rank sum test; Pearson's Chi-squared test

Table 1: Summary of patient demographics and side of upper extremity injury between four randomized clinical trials.

Discussion: The study identified significant early functional impairment if the dominant arm was injured; however, a difference in functional impairment did not persist in subsequent follow-up assessments. This finding will help inform post-injury patient counselling regarding expectations for functional recovery after upper extremity injuries.

Conclusion: Patients with upper extremity injuries of their dominant side had significantly worse outcomes at two weeks post-injury in both operative and nonoperative groups. Differences in outcomes were no longer significant at 12 months post-injury. Future work is underway to analyse additional PROMs and functional outcomes.

Acknowledgements: Stephanie Yee, Kim Rondeau, Department of Orthopaedic Surgery, University of Calgary

COREF Funded: No

Abstract Type: Full Abstract**Research Pillar:** Clinical Research**Title:** CT-Verified Union Rate Following Arthrodesis of Ankle, Hindfoot, or Midfoot: A Systematic Review**Authors:** Michael Leslie, Christin Schindler, Gareth Rooke and Andrew Dodd

Background: Ankle, hindfoot, and midfoot arthrodesis surgeries are standard procedures performed in orthopaedics to treat pain and functional disabilities caused by various pathologies. While fusions can effectively improve pain and quality of life, non-unions remain a significant concern for surgeons. Traditionally, clinical scales and plain radiographic films determined the success of the fusion. With the increased availability of computed tomography (CT), more surgeons rely on this modality for increased accuracy in determining whether a fusion was successful. Limited studies are available investigating the CT-verified fusion rates of ankle, hindfoot, and midfoot fusions; this study aims to elucidate the overall fusion rate from the current literature.

Methods: A systematic review was performed following PRISMA guidelines using EMBASE and Medline databases from January 2000 to March 2020. Randomized controlled trials, observational cohort studies, case-control studies, and case series were selected for review if they included more than ten patients whose age was 18 or older and had ankle, hindfoot, or midfoot fusions with 75% of the cohort receiving CT scans postoperatively to evaluate union. The primary outcome was to determine the current fusion rates of ankle, hindfoot, and midfoot arthrodesis surgeries as confirmed by CT.

Results: In total, 4,601 citations were screened, resulting in 26 articles being included in the systematic review. A total of 1300 patients were included in the study. The mean age of patients included in the analysis was 55.9 years old, with a mean follow-up of 48 months. The average time from arthrodesis to CT scan was 21.9 weeks. The overall fusion rate for all patients included in the study was 78.7%.

Talonavicular joint (TNJ) fusions had the highest rate of CT verified union at 90%, while the fusion rate for hindfoot procedures was 78%. In subgroup analysis, we found that the fusion rate was statistically significantly worse in male patients and those who smoked with odd ratios of 1.53 ($p = 0.04$) and 1.94 ($p = 0.04$), respectively. Diabetes did not show a statistically significant effect on union rates.

Discussion: This review examines the CT-verified fusion rates for these procedures and compares them to plain film radiograph-confirmed fusion rates. As confirmed by CT, the total rate of non-union of all patients undergoing ankle, hindfoot, or midfoot fusions was 21.3%. This should give patients and surgeons pause when discussing the risks of arthrodesis surgery and offers a more accurate and modern value for informed consent. It is not clear, based on the results of this study, if a routine assessment of union based on CT would improve patient outcomes, however, the results may encourage practitioners to obtain a CT scan in the setting of ongoing pain after fusion surgery despite the radiographic appearance of union.

Conclusion: Ankle, hindfoot, and midfoot fusions are common procedures used in orthopaedics to treat symptomatic arthritis. Historically the outcomes of these procedures were assessed using clinical questionnaires and plain film radiographs. With the increased use of computed tomography, surgeons have been increasingly compelled to use this technology to better assess for union post operatively. The results of this study will give clinicians a more robust figure to quote when discussing foot and ankle arthrodesis. We believe it also provide groundwork for future studies to address non-union rates that will potentially affect one in twenty patients undergoing arthrodesis.

Acknowledgements: N/A**COREF Funded:** No**TABLE 2. Fusion rate by subgroup**

Fusion type reviewed	Number of patients	Fusion rate	Lower confidence interval	Upper confidence interval
All patients	1015	0.79	0.70	0.88
All joints	1301	0.83	0.73	0.93
Ankles	237	0.86	0.73	0.98
TTC	165	0.81	0.66	0.96
STJ	335	0.82	0.64	0.99
TNJ	40	0.90	0.59	1.21
Combined hindfoot	111	0.78	0.60	0.97

TTC: tibiotalar calcaneal, STJ: subtalar joint, TNJ: talonavicular joint, Combined hindfoot: combination of subtalar joints, talonavicular joints or calcaneocuboid joints.

Abstract Type: Full Abstract

Research Pillar: Clinical Research

Title: Inappropriate MRI Use in the Diagnosis of Acute Sciatica

Authors: Bryan Heard, Ish Bain, Roman Krawetz, David Hart, Paul Salo and Ganesh Swamy

Background: Magnetic resonance imaging (MRI) is a resource that warrants judicious use in Canada. Sciatica is a painful and debilitating condition resulting from compression (often from a herniated disc) of lumbosacral nerve roots. For most patients, this condition is self-limiting and resolves within 6 to 12 weeks. Given the high sensitivity and specificity of the diagnosis based on patient history and physical exam (90% and 71%, respectively), many would argue that MRI is not necessary in the diagnosis of acute sciatica. The goal of this study was to identify the incidence of MRI use in patients from an acute sciatica clinic, and then to elucidate any cost and time savings that could be realized by more appropriate MRI allocation.

