press-fit humeral stem and a peripherally cemented pegged glenoid designed for central bone ingrowth. One hundred and fifty-two patients were randomized based on treatment of the central peg (NG, ABG, DBM). Functional outcome, osseous integration of the central peg, and glenoid loosening were assessed at a minimum of 1 year postoperative.

Results: There were statistically significant improvements in functional outcome in all groups from baseline to postoperative, with no difference between groups. Central bone in-growth was observed in 90% of cases treated with ABG, 70% of cases treated with DBM, and 62% of cases treated with no bone graft.

Conclusion: At short-term follow-up there is no difference in functional outcome or revision between different surgical techniques for treatment of the central post during placement of an all-polyethylene glenoid designed for bone in-growth. Osseous integration appears to be higher with ABG compared to leaving the central post untreated.

Paper #20 FACTORS ASSOCIATED WITH HIGH PAIN INTENSITY AFTER TOTAL SHOULDER ARTHROPLASTY

Mariano E. Menendez, MD[a], Sarah M. Lawler, BA[b], David C. Ring, MD, PhD[c], ***Andrew Jawa, MD[a,b],*** *[a]Department of Orthopaedic Surgery, New England Baptist Hospital, Tufts University School of Medicine, Boston, Massachusetts, USA; [b]Boston Sports and Shoulder Center, Waltham, Massachusetts, USA; [c]Department of Surgery and Perioperative Care, Dell Medical School at the University of Texas at Austin, Texas, USA*

Introduction: As reimbursement becomes increasingly tied to quality and patient experience, there is growing interest in alleviation of postoperative pain combined with optimal opioid stewardship. We characterized predictors of severe inpatient pain after elective total shoulder arthroplasty, and evaluated its association with opioid use, operative time, hospital length of stay, discharge disposition, and cost.

Objective: We sought to characterize preoperative characteristics associated with severe pain among patients admitted to a hospital after TSA. Additionally, we evaluated the association of severe postoperative pain with inpatient opioid use, operative time, hospital length of stay, discharge disposition, and cost. An improved understanding of factors contributing to severe postoperative pain—and costlier care—can inform the development of enhanced recovery pathways based on comprehensive care of a patient's physical, mental, and social determinants of health.

Methods: A total of 415 patients undergoing elective primary total shoulder arthroplasty between 2016-2017 were identified from our prospectively collected registry. Severe postoperative pain was defined as peak pain intensity $\geq 75^{th}$ percentile. Multivariable logistic regression modeling was used to determine preoperative characteristics (e.g. demographics, emotional health, comorbidities, American Shoulder and Elbow Surgeons [ASES] score) associated with severe pain. Opioid consumption was expressed as oral morphine equivalents (OMEs). Costs were calculated using time-driven activity-based costing.

Results: In decreasing order of magnitude, the predictors of severe postoperative pain were greater number of self-reported allergies, preoperative chronic opioid use, lower ASES score, and depression. Patients reporting severe pain took more opioids (202 vs 84 mg OMEs), stayed longer in the hospital (2.9 vs 2.0 days), used postacute inpatient rehabilitation services more frequently (28 vs 10%), and were more likely to be high-cost patients (23 vs 5%; all $P < .001$), but they did not have longer surgeries (166 vs 165 minutes, $P = .86$).

Conclusion: Efforts to address psychological and social determinants of health might do as much or more than technical improvements to alleviate pain, limit opioid use, and contain costs after shoulder

Level of Evidence: III, prognostic.

Paper #21 POSTERIOR AUGMENTED GLENOIDS COMPARED TO NON-AUGMENTED GLENOIDS IN ANATOMIC TOTAL SHOULDER ARTHROPLASTY

Richard J. Friedman, MD, FRCSC[a]*, Sean Grey, MD[b], Thomas W. Wright, MD[c], Pierre-Henri Flurin, MD[d], Joseph D. Zuckerman, MD[e], Christopher Roche, MBA, MS[f], [a]Medical University of South Carolina, Charleston, South Carolina, USA; [b]Ortho Center of the Rockies, Fort Collins, Colorado, USA; [c]University of Florida, Department of Orthopaedics, Gainesville, Florida, USA; [d]Bordeaux-Merignac Clinic, France; [e]Hospital for Joint Diseases, New York, New York, USA; [f]Exactech, Gainesville, Florida, USA*

Purpose: The use of a posterior augmented glenoid to correct posterior wear, subluxation and retroversion remains controversial. The purpose of this study is to compare the clinical and radiographic outcomes of patients with significant posterior glenoid wear treated with a posterior augmented glenoid and compare them to age/gender/follow-up matched patients without glenoid wear treated with a non-augmented pegged glenoid in anatomic total shoulder arthroplasty (aTSA).

