



# UC San Diego

## School of Medicine

### Orthopaedic Surgery

OREF SOUTHWEST REGION  
RESIDENT RESEARCH SYMPOSIUM  
Wednesday, October 6, 2021

University of California, San Diego  
Virtual Resident Research Symposium

Hosted by:  
**Susan Bukata, MD, FAOA, FAAOS**  
Professor and Chair  
Department of Orthopaedic Surgery  
University of California, San Diego

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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](http://www.oref.org). Follow OREF on its Facebook page (OREFtoday) and on Twitter (@OREFtoday).

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**OREF SOUTHWEST REGION RESIDENT RESEARCH SYMPOSIUM**  
**SUMMARY AGENDA**  
Wednesday, October 6, 2021

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- 7:00 a.m. – 7:05 a.m.      **Welcome and Introductions**  
Susan Bukata, MD, FAOA, FAAOS  
Professor and Chair  
Department of Orthopaedic Surgery  
University of California, San Diego
- 7:05 a.m. – 7:10 a.m.      **Opening Remarks**  
D.C. Covey, MD, MSc, FACS  
CME Course Director  
Department of Orthopaedic Surgery  
University of California, San Diego
- 7:10 a.m. – 7:14 a.m.      **OREF Welcome**  
Mr. Lee Grossman  
Chief Executive Officer  
Orthopaedic Research and Education Foundation
- 7:14 a.m. – 7:52 a.m.      **Session I – Resident Research Presentations & Discussion**  
**Moderator: BT Kent, MD**
- 7:52 a.m. – 8:02 a.m.      **Break**
- 8:02 a.m. – 8:40 a.m.      **Session II – Resident Research Presentations & Discussion**  
**Moderator: CDR Brad Deafenbaugh, MD**
- 8:40 a.m. – 8:50 a.m.      **Break**
- 8:50 a.m. – 9:28 a.m.      **Session III – Resident Research Presentation & Discussion**  
**Moderator: Alexandra Schwartz, MD**
- 9:28 a.m. – 9:38 a.m.      **Break**
- 9:38 a.m. – 10:16 a.m.      **Session IV – Resident Research Presentations and Discussion**  
**Moderator: CDR James Bailey, MD**
- 10:16 a.m. – 10:26 a.m.      **Break**
- 10:26 a.m. – 11:21 a.m.      **Keynote Address**  
**“Building a Research Team as an Early Career Investigator: Lessons Learned”**  
Prism Schneider, MD, PhD, FRCSC  
Associate Professor of Orthopaedic Surgery and  
Community Health Sciences  
University of Calgary
- 11:21 a.m. – 11:31 a.m.      **Awards Presentation and Closing Remarks**

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**KEYNOTE SPEAKER**

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**Prism Schneider, MD, PhD, FRCSC**

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**Associate Professor of Orthopaedic Surgery and  
Community Health Sciences  
University of Calgary**

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Dr. Prism Schneider is an Orthopaedic Trauma Surgeon and Associate Professor of Orthopaedic Surgery and Community Health Sciences at the University of Calgary. She also holds the positions of Orthopaedic Trauma Research Lead and Resident and Fellow Research Director for Orthopaedic Surgery. Dr. Schneider spends 50% of her time as a traumatologist at the Foothills Medical Centre Level 1 trauma centre and the other 50% of her time is devoted to her research endeavours. She obtained her MD from the University of Calgary and has completed post-graduate training including a PhD in Biomechanics and two Orthopaedic Trauma Fellowships, one at the University of Texas and one at McGill University.

Dr. Schneider's research interests involve understanding the cellular and systemic inflammatory response to injury, including trauma-induced coagulopathy and post-traumatic joint contractures, clinical trials for optimizing surgical outcomes, and using advanced imaging to study the micro-architecture of fracture healing. She also has a particular interest in identifying and assisting patients who are injured due to violence in the home. Dr. Schneider has completed several multi-centre randomized controlled trials in collaboration with the Canadian Orthopaedic Trauma Society, in order to define surgical indications following injury and to determine the optimal surgical techniques to help improve patient outcomes. Dr. Schneider's trauma-induced coagulopathy research program is funded by the Orthopaedic Research and Education Foundation, the Canadian Institutes for Health Research, and the Canadian Foundation for Innovation. She is an emerging leader in injury-related coagulopathy and her program aims to use a precision medicine approach to prevention of venous thromboembolism.

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## Judges and Moderators

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### Judges

Michael Thompson, MD  
Scripps Health

CDR James Bailey, MD  
Naval Medical Center San Diego

Alexandra Schwartz, MD  
University of California, San Diego

CDR Brad Deafenbaugh, MD  
Naval Medical Center San Diego

### Moderators

CDR James Bailey, MD  
Naval Medical Center San Diego

CDR Brad Deafenbaugh, MD  
Naval Medical Center San Diego

BT Kent, MD  
University of California, San Diego

Alexandra Schwartz, MD  
University of California, San Diego

**OREF Southwest Region Resident Research Symposium**  
**DETAILED AGENDA**  
Wednesday, October 6, 2021

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7:00 a.m. – 7:05 a.m.	<b>Welcome and Introductions</b> Susan Bukata, MD, FAOA, FAAOS Professor and Chair Department of Orthopaedic Surgery University of California, San Diego
7:05 a.m. – 7:10 a.m.	<b>Opening Remarks</b> D.C. Covey, MD, MSc, FACS CME Course Director Department of Orthopaedic Surgery University of California, San Diego
7:10 a.m. – 7:14 a.m.	<b>OREF Welcome</b> Mr. Lee Grossman Chief Executive Officer Orthopaedic Research and Education Foundation
	<b>Session I – Resident Research Presentations &amp; Discussion</b> <b>Moderator: BT Kent, MD</b>
7:14 a.m. – 7:18 a.m.	<i>The Deep Region of the Supraspinatus is Architecturally Distinct</i> Isabella Wu, MD, University of California, San Diego
7:18 a.m. – 7:22 a.m.	<i>Muscle Fibroadipogenic Progenitors Support Satellite Cells Through Mitochondrial Donation that is Enhanced with Beta-Agonist Treatment</i> Michael Davies, MD, University of California, San Francisco
7:22 a.m. – 7:26 a.m.	<i>Active Rheumatoid Arthritis in a Mouse Model is Not an Independent Risk Factor for Periprosthetic Joint Infection</i> Rishi Trikha, MD, University of California, Los Angeles
7:26 a.m. – 7:30 a.m.	<i>A Simple and Versatile Test for Elbow Posterolateral Rotatory Instability</i> Kathryn D. Dwight, MD, University of California, San Diego
7:30 a.m. – 7:34 a.m.	<i>A Simple Hip Spine Classification for Total Hip Replacement—Validation and Large Multi-Center Series</i> Abhinav Sharma, MD, University of California, Irvine
7:34 a.m. -7:38 a.m.	<i>Minimizing Opioid Prescriptions via Multimodal Pain Management Following Orthopaedic Sports Procedures</i> J. Preston Van Buren, MD, Naval Medical Center, San Diego
7:38 a.m. – 7:42 a.m.	<i>Reducing Overuse of Prophylactic Antibiotics in Carpal Tunnel Release</i> Kevin M. McKay, MD, Loma Linda University
7:42 a.m. – 7:52 a.m.	<b>Question and Answer</b>
7:52 a.m. – 8:02 a.m.	<b>Break</b>