Methodology: Patients were referred primarily from the emergency department and from primary care, after meeting our set inclusion criteria. All patients were seen within 4 weeks of their first presentation of sciatica, and were seen and assessed by a spine surgeon in our acute sciatica clinic. Incidence of MRI use in surgical and non-surgical patients was calculated.

Results: Of 128 patients enrolled in our study, 15 (12%) required surgical intervention while 113 (88%) experienced spontaneous resolution of their sciatica. Of the 113 patients that experienced spontaneous resolution, 49 (43.5%) received an MRI. Further to this, 11 (9%) non-surgical patients received an additional MRI. Understandably, 15 (100%) of surgical patients received an MRI. However, within the surgical population 7 (47%) patients received an additional MRI prior to surgery. Given the cost-estimate of \$750CDN per MRI, \$50,250 was the total cost for these 67 MRIs. No patients became surgical as a result of MRI findings.

Discussion and Conclusions: It is apparent that a large proportion of our patients, both surgical and nonsurgical, may have received an unnecessary MRI. Specifically, there were up to 67 potentially unnecessary MRIs conducted within just 128 patients in this study. The patients in this study met the inclusion criteria with a high sensitivity and specificity for sciatica, and in the absence of other spinal conditions. While some MRI usage in this non-surgical population may have been warranted, it is unlikely that the significant number of scans are justifiable. In a conservative cost estimate (excluding time in scanner, tech time, and radiologist time), \$50,250.00 could have been saved.

It is unclear what leads to the overuse of MRI in the work up for acute sciatica. Perhaps diagnostic uncertainty in some referring doctors is contributing. This study suggests that a clinic dedicated to the treatment of acute sciatica could have immediate benefits in health care resource allocation.

Acknowledgements: The authors would like to acknowledge the Fraternal Order of Eagles Spine Grant, and the Alberta Spine Foundation for providing monetary support to this project.

COREF Funded: No

Abstract Type: Proposal

Research Pillar: Basic Science

Title: Optimal Construct for Fixation of Femoral Neck Fractures: A Biomechanical Analysis

Authors: Anna-Lee Policicchio, Ifaz Haider, Helena Greene, Scott Willms, Paul Duffy, Robert Korley, Andrew Dodd, Ryan Martin, Kent Paulson, Jessica Duong and Prism Schneider

Background: Femoral neck fractures (FNF) in young patients typically result in unstable vertical shear fractures. The optimum construct for fixation remains controversial and fixation failure rates range as high as 30-50%. Augmented constructs with mini-fragment plates and fixed-angled devices are being used to generate increased stability and may minimize complication rates. Presently, there are no cadaveric biomechanical studies comparing the stability of augmented femoral neck fixation using a Pauwels screw, an inferior buttress plate, or the femoral neck system. This study aims to quantify the biomechanical properties of these constructs using cadaveric models to determine if an optimal configuration can be identified.

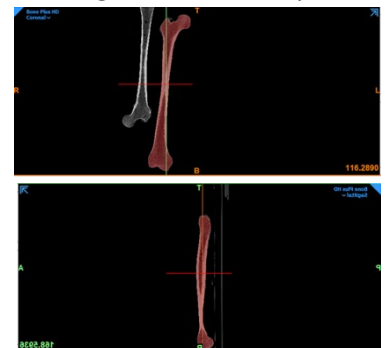
Methods: In this biomechanical analysis, cadaveric proximal femurs will be osteotomized to simulate unstable Pauwels type III (70-degree vertical angle) FNFs with postero-medial comminution. The models will be randomized to one of six fixation constructs based on CT scan assessment of bone mineral content and each construct will undergo non-destructive and load-to-failure testing in four separate cadavers. The constructs to be tested include:

1. Three cannulated screws (7.3mm) in an inverted triangle configuration augmented with a Pauwels screw
2. Three cannulated screws (7.3mm) in an inverted triangle configuration augmented with a non-locking, inferior buttress plate (5-hole, 2.7mm limited contact plate)
3. 135-degree, 3-hole DHS and antirotation screw augmented with an anterior and posterior Pauwels screw
4. 135-degree, 3-hole DHS and antirotation screw augmented with a non-locking, inferior buttress plate (5-hole, 2.7mm limited contact plate)
5. Femoral neck system
6. Femoral neck system with augmentation

Using the MTS 858 Mini Bionix, each FNF model will be loaded cyclically to establish torsional stiffness and axial stability. Next, construct failure strength will be measured under monotonic compressive load, in a direction consistent with peak load during gait. Demographic data from the specimens will be reported and compared using statistical analyses to evaluate stiffness and strength differences between each construct.

Results: Across all specimens, the mean age is 66.7 years (± 13.7), with five of the 26 femurs being female (19.2%). One-way ANOVA demonstrated no significant differences in bone mineral content between groups (Figure 1). Based on this analysis, the randomized groupings of specimens can be used to reliably evaluate mechanical differences between each construct.

Figure 1. Coronal (top) and sagittal (bottom) CT scan assessment of bone mineral content for a single specimen.



