Department of Orthopaedic Surgery and Rehabilitation

Wake Forest University School of Medicine

34th Annual Gary Poehling, MD Resident Research Day

5th Beth Smith, PhD and Tom Smith, PhD Visiting Professor

David G. Lewallen, MD

June 20, 2025

Atrium Health Wake Forest Baptist

Wake Forest University School of Medicine

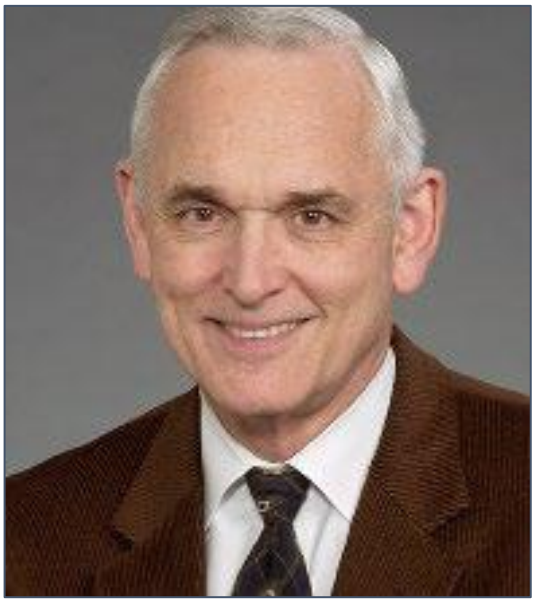
The Department of Orthopaedic Surgery Resident Research Day and Visiting Professor is a yearly event where PGY5, PGY3, PGY2 Podiatry, and Physician Scientists highlight their research through podium presentations. Monetary awards are given to the top basic science, top clinical, and top podiatry research projects. Recipients are selected based on the overall evaluation of their research project and scored by the Visiting Professor.

The Visiting Professor highlights the event with presentations that provide insight on the technical aspects of their research and advising residents on how to transition from residency to fellowships to a faculty position. The Visiting Professor is an esteemed colleague in an orthopaedic specialty. This year's Visiting Professor is an expert in adult reconstruction and invited by Dr. Molly Hartzler, Assistant Professor of Orthopaedic Surgery.

David G. Lewallen, MD

Dr. David Lewallen is currently a Professor of Orthopedic Surgery at Mayo Clinic in Rochester, MN. After completing his Orthopedic Surgery Residency at Mayo Clinic, and a fellowship in Orthopedic Biomechanics at Beth Israel Hospital in Boston, MA he returned to Mayo Clinic as an Orthopedic Surgery Consultant in 1984. He has since enjoyed a busy clinical practice focused initially on orthopedic trauma and for over 40 years on complex adult reconstruction problems involving the hip and knee. He has participated in the development of several novel implant designs for hip and knee arthroplasty, especially centered around revision surgery and the management of periarticular bone loss of both the hip and the knee. He has been continuously engaged in the education of orthopedic surgery residents and adult reconstructive fellows over his career and has previously served as fellowship director and chair of the division of Adult Reconstructive Surgery. His clinical research interests have spanned a broad range of primary and revision arthroplasty issues involving both the hip and the knee and have particularly focused on the prevention and treatment of arthroplasty complications. He helped lead the initial development of the American Joint Replacement Registry, served as the first Chair of the original AJRR board, and subsequently served as the medical director of the AJRR from 2013 to 2000. He continues currently to collaborate with others as co-director of the NIH funded American Joint Replacement Research Collaborative (AJRR-C) helping to foster the development and support of a strong national network of both infrastructure and young investigators focused on large database research and registry science all aimed at improving arthroplasty patient outcomes.

Gary G. Poehling, MD



Dr. Gary G. Poehling received a B.S. degree from Marquette University in 1964 and his M.D. degree from Marquette School of Medicine in 1968. He completed an internship and residency in general and thoracic surgery at Duke Medical Center from 1968-1970. He served in the United States Air Force from 1970-1972 at the 655th Tactical Hospital in Tachikawa, Japan. After fulfilling his military duty, Dr. Poehling completed his orthopaedic residency at Duke Medical Center from 1972-1976, serving as Chief Resident his final year. He subsequently joined the faculty of Bowman Gray School of Medicine, now Wake Forest University School of Medicine, and Department of Orthopaedic Surgery as an Assistant Professor. Dr. Poehling served as Interim Chair of the Department in January 1989 and was formally appointed as Chair in October 1989 and served in that capacity for 18 years and served as Editor in Chief for the Journal of Arthroscopy for 24 years.

Dr. Poehling has over 43 years of experience as an orthopaedic surgeon. He pioneered the use of arthroscopy and was influential in defining various procedures that can be performed arthroscopically. Together with James Roth, MD and Terry Whipple, MD, Dr. Poehling pioneered the use of wrist arthroscopy in 1985. Dr. Poehling also was one of the first orthopaedic surgeons to use arthroscopic operative techniques in the elbow. Dr. Poehling has also served as a proponent for the development and use of minimally invasive surgical techniques. As an academic surgeon he has promoted the application of computer technology for training residents and medical students. He has championed the importance of orthopaedic outcome studies and evidence-based medicine.

Beth Smith, PhD and Thomas Smith, PhD

Beth Smith earned her PhD in Toxicology from Texas A&M in 1974. She completed post-doctoral work at Wake Forest School of Medicine in 1978 with Richard St. Clair, PhD. Dr. Smith began her career at Wake Forest School of Medicine in 1987 in the Department of Orthopaedic Surgery as a Research Assistant. Her research interests were botulinum toxin to treat cerebral palsy. Her work using intramuscular toxin injections to manage muscle spasticity changed the management of pediatric patients with cerebral palsy worldwide. Dr. Smith published journal articles, book chapters, and books throughout her career. During her tenure, she was the Director of the Orthopaedic Research Lab, Coordinator of the Spasticity Management Workshops, served as Chair of the Division of Surgical Sciences Research Day from 1993-1997, and Chair of the Department of Orthopaedic Surgery Resident Research Day from 1991 until her retirement in 2018.