**OREF Southwest Region Resident Research Symposium**  
**DETAILED AGENDA (Continued)**  
Wednesday, October 6, 2021

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**Session II – Resident Research Presentations & Discussion**

**Moderator: CDR Brad Deafenbaugh, MD**

- 8:02 a.m. – 8:06 a.m.      *Arthroscopic Shoulder Stabilization in High School Football Players Recurrent Instability with Return to Contact Sport*  
Jessica Reilly Stambaugh, MD, Naval Medical Center, San Diego
- 8:06 a.m. – 8:10 a.m.      *Knowledge and Opinion on Cannabinoids Among Orthopaedic Traumatologists*  
Garwin Chin, MD, University of California, Irvine **(Not presenting)**
- 8:10 a.m. – 8:14 a.m.      *Pelvic Stability During Total Hip Arthroplasty Motions: Comparing Different Hip Positioners*  
Ashish Mittal, MD, St. Mary's Medical Center, San Francisco
- 8:14 a.m. – 8:18 a.m.      *Industry Payments to Foot and Ankle Surgeons and Their Effect on Total Ankle Arthroplasty Outcomes*  
John Scott Donoughe, MD, Naval Medical Center, San Diego
- 8:18 a.m. – 8:22 a.m.      *Management of Sublime Tubercle Injuries in Adolescents: Hints of a Classification Scheme*  
Sarah Fogleman, MD, Naval Medical Center, San Diego
- 8:22 a.m. – 8:26 a.m.      *Arthroscopic Hip Surgery in the Military: Does Medical Board Status Affect Patient Reported Outcomes?*  
Thomas Kelsey, MD, Naval Medical Center, San Diego
- 8:26 a.m. – 8:30 a.m.      *Predicting Fragility Fracture Using Opportunistic Computed Tomography Scans*  
Kevin Taniguchi, MD, Naval Medical Center, San Diego
- 8:30 a.m. – 8:40 a.m.      **Question and Answer**
- 8:40 a.m. – 8:50 a.m.      **Break**

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**OREF Southwest Region Resident Research Symposium**  
**DETAILED AGENDA (Continued)**  
Wednesday, October 6, 2021

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**Session III – Resident Research Presentation & Discussion**

**Moderator: Alexandra Schwartz, MD**

- 8:50 a.m. – 8:54 a.m.     *Inter-Observer and Intra-Observer Reliability of Classification Systems for Radiographic Complications After Radial Head Arthroplasty*  
Ryan Halvorson, MD, University of California, San Francisco
- 8:54 a.m. – 8:58 a.m.     *Proximal Scaphoid Nonunions: Treatment with Ipsilateral Hamate Transfer*  
Shian Liu Peterson, MD, Naval Medical Center, San Diego
- 8:58 a.m. – 9:02 a.m.     *Digital Footprint of Orthopedic Residencies*  
Nicholas Perry, MD, Naval Medical Center, San Diego
- 9:02 a.m. - 9:06 a.m.     *Characteristics of Highly Active Adaptive Athletes During the COVID-19 Pandemic*  
Tyler Paras, MD, University of California, San Diego
- 9:06 a.m. – 9:10 a.m.     *Pediatric Knee Arthrocentesis: Does Reactive Synovitis Exist in the Knee?*  
Todd Heig, MD, Naval Medical Center, San Diego
- 9:10 a.m. – 9:14 a.m.     *Conversion to Knee Arthrodesis from Prior Total Knee Arthroplasty in a Patient with Arthrogyrosis*  
Peter Baglien, MD, Naval Medical Center, San Diego
- 9:14 a.m. – 9:18 a.m.     *Classifying Ischial Tuberosity Avulsion Fractures by Ossification Stage and Tendon Attachment*  
Brendon Mitchell, MD, University of California, San Diego
- 9:18 a.m. – 9:28 a.m.     **Question and Answer**
- 9:28 a.m. – 9:38 a.m.     **Break**

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**OREF Southwest Region Resident Research Symposium**  
**DETAILED AGENDA (Continued)**  
Wednesday, October 6, 2021

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**Session IV – Resident Research Presentations & Discussion**

**Moderator: CDR James Bailey, MD**

- 9:38 a.m. – 9:42 a.m.     *Predictors of Optimal Outcomes of Selective Thoracic Fusion at 5 Years*  
Amelia M. Lindgren, MD, University of California, San Diego
- 9:42 a.m. – 9:46 a.m.     *Comparison of CT Angiography and Physical Exam in the Evaluation of Vascular Injury in Extremity Trauma*  
Hunter Warwick, MD, University of California, San Francisco
- 9:46 a.m. – 9:50 a.m.     *Characterization of Constriction Band Syndrome Limb Involvement*  
Leah Demetri, MD, University of California, San Francisco
- 9:50 a.m. – 9:54 a.m.     *Anatomic Radial Head Arthroplasty: The Importance of Implant Angle*  
Matthew Cherches, MD, University of California, San Francisco
- 9:54 a.m. – 9:58 a.m.     *Early Complications of the Femoral Neck System for the Treatment of Femoral Neck Fractures*  
Matthew Siow, MD, University of California, San Diego
- 9:58 a.m. – 10:02 a.m.     *Surgical Planning Using Standard Preoperative Radiographs is Predictive of Successful Pedicle Screw Placement*  
Ryan O’Leary, MD, University of California, San Diego
- 10:02 a.m. – 10:06 a.m.     *Early Gender Differences in Pain and Functional Recovery Following Spinal Arthrodesis*  
Matthew Gulbrandsen, MD, Loma Linda University
- 10:06 a.m. – 10:16 a.m.     **Question and Answers**
- 10:16 a.m. – 10:26 a.m.     **Break**
- 10:26 a.m. – 11:21 p.m.     **Keynote Address**  
**“Building a Research Team as an Early Career Investigator: Lessons Learned”**  
Prism Schneider, MD, PhD, FRCSC  
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## The Deep Region of the Supraspinatus is Architecturally Distinct

Isabella Wu, MD

University of California, San Diego

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**Purpose:** To determine the muscle architecture of the deep supraspinatus (SSP)

**Significance:** The supraspinatus is most frequently involved in rotator cuff tears, a common orthopedic condition. Yet the muscle architecture has only been described for the anterior and posterior regions.

