University of Saskatchewan &
University of Manitoba

Combined Orthopedic Resident Research Day

Friday, November 24, 2017

Twilight Room, The Willows
Saskatoon, Saskatchewan

VISITING PROFESSOR

Graham JW King, MD, MSc, FRCSC

Professor, Departments of Surgery, Medical Biophysics and Biomedical Engineering at the University of Western Ontario, Chief of Surgery and Director of the Roth McFarlane Hand and Upper Limb Centre at St. Joseph's Health Centre

Dr. Graham JW King received his MD degree at the University of British Columbia.

After completing a rotating internship at the University of Alberta he went to the University of Toronto to train in orthopaedic surgery. During a research year in Toronto he became interested in orthopaedic biomechanics and soft tissue healing.

After qualifying as an orthopaedic surgeon in 1989 he completed a clinical fellowship in hand and wrist surgery and a Masters of Science degree at the University of Calgary. He then travelled to the Mayo Clinic to gain further clinical experience in wrist and elbow surgery and additional research experience in upper extremity bioengineering.

In 1992 he joined the Department of Surgery at the University of Western Ontario. He established the Bioengineering Laboratory at the Hand and Upper Limb Centre at St. Joseph's Health Centre. With his collaborators he has developed strong linkages with the Departments of Medical Biophysics and Mechanical Engineering.

Over the past 20 years the laboratory has been successful in attracting extensive peer review funding including CIHR, CAS, CAN and NSERC and has numerous industry collaborations.

His current research interests focus on the biomechanics of the wrist and elbow as well as computer and image guided surgery. He has received the Premier's Research Excellence Award from the Government of Ontario and the J. Edouard Samson Research Award from the Canadian Orthopaedic Research Society.

He has represented the Canadian Orthopaedic Association as a North American Travelling Fellow and an American, British and Canadian Travelling Fellow. He has also served as the president of the Canadian Orthopaedic Research Society.

Orthopedic Surgery
FACULTY & RESIDENTS

University of Saskatchewan

Dr. Anthony King
Division Head

Dr. David Sauder
Program Director

Dr. Jonathan Norton
Research Director

Dr. Laura Sims, PGY5
Dr. James Ardell, PGY4
Dr. Paul Kulyk, PGY4
Dr. Matthew Mastel, PGY3
Dr. Kristen Pugh, PGY3
Dr. Sameh Ibrahim, PGY3
Dr. Sarah McLaren, PGY2
Dr. Scott Willms, PGY2
Dr. Kristi Billard, PGY1
Dr. Shizar Goosheh, PGY1

University of Manitoba

Dr. Peter MacDonald
Orthopedic Section Head

Dr. Ted Tufescu
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Jeff Leiter, PhD
Research Chair

Dr. Mina Aziz, PGY5
Dr. Yiyang Zhang, PGY4
Dr. Graeme Matthewson, PGY3
Dr. Gabriel Larose, PGY3
Dr. Samuel Larrivée, PGY3
Dr. Jonathan Tan, PGY2
Dr. Mark Xu, PGY2
Dr. Ian Laxdal, PGY1
Dr. Kevin Stockwell, PGY1

2017 COMBINED SASKATCHEWAN & MANITOBA

9:00	**Continental Breakfast**	
9:35	**Welcome & Introduction**	**Jonathan Norton**
9:40	**Changes in Motor Latency During Spinal Decompression – Midterm Analysis**	**James Ardell Raymond Khan**
9:50	**Traumatic Gluteal Laceration with Open Sciatic Nerve Injury Following Fall from a Horse: A Case Study**	**Sarah McLaren**
10:00	**Fermoral Nerve Blocks: Why are they Not Performed?**	**Ian Laxdal**
10:10	**Intraoperative Fracture Risk – Traditional Versus Compaction Broaching Methods for Total Hip Arthroplasty**	**Kevin Stockwell**
10:20	**Questions**	
10:35	**Coffee Break**	
10:50	**The Effects of Rotator Cuff Repair on Sleep and Upper Extremity Use – A Research Proposal**	**Samuel Larrivée**
11:00	**EMG Analysis of Deltoid Activity Pre and Post Reverse Total Shoulder Arthroplasty for Rotator Cuff Arthropathy**	**Graeme Matthewson**
11:10	**Is Patient Satisfaction in Arthroscopic Shoulder Surgery Improved by Personalized Patient Videos? A Randomized Control Study**	**Laura Sims**
11:20	**Questions**	
11:35	**Developing a Career as a Surgeon Scientist**	**Graham King**
12:00	**Luncheon**	

