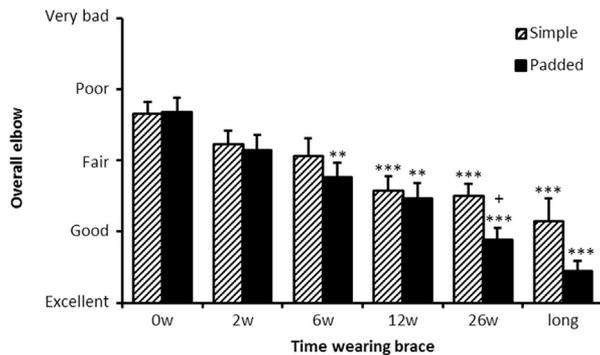


Results: The two groups, counterforce and placebo, were similar in age, sex, hand dominance and duration of symptoms. Both braces improved patient rated pain frequency and severity ($p < 0.01$), difficulty with picking up objects and twisting motions, and overall elbow function ($p < 0.001$) at 6 months and 3 years. Both braces also improved the lateral epicondyle tenderness, grip strength ($p < 0.01$) and modified ORI-TETS (Orthopaedic Research Institute – Tennis Elbow Testing System) force ($p < 0.05$) at 6 months. Significant intergroup differences were detected for frequency of pain at rest at 6 and 12 weeks ($p < 0.05$), level of pain at rest at 2 weeks ($p < 0.001$) and for the patient rated overall elbow function at 26 weeks ($p = 0.041$).

Conclusion: The counterforce brace provides significant reduction in the frequency and severity of pain in the short term (2-12 weeks), as well as overall elbow function at 26 weeks, compared with the placebo brace.



Patient rated overall elbow function. Data are presented as mean (standard error of mean), ** $p < 0.01$ and *** = $p < 0.001$ compared with time 0 using Wilcoxon signed rank tests. + = $p < 0.05$ for comparison between groups using Mann-Whitney rank sum test. w, weeks

Methods: Nine fellowship-trained specialists from seven institutions independently completed four series surveys consisting of 60 total elbow MRIs with UCL tears using a newly proposed six-stage classification system. The first and third surveys contained a total of 60 coronal MRI images, while the second and fourth contained the same MRI images with both coronal and axial views presented in a random order to assess intraobserver variability using the weighted kappa value and impact of additional imaging views. Weighted kappa values were also calculated for each of the four surveys to acquire interobserver reliability. Reliability analysis was repeated using a two-group classification analysis for distal and non-distal disease. Observer readings were compared to intraoperative UCL findings.

Results: For the newly proposed six-stage MRI-based classification, intraobserver and interobserver reliability demonstrated near perfect and substantial agreement, respectively. These values only increased when sub-stratified into the two-group distal and non-distal disease classification ($p < 0.05$). The additional axial view did not statistically improve the agreement between and among readers. Observer readings were accurate for tear grade (partial and complete), proximal location, and distal location, but not midsubstance tears, when compared to intraoperative findings from 30 elbows.

Conclusion: Our newly proposed six-stage MRI-based classification utilizing grade and location of the injury was found to have substantial to near perfect agreement between and within fellowship-trained observers. The results of this study provide a foundation for future validation studies, in which the classification system may be associated with clinical decision-making and patient outcomes.

Paper #12 THE DETERMINATION OF INTEROBSERVER AND INTRAOBSERVER RELIABILITY OF A MAGNETIC RESONANCE IMAGING BASED CLASSIFICATION SYSTEM FOR ULNAR COLLATERAL LIGAMENT INJURY

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Background: Despite improvements in the biomechanics and surgical options for UCL tears, there remains a need for a reliable classification of UCL tears that has the potential to guide clinical decision-making.

Purpose: The purpose of this cross-sectional study was to assess the intraobserver and interobserver reliability of the newly proposed MRI-based classification to UCL tears. Secondary objectives included assessing the impact of additional views, discrimination between distal and non-distal tears, and correlation of imaging reads with intraoperative findings of the UCL.

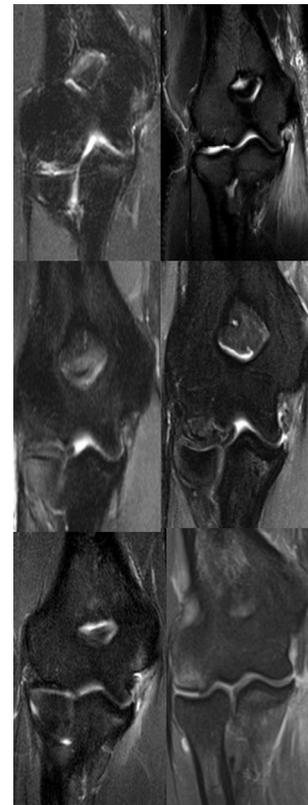


Figure 1 Examples of each UCL tear
Top left: 1A, proximal partial Top right: 1B, proximal complete
Middle left: 2A, midsubstance partial Middle right: 2B, midsubstance complete
Bottom left: 3A, distal partial Top left: 3B, distal complete

Table 1 MRI-based classification scheme for tears of the UCL.

Stage	Description
1A	Partial tear of the proximal/humeral UCL
1B	Complete tear of the proximal/humeral UCL
2A	Partial tear of the midsubstance UCL
2B	Complete tear of the midsubstance UCL
3A	Partial tear of the distal/ulnar UCL
3B	Complete tear of the distal/ulnar UCL

Paper #13 PREOPERATIVE EVALUATION OF SPINOGLYNOID GANGLION CYST WITH MRI, EMG AND ISOKINETIC MUSCLE TEST: DOES SIZE MATTER?

