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Predictors of pain and functional outcomes after operative treatment for rotator cuff tears

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Background: Optimal patient selection is key to success of operative treatment for cuff tears. We assessed predictors of pain and functional outcomes in a longitudinal cohort of patients undergoing operative treatment.
Methods: From March 2011 to January 2015, a cohort of patients with rotator cuff tears undergoing rotator cuff surgery was recruited. Patients completed a detailed health and demographic questionnaire, standardized shoulder questionnaires, including the Shoulder Pain and Disability Index (SPADI), and underwent a magnetic resonance imaging scan. Patients received follow-up questionnaires at 3, 6, 12, and 18 months. We assessed longitudinal predictors of SPADI using longitudinal mixed models. Interactions with follow-up duration after surgery were also assessed.
Results: In our analysis (n = 50), a lower Fear-Avoidance Beliefs Questionnaire physical activity score ($P = .001$) predicted a lower SPADI score (better shoulder pain and function). Those consuming alcohol 1 to 2 times per week or more had lower SPADI scores than those consuming alcohol 2 to 3 times per month or less ($P = .017$). Both of these variables had a significant interaction with duration of follow-up. Variables that were not significant predictors of SPADI included sociodemographic characteristics, magnetic resonance imaging characteristics, such as tear size and muscle quality, shoulder strength, and variations in surgical techniques/performance of adjuvant surgical procedures.
Conclusions: Those with higher fear avoidance behavior and alcohol use of 1 to 2 times per week had worse shoulder pain and function at 18 months of follow-up. These data can be used to select optimal candidates for operative treatment of rotator cuff tears and assist with patient education and expectations before treatment.
Level of evidence: Level II; Prospective Cohort Design; Treatment Study

Keywords: Rotator cuff; surgery; predictors; outcomes; SPADI; shoulder pain; cohort

This study was approved by Partners Institutional Review Board Protocol #2009-P-000329 and Vanderbilt Institutional Review Board Protocol #140857.

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An estimated 272,148 rotator cuff repairs were performed on an ambulatory basis in the United States in 2006.[6,14] There has been an increase in surgery as the initial treatment for rotator cuff tears over time.[30] Optimal outcomes of operative treatment for rotator cuff tears are achieved by patient selection based on characteristics that predict better pain and functional outcomes after surgery. Few studies have analyzed a limited number of factors associated with better outcomes after operative treatment.[3,5,8,12,18,19,21-23,26-28] A comprehensive longitudinal analysis of possible predictors of better outcomes after operative treatment in a well-defined multicenter cohort is lacking according to our assessment.

We assessed predictors of better shoulder pain and function after surgery in a longitudinal multicenter cohort of patients with rotator cuff tears. This information can be used to guide clinicians and patients in identifying optimal candidates for surgical treatment of rotator cuff tears.

Materials and methods

Patient population

Between March 2011 and January 2015, the Rotator Cuff Outcomes Workgroup (ROW) cohort study recruited patients aged 45 years and older with symptomatic (for at least 4 weeks) rotator cuff tears undergoing operative treatment. Patients were recruited from sports/shoulder clinics in 3 academic settings and 1 community setting. Exclusion criteria were a current shoulder fracture, prior shoulder surgery on the index shoulder, and active cervical radiculopathy elicited as neck pain radiating to the shoulder/arm/hand. Patients provided informed consent. Although this analysis was performed in patients undergoing rotator cuff surgery, the entire ROW cohort recruited patients with and without tears and also those undergoing operative and nonoperative treatments.

Structured history questionnaire and outcome measures

A history questionnaire and outcome questionnaires were administered to each patient at each time point. The history questionnaire, which was abbreviated for follow-up, elicited comprehensive and structured information on patient demographics, comorbidities, symptoms, smoking and alcohol habits, and patient expectations from treatment. Performance of daily manual labor in the patient's current job or last job (if retired) was also asked.

The physical activity scale of the Fear-Avoidance and Beliefs Questionnaire (FABQ) was designed by Waddell et al[31] to assess fear-avoidance beliefs about physical activity in patients with low back pain. We modified the FABQ physical activity questions (4 items that contribute toward scoring) in this scale by using the term "shoulder" instead of "back." The scale has 24 possible points, with a higher score indicating worse fear-avoidance behavior with physical activity in relation to the shoulder.

Mental health was assessed using the Mental Health Inventory (MHI-5),[2] a component of the 36-Item Short Form Health Survey.[32] MHI-5 scores range from 0 to 100. A score of ≤68 on the MHI-5 is indicative of a probable mood disorder, including depression.[17,29]

Shoulder outcomes were assessed using the Shoulder Pain and Disability Index (SPADI),[24] a standardized 13-item questionnaire. SPADI has a pain scale (5 items) and a disability scale (8 items). SPADI scores range from 0 to 100, with lower scores reflecting better shoulder pain and function.

Strength testing

Trained research assistants performed strength testing using a handheld dynamometer in abduction, external rotation, and internal rotation. The affected and contralateral shoulders were both assessed, and a mean of 2 consecutive measurements that were at least 10 seconds apart was used in our analysis. Our detailed protocol for standardized strength testing has been previously described.[15,20] Strength testing using a dynamometer has good intrarater and interrater reliability.[11] We used a ratio of the affected shoulder vs. the contralateral shoulder strength in the analysis.

Surgical characteristics

A surgery report form was used to determine whether a biceps tenodesis or tenotomy was performed and the technique used when performing the rotator cuff repair. The technique was classified into single row, double row, and other (open repair or transosseous equivalent). The surgery report form was completed by the attending surgeon.

Diagnostic imaging

Shoulder magnetic resonance images (MRIs) were read in a blinded fashion by consensus by 2 shoulder experts (L.D.H. and N.B.J. or J.E.K. and N.B.J.). Our previous work has shown good inter-rater and intrarater reliability for these MRI readings compared with a reading by a musculoskeletal radiologist.[13] The κ values ranged from 0.75 to 0.90 for tear presence, tear size, and tear thickness.[13] MRI features were assessed, including tear thickness, tear size in longitudinal and transverse planes, fatty infiltration of the rotator cuff muscles, tendon retraction, and rotator cuff muscle atrophy. Criteria for each of these measurements follow standard nomenclature and have been previously described.[13]

Diagnosis of rotator cuff tear

Rotator cuff tears were diagnosed based on the clinical impression of a sports/shoulder fellowship-trained attending physician and evidence of structural deficit on MRI. Biceps tendon pathology was diagnosed based on the clinician's impression because imaging can be negative even if the patient has symptoms corresponding to biceps pathology or vice versa. An MRI was unavailable for 2 patients in the cohort.

Longitudinal follow-up

Patients were assessed at approximately 3, 6, 12, and 18 months after the baseline visit was completed. Patients were mailed follow-up questionnaires with a prestamped envelope. Patients received phone or email reminders if they did not return the questionnaires and, eventually, a call from the study principal investigator if questionnaires were still not returned. All 50 patients attended at least 1 follow-up