RESIDENT RESEARCH DAY PROGRAM

1:00	**Percutaneous Pin Fixation of Distal Radial Fractures and the Girl with the Curl**	**Kristi Billard**
1:10	**Removal of Bacteria from Prosthetic Surfaces**	**Kristen Pugh**
1:20	**Distal Radial Fractures in Women: Neurological Symptoms Matter**	**Jennifer Mann**
1:30	**Questions**	
1:45	**Canadian National Survey on Surgical Site Infection Prophylactic Strategies in Spine Surgery**	**Mark Xu**
1:55	**Factors Associated with an Increased Risk of Developing a Post-operative Infection Following Spine Surgery**	**Mina Aziz**
2:05	**Evaluation of Pedicle Screw Pullout Strength in Osteoporosis Bone: A Biomechanical Study**	**Jonathan Tan**
2:15	**Questions**	
2:30	**Coffee Break & Group Photo**	
2:50	**The Relationship Between Injury to Surgery Time and The Incidence of Secondary Joint Injury in an ACL Injured Population: A Randomized Control Trial**	**Gabriel Larose**
3:00	**Osteoporosis Management in Post Fragility Hip Fracture Patients: A Quality Improvement Study**	**Scott Willms**
3:10	**Applying the 2010 Osteoporosis Canada Guidelines: Osteoporosis and Fall Prevention Education in Orthopaedic Surgery Residents**	**Yiyang Zhang**
3:20	**Questions**	
3:35	**State of the Art in Total Elbow Replacement**	**Dr. G. King**
4:05	**Conclusion of Academic Program**	**Dr. Sauder**
5:00	**Awards Dinner**	

Changes in Motor Latency During Spinal Decompression – Midterm Analysis

James Ardell, PGY4 Raymond Khan, Jonathon Norton, Allan Woo and Michael Spiess
University of Saskatchewan

Introduction: Lumbar spinal stenosis is a narrowing of the spinal canal which often presents with back and leg pain, weakness, claudication and other neurological symptoms. Surgical decompression has lead to reduction in pain and improved function in patients with spinal stenosis not amenable to non-operative treatments.

Objectives: This study will explore how surgical treatment of spinal stenosis affects walking speed, and if there is a relationship between post-operative walking speed and changes in how fast motor signals are transmitted in the spinal cord intra-operatively. The study will also survey how surgery affects participants' overall quality of life.

Methods: Participants undergoing surgery for spinal stenosis will be asked to complete an SF-36 questionnaire and perform a timed 10m walking speed test at their pre-surgery visit and again at their 3 month follow-up after surgery. Intraoperative measures of motor nerve conduction and any latency decreases will be recorded.

Results: Pending

Conclusion: Pending

Traumatic Gluteal Laceration with Open Sciatic Nerve Injury Following Fall from a Horse: A Case Study

Sarah McLaren, PGY2, Dr. A Dzus
University of Saskatchewan

Background: Peripheral nerve injuries are often seen in orthopedic trauma settings. Traumatic sciatic nerve injuries are often the result of pelvic or femur fractures and are often closed injuries due to the large soft tissue envelope overlying the sciatic nerve. In this case study we will look at an example of an open sciatic nerve injury resulting from a traumatic laceration following a fall from a horse.

Case Presentation: A 40 year old, otherwise healthy, female is bucked from a horse causing a large laceration to her left proximal, posterior thigh after landing on an uncovered metal rod acting as the saddle horn. The patient immediately noticed a large amount of blood and a "floppy foot" . Upon presentation to hospital bleeding has stopped, the patient is stable and a sciatic nerve injury is suspected. After an appropriate trauma workup the patient is transported to the tertiary care hospital where she underwent an irrigation and debridement and exploration of the sciatic nerve. It was found to be in continuity but severely bruised, particularly at the peroneal branch. Plastic surgery was involved and a diagnosis of neuropraxia was given. Post-operatively the patient was given a foot drop splint and made activity as tolerated. At early follow up visits the patient is showing signs of early recovery but still has significant deficit. Ongoing follow-up is still pending.

Discussion: This case has a unique combination of several common orthopaedic trauma presentations, a large open injury resulting in significant damage to the sciatic nerve. The anatomy of the sciatic nerve is important to review when assessing the degree of injury and the prognosis for recovery. The peroneal segment of the sciatic nerve is often the branch that is most easily damaged as in this case. At the time of this abstract we are still in the early phases of recovery but it is recovering as would be expected from a nerve injury that remained in continuity.

Femoral Nerve Blocks: Why Are They Not Performed?

Ian Laxdal, PGY1 Jeff Leiter
University of Manitoba

Background: Femoral nerve blocks are an effective anesthetic for hip fractures in the emergency department. A recent Cochrane Review update demonstrated a decrease in pain, reduction in the risk of developing pneumonia and decreased time to mobilization when compared to systemic analgesia.

