

Resident Research Day



Department of Orthopaedic Surgery & Sports Medicine

Lewis Katz School of Medicine at Temple University

Saturday April 17, 2021

Supported by the John Lachman Orthopaedic Research Fund

Research Day Agenda

4/17/2021

Zoom Meeting online: <https://temple.zoom.us/j/95698562980>

Moderator: Saqib Rehman, M.D.

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| 8:00-9:00am | Grand Rounds Presentation Kenneth A. Egol, MD Joseph E. Milgram Professor of Orthopedic Surgery and Vice Chair, Department of Orthopedic Surgery NYU School of Medicine NYU Langone Health NYU Langone Orthopedic Hospital | “Mistakes I’ve Made in Trauma: Why and What not to do Again” |
| 9:00-11:15 | Resident Research Presentations Etká Kurucan, Jared Colon, Heather Flynn, Rajkishen Narayanan, Bradley Wiekrykas, Dana Cruz, Alexander Johnson, Nimit Lad, John Reynolds | 10 minute presentations 5 minutes for questions |
| 11:30 | Lunch and announcement of winners presented by Dr. Egol and the John Lachman Orthopaedic Research Fund | |

9:00 Etku Kurucan – “Factors Predicting Increased Length of Stay in Patients with Drainable Upper Extremity Abscesses”

Evan Jacquez, Etku Kurucan, Hesham Abdelfattah, Mark Solarz

Hypothesis: Intravenous drug use (IVDU) is associated with longer hospitalizations for patients who undergo irrigation and debridement for the treatment of upper extremity abscesses.

Methods: This is a retrospective review of patients admitted to a single urban teaching hospital for upper extremity abscesses who underwent either bedside or operative irrigation and debridement between 2016 and 2019. Patient characteristics from a preexisting and deidentified database were analyzed over the course of this study. IVDU and non-IVDU patients were compared. In addition, we compared patient characteristics by categorizing length of stay (LOS) into three equally sized groups (<3 days, 3-4 days, >4 days). Chi-square and t-tests were used to compare categorical and continuous variables between groups, respectively. Analysis of variance model was used in the comparison of continuous variables between the three LOS groups. A multivariable regression analysis was also performed for the continuous variable LOS. Statistical significance was set at $p < 0.05$. All calculations were performed using Stata 13.1 (StataCorp, College Station, TX).

Results: 315 patients met inclusion criteria. Mean length of stay for all patients was 5.1 days. IVDU patients were admitted for 5.5 days versus 4.6 days for non-IVDU patients ($p=0.21$). Statistically significant differences were found in the lengths of stay of IVDU patients, with 39.1% of these patients having hospital stays >4 days as

opposed to 34.6% in the 3–4 day group and 26.3% in the <3 day group ($p=0.01$). Hepatitis C ($p<0.01$) and diabetes mellitus ($p=0.04$) were associated with increased lengths of stay in the categorical analysis. Elevated erythrocyte sedimentation rate at the time of admission was also found to be associated with longer hospital stays ($p=0.03$). On multivariable analysis, hepatitis C and diabetes mellitus were associated with increased length of stay ($p=0.01$ and $p<0.01$, respectively).

Summary Points:

- Patients engaging in intravenous drug use were hospitalized for an average of 5.5 days, with a significant proportion experiencing stays >4 days.
- Hepatitis C infection and diabetes mellitus are associated with increased length of stay, as are elevated inflammatory markers on admission
- Further studies investigating the specific causes of increased LOS in IVDU patients with upper extremity abscesses may benefit the multidisciplinary treatment team to direct resources appropriately

9:15 Jared Colon – “Acute Management of Open Long Bone Fractures”

Jared Colon, Conor Mooney, Saqib Rehman

Introduction: Acute management of open fractures seeks to promote bone and wound healing through a series of important interventions, however lack of standardization regarding these interventions can lead to increased complication rates. This paper seeks to update the previous recommendations for management of these injuries put forth by our institution using the best available evidence.

Methods: A literature review was conducted to find the best available literature using the MEDLINE database, focusing on recent literature regarding prophylactic antibiotic administration, local antibiotic delivery, time to debridement, and irrigation techniques published since the prior implementation of the most recent institutional guidelines.

Results: A computerized search yielded a total of 130 articles, of which 61 met criteria for review. The final total was then subdivided based on topic: prophylactic antibiotic administration (n=10), local antibiotic delivery (n=8), time to debridement (n=6), and irrigation techniques (n=4). The remaining 24 articles dealt with multiple subjects or were comprehensive review articles which were included for analysis.

