

Resident Research Day



Department of Orthopaedic Surgery & Sports Medicine

Lewis Katz School of Medicine at Temple University

Saturday April 15, 2017

Supported by the John Lachman Orthopaedic Research Fund

Research Day Agenda

4/15/2017

Clancy Conference Room (MERB 342)

Moderator: Saqib Rehman, M.D.

8:00-9:00am	Grand Rounds Presentation Greg Della Rocca, M.D., PhD, FACS Chief of Orthopaedic Trauma Duke University, Durham NC	“Prevalence of Intimate Partner Violence in Orthopaedic Fracture Clinics”
9:00-10:15	Resident Research Presentations Megan Reilly, Justin Kistler, Peter Eyvazzadeh, Courtney Quinn, Katharine Harper	10 minute presentations 5 minutes for questions
10:15-10:20	Break	
10:20-11:20	Resident Research Presentations Dustin Greenhill, Anastassia Newbury, Arianna Trionfo, James Lachman	10 minute presentations 5 minutes for questions
11:30	Lunch and announcement of winners presented by Dr. Della Rocca and the John Lachman Orthopaedic Research Fund	

Resident Research Presentation Schedule:

- 9:00 Megan Reilly, M.D., PGY 3: "Defining Anterior Inferior Iliac Spine Anatomy Using MRI"
- 9:15 Justin Kistler, M.D., PGY 3: "Multidrug Resistance Trends in MRSA Infections of the Hand"
- 9:30 Peter Eyvazzadeh, M.D., PGY 3: "Underinsured Patients Experience Delayed Access to Care and Higher Rates of Adverse Outcomes for Surgically Managed Rotator Cuff Disease"
- 9:45 Courtney Quinn, M.D., PGY 3: "Incidence of infection in low-velocity gunshot traumatic arthrotomies: does formal joint washout make a difference?"
- 10:00 Katharine Harper, M.D., PGY 4: "A Consistent Anatomical Landmark for Identifying the Lateral Femoral Circumflex Artery in a Direct Anterior Hip Approach"
- 10:20 Dustin Greenhill, M.D., PGY 5: "Inadequate Helmet Fit Increases Concussion Severity in American High School Football Players"
- 10:35 Anastassia Newbury, M.D., PGY 5: "Saving Lives, Killing Fingers: digital necrosis in critically ill patients receiving vasopressor support"
- 10:50 Arianna Trionfo, M.D., PGY 5: "The incidence of postoperative loss of midline function and associated variables in children with brachial plexus birth palsy"
- 11:05 James Lachman, M.D., PGY 5: "Going Rogue with Perioperative Antibiotics in Ankle Fracture Surgery; Whom are we protecting"

9:00 Megan Reilly – “Defining Anterior Inferior Iliac Spine Anatomy Using MRI”

Reilly M, Pendelidis A, Ly J, Ramsey FV, Kropf EJ

Purpose: Subspine impingement is an increasingly recognized cause of hip pain in young athletes. Radiographs can suggest anomalous anatomy of the anterior inferior iliac spine (AIIS), but often a computed tomography (CT) will give more detail. Most patients with hip impingement present with only magnetic resonance imaging (MRI) as their first form of advanced imaging. The risk of radiation exposure from the addition of a CT may not be necessary if the AIIS anatomy can be illustrated on MRI. The purpose of this study is to determine the utility of MRI to define AIIS anatomy and compare our findings to previously reported values obtained using CT scans.

Methods: Pelvic MRI including bilateral hips of 50 asymptomatic patients were evaluated, which included 31 females (average height, 1.62 m; BMI, 28.9 kg/m²) and 19 males (average height, 1.74 m; BMI, 27.6 kg/m²). Axial sequence measurements included: width and the angle of the AIIS relative to the ilium. Hip MRIs of 58 asymptomatic patients were also evaluated, which included 38 females (average height, 1.61 m; BMI, 28.9 kg/m²) and 20 males (average height, 1.81 m; BMI, 28.4 kg/m²). These sagittal measurements included: AIIS length, width, and the horizontal, vertical, and straight distances from the AIIS to the acetabular rim. Values were normalized for height and BMI. Two observers independently obtained all measures which were then averaged and compared to literature reported CT values using student's T-test. The values were deemed statistically similar if they had a p-value greater than 0.05.