Thomas Smith earned his PhD in Physiology from Bowman Gray School of Medicine in 1979. He completed post-doctoral work at the University of Mississippi School of Medicine with Thomas Coleman, PhD and Arthur C. Guyton, PhD. Dr. Smith served as an Assistant Professor in the Department of Physiology and Biophysics at the University of Mississippi School of Medicine from 1980-1982. He began his career at Wake Forest School of Medicine as an Instructor in the Department of Physiology and Pharmacology in 1978, achieving the rank of Assistant Professor in 1982. Dr. Smith joined the Department of Orthopaedic Surgery in 1996 working diligently to improve orthopaedic research until his retirement in 2020. He is an expert in small animal models and microsurgery training. The models he developed are now a resource for the IACUC and multiple collaborators across the institution. His expertise in cardiovascular physiology and applications for orthopaedic research helped establish the Extremity Lab, advanced techniques for re-implantation, and assessment of compartment syndrome. He collaborated with Walt Curl, MD, and Nicole Deal to determine the action mechanism of cold therapy for treatment of contusions. Dr. Smith published journal articles, book chapters, and books throughout her career.

Beth Smith, PhD, and Tom Smith, PhD, have many collaborative accomplishments during their tenure in the Department of Orthopaedic Surgery at Wake Forest University. They were responsible for the growth of industry and grant funding for the lab. With this additional funding, the lab was able to grow the support personnel to facilitate the research interests of the department's faculty and residents. Current personnel comprise 4 research faculty, 3 management level staff, and 10 grants, lab, and project coordinator staff members. The Smiths were instrumental in the establishment and success of the Physician Scientists program starting in 1999. The program has resulted in patents, publications, Physician Scientist training, numerous awards, and the establishment of an orthopaedic research lab at Wake Forest School of Medicine that continues to thrive and grow.

- Patents: 3 awarded; 3 pending
- Book Chapters: 38
- Peer reviewed journal articles: 240
- Grant Funding (PI or Co-I): $19,150,068

Physician Scientists:

- 11 have completed their PhD at Wake Forest University; 12 currently serve as faculty at Medical Schools
- 5 Pending PhDs

Awards

- Koman L, Smith B, Li Z, Smith T. Kappa Delta Award for Clinical Research in Microvascular Physiology. Orthopaedic Research and Education Foundation. American Association of Orthopaedic Surgeons. 1999.
- Koman L, Smith B, Smith T. Kappa Delta Award for Clinical Research in Translational Uses of Botulinum Toxins. Orthopaedic Research and Education Foundation. American Association of Orthopaedic Surgeons. 2019
- Co-authors for 3rd, 4th, and 7th most frequently cited article from the Journal of Pediatric Orthopaedics
- Co-authors for top 100 classic papers of pediatric orthopaedic Surgery in JBJS (19th, 21st, and 30th most frequently cited)

Thirty-Fourth Annual Gary Poehling, M.D. Resident Research Day
June 20, 2025

Fifth Annual Beth Smith, PhD and Tom Smith, PhD Visiting Professor

David G. Lewallen, MD

8:00	Welcome Cynthia Emory, MD Professor and Chair of Orthopaedic Surgery and Rehabilitation
8:05	Visiting Professor Introduction Molly Hartzler, MD
8:10	***"Using National Registries to Help Drive Orthopaedic Innovation"*** David G. Lewallen, MD
Emcee:	Edward Beck, MD
	Physician Scientists:
9:00	Ayobami Ogunsola, MBBS, MPH
9:07	Jeffrey Austin Foster, MD
9:14	Discussion
	PGY3 – Orthopaedic Residents:
9:30	Brooke Dickens, MD
9:37	Kristen Harmody, MD
9:44	Nequesha Mohamed, MD
9:51	Drew Recker, MD
9:58	Maddie Smith, MD
10:05	Discussion
10:20	**BREAK**
	PGY2 - Podiatry Residents
10:30	Hayden Bush, DPM
10:37	Brooke Kiefer, DPM
10:44	Alec Wroblewski, DPM
10:51	Discussion
11:10	***"Five Things I Wish Someone Had Told Me When I Was Finishing Training"*** David G. Lewallan
12:00	**Lunch**
	PGY5 – Orthopaedic Residents
12:45	Ameen Barghi, MD
12:52	Alexus Cooper, MD

12:59	Chukwuweike “Ikey” Gwam, MD, PhD
1:06	Elliott Voss, MD
1:13	Hunter Yancey, MD
1:20	Discussion
1:35	Podiatry Award Winner Presentation
1:40	**CONCLUSION OF RESIDENT RESEARCH DAY**
1:45	PGY2 Case Presentations

The Effect of Amniotic Fluid Stem Cell Conditioned Media (AFS-CM) on Inflammation and Oxidative Stress in End-stage Osteoarthritic Chondrocytes In-vitro

Author Names: **Ayobami S. Ogunsola, MBBS, MPH**

Faculty Research Mentor: Xue Ma, MD, PhD

Introduction: Osteoarthritis (OA) is a degenerative joint disease affecting approximately 240 million people worldwide. It prominently manifests in the knee and is characterized by progressive cartilage damage leading to pain, reduced mobility, and joint deformity. Chronic low-grade inflammation, driven by oxidative stress and age-related changes, such as mitochondrial dysfunction, cellular senescence, stem cell exhaustion, and mechanical stress, plays a prominent role in the pathogenesis of OA. Total knee arthroplasty (TKA) is the definitive treatment option for osteoarthritis. However, patients may be prescribed physical therapy, analgesics, and corticosteroid injections during the early phase of the disease. Several orthobiologics, such as platelet-rich plasma and bone marrow aspirate, have been used to treat OA, but clinical outcomes remain inconclusive. Currently, there are no FDA therapeutics that target the underlying mechanisms of OA. Our laboratory has successfully observed increased chondrocyte proliferation and a reduction in glycosaminoglycan loss in end-stage OA cartilage explants treated with AFS-CM. Studies have shown that AFS-CM has regenerative, anti-inflammatory, and anti-fibrotic properties making it a suitable alternative for treating patients with OA. This study aimed to evaluate the effect of AFS-CM on inflammation and oxidative stress in end-stage osteoarthritic chondrocytes in vitro.