**Methodology:** Architecture measurements were collected from 25 cadaver SSPs. The deep, [superficial] anterior, and [superficial] posterior were compared using repeated measures ANOVAs.

**Results:** In 13 SSPs without tears, the deep region showed a lower mean pennation angle of  $3.3 \pm 1.0^\circ$  than the posterior region ( $11.0 \pm 3.9^\circ$ ,  $p < 0.0001$ ), which had a higher angle than the anterior region ( $7.6 \pm 2.6^\circ$ ,  $p = 0.0005$ ). Normalized fiber lengths were 21.1% ( $p = 0.0052$ ) and 34.5% ( $p < 0.0001$ ) shorter than posterior and anterior, respectively. Deep region sarcomeres measured  $3.4 \pm 0.2 \mu\text{m}$  compared to  $3.1 \pm 0.2 \mu\text{m}$  (posterior,  $p = 0.0012$ ) and  $3.2 \pm 0.2 \mu\text{m}$  (anterior,  $p = 0.0390$ ). Sarcomere number also decreased in the deep region by 21.2% ( $p = 0.0056$ ) and 34.2% ( $p < 0.0001$ ) compared to posterior and anterior regions, respectively. After including partial ( $n = 3$ ) and full ( $n = 9$ ) tears, all architecture measurements remained different in the deep region versus anterior or posterior.

**Conclusion:** The deep supraspinatus has lower pennation angles, shorter fiber lengths, and fewer but longer sarcomeres. These structural differences suggest a functionally unique 'submuscle' within the supraspinatus.

# Muscle Fibroadipogenic Progenitors Support Satellite Cells through Mitochondrial Donation that is Enhanced with Beta-Agonist Treatment

Michael Davies, MD

University of California, San Francisco

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**Purpose:** To characterize the phenomenon of mitochondrial transfer between muscle fibroadipogenic progenitors (FAPs) and satellite cells (SCs). We hypothesized that FAPs can donate mitochondria to SCs in a process that is enhanced by beta-agonist treatment.

**Significance:** While mitochondrial transfer between cells has been established as a regenerative process in several tissue types, it has never been characterized in skeletal muscle.

**Methods:** FAPs were isolated from human muscle and treated with adipogenic or beta-agonist medium before undergoing single-cell RNA sequencing (scRNAseq). FAPs from both conditions were labeled with MitoTracker and co-cultured with SCs for 24 hours and 1 week. Labeled FAPs were transplanted into injured muscle of NSG mice and fluorescently imaged at 24-hours after transplantation. T-tests with  $p < 0.05$  were used for statistical analysis.

**Results:** scRNAseq of FAPs demonstrated increased mitochondrial gene transcription with beta-agonism. Labeled FAP mitochondria were detected within recipient SCs at 24 hours after co-incubation, with enhanced transfer in the beta-agonist treatment group. *In vivo* analysis of transplanted FAPs demonstrated uptake of labeled mitochondria within injured muscle at 24 hours.

**Conclusion:** Mitochondrial transfer between human FAPs and SCs is a naturally occurring process that can be potentiated with beta-agonist therapy, lending it novel therapeutic value.

## Active Rheumatoid Arthritis in a Mouse Model is not an Independent Risk Factor for Periprosthetic Joint Infection

Rishi Trikha, MD

University of California, Los Angeles

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**Purpose:** - Elucidate how Rheumatoid Arthritis (RA) affects infectious burden in a mouse model of periprosthetic joint infection (PJI).

**Significance:** - Literature is inconsistent with regard to whether RA is an inherent risk factor for PJI following arthroplasty. This study combined well-validated mice models of RA and PJI in a novel fashion to better understand this relationship.

**Methods:** - 36 Collagen-Induced Arthritis (CIA) mice were analyzed against control mice. *Ex vivo* quantification of respiratory burst, *S. aureus* biofilm, and colony forming units (CFU) was performed. *In vivo* longitudinal monitoring of bacterial burden via bioluminescent imaging and CFU quantification was subsequently analyzed between CIA mice, CIA mice treated with etanercept, CIA mice treated with methotrexate and infected control mice.

**Results:** - *Ex vivo*, there was no significant difference in respiratory burst function ( $p=0.89$ ), *S. aureus* CFU counts ( $p=0.91$ ) and biofilm quantification ( $p=0.96$ ) between CIA and infected control mice. *In vivo*, no significant difference in bacterial bioluminescence between all groups was found at any postoperative time points.

**Conclusion:** - These results suggest that moderately severe RA, alone, may not pose significant postoperative infectious risk, thus affecting perioperative management. It is possible that the dysregulation of the immune system of RA is balanced by the general upregulation.

## A Simple and Versatile Test for Elbow Posterolateral Rotary Instability

Kathryn D. Dwight, MD  
University of California, San Diego

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**Introduction:** Posterolateral rotatory instability (PLRI) results from lateral ulnar collateral ligament deficiency. The lateral pivot shift test has been used to diagnose PLRI but can be difficult to perform and is poorly tolerated. We present a new maneuver, the Posterior Radio-capitellar Subluxation Test (PRST), that we believe is easier to perform. Our purpose was to compare the efficacy and reproducibility of the PRST to the lateral pivot shift test.

**Methods:** We obtained 10 cadaveric upper extremity specimens, performed a Kocher approach on each, released the LCL origin in five, then closed. Specimens were randomized, and three attending orthopedic surgeons and one resident blindly performed the PRST then the lateral pivot shift test after re-randomization and assessed presence or absence of PLRI. This process was repeated. The data for each test was analyzed for sensitivity, specificity, and accuracy.

**Results:** For the blinded testing when comparing PRST to the pivot shift test, overall accuracy was 77.5%, compared to 67.5% ( $p = 0.03$ ), sensitivity was 75.0%, compared to 50.0% ( $p = 0.003$ ) and specificity was 80.0%, compared to 85.0% ( $p = 0.55$ ).

**Discussion:** The PRST appears to be as accurate as the lateral pivot shift test, with comparable intra- and inter-observer reliability.

## A Simple Hip-Spine Classification for Total Hip Replacement- Validation and Large Multi-Center Series

Abhinav Sharma, MD  
University of California, Irvine

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**Purpose:** The purpose of our study was to determine if the Hip-Spine Classification reduces dislocation rates in high-risk total hip arthroplasty (THA) patients with spinopelvic pathology.

**Significance:** Patients with spinopelvic pathology have an increased risk of dislocation and revision following THA compared to healthy controls.

**Methods:** 3,777 consecutive THA patients were prospectively evaluated from 2014 - 2019. Patient-specific cup positioning was based on The Hip-Spine Classification: 1 – normal spinal alignment, 2 – flatback deformity (pelvic incidence minus lumbar lordosis >10-degrees); A – normal spinal mobility, B – stiff spine (<10-degree change in sacral slope from standing to seated). Survivorship free of dislocation and intraclass correlation coefficient (ICC) of spinopelvic measurements were recorded.