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Background: There are few studies correlating the size of ganglion cyst at the spinoglenoid notch with electrophysiological alterations, muscle power or pain severity.

Materials and Methods: Between June 2010 and November 2014, 30 patients (24 males and 6 females) who diagnosed with a ganglion cyst at the spinoglenoid notch on MRI were evaluated by EMG/NCV test and isokinetic muscle test. Maximum cyst diameter was measured on MRI and used for comparison. Pain severity was estimated by visual analogue scale (VAS). And, pooled sensitivity and specificity analysis was conducted, with an assessment of the summary receiver operating characteristic (ROC) curve.

Results: EMG/NCV test were examined in 27 out of 30 patients. Eight out of 27 patients were diagnosed with suprascapular neuropathy. The overall mean cyst size was 2.1cm. The cyst size of EMG positive group was 2.7cm, and size of EMG negative group was 1.8cm. When the size of ganglion cysts was increased 1cm, probability of an abnormal EMG/NCV test were increased 4.32 times (odds ratio: 4.32, $p = 0.023$). Area under the ROC curve (AUC) was 0.822, and set point 2.2cm had most sensitivity (87.5%), specificity (73.7%), positive likelihood ratio (3.3). However, there was no significant difference in the peak torque deficit on external rotation (mean: 30.2 (> 2.2 cm) vs. 20.7 (< 2.2 cm); $p = 0.156$) and abduction (mean: 28.6 (> 2.2 cm) vs. 18.4 (< 2.2 cm), respectively; $p = 0.28$) according to the size of ganglion cyst. The mean pain VAS of all 30 patients was 6.22 (range: 3~9), and there was no statistical difference in pain VAS according to the cyst size (mean: 6.06 (> 2.2 cm) vs. 6.50 (< 2.2 cm), respectively; $p = 0.841$). Twenty eight out of 30 patients had a labral lesion associated with spinoglenoid notch cyst on MRI. We performed SLAP repair in 19 cases, biceps tenodesis in 6 cases, biceps tenotomy in 3 cases, and cyst decompression only in 2 cases.

Discussion: Large spinoglenoid notch cysts may compress the suprascapular nerve. Tung¹ et al. reported that average maximum diameter of cysts associated with muscle denervation was 3.1cm. However, this study diagnosed muscle denervation on MRI, not the EMG/NCV study. The strengths of this study were as follows; 1) The current study used needle EMG for the diagnosis of suprascapular neuropathy. 2) This is the first study regarding the correlation with cyst size and suprascapular neuropathy. 3) All patients in the present study have taken EMG/NCV test, isokinetic muscle performance test and MRI evaluation. The limitation of study was 1) small number for subgroup analysis, 2) postoperative external rotation power and EMG follow up were not analyzed.

Conclusion: The current data suggested that cyst size reflect the compressive suprascapular neuropathy. Therefore, the decompression surgery would be justified in patients with cyst size greater than 2.2 cm.

¹ Tung GA, Entzian D, Stern JB, Green A. MR imaging and MR arthrography of paraglenoid labral cysts. *AJR. Am. J. Roentgenol.* 2000;174(6):1707-15. <https://doi.org/10.2214/ajr.174.6.1741707>.

Paper #14 * DEVELOPMENT AND VALIDATION OF A RISK CALCULATOR FOR PROLONGED OPIOID USE AFTER SHOULDER SURGERY

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Introduction: Opioid addiction is an escalating problem in the United States, with 33,091 reported deaths due to opioid overdoses in 2015. Although opioids are often an integral part of postoperative pain control, they can have significant side effects including physical dependence, development of tolerance, respiratory depression, and death. Orthopaedic surgeons are the third highest prescribers of opioids among physicians in the United States. Properly identifying patients who are at greater risk for prolonged postoperative opioid use can help direct patients care towards ancillary treatments such as behavioral therapy, pain management and should ultimately reduce the risk of serious harm. We identified patient covariates associated with increased opioid use after shoulder surgery and utilized them to construct a clinical risk calculator to preoperatively predict the risk of opioid usage for longer than 6 weeks following shoulder surgery.

Methods: Patients that underwent shoulder surgery from January 2015 to February 2017 at a tertiary healthcare system were identified and opioid prescription data was collected from the Connecticut Prescription Monitoring and Reporting System (CPMRS). Inclusion criteria were age over 18 and exclusion criteria were patients not registered on CPMRS. Quantities of opioids prescribed were documented. Chart review identified demographic information, active medications, and medical comorbidities. Logistic regression was used to calculate odds ratios of patients using opioids longer than six weeks and multivariate analysis was performed on ten identified risk factors. The coefficients from these ten chosen predictor variables were used to construct a predictive risk calculator. The nomogram was validated by the bootstrapping method, and a calibration plot was used to examine agreement between observed outcomes and predicted probability. Internal recalibration of the data set using the bootstrapping method was done by resampling the dataset with replacement 1000 times and running the model fitting each of the 1000 datasets.

Results: 563 patients met inclusion criteria, whereas 8 patients were not registered with the CPMRS website and were excluded. Multivariable analysis demonstrated that the greatest factors for prolonged opioid use were historical opioid use prior to surgery (within 3 years prior to surgery), followed by insurance type, procedure type, BMI, smoking status, and psychiatric disorders. Other factors included gender, hepatobiliary disease and intestinal disorders, cardiopulmonary disease, and neurologic disorders. The ten identified risk factors of opioid use for greater than 6 weeks following shoulder surgery were then utilized in constructing a predictive risk calculator (Figure 1). The risk calculator is utilized by first identifying the procedure type, and then drawing a line to the "points" scale at the top of the nomogram to determine how many points are assigned to that procedure type. This is then repeated for the 9 remaining risk factors in

*Indicates paper nominated for the Neer Award