Methods: Cartilage samples were obtained from patients who underwent TKA at an outpatient facility. Samples were processed and cultured with 10% fetal bovine serum (FBS) in Dulbecco's modified Eagle's medium (DMEM) at appropriate seeding densities in cell culture plates (96-well or 6-well plates) depending on the experimental goals. At 50% confluence, chondrocytes were starved overnight with 5% FBS in DMEM and were treated the following day with AFS-CM and other treatment conditions, depending on the experimental goals. For total reactive oxidative stress (ROS) activity, there were five treatment conditions [control (5% FBS in DMEM), HD (AFS-CM at 10 mg/ml), interleukin 1β (IL1β, 10 ng/ml), HD + IL1β (ILHD), and L-Buthionine Sulphoximine as positive control (BSO, 1nM)], and four measurement timepoints (3h, 6h, 12h, and 24h). Total ROS activity was measured using a DCFH-DA kit in a 96-well plate fluorescent microplate reader. For other experiments, there were four different treatment groups, excluding the BSO treatment. Mitochondrial ROS activity was measured using a mtSOX deep red probe at three timepoints (3h, 6h, and 24h) and images of MitoSox-stained cells were obtained using a confocal microscope. RNA extraction was performed on day 6 post-treatment, and quantitative polymerase chain reaction (qPCR) was performed to determine the relative expression of the genes of interest (MMP1 and MMP13) across treatment groups.

Results: For total ROS expression (n = 6), pairwise comparison of ROS expressions across treatment groups at different timepoints was performed using the Mann-Whitney U test with FDR correction. Significant reductions in ROS were observed in HD-treated cells at 3, 6, and 12h compared with the control ($q < 0.05$). The ILHD and IL1 groups also showed a significant decrease in ROS levels at 3 h relative to the control. For mitochondrial ROS expression (n =3), two-way ANOVA revealed a significant effect of treatment ($p < 0.0001$), while Tukey's post-hoc test showed that HD treatment significantly reduced the percentage of MitoSox-stained cells at 3, 6, and 24h compared to IL1β treatment. Additionally, ILHD treatment significantly reduced the percentage of MitoSox-stained cells at 6 h compared with IL1β treatment. qPCR analysis (n = 5) using one-way ANOVA showed a trend toward reduced MMP1 expression in the Control and HD treatment groups compared with IL1β treatment, with a large effect size (Cohen's d = -2.369 for control and - 1.120 for HD, $p = 0.159$). In addition, no significant differences were observed in the expression of MMP13 across treatment groups.

Conclusion: These findings suggest that AFS-CM may reduce oxidative stress and inflammatory responses in end-stage OA, highlighting its potential as a therapeutic alternative for OA management.

Osteoclast-Neuron Crosstalk Elicits Radiation-Induced Pain

Jeffrey A. Foster[1], Sun Park[2], Joseph Moore[2], Kaitlyn Reno[2], Alicia Costa-Terryll[2], Michael Farris[2], Ryan T. Hughes[2], Michael T. Munley[2], Mitu Sharma[3], Yixin Su[3], Sangeeta Singh[3], Gagan Deep[3], Sameh Almousa[1] Alejandro Pluma Pluma[4], Edgar Alfonso Romero-Sandoval[4], & Jeffrey S. Willey[2]

Faculty Research Mentor: Jeffrey S. Willey, PhD

Introduction: Chest wall pain affects up to 40% of patients with lung cancer who receive thoracic stereotactic body radiotherapy (SBRT). The mechanism(s) responsible for this radiation-induced pain response are unclear. Preliminary data from our group has shown that radiation increases the resorptive activity of osteoclasts (OCs). When neurons are treated with conditioned media from irradiated OCs, there is elevated expression of pain biomarkers Calcitonin Gene-Related Peptide (CGRP) and Substance P (SP). However, this increased expression of pain biomarkers is prevented when neurons are treated with conditioned media from irradiated OCs that have been administered bisphosphonates (BPs), which inhibit the resorptive ability of OCs. In a recent clinical trial comparing the use of BPs versus placebo in patients with lung cancer undergoing SBRT, BPs were associated with reduced rates of Grade 2+ chest wall pain. Therefore, the objective of this *in vitro* study was to identify the molecular signals through which irradiated OCs may elicit pain in nearby neurons.

Methods: RAW264.7 cells (murine macrophages) were differentiated into OCs using RANKL (35 ng/mL) and treated with one of the following four treatments: A) No radiotherapy (RT); B) RT (10Gy); C) BP (risedronate, 50μM); or D) RT+BP. RT was administered using the Precision X-ray SmART$^+$ system (220kVP X-Rays). Small extracellular vesicles (sEVs) were isolated from the conditioned media of irradiated OCs via sequential centrifugation and validated via nanoparticle track analysis (NTA) and electron microscopy. To evaluate potential molecular effectors of radiation-induced pain, dorsal root ganglia (DRGs) from T1-T13 were isolated from WT C57BL/6 mice for culture. Neuronal cultures were treated with OC conditioned media (No RT or RT) ± an inhibitor for TGFβ-R1 (Ly2157299). Expression of pain biomarkers CGRP and SP were quantified via RT-qPCR.

Results: Proteomics assessment of sEVs isolated from the conditioned media of irradiated OCs identified molecular signaling pathways potentially implicated in OC-mediated pain signaling. Among these pathways, TGFβ-R1 and TRPV2 were two identified pathways that are each associated with bone loss and pain signaling. Relative protein abundance of both TGFβ-R1 and TRPV2 was significantly increased following RT exposure; however, this release was inhibited when OCs were treated with BP. Finally, expression of TGFβ-R1 and pain biomarkers, CGRP and SP, was increased in sensory neurons treated with conditioned media from irradiated OCs. This increased expression was prevented when sensory neurons were treated with a TGFβ-R1 inhibitor.