Hypothesis: It was hypothesized that nerve blocks would be underrepresented as a pain management strategy in the Emergency Department for acute femoral neck fractures.

Study Design: Survey

Methods: Canada Wide Survey

Results: 272 Emergency physicians took part in the survey and identified as having a variety of levels of experience. The cohort was composed of residents (42/272; 15.4%), attending physicians with five years or less of experience (62/272; 22.8%), attending's with 6-15 years' experience (86/272; 31.6%) and greater than 15 years of experience (82/272; 30.2%). Slightly more than half of participants work in tertiary centers (140/272; 51.5%) and a minority (32/272; 11.8%) were from rural hospitals. The vast majority (270/272; 99.3%) have ready access to an ultrasound machine in their emergency room. The majority of respondents (192/256; 75.9%) chose intravenous opioids as their first line of analgesia. Of practitioners who did not identify intravenous opioids, acetaminophen (34/256; 19.2%) and peripheral nerve blocks (10/265; 7.6%) were the most popular pain management modalities.
In response to practitioner comfort with peripheral nerve blocks for hip fractures, most were not confident in their ability to safely and effectively perform this procedure. Most were not at all confident (117/260; 45.0%) or somewhat confident (61/260; 23.5%). A minority identified as very or extremely confident. Respondents were asked to identify barriers which interfere with performing nerve blocks for hip fractures in the emergency room.

Conclusion: Femoral nerve blocks are an extremely underutilized procedure in Canadian Emergency departments and a lack of formal training seems to be the single most important barrier to increased utilization.

Intraoperative Fracture Risk—Traditional Versus Compaction Broaching Methods for Total Hip Arthroplasty

Kevin Stockwell, PGY1 Burnell, Trevor Gascoyne
University of Manitoba

Background: More than 31,000 total hip arthroplasties (THAs) were conducted in Canada in 2010 and the demand is expected to increase nearly 3-fold as the population ages. Intraoperative fracture is a major complication for modern THAs which rely on a press-fit design to achieve stability. These fractures occur in 3-28% of cases and threaten stability and longevity of the prosthetic. Two predominant surgical
preparation techniques of the femur are compaction broaching (bone conserving) and standard broaching (bone extracting).

Purpose: This study sought to compare forces, strains, and energies experienced by standard or compaction broached cadaveric femurs during femoral stem implantation to predict
intraoperative fracture risk.

Study Design: Cadaveric Biomechanical Test.

Methods: This study sought to compare forces, strains, and energies experienced by standard or compaction broached cadaveric femurs during femoral stem implantation to predict intraoperative fracture risk. Strain gauges were attached to four matched-pair femurs in areas of reported intraoperative fracture, namely the calcar region. Four metrics were used to compare the broached femurs: peak hoop strain, strain energy retention, peak force, and total energy invested. The femurs were implanted with femoral stems and then loaded to fracture, the four comparison metrics were analyzed for both implant and fracture.

Results: The small sample size of this study (n=4) limited its ability to draw statistically significant conclusions. However, trends in the data suggest that compaction broached femurs display a higher strain energy retention, lower force to implant and fracture, lower energy to implant ($p = 0.03$) and fracture.

Conclusions: These findings suggest that compaction broached femurs are at higher risk of intraoperative fracture. This study emphasises that surgeons must employ careful selection of implant systems and techniques when operating on patients at risk of intraoperative fracture.

The Effects of Rotator Cuff Repair on Sleep and Upper Extremity Use—A Research Proposal

Samuel Larrivée, PGY3 Jason Old, Jeff Leiter
University of Manitoba

Background: Shoulder pain is a common complaint in general and orthopedic surgery practice. A significant proportion of the affected patients suffer from rotator cuff tears (RCT). With the aging population, RCT have become more frequent and cause significant impact on daily activity and sleep quality. However, the effect of RCT and subsequent arthroscopic repair on patient's sleep and upper extremity use is not well known.

Hypothesis: We hypothesize that rotator cuff repair will subjectively and objectively improve both upper extremity activity and sleep quality in patients undergoing surgery.

Study Design: Prospective cohort study

Methods: Twenty (20) patients with MRI-confirmed rotator cuff tear consenting for an arthroscopic repair will be recruited from an upper extremity orthopedic surgery practice. Participants will complete the Pittsburgh sleep quality index (PSQI), Shoulder activity level scale, Simple Shoulder Test (SST), and American Shoulder and Elbow Society score (ASES) one week prior to the surgery, and at the 3-week, 3-month and 6-month follow-ups. They will also wear the GT9X wrist accelerometer on the affected side for one week at each endpoint. The accelerometer will record activity counts as a proxy for upper extremity use, total sleep time, sleep latency, and sleep efficiency.

