OREF ORTHOPAEDIC RESEARCH AND EDUCATION FOUNDATION®

UCSF University of California San Francisco

OREF SOUTHWEST REGION
RESIDENT RESEARCH SYMPOSIUM
Wednesday, September 21, 2022

University of California, San Francisco
Mission Bay Conference Center
Fisher Banquet Room
1675 Owens Street
San Francisco, California 94158

Hosted by:

Thomas Parker Vail, MD
The Michael and Antoinette Pappas Endowed Chair
James L. Young Professor
Department of Orthopaedic Surgery
University of California, San Francisco

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About OREF:
The Orthopaedic Research and Education Foundation (OREF) was founded in 1955 to ensure an expanding base of knowledge and effective, evidence-based treatment protocols for orthopaedic surgeons to continually improve patient care. Since its founding, OREF has funded well over $100 million in research and educational grants and awards that benefit all of orthopaedics. For more information about OREF grants and awards, please visit www.oref.org. Follow OREF on its Facebook page (OREFtoday) and on Twitter (@OREFtoday).

OREF SOUTHWEST REGION RESIDENT RESEARCH SYMPOSIUM
SUMMARY AGENDA
Wednesday, September 21, 2022

7:30 a.m. – 8:00 a.m.	**Registration and Breakfast** University of California, San Francisco Mission Bay Conference Center Fisher Banquet Room San Francisco, California
8:00 a.m. – 8:03 a.m.	**Welcome and Introductions** Thomas Parker Vail, MD The Michael and Antoinette Pappas Endowed Chair James L. Young Professor and Chair Department of Orthopaedic Surgery University of California, San Francisco
8:03 a.m. – 8:06 a.m.	**OREF Welcome** Lee Grossman Chief Executive Officer Orthopaedic Research and Education Foundation
8:06 a.m. – 8:36 a.m.	**Session I – Resident Research Presentations & Discussion**
8:36 a.m. – 9:06 a.m.	**Session II – Resident Research Presentations & Discussion**
9:06 a.m. – 9:36 a.m.	**Session III – Resident Research Presentation & Discussion**
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9:51 a.m. – 10:21 a.m.	**Session IV – Resident Research Presentations and Discussion**
10:21 a.m. – 10:51 a.m.	**Session V – Resident Research Presentations and Discussion**
10:51 a.m. – 11:45 a.m.	**Keynote Address** **"Don't Stop Believin': Translating Ideas to Practice and Staying "Young" in Orthopaedic Surgery"** Nicholas M. Bernthal, MD Interim Chair and Executive Medical Director David Geffen School of Medicine University of California, Los Angeles
11:45 a.m. – 12:45 p.m.	**Reception** **Lunch and Awards Presentation** Awards Presentation and Closing Remarks University of California, San Francisco Mission Bay Conference Center Fisher Banquet Room

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KEYNOTE SPEAKER

Nicholas M. Bernthal, MD

Interim Chair and Executive Medical Director
David Geffen School of Medicine
University of California, Los Angeles

Nicholas Bernthal, MD is the Interim Chair and Executive Medical Director at the David Geffen School of Medicine at UCLA. He graduated magna cum laude and phi beta kappa from Princeton University and received alpha omega alpha honors from Cornell University Medical School. He did his residency in orthopaedic surgery at UCLA and fellowships in orthopaedic research and musculoskeletal oncology at UCLA and the Huntsman Cancer Institute, respectively. His clinical interests are bone and soft tissue tumors, and his NIH-funded laboratory is pioneering new implant coatings to prevent surgical infections.

Judges

Jeannie Bailey, PhD
University of California, San Francisco

Jeff Barry, MD
University of California, San Francisco

Nicholas M. Bernthal, MD
David Geffen School of Medicine at UCLA

Moderator

Alan Zhang, MD
University of California, San Francisco

OREF Southwest Region Resident Research Symposium
DETAILED AGENDA
Wednesday, September 21, 2022

7:30 a.m. – 8:00 a.m.	**Registration and Breakfast** University of California, San Francisco Mission Bay Conference Center Fisher Banquet Room San Francisco, California
8:00 a.m. – 8:03 a.m.	**Welcome and Introductions** Thomas Parker Vail, MD James L. Young Professor and Chair Department of Orthopaedic Surgery University of California, San Francisco
8:03 a.m. – 8:06 a.m.	**OREF Welcome** Lee Grossman Chief Executive Officer Orthopaedic Research and Education Foundation
	Session I – Resident Research Presentations and Discussion **Moderator: Alan Zhang, MD**
8:06 a.m. – 8:10 a.m.	*Impact of Non-English-Speaking on Perioperative Outcomes in Total Joint Arthroplasty for Asian Patients* Anthony Wiggins, MD, University of California, San Francisco
8:10 a.m. – 8:14 a.m.	*Spanish-Speaking Arthroplasty Patients Have More Limited Health Literacy: A Qualitative Study* Geordie C. Lonza, MD, Los Angeles County-Harbor-UCLA
8:14 a.m. – 8:18 a.m.	*Sex-Based Differences in Utilization Shoulder, Hip, and Knee Replacements* Katherine Woolley, MD, University of California, San Francisco
8:18 a.m. – 8:22 a.m.	*Impact of Social Determinants of Health on Preoperative Opioid Utilization in Patients with Lumbar Degeneration* Jennifer M. O'Donnell, MD, University of California, San Francisco
8:22 a.m. – 8:26 a.m.	*Breaking the Glass: Gender Differences in Endowed Chair Positions and NIH Funding in Musculoskeletal Research* Alicia Asturias, MD, University of California, San Francisco
8:26 a.m. – 8:36 a.m.	**Question and Answer**

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Session II – Resident Research Presentations and Discussion
Moderator: Alan Zhang, MD