Conclusions: Recommendations were updated based on a review of clinical studies on open fracture management. Prophylactic antibiotic recommendations, including coverage of choice and duration of administration, were adapted from the guidelines proposed by the Eastern Association for the Surgery of Trauma workgroup and remained consistent with prior guidelines. In addition, the use of local antibiotic delivery techniques may prove beneficial as an adjunct to systemic prophylactic antibiotic therapy in the management of severe open fractures and in patient populations where prolonged antibiotic therapy is otherwise indicated, however is not routinely recommended. Debridement and irrigation should occur emergently, but only if resources are available. A low-pressure (<2 pounds-per-square-inch) lavage system using a sterile saline solution, with increased volumes for more severe fractures, is recommended prior to fracture fixation to reduce the bacterial load.

9:15 Jared Colon – “Acute Management of Gunshot Fractures”

Jared Colon, Saqib Rehman

Introduction: Gunshot injuries represent a significant portion of healthcare treatment in the United States, with orthopaedic intervention often required due to complications such as fractures, compartment syndrome, nerve injuries, and soft tissue defects. Despite the frequency of these injuries, a consensus regarding definitive management continues to be lacking. This paper proposes guidelines for treatment at our institution using the best available data regarding antibiotic therapy and debridement practices.

Methods: A computerized literature search was performed using the MEDLINE database, including terms such as “gunshot wounds,” “fractures,” and “antibiotics.” Articles investigating antibiotic and debridement practices in gunshot injuries in the adult population were included for review, and articles involving pediatric populations, articles published in languages other than English, and those which did not have clearly defined infection and complication rates were excluded for review.

Results: Ultimate, 36 articles met criteria and were chosen for review. These articles were then subdivided by topic, namely recommendations for antibiotic therapy, debridement practices, and management of low-velocity and pelvic fractures.

Conclusions: Based on the articles reviewed, recommendations were developed regarding management of these injuries. Antibiotic prophylaxis should be given for low-velocity gunshot fractures using an intravenous 1st generation cephalosporin in the emergency department followed by 7 days of an oral 1st generation cephalosporin if the patient is stable for discharge. If the fracture is operative, standard perioperative antibiotics should be given. Superficial bedside irrigation and

debridement should be performed as appropriate prior to reduction/splinting. High-velocity gunshot injuries should receive antibiotic prophylaxis as outlined in the institutional open fracture protocol using the Gustilo-Anderson classification. Extensive emergent operative debridement should be performed in cases where there is significant soft tissue injury, in conjunction with delayed wound closure and a “second-look” prior to definitive fixation. Irrigation and debridement should be performed for all intra-articular injuries with retained missiles. All pelvic gunshot fractures should receive 72 hours of prophylactic antibiotics using a 1st generation cephalosporin and metronidazole. Surgical management of these injuries is reserved for those with pelvic instability requiring operative stabilization.

9:30 Heather Flynn – “Just do your best to stay off it”: A look at the ability of orthopaedic trauma patients to comply with non weightbearing instructions

Heather Flynn, Britt Hankins, D’Andrew Gurseay, Frederick Ramsey, Saqib Rehman

Introduction: The purpose of this study was to examine the self-reported rates of noncompliance with strict non weight bearing (NWB) instructions in a population of orthopaedic trauma patients. Another goal of the study was to better understand patient characteristics and challenges in the home environment that might lead to increased difficulty with adhering to NWB instructions in the orthopaedic trauma patient population.

Methods: A survey study was conducted in person during orthopaedic trauma clinic. The

survey was administered from August 2020 to February 2021. Patients were qualified for the survey if they had a lower extremity injury (treated operatively or nonoperatively) for which they were prescribed a non weight bearing course of 8 weeks or longer. Summary statistics were compiled from the survey results. Statistical significance was defined as $p < 0.05$.

Results: 67 patients participated in the survey study. 36 (53.7%) reported full compliance with NWB instructions, while 19 (28.4%) reported they had ambulated <5 times and 12 (17.9%) reported they had ambulated many times prior to being cleared to begin weight bearing by the orthopaedic surgeon. Race, age, BMI, injury location, and living situation during recovery were not found to be correlated with inability to comply with NWB instructions. Patients who responded that they did not have adequate support during their recovery were statistically more likely to ambulate early ($p = 0.026$).

Discussion/Conclusion: There are many factors that may influence orthopaedic surgeons to prescribe a prolonged NWB course for lower extremity injuries. Our study echoes the results of previous studies that have investigated the ability of orthopaedic patients to comply fully with NWB instructions, which suggest that patient compliance is often poor. Offering additional resources to patients who feel inadequately supported in their recovery may help to improve the ability of patients to comply with NWB instructions.