Results: Measures of AIIS anatomy were successfully obtained on all MRI sequences. Male values showed greater statistical consistency with literature values in all BMI-normalized measures except length and height of AIIS. Comparison of

female values to literature values was statistically different in all BMI-normalized measures except for angle to ilium. Males also showed greater values of statistical similarity than females for anatomic measurements normalized for height.

Conclusion: Several markers of AIIS anatomy correlate between CT imaging and MRI imaging, particularly more in the male population than the female population. MRI may be adequate for gross assessment of AIIS morphology but not all findings were consistent with previously reported CT scan standardized dimensions. CT scan may still be needed in some cases of AIIS impingement, to fully define the anatomy.

9:15 Justin Kistler – “Multidrug Resistance Trends in MRSA Infections of the Hand”

Kistler JM, Tosti R, Ilyas AA, Thoder JJ

Background: Methicillin-resistant *Staphylococcus aureus* has been the most reported pathogen in hand infections at urban centers throughout the country. Antibiotic sensitivity profiles are continually evolving and trends of which are not well known. The purposes of this study are to determine the drug resistance trends for methicillin-resistant *Staphylococcus aureus* and provide recommendations for treatment based on sensitivity profiles.

Methods: A three-year longitudinal, retrospective chart review was performed on all culture-positive hand infections encountered by an urban medical center from 2013 to 2015. The proportions of all organisms were calculated for each year. Methicillin-resistant *Staphylococcus aureus* were additionally analyzed for antibiotic sensitivity.

Results: A total of 191 culture-positive hand infections were identified. Overall, methicillin-resistant *Staphylococcus aureus* grew on culture in 31% of cases; the annual incidence peaked in 2013 at 37%. During the course of the study, methicillin-

resistant *Staphylococcus aureus* was universally resistant to penicillin, oxacillin, and ampicillin. Clindamycin resistant increased during 2013 and 2014 to 26% and 31%, respectively, however, resistance dropped to only 12% in 2015. Levofloxacin resistance increased from prior studies to 52%, 56%, and 47%, respectively in 2013, 2014, and 2015.

Conclusion: Increases in clindamycin and levofloxacin resistance were increased compared to previous studies done prior to 2013, therefore, empiric therapy will likely be ineffective in a large number of hand infections at urban medical centers.

9:30 Peter Eyvazzadeh – “Underinsured Patients Experience Delayed Access to Care and Higher Rates of Adverse Outcomes for Surgically Managed Rotator Cuff Disease”

Piccoli C, Ly JA, Eyvazzadeh PM, Ramsey FV, Kropf EJ

Background: Many factors influence the progression of rotator cuff disease and the success of surgical intervention. One potential factor, insurance carrier status, may significantly affect access to prompt appointments with surgeons. The aim of this study was to assess the effect of insurance status on access to care and patient outcomes in surgically managed rotator cuff disease.

Methods: A retrospective study of 55 patients with full thickness tears was performed. They underwent a shoulder arthroscopy by a single surgeon at the same medical center between September 1, 2009-December 31, 2013. Data including demographics, type of insurance, time between calling and scheduling appointments and surgical outcomes was collected.

Results: Patients with Medicare and Medicaid experienced a delay of 22 days between calling and scheduling appointments with the surgeon compared to 12 days duration for privately insured

patients ($p = 0.0001$). Medicare and Medicaid patients had higher rates of adverse outcomes compared to privately insured patients (14 versus 2 patients, respectively; $p < 0.0001$).

Conclusions: Higher powered studies are needed to verify the relationship between insurance status and surgical outcomes, but the results of this study suggest that a delay to initial evaluation may play a role in affecting surgical outcomes.

9:45 Courtney Quinn – “Incidence of infection in low-velocity gunshot traumatic arthrotomies: does formal joint washout make a difference?”

Quinn C, McKinney R, Rehman S

Background: Traumatic arthrotomies due to low-velocity bullets are frequently encountered in urban hospitals, yet there is a paucity of literature regarding the complications of and treatment recommendations for these injuries. While there is data to support intra-articular bullet removal to prevent mechanical irritation and lead-induced synovitis, the incidence of infection after joint penetration from a gunshot is largely unknown. Several retrospective studies suggest that systemic antibiotics alone may be sufficient to prevent infection if no loose bodies (native or foreign) remain free in the joint. The objective of this study was to determine the incidence of joint infection after sustaining an intra-articular gunshot injury of the hip, knee, or shoulder

Methods: Retrospective review of all patients 18 years or older who sustained an intra-articular gunshot injury of the knee, shoulder, or hip, with a minimum of 3 weeks follow-up. Patients were assessed for the presence of intra-articular bodies, treatment (1. antibiotics and formal irrigation and debridement (I&D) in the operating room, with or without fracture fixation, 2. antibiotics alone, and 3. antibiotics and fracture stabilization without I&D),

and the presence of joint infection at any point during follow-up.