**Results:** 2,081 (987 1A, 232 1B, 715 2A, and 147 2B) patients met inclusion criteria. 70 patients had lumbar spinal fusions, with 51 (73%) having 1-2 levels fusions and 19 (27%) having 3+ level fusions. Dual mobility was used in 166 patients (7.98%), including 100% of 2B and 3+ level fusion patients. Survivorship free of dislocation to 5 years was 99.2%, with a 0.8% dislocation rate. The ICC was 0.83 (95% CI, 0.89-0.91).

**Conclusion:** The Hip-Spine Classification may help reduce the risk of postoperative dislocation in high-risk hip-spine THA patients.

## Minimizing Opioid Prescriptions via Multimodal Pain Management Following Orthopaedic Sports Procedures

J. Preston Van Buren, MD  
Naval Medical Center, San Diego

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**Purpose and significance:** Orthopaedic sports surgery has relied heavily on opioids for postoperative pain management ranking as the third highest opioid prescribers in the United States. Our current study sought to determine the number of opioids actually used by our surgical patients in order to determine the amount that is needed to be prescribed perioperatively.

**Methods:** All orthopedic sports procedures at a Military Treatment Facility were categorized into one of three levels, each representing an increase in perceived analgesic demand. A multimodal pain control program was implemented for each level and groups of patients for each level were compared before and after implementation. Perioperative narcotic prescriptions, pill counts and when patients stopped taking narcotics were compared between the groups at each level.

**Results:** The number of opioids prescribed postoperatively decreased by 37.6% post-implementation of the multimodal pain protocol. The average number of narcotic pills consumed by those in the post-implementation cohort was 35.2% of the narcotic tablets prescribed.

**Conclusion:** A multimodal pain management protocol for perioperative analgesia is an effective strategy in decreasing narcotic use after surgery. Although we are prescribing fewer narcotics with the multimodal pain management protocol, patients are continuing to take only 64.7% of the pills prescribed.

## Reducing Overuse of Prophylactic Antibiotics in Carpal Tunnel Release

Kevin M. McKay, MD  
Loma Linda University

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**Purpose:** An educational intervention that reinforces best practice in carpal tunnel release (CTR) will decrease unnecessary antibiotic prophylaxis. Patient related factors will correlate with a surgeon's decision to administer antibiotics.

**Significance:** Administration of prophylactic antibiotics in clean hand surgery provides little to no benefit in preventing surgical site infection. This practice continues however, despite current surgical guidelines recommending against it.

**Methods:** A year-long evidence-based program was implemented to eliminate antibiotic prophylaxis in CTR. Rates of antibiotic use in all CTR cases at participating medical centers the year of the study were compared to the year prior to the study. Patients were retrospectively grouped into those who received and did not receive antibiotics, and multivariate regression was used to uncover risk factors for use.

**Results: Overall** rate of antibiotic use decreased from 51% in 2017-2018, to 13.5% the final month of the intervention. Logistic regression revealed a higher rate of antibiotic use among patients who had Diabetes Mellitus or who were operated upon by an older surgeon. Antibiotic use also differed significantly between participating medical centers.

**Conclusion:** Antibiotic prophylaxis decreased by 37.5% the year following an evidence-based surgeon led intervention. Risk factors for unnecessary use among patients and surgeons were elucidated.



## Arthroscopic Shoulder Stabilization in High School Football Players Recurrent Instability with Return to Contact Sport

Jessica Reilly Stambaugh, MD  
Naval Medical Center, San Diego

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**Purpose:** Destabilizing shoulder injuries are common in high-school football. The purpose of the study was to determine the rate of recurrent instability after arthroscopic labral stabilization upon return to competitive play and assess for correlation with years of eligibility remaining (YER).

**Significance:** To facilitate expectation management and operative counseling in young contact athletes.

**Methods:** Consecutive high-school football players who underwent arthroscopic stabilization for an anterior traumatic in-season shoulder instability episode(s) between 2012 and 2017 were surveyed to discuss recurrent instability episodes and return to sport. Chi-square statistical analysis was performed.

**Results:** 64 subjects aged 14-17 years met inclusion criteria, with 45 available for survey completion. Mean follow up was 4.1 years. Surgery was career ending in 60% of cases due to reported fear of recurrent football-related injury. The rate of recurrent instability in the cohort was 15.6% with a significant difference versus players who transitioned to non-contact sports ( $p=0.03$ ). A positive correlation existed between YER and recurrent instability events with each year conferring additional 10% risk of reinjury.

**Conclusion:** High-school football players who return to play after arthroscopic shoulder stabilization surgery experience a higher rate of recurrent instability events with increasing risk correlative with remaining years of eligibility.

## Knowledge and Opinion on Cannabinoids Among Orthopaedic Traumatologists

Garwin Chin, MD

University of California, Irvine

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**Purpose:** The purpose of this study is to elucidate sentiments and knowledge base of the orthopaedic trauma community with regard to cannabinoid containing compounds.

**Significance:** Cannabinoids are an increasingly popular therapy among orthopaedic patients for musculoskeletal conditions. A paucity of evidence to support their use in orthopaedics exists, likely due to the incongruence of federal and state legalization and the stigma surrounding cannabis.

**Methods:** A 21-question online survey was distributed to the members of the Orthopaedic Trauma Association with a response window of three months.

**Results:** We evaluated 251 responses. The majority (88%) of respondents did not believe that they were knowledgeable about the mechanism of action of cannabis/CBD, but did feel that there was a role for cannabis or cannabidiol products for managing post-operative pain (73%). A majority of respondents did not believe they would be stigmatized if they suggested CBD (83%) or cannabis (67%) to patients. Despite this, fewer respondents have suggested CBD (38%) or cannabis (29%) to their patients.

**Conclusions:** Sentiment towards cannabinoids among orthopaedic traumatologists is remarkably favorable, however in-depth understanding is admittedly poor and routine use is uncommon. More clinical research for cannabinoids is needed to help orthopaedic traumatologists provide guidance for patients seeking advice for this recently popular therapeutic.

## **Pelvic Stability During Total Hip Arthroplasty Motions: Comparing Different Hip Positioners**

**Ashish Mittal, MD**

St. Mary's Medical Center, San Francisco

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**Purpose:** The purpose of this study was to quantify the pelvic movement that occurred in four commercially available hip positioners with motion of the hip.

**Significance:** Total hip arthroplasty (THA) requires forceful maneuvers that can cause the pelvis to shift from its original position. As rotation of the pelvis may lead to implant malpositioning, quantification of relative motion is important.