Results: Correlation between outcome variables and intra-operative variables (size of tear, type of repair, etc.) will be made using Spearman's rank correlation coefficient. ANOVAs will be used to assess pre- and post-operative change in all variables. Post-hoc analysis of significant variables will be carried using Wilcoxon's signed rank test and Bonferonni's correction.

Conclusion: The results of this study will help surgeons discuss the expected benefit of arthroscopic rotator cuff repair on sleep quality and upper extremity activity with patients considering surgery.

EMG Analysis of Deltoid Activity Pre and Post Reverse Total Shoulder Arthroplasty for Rotator Cuff Arthropathy

Graeme Matthewson, PGY3 Jeff Leiter, Jason Old
University of Manitoba

Background: Rotator cuff disease is a highly prevalent condition that drastically impacts a patient's function and quality of life. With a wide spectrum of pathology from tendinitis to rotator cuff arthropathy (RCA) there are many challenges when trying to bring patients back to an acceptable level of function. Representing the most extreme end of the spectrum, RCA was a particularly difficult etiology to treat up until the advent of the reverse shoulder arthroplasty (RSA). Obviating the reliance on an intact rotator cuff, and passing this on to the deltoid, RSA seemed to be the answer, however, many patients are still unable to regain functional use of their affected arm. Previous studies which analyzed the muscular activity of patients suffering rotator cuff disease have shown out of phase activation of the adductor musculature of the shoulder, which helps to stabilize and center the glenohumeral joint in the absence of an intact rotator cuff. However, this activation comes at a cost as a patient's overhead ROM is then severely limited.

Hypothesis: Following RSA, patients retain a dysfunctional motor pattern and activation of the adductor musculature of the shoulder, despite the inherent stability provided by the implant.

Study design: Case Control Study

Methods: 30 patients will be recruited (10 healthy aged matched volunteers, 10 patients with RCA, 10 patients post RSA). sEMG activity will be recorded for the deltoid (anterior and middle heads), pec major, teres major, and upper trapezius as well as teres minor/infraspinatus. Motion sensors will be attached to the upper arm to standardize the movements and to synchronize the sEMG activity. Movements performed will mimic activities of daily living as well as standard physical examination movements for the shoulder.

Results: As hypothesized there will be increased "out of phase" activation of the adductors of the shoulder which will correspond with a decrease in shoulder elevation.

Conclusion: Out of phase activation of the adductors of the shoulder cause a decrease in shoulder elevation. This activation could be a potential target for physiotherapy interventions to retrain the shoulder musculature to allow improved function in daily activities.

Is Patient Satisfaction in Arthroscopic Shoulder Surgery Improved by Personalized Patient Videos? A Randomized Control Study

Laura Sims, PGY5 Raymond Khan, David Sauder
University of Saskatchewan

Introduction: Outcomes following shoulder arthroscopy can be challenging to accurately assess, with patient satisfaction increasingly recognized as an important component. The purpose of this study was to evaluate whether providing patients with a personalized video of their arthroscopic shoulder surgery improved patient satisfaction.

Methods: This was a multi-surgeon randomized control study performed at a single center. Adult patients undergoing arthroscopic shoulder decompression, rotator cuff repair, or labral repair were enrolled and randomized by a coin-flip method. The control group received no video of their surgery during the study period whereas the intervention group was provided with a narrated video of their procedure following surgery. Patients with a previous ipsilateral shoulder arthroscopy or an inability to participate in follow-up were excluded. Surgeons were blinded to group allocation. Patient satisfaction with their procedure and with the information they received regarding their procedure was assessed at three months using a Visual Analogue Scale (VAS), Likert Scale, and Quick Disabilities of the Arm, Hand, and Shoulder (DASH) score.

Results: Fifty participants were assigned to the intervention group, with 41 completing follow-up and 47 were assigned to the control group, with 39 completing follow-up. Baseline characteristics between groups did not vary significantly. Average VAS satisfaction score for the control group was 8.5 (+/-2.2) and for the intervention 9.0 (+/-1.5) out of a possible score of 10.0. These were not significantly different (P = 0.38). There were no significant differences between groups with respect to Likert and QuickDASH scores. A subgroup analysis did not show any significant differences in any measure at three month follow up.

Discussion: Personalized videos had no influence on patient satisfaction. In general, most patients were satisfied with their surgical procedure independent of the method of information delivery. Surgeons might investigate other means to improve patient satisfaction in the small group of unsatisfied patients.

Percutaneous Pin Fixation of Distal Radial Fractures and the Girl with the Curl

Kristi Billard, PGY1 Dr. Geoffrey H Johnston
University of Saskatchewan

Purpose: Distal radial fractures (DRFs) constitute a most common adult fracture. For those treated surgically, techniques include volar plating and percutaneous pin fixation (PPF). The purpose of the study was to evaluate the clinical outcomes of PPF of DRFs in adult women at our institution.