Results: 94 gunshot traumatic arthrotomies in 93 patients met the final inclusion criteria. Of those joints, 82.98% (78/94) were treated with antibiotics and formal washout, with or without fracture fixation, 14.89% (14/94) of joints were treated with antibiotics alone, and 2.13% (2/94) were treated with antibiotics and fracture stabilization without I&D. There was no incidence of infection in any cases regardless of treatment at any point in follow-up (0/94). The majority of the cases treated non-operatively (12/14, 85.7%) did not have any retained missile fragments or significant bony debris intraarticularly, as compared to 20.5% (16/78) of the joints treated with formal I&D.

10:00 Katharine Harper – “A Consistent Anatomical Landmark for Identifying the Lateral Femoral Circumflex Artery in a Direct Anterior Hip Approach”

Harper KD, Vakil J, Star A

Introduction: The direct anterior approach to the hip has gained popularity in recent years, and in addition to the availability of information available to potential patients, has resulted in an increase in performance of the approach. Surgeons who are not extensively trained in the approach may find themselves attempting the surgery at the request of patients. During a direct anterior approach, if the lateral femoral circumflex artery (LFCA) is not properly identified and ligated, extensive bleeding can occur. Unfortunately, a gap in data remains in regards to the course of the LFCA in relation to the direct anterior approach. The purpose of this study is to develop an easy, reliable method for surgeons, even those unfamiliar with the approach, to be able to identify and ligate the LFCA with minimal bleeding experienced. Our goal is to provide a simple anatomical reference for location of the vessel to ensure a safe approach to the hip.

Methods: A retrospective study was performed at a community hospital over a 3-month period from August 1, 2016 to November 1, 2016 where 146 patients who underwent primary total hip arthroplasty were evaluated. All adult patients who underwent a direct anterior approach total hip arthroplasty performed by one of two attending surgeons were considered for this study. Epidemiological information, as well as radiologic information, including shaft diameter, femoral head diameter, distance from the lesser trochanter to the great trochanter (TD), distance from the lesser trochanter to the LFCA (LT) and offset from the anatomical axis, was collected. The primary endpoint for the study was location of the lateral femoral circumflex artery in relation to the bony anatomical landmarks. Statistical significance was defined as $p < 0.05$.

Results: To ensure accurate measurements without confounding data with magnification values of the c-arm, a ratio measurement was used to describe the location of the LFCA. The distance was calculated as [Distance from lesser trochanter to LFCA (LT) / Distance from lesser trochanter to greater trochanter (TD)]. A similar ratio calculation was made for offset [offset distance / total femur diameter (FD)]. The average distance of the LFCA from the lesser trochanter (represented as LT/TD) is 0.600. 95% confidence interval was 0.367 to 0.884. There is a statistically significant difference in the mean LT/Total based on sex (F = 0.567, M = 0.638; $p = 0.0186$). The average offset from midline of the LFCA (represented as offset / FD) was 0.166 lateral to midline. The overall median value of offset is 0 – which represents a midline location on the anatomical axis of the femur.

Conclusion: This anatomical study has found a reliable way to consistently identify the major vascular structure in the direct anterior approach (the ascending branch of the LFCA). The study was able to confirm that the LFCA is found approximately 2/3 of the way between the lesser and greater trochanter on the anatomical axis of the femur. This technique will allow surgeons to reliably find the

LFCA and safely ligate the bundle, even when unfamiliar with the direct anterior approach. If unable to locate the vascular bundle, reorientation of the approach should occur to ensure dissection is occurring in the correct intermuscular plane.

10:20 Dustin Greenhill – “Inadequate Helmet Fit Increases Concussion Severity in American High School Football Players”

Greenhill DA, Navo P, Zhao H, Torg JS, Comstock RD, Boden BP

Background: There is limited information on the relationship between football helmet fit and concussion severity. Poor helmet fit may predispose football players to a more severe concussion.