Conclusion: Proteomics analysis of sEVs from irradiated OCs revealed potential molecular signaling pathways associated with both bone loss and pain. Among these pathways, TGFβ-R1 and TRPV2 were identified as potential molecular effectors of radiation-induced pain signaling between OCs and neurons. Conditioned media from irradiated OCs increased expression of TGFβ-R1, CGRP, and SP in sensory neurons. This increased expression of pain biomarkers was prevented when neurons were treated with a TGFβ-R1 inhibitor. Therefore, TGFβ-R1 may serve as a therapeutic target for preventing radiation-induced chest wall pain in lung cancer patients undergoing thoracic SBRT.

Infection Prevention with Profend: Evaluating Efficacy for Adult Hip Fracture Patients at Atrium Health Wake Forest Baptist Hospital

Brooke Dickens MD, Kristen Harmody MD, Edward Beck MD, Haylie Coffee MSN RN

Faculty Mentor: John Shields MD

Introduction: Infection can be a devastating complication after orthopedic surgery, with surgical site infections deleteriously affecting patient outcomes as well as hospital metrics such as readmissions and costs. One of the most common orthopaedic pathologies addressed surgically is the hip fracture, with patients undergoing either partial hip replacement, total hip replacement, or intramedullary nailing. Patients sustaining hip fractures are a vulnerable population, as their fracture is the result of trauma and requires urgent surgery along with hospital admission. These patients lack scheduled time for optimization and may also have additional injuries and medical comorbidities requiring other specialized care. Infection burden within the trauma population and hip arthroplasty population at Wake Forest Baptist Medical Center remains an area for continued improvement. With the goal of preventing surgical site infections, PDI Healthcare developed the Profend nasal decolonization swab, which has been shown to significantly reduce the presence of Staph Aureus in addition to other bacteria post application. We hypothesize administration of Profend nasal decolonization prior to surgery will meaningfully decrease the incidence of surgical infections amongst our patients undergoing emergency surgery for hip fractures at Wake Forest Baptist Medical Center. We hope this intervention can provide an effective strategy to reduce MRSA colonization in the acute surgical setting, decrease overall surgical site infections for the entire hip fracture population regardless of fixation, and limit healthcare burden from surgical site infections.

Methods: From 7/1/25 to 12/31/25, every patient presenting to Wake Forest Baptist Medical Center main campus to undergo emergency surgical fixation of their hip fracture with hemiarthroplasty, total hip arthroplasty, or intramedullary nailing will be enrolled in the study. Each patient will receive a MRSA nasal colonization screening test prior to surgery. Each patient will receive a Profend nasal decolonization swab in preoperative holding prior to their hip fracture surgery. After surgery, each patient will receive another MRSA nasal colonization screening test in the postoperative anesthesia care unit. We aim to track deep and superficial infections within the first postoperative year, and the specific infectious agents involved in each infection with the first postoperative year. Additionally, we aim to compare infection rates and species amongst the different fracture types and surgical fixation used.

Results: still in process – official rollout of the project is July 1, 2025

Conclusion: still in process **–** however if meaningful reduction within this patient population, goal is to expand to entire trauma population

Factors Influencing Aseptic Loosening in Total Knee Arthroplasty: The Impact of Age and Race

Caitlyn Perrone, MS, **Kristen C. Harmody, MD**, Ava McKane, MS, Deron Morrison, MS, John Shilt, PA, Garrett Bullock, PhD, DPT, John Shields, MD

Faculty Mentor: John Shields, MD

Introduction: Total knee arthroplasty (TKA) is used for treatment of osteoarthritis (OA) with 1.1 million procedures performed in the U.S. in 2022. Aseptic loosening (AS), a major cause of TKA failure, is influenced by factors like high BMI and cementing techniques. This study hypothesizes that higher bone density in Black or African American males contributes to increased early AS rates.

Methods: IRB approval was granted for a retrospective chart review from 2013 to 2022. Inclusion criteria consisted of primary TKA. Excluded cases were those performed in outside hospital settings and TKA revisions. Patient demographics, diabetes, hypertension, laterality, vendor, implant design, manipulation under anesthesia (MUA), and tibial AS were recorded. Descriptive statistics, odds ratios (OR) with 95% confidence intervals (CI), and p-values were used to evaluate the impact of patient factors on aseptic loosening rates.

Results: A total of 1540 patients were included, and 733 followed up for two years. The prevalence of tibial AS was 1.0% (95% CI: 0.5, 1.6) for all follow-ups and 1.7% (95% CI: 0.9, 3.0) for two-year follow-up. Patients with tibial AS who met the two-year follow-up were younger (mean age 63.4 years) than those without loosening (mean age 66.2 years). Black or African American patients had significantly higher odds of tibial AS: 3.7 times (95% CI: 1.3, 11.1, $p < 0.001$) for all follow-ups and 4.4 times (95% CI: 1.4, 14.2, $p < 0.001$) for the two-year follow-up.

Conclusion: Younger patients and black or African American patients have statistically significant higher rates of tibial AS. We hypothesize that this is secondary to increased bone density resulting in decreased cement penetration. Future studies should focus on larger, more diverse populations and explore the underlying mechanisms driving these associations.

The Effects of Diabetes and Sedentary Lifestyle on Knee Joint Cartilage in a Mouse Model

Nequesha Mohamed, Levi Moeller, Alicia Costa-Terryll, Kaitlyn Reno, Jeffrey Willey

Faculty Mentor: Jeffrey Willey

Introduction: Osteoarthritis (OA), as a common disability of aging, has risen in incidence over the past 30 years globally. Often excess loading can lead to joint damage and eventually OA. Diabetes (DM) is also associated with an increased risk of OA and joint failure. There is also spaceflight data which indicates that reduced weight bearing also contributes to OA. It is unclear if reduced weight bearing with DM, which is often associated with reduced weight bearing through a sedentary lifestyle, would lead to worsened OA. Likewise, it is unclear if running exercise (return to activity) could reverse some joint damage from DM and/or reduced weight bearing. This study examines if OA is worsened in mice exhibiting combined joint challenges, including a hindlimb unloading (HLU) model for sedentary lifestyle, and if running exercise had any effect on subsequent joint health.