**Methods:** An infrared marker was attached to the ilium of a cadaver secured in the lateral decubitus position. Four commercially available hip positioners were used. Multiplanar rotation and translation was captured using a camera system while the hip was moved through six motions (Flexion, Extension, Internal Rotation, External Rotation, Push, and Pull).

**Results:** The ExactFit hip positioner resulted in the least amount of motion of the pelvis, with a maximum rotation of the pelvis of up to 3.2°. The Stulberg and Pegboard positioners had rotations up to 7.8° and 17.1°, respectively. The Beanbag allowed rotations up to 41.5°.

**Conclusion:** Rotation of the pelvis during simulated motions of the pelvis varied widely based on hip positioner used. The ExactFit and Stulberg hip positioners provided increased stability and thus may reduce the risk of component malpositioning and related complications.

## Industry Payments to Foot and Ankle Surgeons and Their Effect on Total Ankle Arthroplasty Outcomes

John Scott Donoughe, MD  
Naval Medical Center, San Diego

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**Purpose:** We compared physician-reported conflict-of-interest (COI) disclosures in *Foot and Ankle International (FAI)* with CMS database information. We hypothesized that reported outcomes of total ankle arthroplasty would not be affected by the presence of industry payments.

**Significance:** The Centers for Medicare & Medicaid Services (CMS) Open Payments public (OPP) database provides a means for increased transparency of physicians' financial relationships with industry. Total ankle arthroplasty is a procedure with long term clinical implications and variable outcomes published in the existing literature.

**Methodology:** Articles published in FAI reporting clinical outcomes of total ankle arthroplasty from 2015 and 2019 were reviewed. Payment information in the CMS database was cross-referenced with disclosure statements and ICMJE forms associated with the manuscript. Statistical analysis was performed to determine if industry payments were appropriately disclosed or influenced outcomes

**Results:** We reviewed 173 articles pertaining to ankle arthroplasty, with 27 meeting inclusion criteria. Of 120 total authors with 98 unique authors, 114 (95%) disclosed appropriately in disclosure statements. Twenty-two studies (82%) had appropriate declarations for the entire manuscript. For the 27 senior authors, only 2 discrepancies between manuscript disclosure and the Open Payments public database were noted, showing 13 total disclosures in the Open Payments public database vs 11 disclosed in the manuscript. There was no relationship between industry payments and the outcome of the manuscript ( $P = .725$ ).

**Conclusion:** The majority of author disclosure statements accurately reflected the Open Payments public data. Additionally, payments were not significantly associated with positive outcomes reported for the specific implant. Overall, authors publishing on ankle arthroplasty in FAI are disclosing appropriately.

## Management of Sublime Tubercle Injuries in Adolescents: Hints of a Classification Scheme

Sarah Fogleman, MD  
Naval Medical Center, San Diego

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**Purpose:** The objective of this study was to characterize injury pattern, treatment, and outcomes for sublime tubercle avulsion (STA) fractures in adolescents.

**Significance:** While the management of ulnar collateral ligament (UCL) injuries has been extensively reported, little has been published on the treatment of the less common bony avulsion fracture of the sublime tubercle.

**Methods:** A multicenter retrospective review was conducted identifying STA fractures from surgeon and radiology records. Patients  $\leq 19$  years old with an STA fracture on at least one imaging modality were included. Data collected included demographics, clinical presentation, and objective and patient reported outcomes.

**Results:** 40 patients were identified with STA fractures. About two-thirds of cases were simple, or isolated, STA fractures. One-third were complex injuries, with at least one associated fracture. Simple injuries fared better with 87% experiencing good or excellent outcomes based on Roberts Criteria, compared to 54% of those with complex injuries. Only 25% of overhead athletes initially managed non-operatively ultimately underwent UCL reconstruction.

**Conclusion:** Outcomes differ significantly based on the presence or absence of associated injury, with complex injuries at risk for poorer outcomes. Unlike purely ligamentous injuries, bony avulsions may be treated nonoperatively with good results and return to throwing in adolescents.

## **Arthroscopic Hip Surgery in the Military: Does Medical Board Status Affect Patient Reported Outcomes?**

**Thomas Kelsey, MD**  
Naval Medical Center, San Diego

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**Purpose/Significance:** Hip arthroscopy can be successful in active-duty patients with FAI who have failed non-operative treatment. Return to duty has been suggested to be a poor indicator of clinical outcomes in active-duty populations, but prior studies have not reliably included joint-specific patient reported outcome (PRO) measures. Our hypothesis is that patient reported outcomes would be similar between patients who returned to full duty vs. those referred to the medical board system.

**Methods:** Active-duty patients undergoing hip arthroscopy performed at a single institution from July 2018 to January 2020 were included. PRO data were collected preoperatively, at six weeks, six months, and 12 months after surgery. The PEB database was queried to determine return to duty status vs medical board. Patient reported outcomes were then compared between the RTFD vs. MEB groups.

**Results:** 93 patients were included. RTFD included 53 patients and MEB included 40 patients (43%). the HOOS score was superior in the RTFD group (60 vs. 40 in the MEB group) at 6-month follow-up. PROMIS PI scores were lower in the RTFD group at 6-month follow up indicating improved pain.

**Conclusion:** Our hypothesis that MEB status was independent of joint-specific PRO was not supported by the data. The reasons for the lower PRO in the MEB group are likely multifactorial.

## Predicting Fragility Fracture Using Opportunistic Computed Tomography Scans

Kevin Taniguchi, MD  
Naval Medical Center, Dan Diego

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**Purpose:** Assess the risk of future fragility fractures based on assessment of vertebral density measured on CT scan obtained for other indications.

**Significance:** Osteoporotic fractures are an increasingly prevalent source of morbidity among the elderly population. There is a significant gap between those indicated for osteoporosis screening and those who undergo appropriate screening. Opportunistic detection of low bone mineral density on computed tomography (CT) scans has been used in the past to identify patients with osteoporosis.

**Methods:** Retrospective review of patients with fragility fractures age and gender matched to controls without history of fragility fracture who received a CT scan of the abdomen. The Hounsfield units at T12 and L1 were measured on 91 patients with fragility fractures and 91 controls.

**Results:** The mean Hounsfield units at T12 was 103.5 in the fracture cohort compared to 139.6 in the controls ( $p < 0.001$ ). At L1 the mean Hounsfield units was 96.84 compared to 139.2 for control patients ( $p < 0.001$ ).

**Conclusion:** This study demonstrated that lower bone density values, measured via Hounsfield units on opportunistic CT scans are associated with increased rates of future fragility fractures.

## Inter-Observer and Intra-Observer Reliability of Classification Systems for Radiographic Complications After Radial Head Arthroplasty

Ryan Halvorson, MD  
University of California, San Francisco

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**Purpose:** Although several classifications are used to assess radiographs following radial head arthroplasty (RHA), little is known about the reliability of these classification systems. The purpose of this study was to determine the inter-observer and intra-observer reliability of these classifications.