Methods: Data from concussion injury reports were obtained from the National High School Sports-Related Injury Surveillance System over a 9-year period. Symptoms, duration, and helmet parameters (fit, interior padding) were analyzed for all first-time concussions.

Results: Data from 4580 concussions were analyzed. Concussions with a helmet that did not fit properly (3.22%), as determined by an athletic trainer, had higher rates of drowsiness (RR=1.46, p=0.005), hyperexcitability (RR=2.38, p=0.047), and sensitivity to noise (RR=1.88, p<0.001); had more symptoms (5.34 vs. 4.54, p=0.004); and longer symptom duration (p=0.04). Athletes with helmets lined with an air bladder had higher rates of sensitivity to light (RR=1.13, p=0.02), sensitivity to noise (RR=1.25, p=0.009), and longer symptom duration (p=0.004) compared to foam or gel liners.

Conclusions: An improperly fitted football helmet is a risk factor for a concussion with more symptoms and of longer duration. Concussions of longer duration are also more common in players with an air-bladder lined helmet. Current high school football rules should mandate supervision and maintenance of helmet fit throughout the season,

prior to impact. Team physicians, athletic trainers, coaches, and high-school officials should ensure proper oversight of helmet fit in high school athletes in order to decrease concussion severity and duration.

10:35 Anastassia Newbury – “Saving Lives, Killing Fingers: digital necrosis in critically ill patients receiving vasopressor support”

Newbury A, Trionfo A, Thoder JJ. (statistics by Greenhill D)

Background: Digital necrosis of the upper extremity is a rare yet severe condition that generally leads to amputation of the fingers and/or hand. Necrosis is primarily caused by diminished or total loss of blood supply to body tissues, which can result from a variety of factors. Upper extremity digital necrosis is an increasingly prevalent problem in hospitalized patients. There are several known risk factors in special patient populations, such as scleroderma and other connective tissue disorders. However, little is known about risk factors in a population of critically ill patients requiring blood pressure support. The purpose of this study was to identify risk factors for upper extremity digital necrosis in critically ill patients receiving vasopressor support.

Materials and Methods: A retrospective chart review was conducted to gather a cohort of patients with upper extremity ischemia, stratify the extent of the comorbidities, using the APACHE II, a severity-of-disease classification system and mortality predictor, and identify the type, number and total dosage of vasopressors given. This data was then compared to a control group of intensive care patients who received pressure support, but did not develop upper extremity ischemia.

Results: The ischemia group was found to have higher predicted mortality, than did the non ischemic group. An elevated serum sodium, low GCS, presence of organ insufficiency, elevated APACHE II score, presence of hypertension, and

increasing total number of comorbidities were found to be independent risk factors for the development of ischemia. Total number of vasopressors, total days of vasopressor therapy and total vasopressor doses were significantly higher in the ischemia group than the control group. The number of vasopressor agents, as well as the total days and doses of therapy had a moderate correlation with development of digital ischemia and a moderate negative correlation with days to development of ischemia. The odds ratio predictive of ischemia was highest for number of vasopressors (OR = 7.4 (p=0.0007; 95% CI 2.7-20.2), followed by number of vasopressors days (OR = 2.1 (p=0.0006; 95% CI 1.4-3.2), and lowest for APACHE II score (OR = 1.1 (p=0.03; 95% CI 1.01-1.1). No correlation was found between burden of disease, number of vasopressors used, or duration of vasopressor therapy with level of ischemia.

Discussion: Although demographically similar, the patients who developed ischemia had a greater burden of disease as evidenced by an elevated APACHE II score. Moreover the mortality rate amongst those who developed ischemia was significantly higher than amongst those that didn't. This likely contributed for the need for higher number of agents and longer duration of therapy, which in turn led to the development of ischemia. In evaluating the independent risk factors, an elevated serum sodium is likely an indicator of electrolyte abnormalities, which represent an advanced dysregulated state. Lower GCS are indicators of a decompensated state, with an overall poor prognosis. With increasing vasopressor therapy use the process of ischemia appears to be accelerated, reaching a critical point in the decompensated patient. However, the actual estimate mortality at the time of admission to the ICU only weakly correlates with the time of ischemia and no correlation exists between the extent of the ischemia and estimated mortality, indicating a need for individualized treatment plans tailored to specific patients' needs and a high level of vigilance for digital ischemia when vasopressor therapy is initiated.