Discussion: This will be the first biomechanical study using cadaveric specimens to compare different augmented FNF fixation constructs. Within this unique subset of hip fractures, implant choice and bone quality are important factors affecting fracture healing and outcomes for young patients. The results of this study will help guide surgical decision-making and may inform a future prospective clinical trial.

Conclusion: This study may support novel, augmented configurations for FNF fixation to better withstand physiologic hip forces and decrease the high complication rates seen in young patients with FNFs.

Acknowledgements: Biomechanics Lab in the McCaig Institute for Bone and Joint Health, the COREF resident grant and the Calgary Surgical Research and Development Fund grant, Foothills Orthopaedic Trauma Research Team, Jessica Duong.

COREF Funded: Yes.

Abstract Type: Full Abstract

Research Pillar: Clinical Research

Title: Fluoroscopic Assisted Digital Navigation During Anterior Approach Total Hip Replacement Improves Patient Outcomes

Authors: Manjot Birk, Panayiotis Megaloikonomos, Bryan Heard, Sophie Piroozfar and Rajrishi Sharma

Background: In Canada, total hip arthroplasty (THA) is amongst the most commonly performed inpatient surgery. Despite the enormous volume and success of THA, complications can occur, for example post-operative leg length discrepancy (LLD). Fluoroscopic guidance is a well-established technique in anterior approach total hip arthroplasty (AA-THA), aiming to enhance appropriate implant size and positioning. The primary objective of this study was to assess whether the implementation of non-invasive fluoroscopy-assisted digital navigation software, Depuy-Synthes Velys Digital Navigation, improves the accuracy of post-operative LLD in AA-THA. Secondary outcomes included length of operative time, fluoroscopy time, 30-day readmission and postoperative mechanical and medical complications.

Methods: Using a retrospective cohort study design, 435 patients were identified from the prospectively collected patient-level provincial administrative data repositories that are stored and maintained by the Alberta Bone and Joint Health Institute (ABJHI). The first 25 were excluded to remove effects of the learning curve for AA-THA, and the first 10 patients were excluded after the implementation of the Velys navigation system to remove the impact of the learning curve for the navigation system. Therefore, A total of 400 patients were included in the study. Patients were classified into 2 separate cohorts: 153 underwent surgery without the use of a navigation system and 247 underwent surgery with navigation. Outcome data were extracted from Alberta Bone and Joint Health Institute (ABJHI). Fluoroscopy time was extracted from the radiology department software and leg lengths were measured on post-operative radiographs and verified by four authors (RS, MB, PM, BH).

Results: There was no statistically significant difference between the groups with respect to age (mean 66+/-10 years old $p=0.856$), gender (230 patients female $p=0.469$) and a BMI (mean 28+/-5 $p=0.724$). The Velys navigation software was able to increase the accuracy by allowing closer achievement of no post-operative leg length discrepancy. Specifically, after the use of the navigation, there was no statistically significant difference between the achieved LLD and zero LLD, versus there was a significant difference to achieve zero LLD prior to the use of the navigation software ($p<0.001$). The navigation software required more fluoroscopy time with a median time before navigation of 0.33 seconds versus 0.55 seconds after implementation ($p=0.004$). Case time was significantly reduced from 107min prior to use of navigation versus 103 min after implementation ($p=0.025$). With the use of the digital navigation system, there was no increase in 30-day readmission ($p>0.999$), no increase in mechanical events including fracture and dislocation, and no increase in medical events ($p=0.526$).

Discussion and Conclusion: The use of the Depuy-Synthes Velys Navigation software is safe and effective to achieve more accurate post-operative leg length. Despite the increase in fluoroscopic time, there is a small but statistically significant reduction in operative time. The value of such technology would be expected to substantially increase if used during the learning curve when introducing AA-THA to contemporary practice.

Acknowledgements: None

COREF Funded: No

Abstract Type: Full Abstract

Research Pillar: Clinical Research

Title: Evaluating Venous Thromboembolism in Patients with Metastatic Bone Disease: Are We Treating Patients with Appropriate Thromboprophylaxis?

Authors: Annalise Abbott, Benjamin Wajda, Joseph Kendal, Brett Lavender, Shannon Puloski, Prism Schneider and Michael Monument

Background: Metastatic bone disease (MBD) has a substantial impact on quality of life in cancer patients. Despite the prevalence of MBD, limited data exists on the incidence of post-operative venous thromboembolism (VTE), neither pulmonary embolism (PE) nor deep vein thrombosis (DVT), nor are there guidelines for prescribing thromboprophylaxis in this high-risk patient population. The primary objective of this study was to evaluate the use of VTE prophylaxis in patients with MBD undergoing orthopaedic surgery. The secondary objectives were to determine the incidence of VTE and identify risk factors for developing VTE post-operatively.

Methods: A retrospective, multicenter study was conducted of all patients presenting for orthopaedic surgery for MBD of the long bones or pelvis across nine hospitals in southern Alberta, Canada between 2006 and 2021. VTE events were identified through chart review and were defined as an imaging diagnosis of a DVT or PE using doppler ultrasound, ventilation perfusion scan, or CT pulmonary angiogram. Outpatient prescriptions for post-operative thromboprophylaxis or therapeutic anticoagulation were obtained from the regional Pharmaceutical Information Network (PIN). The PIN data search included prophylactic and therapeutic dosages for low-molecular weight heparin and direct oral anticoagulants as well as therapeutic dosages of warfarin prescribed up to 90 days post-operatively. A binomial logistic regression was performed to identify risk factors for developing VTE.