8:36 a.m. – 8:40 a.m.	*Correlates and Outcomes of Goal Concordant Care: A Cross-Sectional Study in Hand and Upper Extremity Surgery* Jeffrey W. Kwong, MD, University of California, San Francisco
8:40 a.m. – 8:44 a.m.	*An Analysis of the Prognostic Factors for Adult Patients with High-Grade Extremity Sarcomas in the California Cancer Registry, 1988-2017* Sarah Stroud, MD, University of California, San Francisco
8:44 a.m. – 8:48 a.m.	*Complications After Surgical Treatment of Benign Bone Tumors* Matthew Henriques, MD, Naval Medical Center San Diego
8:48 a.m. – 8:52 a.m.	*Durability of Proximal Femur Replacements: A Forty Year Experience* Rishi Trikha, MD, University of California, Los Angeles
8:52 a.m. – 8:56 a.m.	*Heterogeneous Human Fibroadipogenic Cells Subpopulations are Altered in Injury* Steven Garcia, MD, University of California, San Francisco
8:56 a.m. – 9:06 a.m.	**Question and Answer**

Session III – Resident Research Presentations & Discussion
Moderator: Alan Zhang, MD

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9:10 a.m. – 9:14 a.m.	*Complication and Revision Rates in Cemented Versus Uncemented Total Knee Arthroplasty* Jose George, MD, Harbor UCLA Medical Center
9:14 a.m. – 9:18 a.m.	*Multi-Domain Recovery Trajectories Following Total Joint Arthroplasty Related to Opioid Use and Emergency Room Utilization: A Longitudinal Multivariable Clustering Analysis of a Large Cohort* Ryan Halvorson, MD, University of California, San Francisco
9:18 a.m. – 9:22 a.m.	*Fungal Periprosthetic Joint Infection Identification via Molecular Diagnostic Analysis* Peter Hsiue, MD, University of California, Los Angeles
9:22 a.m. – 9:26 a.m.	*No Correlation Between Clinical Outcomes and Changes in the Tibia-Metaphyseal Angle Following Total Knee Arthroplasty* Matthew Cherches, MD, University of California, San Francisco
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OREF Southwest Region Resident Research Symposium
DETAILED AGENDA (continued)
Wednesday, September 21, 2022

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Moderator: Alan Zhang, MD

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Joseph Wick, MD, University of California, Davis

9:55 a.m. – 9:59 a.m. *Perioperative Hyperglycemia Increases Rates of Infection in Spine Surgery*
Ryan A. Finkel, MD, Cedars-Sinai Medical Center

9:59 a.m. – 10:03 a.m. *Return to Surfing Following Hip Arthroplasty*
Garrett K. Berger, MD, PharmD, University of California, San Diego

10:03 a.m. – 10:07 a.m.. *What is the Surgical Burden of Treatment for High Energy Lower Extremity Trauma?*
Christopher Stewart, MD, University of California, San Francisco

10:07 a.m. – 10:11 a.m. *Can Laser-Assisted Indocyanine Green Angiography Be Used to Quantify Perfusion Changes by Anatomical Location During Staged Fixation of Pilon Fractures? A Pilot Study*
Brendon Mitchell, MD, University of California, San Diego

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Session V – Resident Research Presentations & Discussion
Moderator: Alan Zhang, MD

10:21 a.m. – 10:25 a.m. *ACL Injuries Among Pac-12 Athletes: A 5-Year Epidemiologic Study*
Grant Schroeder, MD, Stanford Health Care

10:25 a.m. – 10:29 a.m. *Effect of Obesity on Short and Long-term Complications of Shoulder Arthroplasty*
Charles Cogan, MD, University of California, San Francisco

10:29 a.m. – 10:33 a.m. *Longer Time Duration from Diagnosis of Femoracetabular Impingement Syndrome to Hip Arthroscopy Increases Risk of Revision Hip Arthroscopy and Post-Operative Narcotic Prescriptions*
Ryan Freshman, MD, University of California, San Francisco

10:33 a.m. – 10:37 a.m. *Outcomes of Allograft Anterior Cruciate Ligament Reconstruction in Adolescent Patients*
Tyler Paras, MD, University of California, San Diego

10:37 a.m. – 10:41 a.m. *Defining Endogenous Mitochondrial Transfer in Muscle Following Rotator Cuff Injury*
Michael Davies, MD, University of California, San Francisco

10:41 a.m. – 10:51 a.m. **Question and Answer**

10:51 a.m. – 11:45 a.m. **Keynote Address**
"Don't Stop Believin': Translating Ideas to Practice and Staying "Young" in Orthopaedic Surgery"
Nicholas M. Bernthal, MD
Interim Chair and Executive Medical Director
David Geffen School of Medicine
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11:45 a.m. – 12:45 p.m. **Lunch Reception**
Awards Presentation and Closing Remarks
University of California, San Francisco
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Fisher Banquet Room

Impact of Non-English-Speaking on Perioperative Outcomes in Total Joint Arthroplasty for Asian Patients

Anthony Wiggins, MD
University of California, San Francisco

Purpose: To identify and quantify differences in perioperative outcomes after total joint arthroplasty (TJA) based on whether or not Asian patients spoke English as a primary language.

Significance: Asian Americans represent the fastest growing ethnic group in the US.

Methods: Retrospective review of an institutional database for patients who underwent TJA from June 2012 - August 2020. Multiple analyses were performed to assess for differences in outcomes based on whether or not patients were English-speaking.

Results: Non-English-speaking patients had longer LOS after both primary total hip (2.53 vs 1.84 days, p=0.0209) and primary total knee (2.58 vs 2.1 days, p=0.0009) arthroplasty. Non-English-speaking patients also experienced higher rates of medical complications (5% vs 0.61%, p=0.0198) and thromboembolic disease (4% vs 0.61%, p=0.049). English-speaking patients were more likely to have been taking opioids on admission (39% vs 25%, p=0.005), and had a higher average daily inpatient oral morphine equivalents (OME) after THA (64 vs 26, p=0.0009).