10:50 Arianna Trionfo – “The incidence of postoperative loss of midline function and associated variables in children with brachial plexus birth palsy”

Trionfo A, Greenhill D, Kozin S, Zlotolow D.

Purpose: To quantify the rate of loss of midline function (LOM) in patients with brachial plexus birth palsy (BPBP) who previously underwent surgery about the shoulder, as well as to identify variables associated with postoperative LOM.

Methods: Records of patients with BPBP who were treated with surgery about the shoulder during a 10-year period were retrospectively reviewed. Levels of palsy, serial physical examinations, and all upper extremity procedures were recorded. LOM was defined as modified Mallet (MMS) or Active Movement Scale (AMS) internal rotation score less than 3. Exclusion criteria were as follows: <1-year follow-up after most recent procedure, insufficient documentation, or preexisting loss of midline function. Odd ratios were computed to identify variables associated with the development of LOM.

Results: Thirty-four (20.9%) of 162 included patients developed LOM. Predictive variables associated with LOM included: global palsy, microsurgical nerve grafting, MMS abduction <4, AMS wrist flexion < 5, AMS wrist extension <5, and AMS finger flexion <5. Among these, patients with global palsy were most likely to lose midline function. Age, closed shoulder reduction with casting in external rotation, shoulder tendon transfers, surgical glenohumeral reduction, and humeral osteotomies were not predictive of LOM.

Conclusions: Approximately one in every five patients with BPBP will develop LOM after undergoing treatment aimed to improve shoulder abduction and external rotation. Patients with global palsy, a history of microsurgery, or a physical exam consistent with persistent upper and middle trunk involvement are at the highest risk for developing subsequent LOM

11:05 James Lachman – “Going Rogue with Perioperative Antibiotics in Ankle Fracture Surgery; Whom are we protecting?”

Lachman J, Elkrief J, Pipitone P, Haydel C.

Introduction: Surgeon preference has been replaced in favor of an approach using evidence based medicine for most things in Orthopaedics. The use of perioperative antibiotics in ankle fracture surgery is standardized for inpatients (twenty-four hours of antibiotics post-operatively) but variable for outpatient surgery. Some surgeons prefer to prescribe twenty-four hours of oral(PO) antibiotics while others give no antibiotics at all post-operatively. In this study, inpatients receiving twenty-four hours of intra-venous antibiotics were compared to those patients receiving twenty-four hours of PO antibiotics and those receiving no post-operative antibiotics.

Materials and Methods: 1442 patients with ankle fractures requiring open reduction internal fixation were retrospectively reviewed in this multi-centered study. Demographic data including age, sex, BMI, and race were collected. Clinical data including diabetes status, smoking status, hepatitis C virus (HCV) or human immunodeficiency virus(HIV) status, draining wound, infection requiring additional antibiotics(abx), and infection requiring return to operating room (RTOR) were compared across the groups.

Results: See data table for complete results. These data suggest no differences in incidence of draining wound, cellulitis, or return to OR for infection between the three groups. No differences were noted amongst the groups for any risk factors for infection including BMI, previous infection, smoking status, HCV/HIV status, or diabetes.

Discussion: The use of antibiotics post-operatively, whether intra-venous or oral, did not decrease the incidence of clinically significant or clinically insignificant post-operative infection. Based on the findings in this study, there is no justification for prescribing PO antibiotics to patients undergoing

outpatient open reduction and internal fixation of ankle fractures. Furthermore, inpatients undergoing the same procedure did not show any advantage to post-operative antibiotics and may also not benefit from this practice.

	Inpatient group (IV antibiotics 24hrs)	Outpatient Group 1 (PO antibiotics 24hrs)	Outpatient Group 2 (No antibiotics)	Totals
Number(ankles)	439	483	520	1442
Diabetes	61(13.8%)	71 (14.7%)	68 (13.1)	200(13.9%)
Smoker	131 (29.8%)	121 (25%)	143 (27.5%)	395(27.4%)
HCV/HIV	6 (1.4%)	4(0.8%)	9 (1.7%)	19(1.3%)
Draining Wound	24(5.4%)	29(6.0%)	25(4.8)	78(5.4%)
Infection requiring additional Abx	19(4.3%)	23(4.8)	29(5.6)	71(4.9%)
Infection requiring RTOR	4(0.9%)	3(0.6%)	4(0.7%)	11(0.7%)
*None of these differences are statistically significant				