

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 spino-glenoid 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 spino-glenoid 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 spino-glenoid 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 spino-glenoid 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

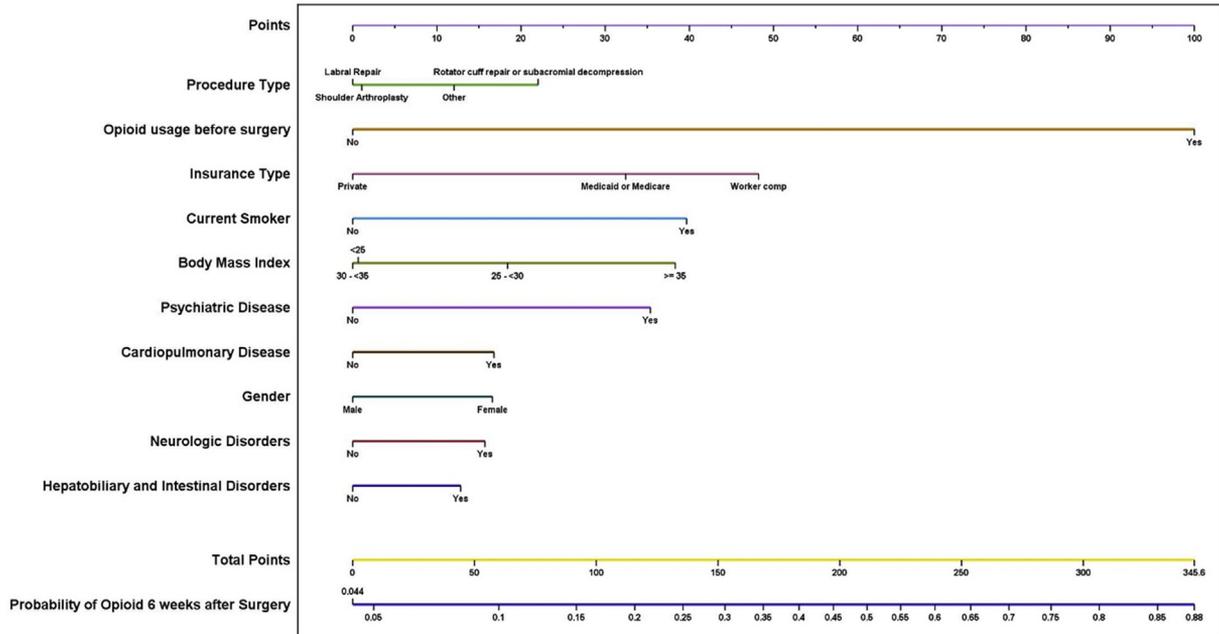


Figure 1 Predictive Clinical Risk Calculator of Opioid Use Longer Than 6 Weeks After Shoulder Surgery.

the nomogram. The “points” from each of the 10 risk factors is then added, and the total points are converted to an estimate of the probability of patients using opioids longer than six weeks, using the point to risk conversion scale at the bottom of the nomogram. The prediction accuracy for this model was good with a calculated concordance index of 0.766 (95% confidence interval 0.736-0.820).

Conclusion: We developed and validated a preoperative clinical risk calculator to predict prolonged opioid use following shoulder surgery. This may be a valuable clinical decision-making tool to decrease opioid over prescription, identify patients benefiting from

referral to pain management specialists, and reduce the risk of opioid abuse and addiction. Although several previous studies have attempted to identify risk factors of prolonged opioid use, none to our knowledge have utilized these risk factors to develop a preoperative multivariate predictive risk calculator of postoperative opioid use. Ideally, such a predictive risk calculator would be integrated into the electronic medical record or available as an application to allow facile calculation of prolonged opioid usage and appropriate targeting of resources for patients at risk following shoulder surgery.

Level of Evidence: Retrospective cohort study, Level III