Conclusion: Non-English-speaking Asian patients were less likely to be taking opioids prior to admission, received fewer opioids during admission, and experienced higher LOS, rates of medical complications, and thromboembolic disease after TJA compared to English-speaking Asian patients.

Spanish-Speaking Arthroplasty Patients Have More Limited Health Literacy: A Qualitative Study

Geordie C. Lonza, MD
Los Angeles County-Harbor-UCLA

Purpose: To quantify the health literacy of total joint arthroplasty (TJA) patients and assess their comprehension after surgical discussion.

Significance: Patients with limited health literacy have difficulty understanding risks and benefits of surgery, which can negatively affect postoperative satisfaction.

Methods: We performed a questionnaire-based study on 26 adult patients undergoing primary TJA at a county hospital. Demographics, Newest Vital Sign (NVS) health literacy, Decisional Conflict Scale (DCS), Amsterdam Preoperative Anxiety and Information Scale (APAIS), and knowledge scores were collected and compared to model study averages using Student's *t*-test.

Results: Average age was 56+/-11 years, 50% female, 60% Spanish-speaking, 44% completing less than high school, and 62% annual household income <$25,000 per year. NVS for English (3.1+/-1.6) and Spanish (1.0+/-1.6) were comparable to the model population with *P*=0.546 and 0.169. APAIS for women (18.2+/-4.7) and men (13.9+/-7) were similar with *P*=0.089 and 0.343. Knowledge scores were significantly higher in our population (54.9%+/-26.9, *P*= 0.049) but lower in Spanish-speaking (50+/-24.9) than English-speaking patients (62+/-26.9). Our patients had less decisional conflict (Total 11.4+/-14.3, *P*=0.044, Uncertainty 2.9+/-14.7, *P*=0.003, and Values 9.6+/-24.6, *P*=0.003).

Conclusion: Spanish-speaking patients have limited health literacy and difficulty understanding surgery risks and benefits, and female patients have higher levels of anxiety.

Sex-Based Differences in Utilization Shoulder, Hip, and Knee Replacements

Katherine Woolley, MD
University of California, San Francisco

Background: Studies have found that females have a higher prevalence of osteoarthritis but lower rates of joint replacement surgery (JRS). The reasons for this remain unknown. We hypothesize females in our university population undergo JRS less with different barriers than males.

Methods: A database of JRS candidates was created and patients who declined surgery were invited to focus groups to better understand their reasoning. Two independent sample t-tests, Mann Whitney U, and Chi-square tests were utilized with two-tailed significance <0.05.

Results: The cohort was 62% female. Female shoulder patients were older (77.5±7.7 vs. 73.5±7.5 years), had higher VAS (6.7±2.2 vs. 5.3±2.4), and CCI (4.6±1.6 vs. 4.0±2.0). Male knee patients had symptoms for longer (65.3±117.2 vs. 39.3±48.0 months). There were no significant differences in proportions of females vs males who underwent surgery. Focus groups found barriers for male patients involved waiting for technology advancements whereas females experienced negative provider interactions, needed to self-advocate for treatment, and feared post-operative pain.

Conclusion: We did not find a sex difference in JRS utilization, but this study is isolated to our university population and may not reflect national trends. Subsequent studies will utilize a survey to query the cohort to further understand these different barriers.

Impact of Social Determinants of Health on Preoperative Opioid Utilization in Patients with Lumbar Degeneration

Jennifer M. O'Donnell, MD
University of California, San Francisco

Purpose: We aimed to evaluate the social determinants of health (SDOH) which are associated with perioperative opiate use among lumbar spine patients.

Significance: Socioeconomic and environmental factors, termed SDOH, have been demonstrated to significantly impact health outcomes in spine patients. To decrease opioid utilization, these factors must be understood.

Methodology: This retrospective case-control study included patients undergoing spine surgery for lumbar degeneration in 2019. Preoperative opioid users (OU) were compared with opioid-naïve (ON) patients regarding SDOH including demographics like age and race, and clinical data such as activity and tobacco use. Multivariate logistic regression was used.

Results: Ninety-eight patients were opioid-naïve and 90 used opioids preoperatively. All OU had ≥3 months of use, had more prior spine surgeries (1.07 vs. 0.44, $p<0.001$) and more comorbidities including diabetes, hypertension, and depression ($p=0.021$, 0.043, 0.017). Unemployment [odds ratio (OR): 5.29, $p<0.001$], lower levels of activity (OR: 3.34, $p=0.007$), and community median income between $60,000-79,999 (OR: 3.55, $p=0.019$) were risk factors for preoperative opioid use. At one year postoperatively, OU had higher rates of opiate use [72.2% vs. 15.3%, $p<0.001$].

Conclusion: Unemployment, low physical activity level, and low community median income were associated with preoperative opioid use and longer-term opioid use postoperatively.

Breaking the Glass: Gender Differences in Endowed Chair Positions and NIH Funding in Musculoskeletal Research

Alicia Asturias, MD
University of California, San Francisco

Purpose: Determine if gender is an independent variable for achieving endowment in musculoskeletal medicine.

Significance: Orthopedics has the lowest number of full-time faculty positions held by women (19%). Endowed chairs are the most coveted of these positions and no prior study has examined gender disparities at this level in musculoskeletal medicine. Disparities would represent a glass ceiling for women researchers and surgeons and warrants examination.

Methodology: The top 100 principal investigators (PIs) in musculoskeletal medicine were identified using NIH funding data from 2019-2021. Public sources were used to obtain endowment and demographic data for each investigator. Analysis was performed.

Results: Of the 137 PIs identified, 29% (40) were women and 71% (97) were men. Twenty-three researchers (16.8%) had endowments, including 22 men and one woman ($p = 0.003$). There was no significant difference between the average NIH funding between women ($701,999.75) and men ($952,515.59) at large ($p = 0.37$), however sample size was limited in comparing funding at the endowment level.