Results: A total of 558 patients were included with a median age of 67.3 years and 52.0% of patients were female. Breast, lung, prostate, renal cell carcinoma, and multiple myeloma were the most common primary cancers (n=461, 82.5%). Lower extremity surgery was more prevalent, with 487 patients (87.3%) undergoing surgery of the femur, tibia, or pelvis. The indication for surgery was a pathologic fracture in 344 patients (61.7%). Outpatient thromboprophylaxis was prescribed in only 198 patients (35.5%). Median duration of thromboprophylaxis was 30 days (IQR: 10-60). Thirty-four (6.1%) patients were on anticoagulation pre-operatively for chronic medical comorbidities. The incidence of VTE was 5.7%. There were 24 PEs (4.3%) diagnosed, and 11 DVTs (2.0%). Notably, 10 PEs and 6 DVTs occurred in patients who were prescribed thromboprophylaxis. VTE was diagnosed a median of 9 days post-operative (IQR: 5-36). Lack of outpatient prescription of VTE thromboprophylaxis (OR: 2.43, 95%CI: 1.08-5.52, p = 0.03) and a pathologic fracture (OR: 3.75, 95%CI: 1.47-9.63, p = 0.006) were identified as risk factors for developing a VTE, while age, sex, functional performance status, primary malignancy, location of bone lesion, surgical technique, presence of visceral metastases, and fixation strategy were not significant.

Discussion: The results of this study have identified low rates of thromboprophylaxis prescribing in this high-risk patient population undergoing orthopaedic surgery for MBD, with a 5.7% rate of VTE. Lack of outpatient prescription of thromboprophylaxis and a pathologic fracture were identified as risk factors for VTE. As patients underwent diagnostic investigations for a VTE based on clinical indications, the true rate of VTE may be greater.

Conclusion: Post-operative thromboprophylaxis is underutilized and insufficient for patients with MBD undergoing orthopaedic surgery. This research highlights the need for evidence-based guidelines to optimize post-operative protocols and improve patient care in this population.

Acknowledgements: Golpira E Assadzadeh

COREF Funding: No

Abstract Type: Full Abstract

Research Pillar: Clinical Research

Title: An Early Coagulation Factor Dominant Hypercoagulability is Followed by a Prolonged Platelet-Dominant Hypercoagulability in Patients with Hip Fracture

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

Background: The risk for venous thromboembolism (VTE) after hip fracture surgery (HFS) is amongst the highest for all surgical procedures. Despite thromboprophylaxis, a sub-analysis of the FAITH and HEALTH trials demonstrated a 2.5% VTE rate. More concerning, 45.3% of VTE events were diagnosed more than six weeks post-fracture, beyond currently recommended duration of thromboprophylaxis. Thrombelastography (TEG) is a whole-blood viscoelastic hemostatic assay which provides a comprehensive real-time analysis of hemostasis, from clot initiation to fibrinolysis. As patients with hip fracture continue to suffer from debilitating VTE events, TEG analysis may provide valuable information on coagulation kinetics responsible for hypercoagulability to guide thromboprophylaxis regimens. The objective of this study was to determine the timing of different phases of coagulation responsible for hypercoagulability in patients after HFS.

Methods: In this prospective cohort study, TEG analysis was performed in patients with hip fracture every 24-hours from admission until post-operative day (POD) 5, then at 2-week, 6-week, and 3-month post-operative follow-up. Hypercoagulability was defined by TEG parameter values beyond the reference range for clot initiation [Activated Clotting Time (ACT), Reaction-time (R-time)], clot propagation [Kinetic-time (K-time) and Alpha-angle (α -angle)]. A hypercoagulable threshold of ≥ 65 mm determined *a priori* was used for Maximal Amplitude (MA), a measure of platelet contribution to maximal clot strength. One-sample t-tests were performed at follow-up timepoints when the TEG parameter was beyond reference range and paired t-test was performed to compare follow-up timepoints to admission values. All statistical tests were two-sided and p-values < 0.05 were considered statistically significant.

Results: In total, 121 patients with a median age of 81.0 (IQR 71-87) were included. ACT and R-time demonstrated progressively shorter time to clot initiation compared to admission values until POD4 [(ACT mean difference=11.7sec, SEM=2.1; $p<0.001$), (R-time mean difference=0.13min, SEM=0.02; $p<0.001$)] signifying an increased coagulation factor dominant hypercoagulability in the early post-operative period. Maximal Amplitude values demonstrated a peak two weeks post-operatively (mean MA=70.8, SD=2.7; $p<0.001$) and remained elevated six weeks post-operatively (mean MA=65.9, SD=4.0; $p=0.04$), before normalizing three months post-operatively. Symptomatic VTE events were detected in three patients (2.5%) post-operatively. All three patients demonstrated platelet-dominant hypercoagulability at the 6-week follow-up, with elevated MA values.

Discussion: Serial TEG analysis was able to quantify early hypercoagulability after hip fracture that is related to increased procoagulant factor activity. This finding supports early thromboprophylaxis within 24 hours of surgery and the use of anticoagulants like LMWH which target procoagulant factors. Interestingly, there was a prolonged platelet-dominant hypercoagulability which extended beyond current recommended thromboprophylaxis duration after hip fracture surgery. Future studies evaluating alternative thromboprophylaxis regimens which consider targeting procoagulant factors and platelet hyperactivity for a prolonged period of time may help prevent VTE events after hip fracture surgery.

