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ORIGINAL ARTICLE

A prospective evaluation of predictors of pain after arthroscopic rotator cuff repair: psychosocial factors have a stronger association than structural factors

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Hypothesis: We evaluated the correlation of preoperative factors with pain after arthroscopic rotator cuff repair (ARCR). We hypothesized that nonstructural factors, including metrics of psychological well-being and preoperative narcotic use, would correlate with higher pain levels postoperatively and that structural factors, such as tear size, would not be predictive.

Methods: Ninety-three patients were prospectively enrolled and evenly distributed by tear size. Patient sex, age, occupation, smoking status, tear mechanism, tear characteristics on magnetic resonance imaging, visual analog scale (VAS) pain scores, narcotic usage, range of motion (ROM) by goniometry, and functional and psychological assessments through the American Shoulder and Elbow Surgeons (ASES) Standardized Shoulder Assessment Form, Simple Shoulder Test, Western Ontario Rotator Cuff Index (WORC), and RAND 36-item Short Form Survey questionnaires were obtained preoperatively. VAS scores and ROM were collected postoperatively at 2 weeks, 6 weeks, 3 months, 6 months, and 1 year. The ASES, SST, WORC, and RAND 36-item Short Form Survey questionnaires were repeated 1 year postoperatively.

Results: The patients (54% men) were a mean age of 56.4 years. There were 68% traumatic tears, 11% smokers, and 13% used narcotics preoperatively. ROM, VAS, ASES, and WORC scores improved significantly from the preoperative to 1-year postoperative assessment. Correlating with increased pain scores at 1 year were preoperative narcotic use, higher preoperative VAS, and lower scores on the WORC index and emotion sections.

Conclusion: Our data show that the factors most predictive of persistent pain after ARCR are psychosocial characteristics, including poor performance on validated measures of emotional well-being. Demographic and tear-specific structural factors did not correlate with postoperative pain scores.

Level of evidence: Level I; Prospective Design; Prognostic Study

Keywords: Rotator cuff; arthroscopic repair; pain; psychosocial; well-being; prediction models

Arthroscopic rotator cuff repair (ARCR) has been shown to relieve pain and improve function in patients who present with symptomatic rotator cuff tears.[10,13,19,20] A small percentage of patients, however, report persistent shoulder pain and

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functional limitations postoperatively.[4,13,14] The ability to predict which patients will continue to report pain after surgery is of interest in the current health care climate, where quality of care assessments and reimbursement are increasingly being linked to patient satisfaction and patient-reported outcome measures.[9] With this shift toward accountability for clinical outcomes, it is important to understand the patient-specific factors that influence these subjective metrics.

In patients with rotator cuff tears, it would be intuitive that size and morphology of the tear would correlate with shoulder pain and disability. Recent literature has challenged this notion and has shown that structural factors play a limited role in predicting pain and function in patients with rotator cuff tears.[5] Furthermore, several studies have shown that psychosocial influences, including mental health and psychological distress, are correlated with pain in patients who present with rotator cuff pathology.[2,3,11,15,23] The relationship between psychosocial factors and postoperative pain after ARCR has not been well defined, particularly in the early postoperative period.

This study prospectively evaluated which preoperative factors correlate with persistent postoperative pain and dysfunction after ARCR. We hypothesized that nonstructural factors, such as metrics of psychological well-being and preoperative narcotic use, would correlate with higher pain levels postoperatively in the early postoperative period and at 1 year.

Materials and methods

Patients who were scheduled to undergo ARCR by the senior authors (J.D.B., G.L.J., J.Y.B.) were prospectively enrolled. An a priori power analysis was performed to determine the sample size needed to detect a difference in clinical outcomes between patients with various tear sizes and set at 93 patients. The inclusion criteria were patients with a symptomatic, magnetic resonance imaging (MRI)-documented full-thickness acute rotator cuff tear or a full-thickness and high-grade partial thickness rotator cuff tear in whom appropriate nonoperative management had failed. Patients were separated into 3 evenly distributed groups by small, medium, and large tear size based on MRI measurement. Massive tears, irreparable tears, and revision repairs were excluded. Subacromial decompression, acromioplasty, labral débridement, distal clavicle excision, and biceps tenotomy or tenodesis were concomitantly performed when indicated. Patients undergoing any other concomitant procedure were excluded.