Method: In this retrospective review, the authors identified adult women (n=24, age 28-84) whose DRF treatment consisted of closed reduction, PPF and cast immobilization and who had consistent post-operative follow-up. Measurements of patient rated wrist evaluation (PRWE) scores at nine (n=13), 12 (n=17), 26 (n=15) and 52 (n=9) weeks post-fracture were reviewed. The patients were divided into three groups; those with poor outcomes (loss of fixation or development of chronic regional pain syndrome, n=7), average outcomes (n=12), and excellent outcomes (n=5). Statistical comparisons used a two-way (treatment, time) analysis of variance (ANOVA) with a Post-hoc Tukey test. Significance was set at $p \leq 0.05$.

Results: The PRWE averages and ranges at nine, 12, 26, and 52 weeks were 62 (14 - 115), 64 (6-139), 41 (2-125) and 53 (15-127), respectively. Subgroup analysis of the poor, average, and excellent outcome groups revealed average PRWE scores at 12 weeks of 103, 62, and 18, respectively. ANOVA demonstrated statistically significant difference between the groups ($p<0.001$), and the Tukey test revealed a significant difference between the poor and excellent outcome groups ($p<0.01$).

Conclusion: In our experience, DRFs in women treated by PPF do not fare as predictably well as their counterparts treated by plating.

Our findings remind us of Longfellow's poem "*There was a little girl, Who had a little curl, Right in the middle of her forehead. When she was good, She was very good indeed, But when she was bad she was horrid*."

Surgeons should keep this unpredictability of PPF in mind when choosing surgical treatment for DRFs, at least in adult women.

Removal of Bacteria from Prosthetic Surfaces

Kristen Pugh, PGY3 William Dust, Joseph Blondeau
University of Saskatchewan

Background: Infections in total joint arthroplasties are a costly and disastrous complication. The gold standard treatment is a staged revision. Stage one consists of removing the prosthesis and treating the infection. Stage two involves putting the joint back in once the infection is cleared. A popular initial procedure is to perform an arthrotomy and irrigation and debridement of the joint, followed by a course of intravenous and oral antibiotics while retaining the components. The literature suggests the success is a function of how long the infection was present before the irrigation and debridement is performed. Some literature suggests that after only 2-3 days an irrigation and debridement is futile, while others suggest that if it is done before 2-4 weeks the chances of success are good. Most of the literature suggests if the infection exists for longer than 4-6 weeks, the best treatment is to proceed straight to a staged revision.

Research Question: How effectively can we remove bacteria from prosthetic joint surfaces as a function of time?

Methods: Sixty prostheses (30 femoral stems and 30 polyethylene surfaces) to be contaminated with staphylococcus epidermidis and incubated. Prostheses have been split into 3 groups of 20 components (10 femoral stems and 10 polyethylene surfaces) per group. Group 1 will be incubated for 2 days, group 2 for 3 weeks and group 3 for 6 weeks. A trial was performed in the lab using 1 femoral stem and 1 polyethylene surface, which were contaminated and incubated for 2 days. Swabs were taken from each surface and plated to blood agar plates and then incubated overnight at 35-37 Celsius in oxygen. Additionally, each surface was irrigated with 3 litres pulsed irrigation using normal saline. After irrigation, each surface was swabbed and once again plated on blood agar plates and incubated as above. The plates were examined for organism growth the next day.

Analysis: By performing quantitative cultures pre- and post-irrigation, we will be able to determine the proportion of bacteria removed from metal and polyethylene surfaces at each of the three times. We will then be able to compare the proportions removed as a function of the three times.

Results: Initial results show there was a clear substantial decline in organism numbers after irrigation.

Discussion: the study has not gone forward at present due to containment issues with pulsed irrigation of the contaminated components within the lab. We are currently looking for a solution to this problem before proceeding with the study.

Conclusions: Not available at this time

Distal Radial Fractures in Women: Neurological Symptoms Matter

Jennifer Mann, Med III Geoffrey HF Johnston, Jonathan Norton
University of Saskatchewan

Purpose: Distal radial fractures (DRFs) are amongst the most common of adult fractures. Many patients have neurological symptoms. But are such symptoms benign?

The objectives of this study were to first document the prevalence of recorded neurological symptoms after a DRF in a cohort of adult women, and then secondly to compare the functional recovery, multi-dimensionally, of patients who experienced neurological symptoms and those who did not, after either non-operative or surgical management.

Methods: The clinical records of 490 DRF patients treated sequentially (300 non-operatively and 190 operatively) were reviewed.