Methods: To compare OA development, 60 normal and 60 DM mouse models were obtained, and placed in groups to simulate normal activity (ground) and sedentary lifestyle (HLU) for 30 days. This resulted in four main study arms: 1) normal ground mice; 2) DM ground mice; 3) normal HLU mice; 4) DM HLU mice. The HLU group was placed in tail-suspension units to simulate reduced weight bearing. After 30 days, a subset of each group was exercised 3 times weekly for 2 weeks on a treadmill for 20 minutes (RUN). After mouse harvest, the right knee joints were fixed and processed for histological assessment of bone and cartilage by and immunohistochemistry using ADAMTS5 and MMP13 antibodies, and medians compared with visual analytic software.

Results: Normal HLU mice had +201.3% ADAMTS5 in the meniscus vs normal ground mice. The DM HLU RUN mice had -48.1% ADAMTS5 in meniscus and -52.9% ADAMTS5 in the cartilage vs DM HLU Non-RUN. Normal HLU RUN mice had +65.9% MMP13 in meniscus vs normal ground RUN mice. All other RUN vs non-RUN groups had comparable levels of ADAMTS5 and MMP13.

Conclusions: Reduced weight bearing increased ADAMTS5 and MMP13 in non-DM mouse menisci, while running reduced ADAMTS5 in DM/RUN HLU mouse meniscus compared to DM/Run Ground mice. No changes were seen in ADAMTS5 expression in the non-run DM groups, nor in MMP13 in any other groups. These results indicate that reduced weight bearing could contribute to a joint degradation phenotype, and running after sedentary lifestyle could help mitigate this development in diabetic individuals. Future studies could focus on optimal duration of running exercise to optimize ADAMTS5 reduction.

Donor Site Morbidity at Six Months Following ACL Autograft Harvest: A Prospective Comparison of Bone-Patellar Tendon-Bone and Quadriceps Autografts

Andrew J. Recker, MD, Caleb D. Puckett, BS, John B. Gordon, BS, Matthew Gwilt, MS, Nicholas A. Trasolini, MD, John B. Hubbard, MD, Brian R. Waterman, MD

Faculty Mentors: Nicholas Trasolini, MD and Brian Waterman, MD

Introduction: Bone-patellar tendon-bone (BTB) autografts and quadriceps tendon (QT) autografts are the current standard of care for anterior cruciate ligament reconstruction (ACLR). Limited prospective data exists addressing specific donor site morbidity concerns between these two options for graft harvest. We hypothesize QT will have less donor site morbidity than BTB.

Methods: We conducted a prospective series of consecutive patients undergoing BTB or QT ACL autograft harvest for ACLR. Patient-reported outcomes were collected preoperatively and at 6-month follow-up. An ACL Donor Site Morbidity Questionnaire (Range 0 (poor)-100 (excellent)), and Kujala Anterior Knee Pain Scale Questionnaire (Range 0 (poor)-100 (excellent)) were administered. Statistical analysis was performed with Student t-tests for continuous variables and χ^2-tests were performed for categorical variables. In addition to the primary analysis, a secondary 1:1 matched cohort analysis was performed based on sex, age, and Tegner Activity Level score.

Results: A total of 42 (95.45%) patients had 6-month follow-up and were included in final analysis. The cohort consisted of 12 (28.57%) BTB, and 30 (71.43%) QT grafts with a mean age of 24.48±9.02 and mean follow up time of 6.3±0.5 months. Comparable Donor Site Morbidity Scores were seen for both BTB and QT cohorts, with scores of 69.18±9.12 and 66.57±16.06, respectively (p=0.511). At 6 months postoperatively, 8 (66.67%) of patients undergoing BTB graft harvest experienced new-onset numbness, while only 10 (35.7%) undergoing QT graft harvest experienced new-onset numbness (p=0.007).
Interestingly, 13 (43.33%) of patients with QT harvest, while only 2 (16.67%) with BTB harvest reported flexion deficiency at 6-month follow-up (p=0.002), with similar baseline scores. The two cohorts demonstrated similar postoperative anterior knee pain (p=0.998), donor site pain (0.545), kneeling pain (p=0.912), quadriceps atrophy (p=0.998), and satisfaction with scar appearance (p=1.00). The matched cohort analysis demonstrated only 4 (33.33%) patients with new-onset numbness (p=0.111), 5 (41.67%) patients reporting flexion deficiency (p=0.379), and similar postoperative anterior knee pain (p=0.145), kneeling pain (p=1.00), quadriceps atrophy (p=1.00), and satisfaction with scar appearance (p=0.931) for those undergoing QT graft harvest. Additionally, 6 (50.0%) of patient undergoing BTB graft harvest, while only 2 (16.67%) in the matched QT cohort reported pain at the donor site (p=0.022).

Discussion/Conclusion: Patients undergoing BTB autograft harvest reported significantly higher rates of hypoesthesia and donor site pain, while patients undergoing QT autograft harvest reported higher rates of flexion deficiency at 6-months post-operatively. Physicians can use this information when counseling patients on graft choices.

Technique for Reverse Obliquity or Unstable Proximal Femur Fractures

Maddie Smith, Hunter Yancey, Mattie Raiford

Faculty Mentor: Dr. Eben Carroll

Introduction: Hip fractures are some of the most common fractures in the elderly. They can also be seen in high energy mechanisms in younger patients. Unstable intertrochanteric fractures have features including reverse obliquity, lateral wall instability, comminution of the posteromedial cortex, displaced lesser trochanter fractures and subtrochanteric extension patterns. Stable intertrochanteric hip fractures are able to be treated with dynamic hip screw, femoral neck system, or intramedullary device. Unstable fracture patterns have classically been treated with intramedullary devices alone for fixation. However, these unstable fractures can still fail with intramedullary fixation. The technique of adding a lateral compression plate to intramedullary fixation is able to recreate the compromised lateral wall and prevent subsidence of the fracture.

The surgical technique is as follows: A direct lateral incision is utilized to approach the proximal femur. The fracture is then reduced under direct visualization. Common tools utilized for reduction were point-to-point clamps, ball spike, bone hook, and Kirschner wire fixation. Adjunctive, reductive 3.5 LCP was placed on the lateral proximal femur to maintain reduction. Often, unicortical locking screws were utilized to keep the intramedullary space clear for the intramedullary nail. At this point, a cephalomedullary or reconstruction-style nailing is completed in the standard fashion. The nail should be placed in an antegrade direction, with screws or blade placed into the femoral head. These authors have utilized 2 distal interlocking screws.