9:45 Rajkishen Narayanan – “A Systematic Review of Local and Intravenous Steroid Use for Dysphagia after Anterior Cervical Discectomy and Fusion (ACDF)”

Rajkishen Narayanan, Ronit Shah, Theresa Pazonis

Introduction: Dysphagia is a common complication after ACDF and can be a source of significant postoperative morbidity. The purpose of this study is to present the current literature regarding the effect of intravenous (IV) and locally administered steroids intraoperatively in the management and prevention of postoperative dysphagia.

Methods: We searched MEDLINE, EMBASE, and the Cochrane library databases without time restriction using the terms “dysphagia” and “ACDF”. We included in our review randomized control trials (RCTs) that investigated the effects of IV and local steroids on dysphagia after ACDF. Studies which did not evaluate pre- and post-operative dysphagia with a specific clinical or radiographic outcome were excluded.

Results: The initial search yielded 259 citations. Ten of these studies met the inclusion and exclusion criteria. All of them were prospective RCTs which were evaluated as level 1 evidence. One study found no significant difference between locally and IV administered intraoperative steroids. Four studies found a significant reduction in dysphagia symptoms in the short term post operative period when comparing local steroids to a placebo. Another four studies found similar effects on dysphagia when comparing IV steroids to a placebo. Of the two studies comparing IV to local steroids, one study found no difference in the effect on

dysphagia while another found that local steroids had a greater impact on dysphagia reduction in the first 6 weeks after surgery, but at 1 year, both local and IV steroids had significantly reduced dysphagia rates compared to the control.

Conclusions: More recent literature provides supporting evidence that perioperative IV and local steroid use can reduce incidence and severity of dysphagia after ACDF. For patients who receive locally administered steroids, there may be a greater protective effect in the early postoperative period compared to IV steroids.

10:00 Bradley Wiekrykas – “Civilian firearm vs non-firearm humeral shaft fractures: Comparing rates of neurovascular injury, compartment syndrome, early infection, and union”

Bradley D. Wiekrykas, Rachel Thomas, Saqib Rehman

Purpose: Humeral shaft fractures account for about 1-2% of all fractures and 14% of fractures of the humerus. Approximately 10% of gunshot fractures to the extremities involve the humerus. Successful union rates have been reported with nonoperative, intramedullary nail, open reduction and internal fixation, and minimally invasive plate osteosynthesis treatment. The primary purpose of this study was to determine if civilian firearm humeral shaft fractures have similar union rates to non-firearm humeral shaft fractures when treated nonoperatively and operatively. The secondary purpose was to compare rates of neurovascular injury, compartment syndrome, and early infection.

Methods: A retrospective review was performed using International Classification of Diseases, Ninth (ICD-9) and Tenth (ICD-10) Revision codes to identify all adult patients treated for an extra-articular humeral shaft fracture at a single level-1 trauma center over a period of 10 years with at least 12 weeks of follow up. Chart and radiographic review were performed to identify patient demographics, injury mechanism, neurovascular injury, compartment syndrome, infection, definitive treatment, and union.

Results: Over the 10-year period there were 1,127 patients with an ICD code for a humerus fracture. Of these patients, 123 met inclusion criteria. There were 32 firearm fractures of which 18 (56.3%) were initially treated operatively and 14 (43.7%) nonoperative and 91 non-firearm fractures 33 (36.3%) treated operatively and 58 (63.7%) nonoperative. Overall, there were 8 vascular injuries, 7/32 (21.9%) in the firearm group and 1/91 (1.1%) in the non-firearm group ($p=0.0002$). A nerve injury was observed in 11/32 (34.4%) of firearm fractures and 5/91 (5.5%) non-firearm fractures ($p<0.0001$). Infections were diagnosed in 5/32 (15.6%) of firearm fractures and 2/91 (2.2%) non-firearm fractures ($p=0.007$). Of the firearm infections, 2 were initially treated with external fixation and had prophylactic fasciotomies, 1 had a draining sinus 2 years post open reduction and internal fixation, and 2 initially treated nonoperative had a superficial firearm wound infection treated with oral antibiotics. There were no deep infections in the firearm initial nonoperative treatment group. Overall, 107/123 (87.0%) fractures went on to union, 28/32 (87.5%) in the firearm group and 79/91 (86.8%) in the non-firearm group ($p=0.88$). 58/72 (80.6%) of fractures treated initially with nonoperative treatment went on to union, 12/14 (85.7%) in the firearm group and 46/58 (79.3%)

in the non-firearm group ($p=0.59$). 49/51 (96.1%) of fractures treated initially with operative treatment went on to union, 16/18 (88.9%) in the firearm group and 33/33 (100%) in the non-firearm group ($p=0.06$). The 2 nonunion in this group were initially treated in external fixation due to a vascular injury. 15/72 (20.8%) failed initial nonoperative treatment (14 nonunion and 1 loss of acceptable alignment) with 2/14 (14.3%) in the firearm group and 13/58 (22.4%) in the non-firearm group ($p=0.59$). No patients were diagnosed or treated for compartment syndrome although prophylactic fasciotomies were performed in 7/8 patients who had a vascular injury and repair.