Conclusion: Following hip fracture surgery, patients demonstrate an early procoagulant factor dominant response followed by a prolonged platelet dominant hypercoagulable response. As patients with hip fracture continue to suffer from VTE events, extended thromboprophylaxis with antiplatelet agents may be of benefit.

Acknowledgements: Foothills Orthopaedic Trauma Research Team

COREF Funded: Yes

Abstract Type: Full Abstract**Research Pillar:** Clinical Research**Title:** Distal Fibular Fractures: A Comparison of Outcomes Following Posterolateral Antigliding Fixation to Other Fixation Techniques**Authors:** Logan Woods, Kim Rondeau and Prism Schneider

Background: Distal fibula fractures are a common injury, often requiring surgical management. Surgical fixation techniques described include intramedullary fixation, tension band wiring, lateral plating, locked compression plating, and antiglide plating. Biomechanical studies have shown antiglide plating to be superior to lateral plating and lateral implants can result in soft-tissue irritation; however, lateral plating remains the most performed technique. We hypothesized that the antiglide plating technique will have lower rates of implant removal, wound complication, infection, and overall secondary surgery rates.

Methods: A multi-centre retrospective observational cohort study was performed using data collected from the Alberta Health Services Data Integration, Measurement and Reporting (DIMR) repository. Inclusion criteria were patients 18 years of age and older with an isolated ankle fracture that underwent surgical fixation in Alberta between January 1st, 2010 and 2019 and had at least two follow-up visits after surgery. Those with multiple injuries, open fractures, pathologic fractures, and pre-existing ankle implants were excluded. Xray and chart review was performed on the first 100 patients to collect injury information, fixation type, and instance of secondary surgery or implant removal. Continuous variables are reported as means and standard deviations. Categorical variables are reported as number and proportions. Pearson's Chi-squared, Kruskal-Wallis rank sum and t-tests were used as appropriate and Fisher's exact tests were used when group sizes were less than five.

Results: Of the first 100 patients analysed, the most common form of fixation was lateral plating (76%). Only 17 patients received antiglide plating and seven received locking plate fixation. Patients who received locking plate fixation were significantly older. Implants were removed in 57% of those who received locking plate fixation, 30% of those with lateral plating, and only 12% of those with antiglide plating. These findings did not meet statistical significance. Logarithmic regression found syndesmotic fixation to be predictive of secondary surgery for implant removal.

	Fixation Type			p-value ²
	Lateral Plate, N = 76 ¹	Antigliding plate, N = 17 ¹	Locked Compression Plate, N = 7 ¹	
Age	38 (15)	37 (12)	63 (16)	0.004
Sex				0.4
F	29 / 76 (38%)	9 / 17 (53%)	4 / 7 (57%)	
M	47 / 76 (62%)	8 / 17 (47%)	3 / 7 (43%)	
Implants Removed				0.074
No	53 / 76 (70%)	15 / 17 (88%)	3 / 7 (43%)	
Yes	23 / 76 (30%)	2 / 17 (12%)	4 / 7 (57%)	
Weber Classification				0.13
A	2 / 76 (2.6%)	0 / 17 (0%)	0 / 7 (0%)	
B	43 / 76 (57%)	13 / 17 (76%)	7 / 7 (100%)	
C	31 / 76 (41%)	4 / 17 (24%)	0 / 7 (0%)	

¹ Mean (SD); n / N (%)
² Kruskal-Wallis rank sum test; Fisher's exact test

Discussion: Early results of the current study show that lateral plating continues to be the most commonly used method of distal fibula fixation. Statistically significant differences in rates of implant removal between distal fibula fixation techniques were not found; however, early trends do suggest that implant removal rates may be lower in patients who receive antiglide fixation. Ongoing analysis of this large provincial cohort of patients may elicit differences in outcomes between fixation types. Future directions will include economic analysis, reporting on indications for implant removal, and time to secondary surgery.

Conclusions: Reducing healthcare costs is important to stakeholders including patients, administrators, employers, and healthcare providers; therefore, further investigation into strategies for reducing secondary surgery, will help surgeons make informed surgical decisions.

Acknowledgements: Foothills Orthopaedic Trauma Research Team, especially Stephanie Yee and Jessica Duong**COREF Funded:** Yes

Abstract Type: Proposal

Research Pillar: Clinical Research

Title: External Validation of a Machine Learning Algorithm for Predicting Concurrent Posterior Malleolar Fractures in Patients with Diaphyseal Tibial Fractures

Authors: Julian Rizos, Sheila Sprague and Prism Schneider

Background: Multiple recent studies have demonstrated a high incidence of posterior malleolar fractures (PMFs) in patients with tibial shaft fractures (TSFs) that cannot be identified using only plain radiographs. This poses significant implications for surgical planning that may impact patient outcomes, as failure to identify occult PMFs results in a missed opportunity for surgical fixation of the articular injury before intramedullary nail placement, an operative sequence that prevents secondary displacement of the PMF intraoperatively and likely mitigates the risk of degenerative arthritis. While computed tomography (CT) scans are effective in identifying occult PMFs, this imaging modality exposes the patient to greater radiation, is costly, is not available in all surgical centers, and may delay surgery. Hendrix et al. (2020) recently ventured a solution to this problem by developing a machine learning-based model that accurately predicts the probability of occult PMFs in patients with TSFs based on patient- and fracture-specific characteristics. The purpose of this study is to externally validate and improve this prognostic tool with a large external data set. This study also serves to provide data for training the algorithm, thereby increasing its robustness. Additionally, this study aims to secondarily clarify the discrepancy between studies that observed negative clinical sequela of missed PMFs in a high proportion of patients with TSFs versus more recent publications, which calls this claim into question. Lastly, this study will examine the association between novel patient and fracture characteristics in this population including sex, time-to-union, and presence of union at final follow-up.