Methods: This study is a case series with operatively treated unstable intertrochanteric fractures. Basic chart review was completed for demographic information, fracture classification, and surgical treatment. Fracture alignment and union were noted during surgery and at the most recent follow up.

Results: 8 hips with AO classification of 31A2 or 31A3 have been treated thus far with the plate-nail construct. The average age of the patients included are 63.6 years with range of 31 to 79 years. Of those, only 2 have had 6 months of follow up to this point. These 2 patients have shown union of their fractures. They have also had unchanged fracture alignment and no complications. Only one of the patients has had pain limiting their function. They have all been bearing weight.

Conclusion: At this point, early conclusions seem to support the stability of the plate-nail construct in comparison to sole intramedullary fixation for unstable intertrochanteric fractures. The increased exposure for the approach has not shown any increase in time to ambulation or fracture healing comparatively to standard intramedullary nailing. Further patient enrollment and longer follow up for the remainder of patients will continue.

Impact of Consultation Time to the Primary Surgical Services on Length of Stay at a Tertiary Care Center

Hayden Bush, DPM , Brennan Reardon, DPM, Nicholas Powers, DPM

Faculty Mentor: Nicholas Powers, DPM

Introduction: The primary aim of this study was to evaluate the impact of emergency department consultation time to the primary surgical service for foot-related disease on the inpatient length of stay at a tertiary care center. The secondary aim of this study was to evaluate for independent factors which might increase length of stay.

Methods: Data was extracted by searching for all procedures performed including incision and drainage, debridement, and amputation of lower extremity (CPTs) following inpatient admission from the emergency department from June 1, 2015 through December 15, 2020. Consult services include podiatry, orthopedics, vascular surgery, and plastic surgery.
Time to consultation, inpatient admission, first surgical intervention, and length of stay was collected. Surgical team(s), American Society of Anesthesia (ASA) classification, number of surgeries, intensive care unit admissions and outcome of major amputation was also collected to evaluate for any independent predictors of prolonged length of stay within the diabetic foot cohort.

Results: A total of 122 patients were included in the study. A total of 19 (14%, 95% CI: 10, 22) patients underwent foot amputation.
After controlling for diagnosis of diabetes mellitus and ASA score, there was no association between time from emergency department consultation to surgical services to amputation [1.0 (95% CI: 0.9, 1.1), p = 0.503].
After controlling for diagnosis of diabetes mellitus and ASA score, there was no association between time from emergency department consultation to surgical services to length of hospital stay [1.00 (95% CI: 0.9 1.1), p = 0.437].

Conclusion: The most remarkable component of this research is that there is no association between time from ED consultation to amputation. This shows that, although consultation should not be delayed in the emergency setting, it is not a statistically significant factor that affects either time to amputation nor for overall length of stay. Rather, it highlights the effectiveness of interdepartmental cooperation, especially between the emergency department and surgical services for the treatment of foot and ankle related diseases.

Re-operation Rate of Pronation External Rotation versus Supination External Rotation Ankle Fracture Patterns

Brooke E. Kiefer DPM; Stephen K. Polacek DPM; Lindsay K. LeSavage DPM; Joni Evans MS; Cody Blazek DPM

PI: Nicholas Powers DPM, FACFAS

Introduction: Pronation External Rotation (PER) ankle fracture patterns are relatively rare compared to Supination External Rotation (SER) patterns. Patients with rotational ankle fractures are predisposed to development of post-traumatic ankle arthritis, which can lead to further surgical intervention. The purpose of this study was to investigate reoperation rates influenced by PER vs SER fracture patterns as well as demographic characteristics.

Methods: A retrospective chart review was conducted to identify the reoperation rate of patients who underwent ORIF for ankle fractures between January 1, 2013 and January 1, 2018. 113 patients that underwent ORIF with a fracture pattern of SER or PER were included. Demographic characteristics influencing reoperation rate were also investigated.

Results: Overall reoperation rate was 13.3%. Among the SER group (n=86), the average reoperation rate was 12.8%. Among the PER group (n=27), the average reoperation rate was 14.8%. No statistical significance was found between SER or PER fracture pattern in regards to the reoperation rate or the time from the initial surgery to the second surgery. However, there was a statistically significant difference in weight and BMI associated with higher likelihood of reoperation. Additionally, more females and elderly patients were found to have SER fracture patterns.

Conclusion: This is the first study to our knowledge specifically addressing reoperation rates following these injury patterns. No statistically significant difference was found in reoperation rates between patterns. Patient demographics did have influence on the need for further operation. This review may help guide patient expectations during operative treatment for ankle fractures.

Efficacy of Dexamethasone Iontophoresis as Treatment for Achilles Tendonitis

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Faculty Mentor: Dekarlos Dial, DPM

Introduction: Insertional Achilles tendinopathy (IAT) is often caused by mechanical overload, repetitive strain, and degeneration, making it difficult to manage conservatively. Non-surgical treatments such as eccentric exercises, shockwave therapy, and medication are commonly used to relieve symptoms and restore function. Still, their effectiveness varies depending on the severity and chronicity of the condition. Dexamethasone iontophoresis (DI) has emerged as a successful treatment in resolving tendon inflammation, however data regarding use in cases of insertional tendinopathy is limited.

Methods: This retrospective study evaluated the effectiveness of DI in patients with IAT or retrocalcaneal bursitis. We analyzed 159 patients, of which 87 received three or more DI treatments. We compared first and last-visit pain scores, range of motion (ROM), and posterior heel spur size radiographic measurements.

Results: No significant differences between treatment groups were observed in pain or ROM (p-values >0.3). However, a substantial difference in posterior heel spur size was found, with more prominent spurs associated with more than three treatments (p-value = 0.019). Although not statistically significant, a trend was noted where increased spur size and Haglund bump height were linked to a higher likelihood of surgical intervention.