Conclusion: Top male investigators are 11.4 times more likely to receive endowments in musculoskeletal medicine than their female counterparts, demonstrating that endowments are rare for qualified women and represent an opportunity for improvement.

Correlates and Outcomes of Goal Concordant Care: Cross-sectional Study in Hand and Upper Extremity Surgery

Jeffrey W Kwong, MD
University of California, San Francisco

Purpose: To evaluate rates of goal concordance (defined as alignment of patients' pre-visit goals with treatment received) and its association with patient satisfaction and experience.

Significance: Goal concordance is associated with improved outcomes in many chronic diseases but has not been previously investigated in orthopaedic surgery.

Methods: Patients were recruited prospectively from three hand surgery clinics. Before seeing the surgeon, patients ranked their treatment goals from a list. After the visit, patients listed the treatments they received from the same options. Concordance was achieved if the patient's #1 goal matched the treatment received. We evaluated the association between concordant treatment and Press Ganey (PGOMPS) and Likelihood to Recommend (LTR) scores.

Results: 50 patients were recruited. Leading treatments included information (60%), surgery (12%), and imaging (12%). Concordance was high (68%). Concordance was not associated with PGOMPS score or LTR. Age, sex, English proficiency, employment status, education level, health literacy, symptom duration, and functional disability were not associated with concordance.

Conclusion: While concordant care was achieved the majority of the time, it was not associated with patient satisfaction, patient experience, or multiple covariates. Further studies are needed to characterize drivers of concordant care to understand how to align patient and surgeon goals.

An Analysis of the Prognostic Factors for Adult Patients with High-Grade Extremity Sarcomas in the California Cancer Registry, 1988-2017

Sarah Stroud, MD
University of California, San Francisco

Purpose: Are nonwhite race, public insurance, or low neighborhood socioeconomic status (nSES) associated with amputation or mortality in primary extremity sarcomas?

Significance: Prior studies show more amputations for extremity sarcomas in nonwhite and publicly insured patients with conflicting effects of race on mortality. We investigated the effects of race, insurance, and nSES on amputations and mortality using the California Cancer Registry (CCR).

Methodology: The CCR data were obtained from 1988-2017 for adults with a primary extremity sarcoma. Standard treatments (i.e. chemotherapy, surgery, radiation, or combinations of these) were defined for osseous sarcomas. Multivariate and sequential modeling analyses assessed the interactions between race, insurance, and nSES.

Results: 7,180 patients were included, mean age 57. Amputation rate, but not receipt of standard treatment, varied by race and was highest among Black patients. Mortality was lower among Asian and Hispanic patients than whites, but higher among Black patients, Medicaid patients, and those with low nSES. Sequential modeling demonstrated 36% and 12% decreases in parameter estimates for the effect of Black race on mortality when accounting for nSES and insurance respectively.

Conclusion: Amputation rates and mortality were highest among Black patients. Low nSES and public insurance status likely account for some of these effects.

Complications After Surgical Treatment of Benign Bone Tumors

Matthew Henriques, MD
Naval Medical Center San Diego

Purpose: We hypothesized a low complication rate following excision of benign bony lesions.

Significance: The literature lacks consolidated reporting of postoperative complication rates and associated preoperative risk factors for excision of benign bony lesions.

Methodology: The NSQIP database (2014-2018) was filtered by CPT and ICD codes. Inclusion criteria were extremity location and treatment of bone cyst and benign tumor. Exclusion criteria were non-extremity location, infection, malignancy, pseudotumors, open biopsy, radical/wide resection. 1,945 cases resulted, representing 0.04% of the database. Adverse 30-day outcomes and preoperative risk factors were evaluated.

Results: The most common complications were unplanned readmission (2.00%), blood transfusions (1.49%), unplanned reoperation (1.29%), and superficial infection (1.00%). There were no cases of CVA, MI, or death. Comparing patients without a complication to with one, diabetes (7.1% vs 15.6%), smoking status (17.7% vs 32.3%), ASA Class of 3 or 4 (20% vs 47.9%), and history of bleeding disorder (0.8% vs 8.3%) all demonstrated significance ($p<0.001$).

Conclusion: Excision of benign bony lesions demonstrated a mean complication rate of 0.84%. Diabetes, ASA class of 3 or 4, smoking status, and history of bleeding disorder were all significantly associated with complication. This allows for improved preoperative counseling when discussing operative management with patients.

Durability of Proximal Femur Replacements: A Forty Year Experience

Rishi Trikha, MD
University of California, Los Angeles

Purpose: Increased interest in acetabular wear and the rarity of proximal femur replacements (PFRs) has made the understanding of the durability of these implants and their mechanisms of failure crucial.

Significance: PFRs are an effective surgical option for the treatment of primary and metastatic tumors causing large bony defects.

Methods: All patients undergoing a primary or revision PFR for an oncologic diagnosis at a single institution between 1982-2020 were reviewed. This study utilized the validated Henderson Failure Classification.

Results: 132 PFRs for 124 patients were included, including 122 primary and 10 revision PFRs. 11/122 primary PFRs (9.0%) failed at a mean of 111.49 months, while 3/10 revision PFRs (30.0%) failed at a mean of 120.51 months. There was an infection rate of 2.5% (3/122) for primary PFRs and 10% (1/10) for revision PFRs.

Conclusion: Neither stem length nor resection length was correlated with failure, perhaps due to the stem location being distal and not being subjected to a higher muscular deforming force. The rate of infection for PFRs was also relatively low in this dataset. This study represents one of the largest available on PFRs over a 40-year study period and highlights the remarkable durability of these implants.