Methods: This a retrospective review of a provincial data base produced by the Alberta Health Services' Analytics, Data Integration Management and Reporting Team (DIMR). Inclusion criteria are: adult patients with an acute TSF, skeletal maturity, and clear demonstration of a PMF on plain radiographs or 3D imaging to rule out occult fractures. Exclusion criteria include previous tibial injury or surgery, pathologic fractures, and tibial plateau or pilon fracture patterns. Researchers will manually analyze the data before applying the machine learning algorithm. The ability of the model to discriminate between TSF patients with an associated PMF versus those without will be assessed by calculating the C-statistic and agreement between the observed outcome / predicted probability will be measured using a calibration curve. Overall model performance will be assessed by calculating the Brier Score. True positives, false positives, true negative, false negatives, and accuracy will be calculated. All other categorical data will be reported as proportions and descriptive statistics used for quantitative analysis.

Results: The DIMR dataset includes 1123 patients with TSFs. In preliminary review of 115 of these patients, 30% met inclusion criteria. Among the patients with minimally or nondisplaced fractures that did not undergo PMF surgical fixation, 75% did not displace despite TSF nailing and the remaining 25% displaced by only ~1mm. The preliminary analysis observes all PMFs uniting between 2-4 months.

Discussion/Conclusion: We hypothesize that this review will successfully identify risk factors for PMFs in a large external dataset of patients with TSFs, supporting external validation and clinical implementation of Hendrix et al.'s machine learning algorithm. Additionally, this review will demonstrate low rates of displacement among PMFs that do not undergo surgical fixation prior to intramedullary nail placement.

Acknowledgments: Foothills Orthopaedic Research Team, including Jessica Duong, Leah Kennedy, Stephanie Yee, and The Machine Learning Consortium

COREF Funded: Yes

Abstract Type: Proposal

Research Pillar: Clinical Research

Title: Venous Thromboembolism Rates Following Multi-ligamentous Knee Reconstruction and Current Thromboprophylaxis Practices: A Systematic and Retrospective Review

Authors: Michael Leslie, Daniel You, Ryan Martin and Prism Schneider

Background: Venous thromboembolism (VTE) events remain a concerning complication for patients with orthopaedic injuries. Development of VTE can manifest as deep vein thrombosis (DVT) or pulmonary embolism (PE) and can range from being asymptomatic to being fatal. VTE remains the most common preventable cause of perioperative deaths in orthopaedic surgery. There are well established datasets outlining rates of VTE in patients with pathology in the upper and lower legs, with guidelines for type and duration of thromboprophylaxis depending on the location of injury and subsequent orthopaedic procedure performed. However, there is a paucity of data related to the rates of VTE in patients who sustain knee dislocations requiring multi-ligamentous knee reconstructions. Symptomatic VTE can occur in 2 – 3.5% of patients following multi-ligamentous knee reconstructions, which represents a significant risk for patients and a significant source of morbidity and mortality.

The aims of this study is to complete a systematic review of the literature to determine the rate of VTE in this patient population and to evaluate the current agents and duration of thromboprophylaxis used perioperatively. Further, we plan to access the Alberta Bone and Joint Health Institute (ABJHI) data repository to retrospectively review patients with knee dislocations who have undergone multi-ligamentous knee reconstruction surgery to determine the local rates of VTE in Alberta and common thromboprophylaxis practices.

Methods: 1. *Systematic Review:* In accordance with PRISMA guidelines, the databases Ovid MEDLINE, EMBASE, and CENTRAL will be searched using unique strategies to each database. Search terms will include those related to knee dislocation, VTE, and multi-ligamentous reconstruction of the knee (ACL, MCL, PCL, LCL, tibial eminence fractures, and multi-ligamentous injuries). The final search terms will be optimized with the assistance of a health sciences librarian with expertise in systematic review. The results will be compiled using Covidence (Alfred Hospital, Melbourne, Australia) and duplicates will be deleted. Title and abstract screening will be performed by two independent reviewers and the data will be extracted using a study-specific data extraction form. A third reviewer will assist in reconciliation of any discrepancies in meeting inclusion criteria.

2. *Retrospective Analysis:* The proposed study is a retrospective review of the ABJHI data repository to determine the rate of VTE in patients with knee dislocations and/or multi-ligamentous knee reconstruction surgeries in Alberta. Ethics approval will be obtained, data will be extracted from the ABJHI database, and patient information will be de-identified and stored on a study-specific REDCap database. Collaborating ABJHI data analysts will develop a search strategy and cohort definitions based on ICD-10 and CCI codes. Patients aged 18 years and older, who have sustained knee dislocations requiring surgical reconstruction will be included. VTE events within three months from the time of surgery will be included as post-operative VTE (per International Society of Thrombosis and Hemostasis). Descriptive statistics will be presented and t-tests and Chi square analyses will be used to compare those with and without VTE events.