Conclusion: This study suggests DI may provide short-term relief in IAT but does not significantly improve long-term functional outcomes. Radiographic analysis can guide treatment, particularly in more prominent posterior heel spurs. Further prospective research is needed to explore the long-term efficacy of DI in managing IAT.

Pre-procedural Transition Unit: Improving Capacity Management During High Census Times

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Faculty Mentor: Cynthia Emory

Introduction: Hospital capacity constraints during high-census periods negatively impact patient care by causing delays, increasing the risk of adverse events, and reducing patient satisfaction. Orthopaedic trauma patients frequently require inter-hospital transfers and are particularly vulnerable to delays due to emergency department (ED) overcrowding. This study evaluated the efficacy of a Pre-procedural Transition Unit (PTU), designed to accept patients directly from external hospitals requiring urgent specialty-specific surgical interventions, bypassing traditional ED and inpatient bottlenecks.

Methods: A retrospective observational study was conducted at a tertiary academic medical center from July 2022 through 2025. The PTU, a dedicated 5-bed unit staffed continuously by specialty-trained nursing personnel, accepted adults requiring urgent procedural interventions within 48 hours of transfer. Patients were stratified into treatment (PTU) and control (standard inpatient care) groups. Outcomes analyzed included hospital length-of-stay (LOS), clinical complications (mortality, infections, deep vein thrombosis, myocardial infarction), and readmission rates at 30, 60, and 90 days. Risk ratios and differences with 95% confidence intervals were calculated using R version 4.3.1.

Results: Of 21,110 patient encounters analyzed, 9,332 were managed in the PTU, and 11,778 received standard inpatient care. PTU patients experienced significantly shorter median hospital stays on medical-surgical floors (55.2 vs. 68.1 hours), intensive care units (51.5 vs. 69.5 hours), and intermediate care units (43.9 vs. 75.5 hours). Clinical outcomes improved markedly in the PTU cohort, with lower rates of urinary tract infections (RR=0.21; $p<0.001$), pneumonia (RR=0.51; $p<0.001$), and deep vein thrombosis (RR=0.64; $p=0.013$). PTU admissions demonstrated significantly reduced 30-day inpatient readmissions (RR=0.17; $p<0.001$) and ED revisits (RR=0.29; $p<0.001$).

Conclusion: Implementation of a specialized PTU effectively reduced hospital stay durations, clinical complications, and readmission rates for orthopaedic trauma patients during high-capacity periods. Future prospective multicenter studies should evaluate additional quality metrics, including patient satisfaction and optimal patient selection criteria, to further validate the efficacy and generalizability of PTUs.

Predictive Value of the Area Deprivation Index for Healthcare Utilization in Total Hip Arthroplasty Patients: Does your patient's zip code matter?

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Introduction: Nearly 500,000 primary total hip arthroplasties (THA) are performed annually in the US. However, there is little information on the interplay between patients' socioeconomic and geographic factors and their outcomes following primary THA. We extrapolated patient zip codes to area deprivation index (ADI) scores and hypothesized patients with higher ADI scores (less resources) would experience greater rates of missed appointments, re-admissions, and complications.

Methods: We retrospectively analyzed 3,692 THA patients from a single academic health system (2020–2023), matched to national and state-level ADI scores using 9-digit ZIP codes. Outcomes included length of stay (LOS), no-show rates, readmission, and mortality. Predictors were ADI (quartile/decile), distance to hospital, insurance type, employment, BMI, smoking status, and Charlson Comorbidity Index (CCI). Regression modeling was stratified by hospital site (Davie vs. Baptist). Inflection-point analysis identified ADI thresholds predictive of outcomes. All analyses were performed using Python 3.11 and R.

Results: Higher ADI was independently associated with increased no-show rates (OR: X.XX, $p<0.05$), prolonged LOS (β = X.XX days, $p<0.05$), and elevated readmission risk. Medicaid and uninsured patients showed stronger correlations with high ADI. Differences in ADI and utilization patterns were observed between the two hospital sites, with Baptist serving a more disadvantaged cohort. A national ADI score above the 75th percentile predicted increased healthcare utilization across multiple domains.

Conclusion: ADI is a significant predictor of healthcare utilization after THA and may help identify vulnerable populations. Geographic and insurance-linked disparities underscore the need for targeted intervention.

Amniotic Fluid Stem Cell-Conditioned Media As A Therapeutic Adjunct In Peripheral Nerve Injury Repair: Insights From A Sciatic Nerve Mouse Model

Chukwuweike Gwam MD, PhD, MBA

Faculty Mentor: Xue MA MD, PhD

Introduction: Peripheral nerve injuries can result in severe and lasting morbidity, including motor weakness, pain, and functional deficits, even with timely intervention. Treatment options include non-operative management and surgical interventions such as direct end-to-end nerve repair for low-tension injuries or grafting techniques (autograft, allograft, and tissue-engineered grafts) for large-gap injuries. Recent research has focused on the regenerative potential of human amniotic fluid stem cells (AFS) due to their paracrine effects. Amniotic fluid stem cell-conditioned media (AFS-CM) has emerged as a promising therapeutic adjunct, offering ease of formulation and low immunogenicity. However, the role of AFS-CM in peripheral nerve repair remains poorly understood. This study investigates the effects of AFS-CM on peripheral nerve recovery in a sciatic nerve injury model in CD1 mice.

Methods: Thirty-six male CD1 mice underwent sciatic nerve transection of the left hindlimb and were divided into three groups: (1) control group—direct end-to-end nerve repair; (2) hydrogel group—reconstruction with a hydrogel-coated silicone graft; and (3) AFS-CM group—reconstruction with an AFS-CM-infused hydrogel-coated silicone graft. Post-surgical treatments were administered biweekly via hydrogel (control and hydrogel groups) or hydrogel plus AFS-CM (AFS-CM group). Functional recovery was assessed through gait analysis, electromyography (EMG), and nerve conduction studies at two weeks, one month, and two months. Muscle and nerve tissues were analyzed using immunohistochemistry. Statistical analyses included ANOVA and generalized linear models, with a significance threshold of $p < 0.05$.