Heterogeneous Human Fibroadipogenic Cells Subpopulations are Altered in Injury

Steven Garcia, MD
University of California, San Francisco

Purpose: We hypothesize that human fibroadipogenic progenitor (hFAP) cells are a functionally heterogeneous population.

Significance: hFAPs are non-myogenic stem cells within skeletal muscle defined by expression of PDGFRa. PDGFRa+ cells have been shown to both aide myogenesis and promote degeneration. Whether this dual role of PDGFRa+ cells during injury is driven by PDGFRa+ subpopulations with distinct functions remains unclear.

Methodology: Isolated PDGFRa+ hFAPs from healthy and injured muscle underwent single-cell RNAseq (n=14). Characterization was performed with immunofluorescence staining and full-spectrum flow cytometry.

Results: hFAPs (24,928 cells) were analyzed and transcriptomically distinct clusters were identified by differential gene analysis. Differential expression of THY1, DLK1, and CD55 marked three overarching meta-subpopulations of hFAPs, while TPPP3 marked a muscle tenocyte progenitor population. Flow cytometry validation determined THY1+DLK1-CD55- cells were 11.8%, CD55+THY1-CD55- were 12%, and DLK1+THY1-CD55- were 6% of the total hFAP population. Proliferative (THY1+), pro-fibrogenic (CD55+) and tenocyte progenitor (TPPP3+) hFAP subpopulations were proportionally increased in injured muscle compared to healthy controls.

Conclusion: hFAPs are composed of transcriptionally distinct subpopulations that can be isolated based on expressed surface markers. hFAP heterogeneity demonstrated here may suggest evidence for the multiple roles hFAPs fill during muscle regeneration.

Ambulation Distance Within 72 Hours is a Predictor of 90-Day Ambulatory Capacity in Elderly Patients

Canhnghi Ta, MD
University of California, San Diego

Purpose: The purpose of this study was to evaluate the association between ambulatory distance during the acute post-operative inpatient setting and ambulatory capacity at 90 days.

Significance: The inability to mobilize following surgery for geriatric hip fractures is established as a risk factor for significant morbidity and mortality.

Methods: Patients aged 65 and older who underwent surgery for hip fractures from 2014-2019 were retrospectively reviewed. Patients were divided into two cohorts: those who were able to ambulate 5 feet within 72 hours after surgery (early ambulatory) and those who were not (minimally ambulatory).

Results: 170 patients (84 early ambulatory and 86 minimally ambulatory) were available for analysis. Using a multivariable ordinal logistic regression model, statistically significant predictors of ambulatory status at 90 days were ability to ambulate five feet in 72 hours ($p < 0.0001$) and ambulatory distance at discharge ($p = 0.012$). The early ambulatory cohort had 8.85 times the odds of ambulating without assistive devices at 90 days.

Conclusion: Ambulating 5 feet within 72 hours following hip fracture surgery is associated with an increased likelihood of independent ambulation at 90 days postoperatively. This simple and clear goal may be used to help enhance postoperative mobility and independence.

Complication and Revision Rates in Cemented Versus Uncemented Total Knee Arthroplasty

Jose George, MD
Harbor UCLA Medical Center

Purpose: To evaluate revision and complication rates in cementless versus cemented fixation in total knee arthroplasty (TKA).

Significance: The ideal method of fixation in TKA remains debated. This study compares the complication and revision rates between cemented and cementless TKA.

Methods: Primary TKAs between 2016-2021 at a single institution were retrospectively reviewed. Statistical analysis was performed using the Chi-square test.

Results: 288 cemented and 494 uncemented knees were included. Average age was 63.16 years and 63.49 years in the cemented and uncemented groups with a follow up of 42.47 months and 26.23 months respectively. Complications were categorized as infection, fracture, loosening, soft tissue injury, arthrofibrosis, or medical. Any return to the operating room was categorized as a revision. The cemented group had 27 complications and 20 revisions. The cementless group had 60 complications and 39 revisions. There was no difference in overall complications ($p = 0.62$), infection ($p = 0.63$), fracture ($p = 0.43$), loosening ($p = 0.21$), soft tissue injury ($p = 0.62$), arthrofibrosis ($p = 0.07$), medical complications ($p = 0.63$) or revision rates ($p =0.62$) between the two groups.

Conclusion: Cementless fixation is non-inferior to cemented fixation when comparing complication and revision rates in intermediate follow-up.

Multi-Domain Recovery Trajectories Following Total Joint Arthroplasty Related to Opioid Use and Emergency Room Utilization: A Longitudinal Multivariable Clustering Analysis of a Large Cohort

Ryan Halvorson, MD
University of California, San Francisco

Purpose In our analysis of non-linear postoperative patient reported outcome (PRO) trajectories, we hypothesized that clusters of patients with slower and smaller improvements in pain, function, and mental health following total joint arthroplasty would be associated with higher opioid use, emergency department (ED) utilization, and readmissions.

Significance Patient-specific multi-domain recovery trajectories following orthopaedic surgeries are not well characterized and may better associate with long-term clinical outcomes than singular post-operative PROs.

Methods HOOS/KOOS, PROMIS Global Mental Health, and Global Physical Health were recorded at baseline and multiple postoperative timepoints for patients undergoing THA/TKA. Multivariate latent class mixed models were optimized. Opioid use, ED utilization, and readmissions were compared.

Results 4,698 patients (female:39%, age:64.7, BMI:29.5, ASA:2) were included. Cluster1 (84.0%) was characterized by rapid and sustained recovery in all domains. Cluster2 (10.4%) was characterized by slower but eventually full recovery in HOOS/KOOS with moderate PROMIS GPH/GMH. Finally, Cluster3 (5.6%) was characterized by persistently low HOOS/KOOS and PROMIS GPH/GMH. Cluster3 had significantly higher perioperative opioid utilization (mean 479 vs 226(Cluster1) vs 310(Cluster2) OME, p=0.02) and ED visits within one year (5.3% vs 3.4%(Cluster1) vs 2.0%(Cluster2), p=0.03). There was no difference in readmission.