Results: N/A

Discussion: Currently, there are no well-established guidelines regarding thromboprophylaxis for patients following a multi-ligamentous knee reconstruction. Determining VTE rates following surgery, current clinical practice trends, and risk factors for VTE could help guide future thromboprophylaxis research, potentially reducing the morbidity and mortality associated with VTE.

Conclusion: Currently, there are no well-established guidelines regarding the use of thromboprophylaxis following a multi-ligamentous knee reconstruction; therefore, the novel data from this provincial-level study will help help guide future thromboprophylaxis practice guidelines and improve VTE prevention.

Acknowledgments: COREF, Foothills Orthopaedic Trauma Research Team

COREF Funded: Yes

Abstract Type: Proposal

Research Pillar: Clinical Research

Title: Prospective Evaluation of the Effects of Traumatic Brain Injury on Long Bone Fracture Healing

Authors: Gareth Ryan, Jessica Duong, Kim Rondeau and Prism Schneider

Background: Orthopaedic trauma patients with concomitant traumatic brain injury (TBI) are known to produce more fracture callus and experience lower rates of nonunion; however, the underlying mechanisms are poorly understood. Animal models have proposed a link between the hormone leptin, which is responsible for regulating energy storage, and fracture healing in the setting of TBI. Leptin modulates bone formation through direct activation of osteoblasts, inhibition of osteoclasts, and increased expression of osteogenic, osteoinductive, and angiogenic proteins. Specifically, leptin has been shown to upregulate osteogenic proteins in humans, including bone morphogenetic protein (BMP), vascular endothelial growth factor (VEGF), platelet-derived growth factor (PDGF), fibroblast growth factor (FGF), insulin-like growth factor (IGF) and growth hormone (GH). We hypothesize that patients with TBI will exhibit higher leptin and osteogenic protein levels compared to non-TBI patients and will subsequently experience a shorter time to union and lower rates of nonunion following long bone fractures.

Methods: This study will be a single-centre, prospective cohort of 60 patients with diaphyseal tibia or femur fractures with and without concomitant TBI. Patients who are 18-65 years of age with operatively treated diaphyseal tibia and femur fractures will be eligible for participation. TBI criteria will include Glasgow Coma Score (GCS) ≤ 12 and an Abbreviated Injury Score for head injury (AIS-head) ≤ 2 . Head injuries will be classified as concussion, epidural hemorrhage, subdural hemorrhage, subarachnoid hemorrhage, or diffuse axonal injury. Patients with Gustilo-Anderson Type III open fractures, previous fractures of the injured bone, pathological fractures, atypical fractures, known genetic or metabolic bone disorders, or chronic pre-injury systemic steroid use (over three months) will be excluded, as these are known confounders to fracture healing. The primary outcome measure will be radiographic fracture healing at 6-, 12-, and 24-week follow-up assessed using the radiographic union scale in tibia fractures (RUST). Our secondary outcome measures will include plasma levels of leptin, PDGF, VEGF, FGF, IGF, and BMP-2/4/7 measured at four distinct timepoints determined a priori: 24 hours post-injury, and at 2-, 6-, and 12-week follow-up. Leptin and osteogenic proteins will be measured by collecting blood samples at the above timepoints and running custom enzyme-linked immunosorbent assays (ELISA). Demographics including age, sex, gender, past medical history, medication use, smoking, alcohol, substances and socioeconomic status, as well as comorbidities and injury/fracture characteristics will be controlled for in our analyses. Statistical analysis will be performed using t-tests, multivariable Cox proportional hazards analysis.

Results: N/A

Discussion: The findings of this study will provide novel prospective clinical data to improve our understanding of the underlying physiological mechanisms linking TBI and fracture healing. Furthermore, should we establish an association between osteogenic and angiogenic proteins and fracture healing in TBI patients, the results of our study may inform further research into the effects of osteogenic and angiogenic supplementation in non-TBI patients with acute long bone fractures.

Conclusion: The relationship between TBI and fracture healing is poorly understood. This will be one of the first studies to explore the relationship between TBI, fracture healing, osteogenic proteins, and leptin prospectively in humans.

Acknowledgements: Foothills Orthopaedic Trauma Research Team, Calgary Surgical Research Development Fund.

COREF Funded: Yes

Abstract Type: Proposal

Research Pillar: Basic Science

Title: Weight Bearing CT in Scapholunate Interosseous Ligament Instability

Authors: Brodie Ritchie, Sarah Manske and Neil White

Background: The proposed study, to the best of our knowledge, will be the first to utilize weight bearing computed tomography (WBCT) imaging in in-vivo hand and wrist research. In foot and ankle, WBCT has become an increasingly important tool in the diagnosis and preoperative planning of complex pathologies, however hand and wrist has yet to use WBCT either experimentally or clinically. We believe WBCT can be used to improve our understanding of common pathologies that are painful under loading, such as scapholunate interosseous ligament (SLIL) injury. Weight bearing imaging allows surgeons to better assess alignment, instability, and joint space incongruencies in functional positions as compared to the offloaded joint. Foot and ankle studies have previously demonstrated increased accuracy in joint measurements using WBCT compared to radiographs and traditional non-weight bearing CT. The aim of this study is to demonstrate utility of WBCT in hand and wrist surgery through comparison of clinically relevant carpal bone measurements on x-ray, CT, and WBCT in normal healthy controls and patients with SLIL injury.