Conclusions: Firearm humeral shaft fractures have similar rates of fracture union and failed nonoperative treatment but higher rates of neurovascular injury compared to non-firearm humeral shaft fractures. Treatment of these injuries without surgical irrigation and debridement yields a low infection rate.

10:15 Dana Cruz – “Title: Opioid Knowledge and Prescribing Preferences of Orthopaedic Surgery Residents Before and After an Educational Intervention”

Pankti P. Acharya, Brianna Fram, Ryan A. Hoffman, Dana Cruz, Asif M. Ilyas

Purpose: Orthopaedic surgeons are among the highest prescribers of opioids. This study explores the effect of an educational intervention on orthopaedic surgery residents’ opioid knowledge and prescribing practices.

Methods: Orthopaedic residents were surveyed at three urban academic institutions. A presurvey was administered to residents prior to an educational lecture and case-based session. This included background on the opioid

epidemic, multimodal analgesia, opioid consumption in common orthopedic procedures, and state laws regulating prescribing. Following this intervention, residents were given a post-survey to complete.

Results: There was a significant increase in resident confidence concerning their opioid prescribing training ($p=0.03$) and their knowledge of alternative pain management therapies ($p=0.03$). This was accompanied by an objective improvement in knowledge of state prescribing laws and of metrics regarding the opioid epidemic. Hypothetical opioid pills prescribed after common orthopedic procedures decreased between the pre and post-tests.

Conclusions: The educational session significantly improved orthopaedic surgery residents' knowledge about opioids and prescribing habits. Formal resident education on opioid knowledge and evidence-based prescribing strategies is an area of potential improvement to combat the opioid crisis.

10:30 Alexander Johnson – “Thigh compartment syndrome is more common after femur fractures caused by firearms”

Alexander Johnson, Dustin Greenhill, Alec Talsania, Nathan Winek, Christopher Haydel, and Saqib Rehman

Introduction: Thigh compartment syndrome is a rare diagnosis with significant associated morbidity. Currently available data is limited to several small case series with variable conclusions. The purpose of this study was to outline our experience treating thigh compartment syndrome with a specific focus on traumatic mechanisms and injury characteristics that most commonly lead to this disorder.

Methods: We conducted a retrospective review of patients who underwent fasciotomy for TCS at

a Level-1 urban academic trauma center between August 2006 and July 2016 with collected data including demographics, details/timeline of presentation, associated risk factors for compartment syndrome, and outcomes. Additionally, all femoral shaft fractures (AO/OTA type 32) treated at the same institution during this time period were also reviewed to determine fracture mechanism and classification that were most likely to lead to development of thigh compartment syndrome.

Results: Thirty-five total cases of thigh compartment syndrome were included. Mean time from presentation to diagnosis was 18 hours; mean time from diagnosis to fasciotomy was 1 hour. The most common traumatic mechanism was penetrating firearm injury in 19/35 cases. There was an ipsilateral femur fracture present in 23/35 cases. During the study period 461 total femoral shaft fractures were treated at the same institution. Patients with femur fractures caused by firearm trauma were significantly more likely to develop thigh compartment syndrome than patients with femur fractures from other mechanisms (11.2% vs 2.2%; $p<0.001$). Finally, patients with femur fractures classified as AO/OTA type 32B or 32C or significantly more likely to develop thigh compartment syndrome than those with AO/OTA type 32A fractures (2.6% of 32A, 8.3% of 32B, 8.1% of 32C; $p<0.05$). At final follow up, 65.2% of patients experienced persistent symptoms.

Conclusion: Thigh compartment syndrome remains a relatively rare clinical entity with high morbidity, as 65.2% of patients experienced symptoms at final follow up. All patients with a femur fracture are at risk of developing thigh compartment syndrome, but those caused by firearms, or with a higher OA/OTA classification,

are at significantly higher risk. As the mean time from presentation to diagnosis was 18 hours, we recommend compartment checks for 24 hours in any patient presenting with trauma to the thigh.