Conclusions Predicting individual recovery could improve counseling, risk stratification, and decision-making.

Fungal Periprosthetic Joint Infection Identification via Molecular Diagnostic Analysis

Peter Hsiue, MD
University of California, Los Angeles

Purpose: To evaluate the utility of microbial antigen testing (MAT), polymerase chain reaction (qPCR), and next generation DNA sequencing (NGS) in diagnosing fungal periprosthetic joint infection (PJI).

Significance: Fungal PJI are rare and challenging to diagnose. Molecular diagnostics are being increasingly used, but their performance relative to other tests is unknown.

Methods: A single-surgeon, single-institution retrospective review of all fungal PJIs from 2019-2021 was performed. 17 patients met the Musculoskeletal Infection Society's criteria for PJI with minimum 6-month follow-up from explantation. Diagnostic studies included serum/synovial fluid markers, cultures, MAT, qPCR, and NGS.

Results: 13 knees, 3 hips, and 1 shoulder were identified. Polymicrobial infections were common (52.9%) and the most common fungal species identified was Candida (82.3%). Preoperative and intraoperative cultures were fungal positive in 53.8% and 58.8% of patients, respectively, while preoperative aspirate studies were positive in 0% of qPCR, 38.5% of NGS, and 90.9% of antigen tests. Only 4 patients (23.5%) were fungal positive across molecular diagnostics and cultures.

Conclusions: Given the lack of concordance across molecular diagnostics, it is difficult to determine which one identifies a true fungal PJI. Additional investigation is needed so treatments can be appropriately tailored to maximize the chance of fungal PJI eradication.

No Correlation Between Clinical Outcomes and Changes in the Tibia-Metaphyseal Angle Following Total Knee Arthroplasty

Matthew Cherches, MD
University of California, San Francisco

Purpose: This study aims to analyze if post-operative variance of the joint line from pre-operative alignment affects patient satisfaction following primary total knee arthroplasty (TKA). We hypothesized that maintaining a native alignment results in better outcomes.

Significance: TKA is a successful treatment for knee osteoarthritis. Despite numerous advances in implant design and surgical technique, patient satisfaction following TKA has plateaued. Various alignment strategies have been introduced that impact the coronal positioning of the tibial component relative to the tibial mechanical axis.

Methods: A retrospective review identified all primary TKA's with full-length, standing pre-and post-op radiographs. Pre-and post-operative measurements for hip-knee angle, tibial-metaphyseal angle, tibial-axis obliquity angle, and joint-line obliquity angle were recorded. Three-month, 1 year, and 2-year PROM scores were correlated with the change in degrees for each of the angles using a spearman correlation. A two sample T-test was used to compare angular correction with PROM scores.

Results: Two-hundred-and-four patients with a mean age of 67-years were included. Similar improvement across all PROM's were noted regardless of angular changes across all variables.

Conclusion: Variations in coronal tibial alignment from cuts orthogonal to the mechanical axis of the tibia do not adversely impact patient reported outcomes.

Patient Characteristics, Injury Types, and Costs Associated with Secondary Over-Triage of Isolated Cervical Spine Fractures

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Purpose: We hypothesized that patient and injury characteristics may help identify patients requiring inter-facility transfer for isolated cervical spine fractures.

Significance: Patients with isolated cervical spine fractures are often transferred for surgical assessment yet treated nonoperatively. Identifying factors associated with operative management may reduce unnecessary transfers and healthcare expenditures.

Methodology: Patients transferred to a Level-1 trauma center for isolated cervical spine fractures between 2015 and 2020 were identified. Demographics, comorbidities, insurance data, injury characteristics, workup, treatment, and financial data were collected. Multivariable models were constructed to identify factors associated with surgical treatment.

Results: Of 153 patients, nearly 75% were treated non-operatively. Over 97% of transfers were accepted by the general surgery trauma service. BMI, neurologic deficits, smoking status, and post-transfer MRI were associated with surgical treatment. Degree of displacement was associated with surgical treatment for type II dens fractures. Median charges to patients treated operatively and nonoperatively were $380,890 and $90,734, respectively. Median hospital costs for patients treated operatively and nonoperatively were $55,115 and $12,131, respectively.

Conclusion: A large proportion of patients were transferred unnecessarily. Injury characteristics are important for determining need for transfer. Involving spine surgeons in the decision to transfer patients may significantly reduce healthcare resource use.

Perioperative Hyperglycemia Increases Rates of Infection in Spine Surgery

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Purpose: To study hyperglycemia as an independent risk factor for postoperative infection in patients undergoing spine surgery.

Significance: Perioperative hyperglycemia can occur from physiologic stress or medication effects, but its relationship with surgical site infections (SSI) after spine surgery is unclear.

Methods: A retrospective case-control study of 112 patients with SSI following spine surgery were compared with 1:1 uninfected controls. Independent variables including average postoperative glucose were identified. Odds ratios (OR) with 95% confidence intervals were reported. The threshold for inclusion into subsequent nested models was $p<0.1$; statistical significance in the final model was $p<0.05$.

Results: Average serum glucose levels >140 mg/dL within five days post-operatively was an independent risk factor for SSI versus average glucose <100 (OR = 8.3, 95% CI = 1.7-41.2, p = 0.01). A diagnosis of diabetes was not a significant risk factor in the initial model (OR = 1.4, 95% CI = 0.5-4.5, p = 0.5) and was not included in the final model.

Discussion: Postoperative hyperglycemia >140 mg/dL was independently associated with an eightfold higher risk of infection when compared to glucose < 100 mg/dL. The role of perioperative hyperglycemia as a risk factor for postoperative infection, irrespective of diabetes, should be investigated further.