**Significance:** Complications after RHA occur in up to 23% of patients.

**Methods:** Six orthopaedic surgeons reviewed elbow radiographs of 20 patients who underwent RHA and classified them according to the Popovic, Chanlalit, Brooker, and Broberg-Morrey classifications for radiolucency, SS, HO, and RHA, respectively. Four weeks after initial review, radiographic reviews were again completed. Reliability was measured using the Fleiss Kappa and the intraclass correlation coefficient (ICC).

**Results:** Inter-observer reliability was slight for SS (Chanlalit) and the categorical interpretation of radiolucency (Popovic), fair for RCA (Broberg-Morrey), moderate for HO (Brooker), and substantial for the ordinal interpretation of radiolucency (Popovic). Mean intra-observer reliability was moderate for the categorical interpretation of radiolucency (Popovic), HO (Brooker), RCA (Broberg-Morrey), and SS (Chanlalit), and almost perfect for the ordinal interpretation of radiolucency (Popovic).

**Conclusions:** The Brooker classification and number of Popovic zones are reliable for communication between physicians, but caution should be taken with the Chanlalit, Broberg-Morrey, and categorical interpretation of the Popovic classifications.



## **Proximal Scaphoid Nonunions: Treatment with Ipsilateral Hamate Transfer**

**Shian Liu Peterson, MD**  
Naval Medical Center, San Diego

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**Purpose:** We hypothesized that graft harvest from the proximal aspect of the hamate, provides a viable treatment option for proximal pole scaphoid nonunions in an active, military population.

**Significance:** The retrograde blood flow of the scaphoid carpal bone renders it particularly vulnerable to at its proximal aspect, with little consensus on treatment options

**Methodology:** Retrospective review of a single surgeon case series who underwent a scaphoid nonunion open reduction internal fixation with ipsilateral hamate transfer from 2019-2020. Baseline demographics were obtained. Pre-operative/post-operative radiographs and CT were obtained. Descriptive statistics were utilized for analysis

**Results:** 5 patients with proximal scaphoid nonunions underwent an ipsilateral hamate autograft. All patients were males in the United States Marine Corps with an average age of  $22.8 \pm 1.4$  years. The average time from injury to surgery was 423.4 days (range 80-852 days). Pre-operative lunate height was  $8.4 \pm 1.4$ mm. At the time of the most recent follow-up, 5 of 5 patients were healed and 2 of 5 patients returned to full duty

**Conclusion:** This study demonstrates that proximal scaphoid pole nonunions can successfully heal with ipsilateral proximal hamate autograft. This technique has the added benefit of reconstructing the scapholunate ligament utilizing the volar capitolunate ligament. Furthermore, since the harvest site is within the carpus, this technique avoids the risks associated with rib autograft and medial femoral condyle harvests.

## Digital Footprint of Orthopedic Residencies

Nicholas Perry, MD  
Naval Medical Center, San Diego

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**Purpose:** Evaluate the publicly available digital footprint of all current orthopedic residencies.

**Significance:** Just as orthopedic residency applicants strive to be competitive, orthopedic programs must remain mindful of their need to be competitive to attract qualified applicants. The internet is a ubiquitous source of information and likely a source for applying medical students as they evaluate prospective programs.

**Methodology:** Orthopaedic surgery residency programs were identified through ERSA. Each program was evaluated in a binary fashion for 33 factors in the domains of academic structure (didactics, rotations, electives, call, etc), benefits (salary, health, textbooks, lead, etc), personnel (current residents, current staff, alumni, etc), and research (previous projects, current projects, research requirements, etc). Additionally, we searched for a presence on social media and specific diversity statements.

**Results:** 205 orthopedic residencies were identified. 98% had public information. Information included the following domains: academic structure (39%-89%), benefits (72%-20%), personnel (90%-84%), and research (69%-32%). 62% of programs had social media. 31% of programs had diversity statements.

**Conclusion:** Most orthopedic residencies had publicly accessible digital footprint. Less than a third had specific diversity statements, representing an area for improvement. Improved diversity and inclusion recruitment align with priority statements from several national orthopaedic institutions.

## Characteristics of Highly Active Adaptive Athletes During the COVID-19 Pandemic

Tyler Paras, MD

University of California, San Diego

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**Purpose:** The purpose of this study was to assess the factors associated with physical activity level during the COVID-19 pandemic and its association with quality of life in adaptive athletes. We hypothesized higher athlete identity and quality of life in highly active athletes.

**Significance:** No previous study has assessed the activity level of adaptive athletes during the COVID-19 pandemic.

**Methods:** 104 athletes (age 43.1±13.9 years, 73 Male/31 Female) responded to an electronic survey sent to adaptive sports programs in October 2020. Athletes were asked demographic information, activity level from 3/1/2020-10/7/2020, Athletic Identity Measurement Scale (AIMS), and Life Satisfaction Questionnaire 9 (LISAT-9). Athletes were grouped based on training greater than (high-active; HA) or less than (low-active; LA) 5 hours per week, which is the U.S. Department of Health threshold of “highly active” individuals. Unpaired t-tests were used for continuous data and Fisher’s exact test for categorical data.

**Results:** HA athletes played more sports ( $p=.022$ ), were more likely to have started a new sport since the pandemic ( $p=.023$ ), had higher AIMS scores ( $p=.019$ ), and had higher LISAT-9 scores ( $p=.002$ ).

**Conclusion:** HA athletes reported higher life satisfaction and athletic identity. Athletes struggling to train should be encouraged to explore new training modalities that fit their life circumstances.

## **Pediatric Knee Arthrocentesis: Does Reactive Synovitis Exist in the Knee?**

**Todd Heig, MD**  
Naval Medical Center, San Diego

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**Purpose:** Reactive arthritis, or transient synovitis, does not occur within the knee. To identify any clinical criteria that take the place of “Kocher Criteria for the knee to help identify osteoarticular infection.

**Significance:** In 1999 Kocher reviewed 282 patients and identified four lab values that allowed them to reliably differentiate between septic arthritis of the hip and transient synovitis. Obey retrospectively reviewed 104 pediatric patient charts and found that using the Kocher Criteria cut-off of 3 or greater would result in 52% of septic knee cases would have been missed. Additionally, to our knowledge transient synovitis has not been described in the knee.

**Methodology:** All knee aspirations with CPT code 20610 from November 2011 to November 2017 at Rady Children’s Hospital were classified into categories and underlying cause identified. The charts were reviewed, and clinical parameters recorded.

**Results:** 57 aspirations for diagnostic purposes, 37 osteoarticular infections, 27 culture positive, 20 inflammatory, 47 underwent operative management, 33 were infectious and 14 inflammatory. 5 were identified to be reactive arthritis. No clinical parameters or combination of parameters yielded a sensitivity or specificity sufficient for diagnosis.