10:45 Effect of walking on in vivo tibiofemoral cartilage strain in ACL-deficient versus intact knees

Nimit K. Lad, Bryan S. Crook, Amber T. Collins, Charles E. Spritzer, Jocelyn R. Wittstein, Louis E. DeFrate

Introduction: Anterior cruciate ligament (ACL) injuries are a common injury with a major long-term sequelae of early development of knee osteoarthritis (OA), seen within 10-15 years of injury in many patients. Altered mechanical loading of cartilage in the setting of ACL deficiency may predispose cartilage to the degenerative changes leading to knee OA. However, there is limited data regarding the in vivo biomechanical response of tibiofemoral cartilage to activities of daily living (ADLs) in ACL-deficient knees. Therefore, the objective of this study was to assess mechanical loading of tibiofemoral cartilage in response to a treadmill walking stress test.

Methods: In this study, eight otherwise healthy participants with unilateral ACL deficiency completed a stress test to assess the effect of 20 min of level treadmill walking at a speed of 2.5 mph on tibiofemoral cartilage in their ACL-deficient and contralateral ACL-intact knees. Three-dimensional surface models developed from pre- and post-activity magnetic resonance (MR) images of the injured and uninjured knees were used to determine compressive strain across multiple regions of tibiofemoral cartilage (medial and lateral tibial plateaus, medial and

lateral femoral condyles, medial aspect of femoral condyle adjacent to intercondylar notch of the femur).

Results: In the ACL-deficient knees, significantly increased cartilage strain was observed in the region of the medial femoral condyle adjacent to the intercondylar notch (6% in deficient vs. 2% in contralateral, $p = 0.01$) as well as across the medial and lateral tibial plateaus (4% vs. 3%, $p = 0.01$) relative to the contralateral ACL-intact knees. No significant differences in strain were observed in the medial ($p=0.49$) or lateral ($p=0.10$) femoral condyles with strain values ranging from 0-3%.

Discussion: This study demonstrated differences in cartilage strain between ACL deficient knees and contralateral intact knees in response to walking. Increased compressive strain at the medial intercondylar notch and tibial plateau suggests alterations in mechanical loading or the response to load in these regions, presumably related to altered knee kinematics after ACL injury. These changes may disrupt cartilage homeostasis and contribute to subsequent development of osteoarthritis.

11:00 John Reynolds – “Return to Work after Distal Biceps Tendon Repair”

John Reynolds, Michael Reynolds, Jennifer T. Eurich, Asif Ilyas

Background: Distal biceps tendon ruptures can cause significant functional impairment, especially for patients with physically demanding occupations. The purpose of this study is to determine the amount of time required for distal biceps tendon tear patients receiving workers' compensation to return to modified and full work duties after a distal biceps tendon repair

(DBTR) relative to the patient's occupation and surgical techniques used.

Methods: A procedural database from the Rothman Institute identified patients that underwent DBTR from January 1, 2012 to December 31, 2014. 67 patients met eligibility criteria, which included undergoing DBTR and receiving workers' compensation. A retrospective chart review was performed and examined type of occupation, return to work times, type of biceps tendon tear, time from injury to surgery, number of post-op immobilization days, and surgical techniques used

Results: The average return to modified work duty was 48.42 days (range, 6-246) and the average return to full work duty was 133.51 days (range, 40-356). Occupational groups did not significantly differ on days to modified RTW, ($\chi^2(2,60) = 1.66, p=0.44$) or days to full RTW ($\chi^2(2,55) = 0.002, p=1.00$). Patients with complete tendon tear and partial tendon tear did not significantly differ in days to modified RTW ($p=0.44$) or full RTW ($p=0.73$). Patients who underwent different surgical techniques did not significantly differ on days to full RTW ($\chi^2(2,55) = 2.07, p=0.36$), although they marginally differed on days to modified RTW ($\chi^2(2,60) = 5.49, p=0.06$). Patients with 2 incisions had significantly more days to modified RTW (median = 41) than patients with 1 incision (median = 34), ($p=0.04$). Time from injury to surgery did not significantly influence days to modified RTW ($p=0.215$) or full RTW ($p=0.721$). The number of post-op immobilization days was not significant in days to modified RTW ($p=0.682$), however it was significant in days to full RTW ($p=0.046$) with increased post-op immobilization days correlating with increased days to full RTW ($r=0.270$).

Conclusions: This study demonstrates that a reduction in post-operative immobilization days and the single incision technique were the only parameters that were significant in decreasing RTW in workers' compensation patients.

Patients should be counseled on the importance of early mobilization and post-operative rehabilitation, as well as the potential benefit of the single incision surgical technique over the double incision. The findings of our study may have substantial impacts on improving patient rehabilitation, workers' compensation policy making, and employing surgical techniques in practice.