Demographic data, tear-specific factors, and measures of pain and function were collected preoperatively. Sex, age, smoking status, tear mechanism (traumatic vs. atraumatic), and the presence or absence of preoperative narcotic usage was documented. A tear was classified as traumatic if the patient had no prior shoulder pain or dysfunction before a significant traumatic event with sudden onset of pain. Patients with chronic or acute-on-chronic symptoms were classified as having atraumatic tears.

Tear size, retraction, and degree of atrophy were assessed on MRI. Tear size was measured in centimeters in the anterior-posterior dimension. Small tears were defined as <1 cm, medium tears as 1 to 3 cm, and large tears as 3 to 5 cm. Retraction was measured as the distance in centimeters from the supraspinatus tendon stump to the center of the supraspinatus footprint on the greater tuberosity on coronal T2 images. Degree of atrophy in the supraspinatus and infraspinatus muscle bellies was assessed on sagittal T1 images and was graded from 0 to 4 using the Goutallier classification.[8]

Preoperative range of motion (ROM) was measured by goniometry for forward elevation and external rotation and by vertebral level for internal rotation. Visual analog scale (VAS) score for shoulder pain was recorded on a scale of 0 (no pain) to 10 (worst pain possible).

Four functional and psychological assessments were completed at the time of enrollment: the American Shoulder and Elbow Surgeons (ASES) Standardized Shoulder Assessment Form, the Simple Shoulder Test (SST), Western Ontario Rotator Cuff (WORC) index, and RAND 36-item Short Form Survey (SF-36). The WORC index was recorded as a total and also as score for each of its components, which includes a physical, sports, work, lifestyle, and emotion section. The SF-36 was recorded as a total and broken down into its 8 domains: physical functioning, role limitation due to physical health, emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health.

Intraoperatively, the number of anchors used and degree of tendon retraction was recorded. Patients were immobilized in an abduction sling postoperatively, which was worn for the first 6 weeks. Physical therapy was started immediately for patients with small- and medium-sized tears and at 2 weeks for patients with large tears.

VAS pain scores were documented postoperatively in a daily pain journal for the first 14 days and collected during visits at 2 weeks, 6 weeks, 3 months, 6 months, and 1 year. ROM was documented at each visit beginning at the 6-week postoperative visit. Strength was assessed at each visit starting at 3 months. Number of days on narcotics postoperatively was recorded. The ASES, SST, WORC, and SF-36 assessments were repeated at the 1-year postoperative visit.

The Student *t* test was used to compare ROM, VAS, ASES, WORC, SST, and SF-36 scores preoperatively and at 1 year postoperatively. For the correlation analysis, VAS pain scores at each postoperative assessment and 1-year ASES scores were used as dependent variables. Independent variables included the preoperative demographic factors, MRI tear characteristics, and preoperative VAS scores, ASES, WORC, SST, and SF-36 scores. To determine the strength of the relationship between the 2 sets of variables, Pearson correlation coefficients were calculated if both variables were continuous. Point biserial correlation coefficients were used if one of the variables was discrete. Correlation coefficients are reported from –1 to +1, with –1 representing the strongest possible negative correlation and +1 representing the strongest possible positive correlation. Statistical significance was set at $P < .05$.

Results

The patient cohort (54% men) was a mean age of 56.4 years. Of these, 68% presented with traumatic tears, 11% of patients smoked, and 13% of patients reported using narcotics preoperatively. All repairs were arthroscopic double-row transosseous equivalent repairs. All 93 patients had follow-up through the 3-month postoperative visit, 82 though the 6-month postoperative visit, and 73 through the 1-year postoperative visit.

ROM in all planes improved significantly from the preoperative to the 1-year postoperative assessments (Table I): 140° vs. 167° in forward elevation, 56° vs. 64° in external