**Conclusion:** Aspiration gold standard, inflammatory arthropathies are common, and transient synovitis is rare but exists.

## Conversion to Knee Arthrodesis from Prior Total Knee Arthroplasty in a Patient with Arthrogyrosis

Peter Baglien MD  
Naval Medical Center, San Diego

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**Purpose:** The purpose of this unique case is to demonstrate that knee arthrodesis can be an effective treatment in patients with arthrogyrosis who have failed prior surgical management.

**Significance:** There are many variants of the arthrogyrosis multiplex congenita (AMC) disorder which range from isolated limb involvement to complete amyoplasia with severe contractures in all extremities. These patients can require extensive lower extremity surgery, as did our patient, and management of refractory and progressive disease is challenging.

**Methods:** A 37-year-old patient with AMC who had previously undergone a total knee arthroplasty (TKA) and presented with symptomatic loose implants. The patient underwent a knee arthrodesis with a circular external frame for fixation. Post-operative course was complicated by pin site infection, which was successfully treated with removal of the pin and oral antibiotics.

**Results:** The patient has returned to activities of daily living including walking and driving. Patient reported outcomes demonstrate improvement in pain and function.

**Conclusion:** This case suggests that knee arthrodesis is a viable option for patients with AMC and severe knee contractures who have failed extensive surgical management.

## Classifying Ischial Tuberosity Avulsion Fractures by Ossification Stage and Tendon Attachment

Brendon Mitchell, MD  
University of California, San Diego

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**Purpose:** We hypothesized that the radiographic characteristics (size, displacement, location) of ischial tuberosity avulsion fractures in adolescents are related to ossification pattern and tendon involvement.

**Significance:** The appearance of secondary ossification centers about the pelvis are often poorly understood, but of clinical relevance. Currently, no classification system has been described for ischial tuberosity avulsion fractures.

**Methods:** We performed a retrospective review of ischial tuberosity avulsion fractures (n=45). Skeletal maturity and fracture location, size, and displacement were recorded based on initial injury radiographs. Fractures were classified by location: lateral (type-1) or complete (type-2). CT review demonstrated 5 stages of ossification. MRI scans were reviewed to assess the tendinous insertions at the ischial tuberosity apophysis.

**Results:** 47% of the fractures were classified as type-1, and 53% were classified as type-2. Type-1 fractures were associated with younger age ( $p=0.001$ ), lower Risser score ( $p=0.002$ ), lower modified Oxford score ( $p=0.002$ ), less displacement ( $p=0.001$ ), and smaller size ( $p<0.001$ ), when compared with type-2 fractures. 33% of type-1 fractures progressed to nonunion, versus 78% of type-2 fractures.

**Conclusion:** We propose a new classification system based on the ossification pattern of the ischial tuberosity apophysis that reflects skeletal maturity, fracture characteristics, and predicts the probability of subsequent nonunion.

## Predictors of Optimal Outcomes of Selective Thoracic Fusion at 5 Years

Amelia M. Lindgren, MD  
University of California, San Diego

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**Purpose:** To determine the pre-operative factors associated with optimal outcome of selective thoracic fusion (STF) for adolescent idiopathic scoliosis (AIS) at 5 years.

**Significance:** Prior work by Schulz et al. (2014) identified optimal outcomes at 2 years following STF for AIS and found that a preoperative lumbar curve  $<45^\circ$  and lumbar bend  $<25^\circ$  were associated with success.

**Methods:** Patients with primary thoracic AIS (Lenke 1-4C curves) who underwent a STF and had minimum 5-year follow-up were included. Optimal postoperative outcomes for a STF included a deformity-flexibility quotient (DFQ)  $<4$ , lumbar curve  $<26^\circ$ , lumbar correction  $>37\%$ , C7-CSVL  $<2\text{cm}$ , lumbar prominence  $<5^\circ$ , and trunk shift  $<1.5\text{cm}$ . These outcomes were used to determine whether adhering to published recommendations for STF increased the likelihood of obtaining an optimal outcome at 5-year, which included: preoperative lumbar curve  $<45^\circ$ , lumbar bend  $<25^\circ$ , apical vertebral translation ratio  $>1.2$ , and thoracic/thoracolumbar Cobb ratio  $>1.2$ .

**Results:** 127 patients met inclusion. A preoperative lumbar curve  $<45^\circ$  was associated with an increased likelihood of achieving 3 of the optimal outcomes: DFQ $<4$ , lumbar curve  $<26^\circ$ , and lumbar prominence  $<5^\circ$ . Following the 25 ° bend rule resulted in 2 optimal outcomes, while Cobb ratio  $>1.2$  only increased the chance of achieving 1 optimal outcome. AVT  $>1.2$  was not significantly associated with any optimal outcome measures.

**Conclusion:** This study found that at 5 years, performing a STF when there is a preoperative lumbar Cobb  $<45^\circ$  remained the best guideline for increasing the likelihood of an optimal outcome.

## Comparison of CT Angiography and Physical Exam in the Evaluation of Vascular Injury in Extremity Trauma

Hunter Warwick, MD  
University of California, San Francisco

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**Purpose:** Compared to CT angiography (CTA), physical exam will perform similarly in ruling out and predicting the need for arterial injury requiring intervention in extremity trauma.

**Significance:** When evaluating extremity trauma, CTA is not indicated in the setting of a normal or grossly abnormal vascular exam; however, CTA is routinely performed in these situations.

**Methods:** Retrospective review of all CTA studies performed for initial evaluation of extremity trauma at a Level 1 trauma center over a 10-month period. Patients were classified based on initial vascular exam (normal, soft signs, hard signs), and vascular injury on CTA was classified as major (named arteries) or minor (un-named arteries).

**Results:** One hundred thirty-five CTA studies were included. On initial vascular exam, 71% of patients had a normal exam, 22% had soft signs, and 6% had hard signs. The NPV for vascular injury requiring intervention of a normal physical exam was 100%. The PPVs for vascular injury requiring intervention of major injury on CTA and hard signs on physical exam were 35% and 51%, respectively.

**Conclusion:** A normal physical exam can effectively rule out the need for vascular intervention. The presence of hard signs on physical exam may be superior to CTA in guiding treatment decisions for vascular injury.



## Characterization of Constriction Band Syndrome Limb Involvement

Leah Demetri, MD

University of California, San Francisco

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**Purpose:** We sought to characterize the pattern of limb involvement in constriction band syndrome (CBS) by analyzing a large cohort of patients.

**Significance:** CBS is an uncommon congenital condition causing limb deformity, with varying clinical presentation and no clear diagnostic criteria.

**Methodology:** We retrospectively reviewed all patients with CBS at our medical center between 1/1/1998 and 12/31/2018. Medical records were reviewed for demographic data and associated conditions. The pattern of limb involvement was determined from clinical photographs and radiographs.