Return to Surfing Following Hip Arthroplasty

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Purpose: Analyze the return to surfing rate and safety following hip arthroplasty

Significance: To date, no study has analyzed the safety and return rate for this high impact sport so common among Californians.

Methodology: A retrospective chart review was conducted on all primary total hip arthroplasties (THA) and hip resurfacing arthroplasties (HRA) performed by the senior author from 2014-2021. Patients identified as surfers were contacted to complete a survey including surfing history and patient reported outcomes.

Results: 96 hips in 72 patients (68 males, 4 females, median age 56 years (+/-10)) were identified and contacted. There were 77 THAs (mode head size 36mm (n=52); range 36-40mm) and 19 HRAs (mode head size 52mm (n=7); range 48-56). Mean cup inclination and anteversion angles as measured with mediCAD digital imaging software were 41.8 (+/-3.6) and 23.8 (+/-6.2), respectively. With an average follow-up of 21 months, there were no dislocations and no patients reported hip pain while surfing. The average life experience surfing prior to surgery was 30 years (range 3-61 years). Time to re-entering the ocean post-op was a median of 16 weeks (range 2-144). Among 13 patients identified for this study who did not return to surfing, 9 attributed this to lifestyle reasons, 3 attributed it to other arthritic joints, and only 1 patient attributed their limitation to the replaced hip. This group had taken significantly more time off from surfing prior to surgery.

Conclusion: Return to surfing following hip arthroplasty is common and safe in our study population with no complications and specifically no dislocations. Patients with other sites of arthritis and patients who have more extensive time away from surfing prior to hip replacement are less likely to return to sport.

What is the Surgical Burden of Treatment for High Energy Lower Extremity Trauma?

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Purpose: To describe the operative burden of reconstruction or amputation after limb threatening lower extremity trauma.

Significance: Treatment of these injuries often consists of a series of surgeries. Understanding the dynamic treatment pathway is necessary to develop shared decision-making models of therapies that optimize outcomes. An important step toward developing a decision-making model is to describe the burden of surgery.

Methods: Patients 18-60 were enrolled in a prospective multi-center study. The primary outcome was number of surgeries classified as temporizing, definitive, or complication. Poisson regression tested whether ankle/pilon injuries and failed reconstruction underwent the greatest operative burden.

Results: 575 participants underwent 2297 surgeries over eighteen months. Ankle/pilon, hindfoot, and other foot averaged 4.7 (range 1-21), 3.4 (range 1-10), and 3.7 (range 1-14) surgeries, respectively ($p<0.01$). Reconstruction (n=454), amputation (n=92), and failed reconstruction followed by amputation (n=29, 6% of salvages) averaged 3.7 (range 1-21), 4.6 (range 1-14) and 6.2 (range 3-14) surgeries, respectively ($p<0.01$). 847 temporizing, 965 definitive, and 485 complication surgeries were performed.

Conclusion: Ankle/pilon and unsuccessful reconstruction had the greatest burden of surgery, with most undergoing several procedures. These results will allow identification of time-dependent predictors of treatment to be used in dynamic decision-making models that optimize patient outcomes.

Can Laser-Assisted Indocyanine Green Angiography Be Used to Quantify Perfusion Changes by Anatomical Location During Staged Fixation of Pilon Fractures? A Pilot Study

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Purpose: To quantify soft tissue perfusion changes in pilon fractures during staged treatment using laser-assisted indocyanine green angiography (LA-ICGA).

Significance: External fixation is used to allow for soft tissue recovery in the setting of pilon fracture. However, literature in the last decade has demonstrated a potential role for early acute internal fixation, highlighting the need for adjunctive tools to assist in determining tissue perfusion.

Methods: We performed a prospective cohort study including 12 patients with pilon fractures. LA-ICGA using the SPY fluorescence imaging platform was performed. Fractional area of perfusion (FAP) was performed to objectively quantify soft tissue perfusion of the anterior, medial, and lateral ankle at the time of initial external fixation (EF) and at definitive fixation.

Results: FAP averaged 64% medially, 61% laterally, and 62% anteriorly prior to EF placement, and increased to 86% medially, 87% laterally, and 86% anteriorly at definitive fixation. FAP increased 24% medially ($p=0.0004$), 26% laterally ($p=0.001$), and 19% anteriorly ($p=0.002$).

Conclusion: Quantitative improvement in soft tissue perfusion was identified through the course of staged surgical management in pilon fractures. LA-ICGA may be used to determine appropriate timing for definitive surgical intervention based on the readiness of the soft tissue envelope.

ACL Injuries Among Pac-12 Athletes: A 5-Year Epidemiologic Study

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Purpose: To describe the epidemiology of ACL tears among Pac-12 athletes across all sports.

Significance: There is currently minimal injury surveillance data on ACL tears in a broad sample of high-level athletes.

Methods: All athletes sustaining an isolated ACL tear from July 2016 to November 2021 were included in this study. Incidence rates (IR) per athlete-year were stratified by sport, gender, season, mechanism, setting, first injury vs. recurrence, surface, and year.

Results: A total of 313 ACL tears (148 female, 165 male) occurred in 286 athletes. For females, soccer had the highest IR of 5.0% per athlete-year, followed by basketball (2.7%) and gymnastics (2.4%). For males, football had the highest IR of 1.9% per athlete-year, followed by soccer (1.7%) and basketball (1.4%). 70.9% of ACL tears occurred in-season, 73.2% occurred via a non-contact mechanism, and 81.1% were a first injury. Females were significantly more likely than males to suffer an ACL tear during competition (IRR: 1.7, 95% CI: 1.2-2.5), and in the sports of soccer (IRR: 2.9, 95% CI: 1.6-5.2), gymnastics (IRR: 3.1, 95% CI: 1.0-9.3), and softball [vs. baseball] (IRR: 6.0, 95% CI: 1.6-22.2).

Conclusion: The incidence of ACL tears varies widely by sport and gender for Pac-12 athletes.