Recorded "neurological symptoms", including tingling, pins and needles, altered feeling, or numbness, in the hand or wrist were identified.

Non-operative treatment consisted of a closed reduction and 5-6 weeks of casting. Operative fixation typically consisted of either a volar plate and screws (majority), or percutaneous pins.

Serially measured wrist and forearm range of motion (ROM), grip strength, and patient-reported outcomes (PRWE) were available for up to nine, 12, 26 weeks and one year post fracture.

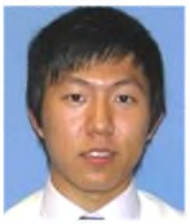
The prevalence of neurological symptoms in the non-operative and operative DRF groups was calculated.

The outcomes of the non-operative and operative groups with and without neurological symptomatology were independently evaluated, using a one-tailed t-test ($p<0.05$).

Results: The prevalence of neurological symptoms in the non-operative and operative DRF groups was 11.3%, and 17.8%, respectively. Median and undefined neurological symptoms were identified more frequently in the surgical group. Radial nerve symptoms were exclusively associated with percutaneous pin fixation.

Neurological symptoms were typically associated with higher PRWE scores and lower restoration of ROM and grip strength, regardless of treatment, at each of the four time points ($p<0.05$).

Conclusion: More than one-in-ten women in this DRF cohort experienced neurological symptoms. Such symptoms were associated with a negative impact on functional recovery. Neurological symptoms in a DRF population are not benign – they matter.



Canadian National Survey on Surgical Site Infection Prophylactic Strategies in Spine Surgery

Mark Xu, PGY2 Michael Goytan, John Street
University of Manitoba

Background: Numerous prophylactic strategies have been proposed to mitigate surgical site infection (SSI) risk. However, no national guidelines exist and practices of Canadian spine surgeons remain unknown.

Goal: We conducted a Canadian Spine Society (CSS) survey to capture current practices with respect to SSI prophylaxis.

Study design: Survey

Methods: CSS membership were emailed a 37-item questionnaire developed following a systematic review of the literature.

Results: Fifty two spine surgeons completed the survey, of whom 94% were fellowship trained. With the exception of preoperative antibiotics in instrumented cases, no SSI prevention strategies were universally utilized by respondents. For all prophylactic strategies, there was greater reported use for instrumented cases as compared to uninstrumented. Strategies used by a majority of respondents were MRSA screening (64% in instrumented and 59% in uninstrumented cases), optimization of diabetic blood glucose (69% and 60%), hair clipping from the operative site (86% and 83%), iodine-impregnated drape application in instrumented cases (60%), routine Cell Saver use, saline wound irrigation (97% and 93%), intrawound vancomycin in instrumented cases (66%), and pre- and post-operative antibiotics. All respondents gave preoperative antibiotics in instrumented cases, with 95% in uninstrumented cases, and almost all used a 1st generation cephalosporin. 90% re-dosed intraoperatively every 4 hours. In penicillin allergy, there was equal use of vancomycin versus clindamycin. 78% gave postoperative antibiotics in instrumented cases versus 53% in uninstrumented cases, with 87% for 24 hours' duration or less. 67% closed with monofilament subcuticular absorbable suture, while 43% used staples. Factors considered high risk by a majority of respondents were obesity, diabetes, immunodeficiency, history of infection, revision surgery, tumor cases, instrumentation, and prolonged surgical duration.

Conclusions: There is significant variation in the adoption of SSI prophylactic strategies by CSS members. This survey will help direct future development of national guidelines for spine SSI prophylaxis.

Factors Associated with an Increased Risk of Developing a Post-operative Infection Following Spine Surgery

Mina Aziz, PGY5 Michael Goytan
University of Manitoba

Background: Post-operative infection is a serious complication of spine surgery and can contribute to the strain on the healthcare system's resources; some studies have estimated the cost of such an infection to be $200,000 per patient. The purpose of this study is to determine what factors affect risk of developing postoperative infection.

Hypothesis: We hypothesize that female gender, smoking, diabetes, having thoracolumbar procedures, having a neurological deficit, increased age, body mass index (BMI), medical comorbidities and number of operative levels increase the patients' risk of developing a post-operative infection.

Study design: Retrospective review of prospectively collected data within the Canadian Spine Outcome Registry Network (CSORN).

Methods: Data was analyzed using the Statistical Analysis System (SAS) statistical software with ANOVA to analyze continuous variables while odds ratios and Fisher's exact tests were used to analyze categorical variables, $p<0.05$.