Methods: This prospective cohort study is approved under University of Calgary REB21-0803. Ten individuals with SLIL injury and ten healthy matched controls will undergo bilateral standard wrist x-rays, WBCT scans in wrist extension in a cone beam CT as well as non-weight bearing CT in a conventional CT (<390 μ Sv). Three trained investigators will perform the following measurements three times: the scapholunate angle, radiolunate angle, capitulate angle, and scapholunate distance. The values will be compared using ANOVA with post hoc Bonferroni correction.

Results: This project remains in the early stages; however, we have obtained images for two controls and four SLIL patients. We hypothesize that measurements will differ between controls and patients with SLIL injury, with WBCT demonstrating increased differences in clinically relevant carpal bone measurements compared to x-ray and non-weight bearing CT. We anticipate no statistical differences in inter and intra rater reliability in trained investigators.

Discussion: This study will be the first to compare clinically relevant measurements using WBCT to those obtained using conventional CT and radiographs in the hand and wrist. Limitations include the small sample size and the need for carpal bone measurements to be completed by trained raters, however, this could be automated in the future.

Conclusion: We believe that wrist WBCT offers the potential to gain a deeper understanding into both normal and abnormal carpal bone pathophysiology, which can inform treatment and ultimately improve outcomes for patients with complex hand and wrist pathologies. Future directions include investigating a spectrum of scapholunate interosseous ligament conditions such as scapholunate advanced collapse and scapholunate and scaphoid nonunion advanced collapse arthritis, dynamic vs. static scapholunate interosseous ligament injury, and eventually perilunate dislocations. The long-term goal of this research is to improve surgical decision making and technique surrounding SLIL injury.

Acknowledgements: McCaig Clinician Scientist Seed Grant

COREF Funded: No

Abstract Type: Proposal

Research Pillar: Clinical Research

Title: Development of a Pediatric-specific Anterior Cruciate Ligament (ACL) Quality of Life (QoL) Outcome Measure

Authors: Christopher Hewison, Denise Chan, Nicholas Mohtadi and Lisa Phillips

Background: Patient reported outcome measures (PROMs) are tools used to evaluate a patient's subjective health experience and the consequences of illness and medical intervention. The use of these outcome measures also play a crucial role in research and health policy. Studies have shown that adult outcome measures used in pediatric populations may not be comprehensible or valid. They recommended modifying these scales - particularly in general instruction, language, question format, and mapping - to adapt to the specific needs of adolescents. This has led to the modification and validation of pre-existing outcome measures for use amongst adolescents.

The rate of anterior cruciate ligament (ACL) ruptures diagnosed among the pediatric and adolescent population is increasing. This rise may be attributed to earlier sports specialization, year-round sports participation, increased awareness, and improved ability to diagnose the injury. The Anterior Cruciate Ligament Quality of Life (ACL QoL) Questionnaire is a disease specific outcome measure which has been validated for use in patients with ACL injuries. It consists of 5 domains: Symptoms and Physical Complaints, Work-Related Concerns, Recreational Activities and Sports Participation, Lifestyle, and Social and Emotional. This questionnaire is commonly used in all patients with ACL injuries, however, it has not been validated for use in the child and adolescent populations. The purpose of this study is to develop a modified version of the ACL QoL questionnaire that can be used in the child and adolescent populations.

Methods: An iterative quantitative and qualitative approach will be used in this study will be divided into three phases.

1) *Item Generation* - Pediatric experts (Surgeons, Sports Medicine Physicians and Physiotherapists) and patients will review a comprehensive list of items collated from existing pediatric knee questionnaires. They will be asked to identify any additional items. Once repeated surveying of participants has resulted in no new items generated, the comprehensive list of items will be formatted into an Item Reduction questionnaire.

2) *Item Reduction* - In the Item Reduction questionnaire, participants will be asked to rate each item on its relevance and importance using a 6-point ordinal scale (0 to 5). They will also be interviewed to provide qualitative feedback about their responses for each of the items. Based on responses, a frequency-importance product will be calculated for each item. An a priori frequency-importance product of 50% or greater will be considered the cut point for inclusion of that item in the questionnaire. Factor analysis will be used to determine the items that load onto the same factor (i.e., belong to the same domain or category). Item-total correlations will be calculated to confirm the reduced items. Pearson correlations will be calculated between each item and the total score within each domain. Those items with high correlations with their a priori construct will be retained in the questionnaire. The final list of items will be formatted into a Pre-test Pedi-ACL QoL questionnaire.

3) *Pre-Testing* - Participants will be asked to complete the Pre-test Pedi-ACL QoL questionnaire, by providing a response for each item using a 100-point visual analog scale (VAS). The responses on each item will be quantitatively analyzed to ensure that the response scale is appropriate and represents the full range of possible responses for the patient. Following completion of the questionnaire, an qualitative interview will be conducted with each patient to ensure that the wording of the Pre-test questionnaire is clear and that participants have interpreted each of the items as they are intended. Up to 3 rounds of pre-testing with groups of 5 patients per round will be completed. After each round, the pre-test questionnaire will be modified to incorporate patients' comments until no new changes are required.

Results: N/A

Discussion: N/A

Conclusion: N/A

Acknowledgements: Office of Surgical Research – Calgary Surgical Research Development Fund

COREF Funded: No