Effect of Obesity on Short and Long -term Complications of Shoulder Arthroplasty

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Purpose: To evaluate for postoperative medical and surgical complications in patients undergoing total shoulder arthroplasty (TSA) with obesity. We hypothesize that complications will increase incrementally with body mass index (BMI).

Significance: The proportion of patients undergoing total shoulder arthroplasty with obesity continues to grow every year in the United States. While comorbid obesity is common amongst total shoulder arthroplasty (TSA) patients, the relationship of obesity on medical and surgical complications remains debated.

Methods: Patients undergoing TSA were studied in the PearlDiver database. CPT and ICD codes were used to compare patients with and without obesity who underwent TSA. A matched comparison was performed at a 1:1 ratio based upon age, sex, and medical comorbidities.

Results: From 2010-2020, a total of 113,634 patients underwent TSA. The percentage of patients with obesity increased from 1% to 34% during this time. The obesity group had higher odds of readmission, DVT/PE, superficial infection, and prosthetic joint infection at 90 days postoperatively but not mechanical complications or revision surgery at 2 years.

Conclusion: Medical complications and infection after TSA are greater in obese patients even when matching for medical comorbidities, age, and sex. Mechanical surgical complications and revision surgery are not higher in obese patients.

Longer Time Duration from Diagnosis of Femoroacetabular Impingement Syndrome to Hip Arthroscopy Increases Risk of Revision Hip Arthroscopy and Post-Operative Narcotic Prescriptions

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Purpose: To examine how timing of surgery for femoroacetabular impingement syndrome (FAIS) influences rates of revision hip procedures, post-operative medical complications, and narcotic prescriptions.

Significance: The optimal timing of hip arthroscopy following diagnosis of FAIS remains controversial.

Methods: A retrospective cohort study of 6,707 patients undergoing hip arthroscopy was performed using the PearlDiver database. Patients were stratified into groups by 3-month intervals based on time from diagnosis of FAIS to surgery. Rates of revision hip arthroscopy, 90-day medical complications, 90-day post-operative narcotic prescriptions, and conversion to total hip arthroplasty (THA) were analyzed.

Results: As time from diagnosis to surgery increased, there was an increasing risk of 2-year revision hip arthroscopy ($P<0.001$) and 90-day narcotic prescription ($P<0.001$), but no differences in rates of 90-day medical complications or future conversion to THA ($P>0.05$). Regression analysis demonstrated that undergoing primary hip arthroscopy >3 months following FAIS diagnosis was an independent risk factor for revision labral repair ($P<0.01$) and revision femoroplasty ($P<0.01$).

Conclusion: Increasing time from diagnosis of FAIS to hip arthroscopy was associated with higher rates of revision arthroscopic hip surgery and greater likelihood of filling an opioid prescription <90 days after surgery, but not increased risk of conversion to THA.

Outcomes of Allograft Anterior Cruciate Ligament Reconstruction in Adolescent Patients

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Purpose: The purpose of this study was to compare clinical outcomes and complications of adolescent patients undergoing ACLR with bone-patellar tendon-bone (BPTB) allograft and autograft. We hypothesized that allograft and autograft patients would have similar clinical outcomes and complication rates.

Methods: We performed a retrospective matched cohort study of skeletally mature patients <18 years old who received a BPTB allograft or autograft ACLR. Patients were offered allograft if they did not intend to return to pivoting or cutting sports and were willing to wait a full year prior to returning to lower-intensity sports. The BPTB autograft cohort was matched 1:1 based on age, sex, and follow-up time. Specific outcomes measures included SANE (Single Assessment Numerical Evaluation), surgery satisfaction rate, pain scores, Tegner Activity Scale, and the Lysholm Knee Scoring Scale.

Results: Both allograft and autograft patients had similar SANE (p=.51), Surgery Satisfaction (p=.77), Pain score (p=.99), Tegner score (p=.21), Lysholm score (p=.62). Re-rupture occurred in 3.6% in the BPTB allograft cohort and in 0% of the autograft cohort (p=.33).

Conclusion: These findings support the use of BPTB allograft in select lower demand adolescent patients; however, more data is needed to determine appropriate indications for this graft choice.

Defining Endogenous Mitochondrial Transfer in Muscle Following Rotator Cuff Injury

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Purpose: To study horizontal mitochondrial transfer from fibroadipogenic progenitors (FAPs) to myogenic cells and examine the effects of beta-agonism on this process.

Significance: FAPs are muscle stem cells that provide support to myogenic cells and regulate muscle homeostasis. This study highlights a novel function of FAPs transferring mitochondria to myogenic cells.

Methods: Mouse and human FAPs were stained with mitochondrial dyes and co-cultured with myoblasts or satellite cells (SCs) and mitochondrial transfer was measured by flow cytometry. Isolated human FAP mitochondria were applied to SCs, and myotube fusion index (MFI) was calculated. Mouse and human single-cell RNA sequencing (scRNAseq) data was analyzed for genes associated with adipogenesis and mitochondrial transfer. PDGFRaCre^{ERT}/MitoTag FAP mitochondria reporter mouse underwent tendon transection and denervation and mitochondrial transfer was analyzed following beta-agonist treatment.

Results: Mouse and human scRNAseq identified an association between adipogenic differentiation and mitochondrial biogenesis in FAPs. Beta-agonism increased mitochondrial transfer in mouse FAP-C2C12 co-cultures (17.8±9.9% vs 99.6%±0.13%, $p<0.0001$). Human SCs treated with FAP mitochondria showed increased MFI compared to PBS (79.0%±7.8% vs 30.6%±9.7%, $p<0.0001$). Rotator cuff injury increased FAP mitochondria transfer to myofibers in mice.

Conclusion: We have described a novel mechanism of endogenous mitochondrial transfer between FAPs and myogenic cells.

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