Results: Out of 4888 patients identified from the registry, 3152 patients had complete data and were included in the analysis. There were 88 infections recorded representing a 2.8% risk of infection. There were no statistically significant differences in gender, age, smoking status, neurological status or number of comorbidities between groups. Patients who developed a post operative infection had more operative levels (3.1±2.4 vs 2.6±1.6) ($p<0.01$). Patients who are diabetic were 1.89 times more likely to develop an infection (CI 1.13-3.15, $p<0.02$) and those undergoing thoracolumbar procedures were 2.65 times more likely to develop an infection (CI 1.27-5.51, $p<0.01$). Those who developed an infection had significantly higher BMI (30.12±6.29 vs 28.68±6.15) ($p<0.03$).

Conclusions: There is a 2.8% overall rate of post-operative spine infection in 20 Canadian centres. The factors that were associated with patient risk of developing a post operative-infection were diabetes, thoracolumbar procedures, more operative levels and increased BMI. This study establishes a benchmark against which the effectiveness of future interventions to reduce infection can be compared.

Evaluation of Pedicle Screw Pullout Strength in Osteoporotic Bone: A Biomechanical Study

Jonathan Tan, PGY2 Michael Goytan
University of Manitoba

Introduction: A pedicle screw construct is a common implant for fusion of the thoracic and lumbar spine. Common causes of failure are screw loosening or pull-out from the bone, often as a result of reduced screw purchase in poor quality bone (Okuyama, 2001).

Hypothesis: Our hypothesis is that in osteoporotic bone, longer, larger diameter screws with deeper threads will have a higher pullout strength compared to short, small diameter screws with shallower threads.

Methods: Computer simulation through finite element analysis (FEA) and biomechanical lab tests can be used to assess and optimize different pedicle screw designs with normal bone and osteoporotic bone. Two main tests will be performed through FEA and biomechanical tests. The biomechanical test will evaluate pullout strength in accordance with ASTM standard F543-13 and with a newly designed test that evaluates pullout strength following cantilever loading. It will be performed in normal bone and osteoporotic bone. The FEA model will be validated by comparing to biomechanical tests. This will be clinically relevant as we will be using Sawbone models that have been validated to cadaver lumbar spines (Nagaraja 2016).

Results: Upon completing testing, we will have results of pullout strength in normal and osteoporotic bone with different screw designs (Stryker Xia 3, Synthes Matrix, Depuy Expedium). Test results will be available before November 2017.

Conclusions: We will be able to compare factors that influence pullout strength in normal and osteoporotic bone. A validated FEA and biomechanical model will be useful tool in testing novel implant designs in osteoporotic bone.

The Relationship Between Injury to Surgery Time and The Incidence of Secondary Joint Injury in an ACL Injured Population: A Randomized Control Trial

Gabriel Larose, PGY3 Meaghan Rollins, Peter McDonald, Jason Peeler, Sheila McRae, Jeff Leiter U of M

Background: The ACL is the most injured ligament of the knee with over 100 000 reconstruction surgery every year in the US [Owings et al 1998]. Previous registry's studies showed that early fixation of the ACL would be cost effective [Mather et al 2014]. However, a new prospective study [Kiadaliri et al 2017] failed to show a difference between early or delayed surgery. Observational studies illustrate that delayed surgery increase the incidence of secondary injuries to the knee [Gupta et al 2016, Anstey et al 2015, Magnussen et al 2013]. However, new observational literature didn't show a difference [Hur et al 2007]. A randomized prospective study was executed to determine the incidence of secondary pathologies after delayed surgery.

Method: Fifty-eight patients with acute ACL rupture confirmed by MRI were recruited at the Pan Am Clinic. Patients (29 each group_ were randomized to either early fixation(EF) (< 12 weeks) or delayed fixation (DF). Secondary pathologies were assessed with an MRI at the time of recruitment and during a direct assessment during the surgery. SPSS was used to compare the incidence of secondary pathology between the two groups ($p<0.05$).

Results: The average waiting time for the early group was 10.5 weeks and for the delayed group 31.5 weeks ($p<0.001$). Both groups were similar for age, gender, smoking status. There were no differences in quality of life and Tegner score. There were no differences in the incidence of damage to any of the compartments at the time of the injury (I-T) or at the time of the surgery (S-T) (IT: medial compartment: EF: 1, DF: 1; none in all the other compartments; S-T: medial: EF:1, RF: 5, $p=0.19$; lateral: EF:3, DF 1, $p=0.61$; patello-femoral: EF:2, dF:2). There were no differences in meniscal injury (I-J: medial EF: 5, DF: 9; lateral EF: 8, DF:12; S-T: medial EF: 5, DF: 3 $p= 0.70$; lateral EF: 10 DF: 10).

Discussion: There were no differences in secondary injury with delayed surgery. However, since the time of injury to reconstruction was longer in the delayed group, the quality of life of these patients stayed decreased for a longer period. This study illustrates that the waiting time may have an impact on the quality of life, but may not be detrimental to the patients' knee.