**Results:** 138 children with CBS were identified. Upper and lower extremities were affected equally. The most prevalent features were distal limb amputation (89%), constriction bands (79%), and acrosyndactyly (68%). There was a strong predilection for involvement of central digits of the hands and feet. On average, 2.5 limbs were affected. Children with single limb involvement (33%) were significantly less likely to have an associated diagnosis compared to children with multiple involved limbs (36% vs. 56%,  $p=0.047$ ). The most common associated conditions were clubfoot (34%) and craniofacial anomalies (12%).

**Conclusion:** Children with CBS can be categorized as having either mild or severe involvement based on the number of involved limbs and associated conditions. This characterization may provide implications for prognosis and treatment.

## **Anatomic Radial Head Arthroplasty: The Importance of Implant Angle**

**Matthew Cherches, MD**  
University of California, San Francisco

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**Purpose:** The aim of this study is to characterize the risk of radial head arthroplasty (RHA) failure with respect to stem positioning in anatomic designs. We hypothesize that variances in radial shaft-implant angle (RSA) will contribute to anatomic implant failure.

**Significance:** Optimal RHA implant design is still subject to debate. Anatomic implants have a theoretical benefit of mimicking native anatomy and may reduce cartilage wear. Thus, replicating pre-injury anatomy remains the goal in anatomic RHA. However, no prior studies have examined how positioning of anatomic implants relative to the proximal radial shaft influences survival.

**Methods:** A retrospective review identified 40 patients who underwent anatomic RHA for fracture at two academic centers. Radiographic review of patients' initial post-op elbow X-Ray was conducted to measure the angle of the implant stem relative to the proximal radial shaft on AP and lateral views. A two sample T-test and two binomial regressions were used to examine failure based on AP and lateral RSA respectively.

**Results:** Larger lateral RSA was associated with component failure ( $p=0.01$ ). Additionally, the odds of failure increase with increasing RSA (OR=1.32, 95% CI 1.11-1.71).

**Conclusion:** RSA may act as an independent risk factor that plays a role in anatomic implant survival.

## Early Complications of the Femoral Neck System for the Treatment of Femoral Neck Fractures

**Matthew Siow, MD**  
University of California, San Diego

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**Purpose:** The Femoral Neck System (FNS) was introduced in 2019, consisting of a blade and screw design. We aimed to evaluate FNS' early outcomes.

**Significance:** Femoral neck fractures (FNFs) are treated with cannulated screws or Sliding Hip Screw (SHS). FNFs have high complication rates leading to implant failure and reoperation.

**Methodology:** We retrospectively reviewed 30 patients who underwent FNF fixation with FNS from February 2019 to March 2020 at our Level 1 Trauma Center for demographics, comorbidities, complications, and functional outcomes.

**Results:** 28 had isolated FNFs, and 2 were polytraumas. Mean age was 64.8 years, BMI was 24.5 kg/m<sup>2</sup>, and Charlson Comorbidity Index was 4.43. 20 sustained FNF after ground level fall. 23 had valgus-impacted/nondisplaced fractures. Surgery for nondisplaced FNFs averaged 46 minutes (range 25-71). There were two reoperations: one AVN with femoral head fracture after a mechanical fall, and one nonunion. Both underwent arthroplasty. Mean Harris hip score with at least 6-week follow-up was 67.3, and EQ-5D was 0.825.

**Conclusion:** FNS is a newer implant for FNFs. Reoperation rate is lower than other constructs. This is the largest study that evaluates FNS. Further studies are needed to comprehend FNS as an alternative to cannulated screws or SHS.

## Surgical Planning Using Standard Preoperative Radiographs is Predictive of Successful Pedicle Screw Placement

Ryan O'Leary, MD  
University of California, San Diego

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**Purpose:** To evaluate the accuracy of a radiograph-based preoperative template for pedicle screw placement in posterior spinal fusion.

**Significance:** Robotic navigation has led to increasing interest in advanced imaging for pedicle screw placement. However, there are no studies assessing the predictability of radiograph-based planning to serve as a baseline comparison.

**Methods:** 95 patients with adolescent idiopathic scoliosis planned for posterior spinal fusion were prospectively enrolled. The fusion construct was templated using standard preoperative radiographs. All screws were placed by freehand technique. The final construct was then compared to the preoperative template.

**Results:** 1787 screws were templated. 1723 of the planned screws were placed (96.4%). 14 (0.8%) screws were abandoned after attempted placement (0-3/case). Of 241 screws planned in hypoplastic pedicles, 13 resulted in the use of a hook or no instrumentation. 53 (0-7/case) screws were not placed due to intraoperative plan change. The majority of deviation from the template was due to unplanned hook use in the upper thoracic spine.

**Conclusion:** Standard spine radiographs allow for accurate planning of freehand pedicle screws. Over 96% of planned screws were successfully placed. This data will serve as a baseline when considering the value and risks of navigation and robotics.

## Early Gender Differences in Pain and Functional Recovery Following Spinal Arthrodesis

Matthew Gulbrandsen, MD  
Loma Linda University Health

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**Purpose:** To analyze gender differences regarding the recovery experience (pain, function, complications) after spinal arthrodesis surgery.

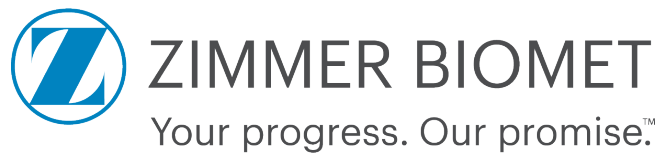
**Significance:** Some studies suggest that women have a lower tolerance to painful mechanical, electrical, and thermal stimuli. However, the effect of gender on the response to pain after spinal arthrodesis, in the setting of lumbar degenerative disease or thoracolumbar deformity, has not been well studied.

**Methods:** Preoperative and post-operative gender-based differences in patient reported outcomes for open posterior spinal arthrodesis at 6 weeks, 3 months, 6 months, and 1 year were studied, including. Statistical analysis included the use of Student's t-test, Chi square, linear regression, Mann Whitney U Test, and Spearman's rho.

**Results:** Primary or revision posterior arthrodesis was performed on 1931 consecutive adults for deformity and degenerative pathologies. Although these values are clinically marginal, females described more pre-op pain (Female VAS=6.54 vs Male VAS=6.41,  $p<0.01$ ) and lower pre-op function (Female ODI=49.73 vs Male ODI=46.52,  $p<0.01$ ). Similar pain and function scores between males and females resulted at 3, 6, and 12-months.

**Conclusion:** Statistically, females have more pain, dysfunction, comorbidities, and are older than males when they undergo spinal fusion. After spinal fusion, males and females have similar pain and functional outcome scores at 3-months, 6-months, and 12-months.

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