Methods: 182 patients undergoing primary aTSA with 2 year minimum follow-up (mean 42 months) were reviewed. 91 patients (mean age = 66 yrs; 37F/54M) received a posterior augmented pegged glenoid and 91 age/gender/follow-up matched patients received a non-augmented pegged glenoid. Patient data was retrospectively reviewed from a multi-institutional WIRB approved registry. Each patient was evaluated preoperatively and at latest follow-up using SST, UCLA, ASES, Constant, and SPADI scoring metrics; active abduction, forward flexion, and internal/external rotation were measured. Radiolucent glenoid line assessment was performed from radiographs at latest follow up. A Student's two tailed unpaired t-test ($P < .05$) quantified differences.

Results: Each cohort demonstrated significant improvements in pain and function following primary aTSA. At latest follow-up, augmented glenoids were generally better than non-augmented glenoids; however, few differences were noted in pre-to-postoperative improvement between augmented and non-augmented glenoids. Augmented glenoids were associated with significantly more improvement in active abduction, forward flexion, and external rotation as compared to non-augmented glenoids. The overall complication rate was 6.6%, where augmented patients had 1 aseptic glenoid loosening compared to 3 cases in the non-augmented group. Radiographic data was available for 70% of the patients. There were no significant differences in the rate of glenoid radiolucent lines (35% augmented, 40% non-augmented) or the average line grade (0.68 augmented, 0.86 non-augmented) between the two cohorts. There were no differences in humeral radiolucent line rates between the two groups.

Discussion: At a mean follow-up of 3.5 years, few clinically relevant differences were observed between the augmented and non-augmented cohorts, despite the augment cohort being disadvantaged by posterior glenoid wear. This is likely due to the correction of the retroversion and posterior subluxation, with improved tensioning of the rotator cuff. There were no patients in which the humeral head re-subluxated posteriorly. Complication rates and radiographic outcomes were similar between the two groups. Posterior augmented glenoids are a viable option for the posteriorly worn osteoarthritic glenoid; however, longer follow-up is necessary to determine how these early results hold up over time.

Paper #22 MUSCLE-DERIVED ACTIVATED ENDOTHELIAL CELLS AS A NEW CELL SOURCE TO ENHANCE TENDON-TO-BONE HEALING: IN VIVO STUDY IN A MURINE ROTATOR CUFF REPAIR MODEL

Susumu Wada, Amir Lebaschi, Yusuke Nakagawa, MD, PhD, Camila Carballo, PhD, PT, Dean Wang, MD, Daniel Nemirov, BA, Zoe Album, BS, Liang Ying, Xiang-Hua Deng, MD, ***Scott A. Rodeo, MD,*** *Orthopaedic Soft Tissue Research Program, Hospital for Special Surgery, New York, New York, USA*

Introduction: Cell-based approaches are expected to improve tendon-to-bone healing in rotator cuff tendon injuries. Recently, a specialized population of endothelial cells which produce signaling molecules that stimulate the intrinsic stem cells in specific tissues have been identified and reported.[4] We hypothesized that endothelial cells from muscle tissue could stimulate and enhance the tendon-to-bone healing. The purpose of the present study is to evaluate the effects of the novel muscle-derived activated endothelial cells (mECs) implanted at the repair site in a murine rotator cuff repair model.

Methods: A total of ninety-four C57BL/6 mice were used in this study (Fig. 1, *A*). Six mice were euthanized and underwent muscle harvest, followed by endothelial cell isolation with subsequent transfection of adenoviral E4ORF1 and green fluorescent protein (GFP) labelling.[2,3,5,7] Eighty-eight C57BL/6 mice underwent unilateral microsurgical supraspinatus tendon (SST) detachment and repair with implantation of 100,000 mECs in a fibrin glue (FG) carrier vehicle (study group) or FG alone (control group). Three mice each were euthanized at 3 and 7 days after the surgery in the study group to check the cell viability and localization using fluorescent microscopy. The other mice were euthanized at 7, 14, and 28 days and used for biomechanical test, histological evaluations (hematoxylin-eosin, Alcian blue, and picrosirius red), immunohistochemical staining (factor VIII) and micro computed tomography (μCT) analysis.[1] Statistical analysis was done using T-test and 2-way ANOVA with post-hoc Tukey's test. The significance limit was set at $P = .05$.