Results: No significant differences were observed in EMG amplitude and latency or in the G-ratio across all groups ($p > 0.05$). Gait analysis revealed significant improvements in overlap distance ($p < 0.001$) and ataxia coefficient ($p = 0.012$) in the AFS-CM group compared to the hydrogel group. The AFS-CM group also demonstrated reduced expression of MURF-1, indicative of less muscle atrophy, and increased expression of alpha-bungarotoxin, suggesting improved neuromuscular junction recovery. Among the groups, no significant differences were noted in malondialdehyde expression, a marker of oxidative stress.

Conclusion: AFS-CM shows promise as a therapeutic adjunct in peripheral nerve repair, improving functional outcomes and reducing muscle atrophy compared to hydrogel-only reconstruction. While electrophysiological and morphological outcomes showed no significant differences, the enhanced gait performance and neuromuscular junction recovery observed in the AFS-CM group highlight its regenerative potential. Further studies are warranted to elucidate the underlying mechanisms and to optimize the clinical application of AFS-CM in peripheral nerve injury management.

Treatment of Femoral Neck Fractures using Novel Femoral Neck Implant in the Setting of Ipsilateral Femoral Shaft Fractures.

Voss, EE, Yancey, HB, Andring, NA, Reiser, JA, Babcock, S, Pilson, HT, Halvorson, JJ, Carroll, EA.

Faculty Mentor: Dr. Jason Halvorson

Introduction: Ipsilateral femoral neck and femoral shaft fractures are relatively uncommon injuries primarily seen as result of high energy trauma. These fractures are often seen in young individuals and treated routinely with osteosynthesis utilizing a variety of different constructs. Operative fixation of these complex injuries present challenges including provisional fixation, maintenance of reduction, implant placement, and the creation of stress risers when using two implants. In many cases, these fractures are addressed with two implants, one for fixation of the femoral neck (historically, sliding hip screw or cannulated screws) and another for the shaft component (retrograde intramedullary nail (rIMN)). There is no clear optimal fixation construct established in the literature. With the advent of newer implants such as the Femoral Neck System (FNS) from Depuy Synthes surgeons have another option to obtain stable proximal fixation as well as implant overlap when treating ipsilateral injuries. The purpose of this study is to report outcomes of utilization of FNS construct for femoral neck fracture in the setting of an ipsilateral femoral shaft fracture and compare these results to a prior cohort of patients treated with variety of different constructs by same group of surgeons.

Methods: This was a retrospective chart review at a level 1 academic trauma center of adult patients who underwent operative fixation of a femoral neck and shaft fractures over 8 year period (2014-2022) with at least 12 weeks radiographic follow up. After institutional approval, charts were identified with CPT codes 27236 and either 27506 or 27507 and screened for ipsilateral femoral neck and shaft fractures that underwent fixation. After becoming available in 2018, FNS was routinely used in conjunction with rIMN for these fracture patterns. Prior to 2018, a variety different constructs were used by the same group of surgeons. Charts were reviewed for demographics, fracture characteristics, implant selection, surgical complications, reoperation, and medical comorbidities. Primary outcome was fracture union.

Results: After retrospective review 49 patients were identified with femoral neck-shaft combination injuries. 42 patients met criteria for inclusion and were included for analysis. 23 patients meeting inclusion criteria were treated with FNS-rIMN to address their femoral neck and shaft fractures. 19 patients met inclusion criteria and were treated with variety of other constructs prior to routine use of FNS at our institution. 22/23 (95.6%) of patients in FNS cohort went on to achieve union of both femoral neck and shaft fractures without reoperation. In the pre-FNS cohort, 16/19 (84.2%) of patients went on to achieve union of both femoral neck and shaft fractures without reoperation ($p=0.1007$). All FNS constructs overlapped. Implants were overlapped in 7 of 19 (36.84%) patients in pre-FNS group. In the FNS cohort, reoperation occurred in 1 patient who was found to have femoral neck and shaft nonunion treated with exchange nailing of shaft fracture nonunion and valgus intertrochanteric osteotomy with blade plate fixation for femoral neck nonunion. 3/19 patients in the pre-FNS cohort developed femoral neck nonunion, 2 of which were treated similarly with valgus intertrochanteric osteotomy and 1 of which was converted to arthroplasty.

Conclusion: Treatment of femoral neck and ipsilateral femoral shaft fractures with the novel FNS and rIMN implant appears to be a viable fixation construct. Our results show noninferiority of FNS-rIMN construct when compared to prior constructs used at our institution with similar results regarding union, implant failure rate and AVN.

Dual Plating with Medial Twist Plate of Distal Femur Fractures

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Introduction: We present a new surgical technique for dual plating of distal femur fractures. This technique consists of standard lateral locked plating combined with a medial plate contoured such that the distal part of the plate rests directly medial, while the proximal portion of the plate lies in the anterior compartment. By utilizing a medial “twist” plate this technique obviates risk to proximal femur vascular anatomy and provides an option for dual plating in distal femur fractures requiring long segment medial fixation.

Methods: Retrospective chart review of adult patients with distal femur fractures treated operatively with dual implant medial twist constructs. At least 6 months of radiographic and clinic follow-up required for inclusion.

Results: 23 patients met inclusion criteria. Both periprosthetic (12) and native (11) femur fractures were included. Average follow up was 20.9 +/- 5.5 months. 17 of 23 patients (73.9%) were made immediately weight bearing as tolerated (WBAT) postoperatively. 6 patients (26.8%) were kept non-weight bearing due to other ipsilateral injuries and fracture pattern. Of the 17 patients made WBAT, 14 (82.3%) were truly weight-bearing with physical therapy per therapy notes. 20 of 23 patients (83.33%) had returned to previous ambulatory status at their final follow-up. There were 0 cases of hardware failure, loss of reduction, nonunion or malunion requiring revision. 2 patients (8.7%) sustained peri-implant fracture at the proximal extent of the construct. Both of these patients were treated with dual plates within 2 holes of each other in length. After these complications, practice was routinely changed to ensure more range in plate length difference to limit stress-riser forces in the proximal femur.

Conclusion: We present a technique and case series for dual plating of distal femur fractures. This technique can be utilized to provide long medial segment fixation in select fracture patterns to allow for stable fixation and early weight bearing.

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