Osteoporosis Management in Post Fragility Hip Fracture Patients: A Quality Improvement Study

Scott Willms, PGY2 Dr. Geoffrey HF Johnston
University of Saskatchewan

Background: Fragility fractures are defined as a fracture occurring spontaneously or following minor trauma such as a fall from standing height or less. The cause is multifactorial but diminished bone density, and particularly osteoporosis is the root cause for this fracture occurrence. It is estimated that people with osteoporosis have up to a seven-fold higher risk of suffering another fragility fracture compared to their normal bone density counterparts. The risk of such fractures is known to be significantly reduced by appropriate treatment of the underlying osteoporosis. According to the 2010 Canadian Osteoporotic guidelines, there is strong evidence to suggest that patients with prior fragility fractures should be treated with osteoporotic medication. However, data from a prospective quality improvement project done in Saskatoon in 2014 showed that hip fracture patients were being substantially undertreated; SHR data suggests the same. Despite this, no steps have been taken to remedy this profound treatment gap.

Objective: The quality improvement project is to increase the number of hip fracture patients being treated for osteoporosis, by targeting the most responsible physician (MRP), the orthopedic surgeons.

Methods: The strategy will be to first educate the Saskatoon orthopedic surgeons as to the importance of osteoporotic medication post fragility hip fracture, as well as to the benefit, and indeed, need for them to initiate pharmacologic management while these patients are in hospital. Secondly we would strive to change post-operative order sets to include alendronate, vitamin D, and calcium as these are the minimal treatment measures for a fragility fracture. Thirdly we will improve patient discharge-from-hospital practices so that patients will be discharged with a prescription for alendronate, and the treating MRPs, including the patients' family doctors, will be informed of these changes, changes which we would recommend that they would assume primary responsibility for ongoing pharmacologic treatment of the osteoporosis.

Outcome: The outcome would be to measure the number, and percentage, of fragility hip fractures being discharged from the acute care hospital having already been started on anti-resorptive medications. Our expectation will be that nearly 100% of fragility hip fractures eligible for such treatment will be started on alendronate.

Applying the 2010 Osteoporosis Canada Guidelines: Osteoporosis and Fall Prevention Education in Orthopaedic Surgery Residents

Yiyang Zhang, PGY4 Ted Tufescu
University of Manitoba

Introduction: Over 6.2 billion dollars are spent every year in Canada addressing fall-related injuries. Over one third of fall-related hospitalizations among seniors are associated with hip fractures. Orthopedic surgeons provide timely surgeries for these hip fractures, which alleviate pain, return functional mobility, and provide mortality benefits. However, as gatekeepers in potentially preventing re-fractures, Orthopaedic surgeons generally fail to treat the underlying cause, osteoporosis.

Hypothesis: The Osteoporosis Slide Kit is effective in teaching Orthopedic residents the basics and latest recommendations on osteoporosis as established by Osteoporosis Canada.

Methods: The PowerPoint presentation from the 2010 Osteoporosis Canada Guidelines slide kit aimed for general practitioners was used as a basis and tailored toward Orthopaedic Surgery residents. There were 15 multiple choice questions derived from the PowerPoint presentation. Questions were administered to the residents before and after a didactic review of the presentation. As well, the same test was administered after 8 weeks to assess for knowledge retained.

Results: For the study, 23 residents from University of Manitoba and University of Calgary participated with their years of training ranging from PGY 1-5. The 15 question test was administered before, after, and 8 weeks post reviewing the presentation. The average of the pre-test and post-test was 9.91±1.41 and 12.4±1.53, respectively. The average of the 8 week post presentation was 10.17±1.70. The Student's Paired T-Test was performed and statistical difference ($p<0.05$) was found between pre-test vs. post-test, and post-test vs. 8 week test.

Conclusion: Osteoporosis is a prevalent condition that can be detrimental on the patient and costly to the healthcare system. The Osteoporosis Kit delivered to Orthopaedic residents for the purpose of improving knowledge demonstrate a positive statistical difference in pre-test and post-test score. However, in our limited sample size, it did not demonstrate retained knowledge in pretest and 8 week post-test. Future studies with sufficient sample sizes would be required to draw firm conclusions regarding adequacy of didactic lecture and multiple choice testing as a learning tool for osteoporosis guidelines.

Notes

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Grateful Acknowledgements to:

Zimmer Biomet

Orthopedic Surgery Residency Training Program
Department of Surgery
University of Saskatchewan
Royal University Hospital
103 Hospital Drive
Saskatoon, SK S7N 0W8
http://www.medicine.usask.ca/surgery