Results: Cell tracking (Fig. 1, *B*): There were GFP positive mECs at the repair site of SST at day #3 in the study group. Biomechanical testing (Fig. 1, *C*): The failure force in the study group was significantly higher than that of the control groups at day #14 (2.87 vs 1.86 N, $P = .0098$). Histology (Fig. 2, *A*): Increased cellularity and vascular tissue formation at the repair site of SST were observed in the study group at day #7. Improved continuity of the repaired SST and the bone tissue was observed in the study group at day #14. Quantitative analysis with μCT (Fig. 2, *B*, 2, *C*): There were no significant differences between two groups at day #28 in bone volume fraction, trabecular number, trabecular thickness, and trabecular separation.

Discussion: This is the first study to demonstrate the activated endothelial cells derived from muscle tissue can enhance healing of the tendon-to-bone as early as 2 weeks. According to previous literatures, tissue-specific endothelial cells establish specialized vascular niches that deploy sets of growth factors called angiocrine factors.[6] These factors may participate actively in the induction, specification, patterning, and guidance of tissue regeneration. Implanted mECs played a critical role in the healing and regeneration process of the SST from the early phase after surgery. mECs might be a promising cell source for the future treatment of soft tissue injuries.

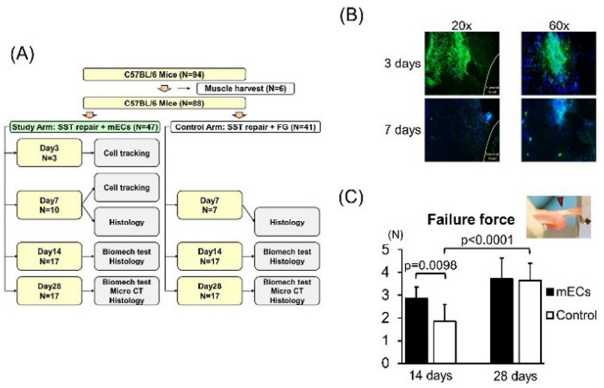

Figure 1 (A) Study design. (B) Cell tracking at day #3 and day #7. mECs were labeled with GFP. (C) Biomechanical tensile test. Failure force at day #14 and day #28.

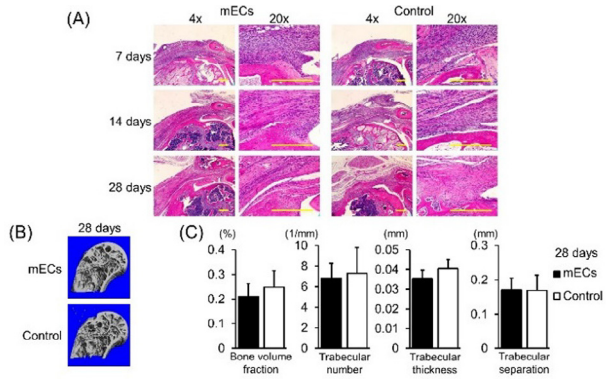

Figure 2 (A) Hematoxylin and eosin staining. Scale bar indicates 300 μm. (B) Representative Micro CT images at day #28. (C) Quantitative Micro CT analysis at day #28.

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Paper #23 IS IT WORTH REPAIRING ROTATOR CUFF TEARS? A PROSPECTIVE COST-UTILITY ANALYSIS USING REAL WORLD DATA

Matthias Flury, MD[a], *Cécile Grobet*[a], *Klaus Eichler, MD, MPH*[b], *Flurina Meier*[b], *Simon Wieser, PhD*[b], *Laurent Audigé, PhD*[a], [a]*Schulthess Klinik, Zurich, Switzerland;* [b]*Winterthur Institute of Health Economics, ZHAW, Winterthur, Switzerland*

Introduction: Knowledge about the costs and benefit of orthopedic surgeries in a real world setting is needed for orthopedic surgeons