Arthroscopic Versus Open Rotator Cuff Repair: Which Has a Better Complication and 30-Day Readmission Profile?

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Purpose: To provide a comparative 30-day postoperative analysis of complications and unplanned readmission rates, using the National Surgical Quality Improvement Program database, after open or arthroscopic rotator cuff repair (RCR). **Methods:** The American College of Surgeons National Surgical Quality Improvement Program database was reviewed for postoperative complications after open or arthroscopic RCR over an 8-year period, from 2007 through 2014. Patients were identified by use of Current Procedural Terminology codes. The open group contained 3,590 cases (21.8%) and the arthroscopic group had 12,882 cases (78.2%), for a total of 16,472 patients undergoing RCR. The risk of complications was compared between the 2 groups, along with patient demographic characteristics, operative time, length of stay, and unplanned readmission within 30 days. We compared dichotomous variables using the Fisher exact test and continuous variables with 1-way analysis of variance. Relative risks (RRs) and 95% confidence intervals (CIs) were calculated when appropriate. **Results:** The open RCR group had a higher prevalence of patients aged 65 years or older and comorbidities such as hypertension, diabetes, chronic obstructive pulmonary disease, smoking, and alcoholism ($P < .05$). Patients undergoing open RCR had a higher risk of any adverse event when compared with arthroscopic RCR patients (1.48% vs 0.84%; RR, 1.17; 95% CI, 1.05-1.30; $P = .0010$). They were also at higher risk of return to the operating room within 30 days (0.70% vs 0.26%; RR, 1.36; 95% CI, 1.09-1.69; $P = .0004$). Open RCR was associated with a longer average hospital stay (0.48 ± 2.7 days vs 0.23 ± 4.2 days, $P = .0007$), whereas arthroscopic RCR had a longer average operative time (90 ± 45 minutes vs 79 ± 45 minutes, $P < .0001$). **Conclusions:** Although both open and arthroscopic approaches to RCR had low morbidity, arthroscopy was associated with lower risks of any adverse event and return to the operating room during the initial 30-day postoperative period. **Level of Evidence:** Level III, retrospective comparative study.

Rotator cuff pathology is the most common cause of shoulder pain in the general and elderly populations.[1-5] Rotator cuff repairs (RCRs) were initially reported in 1911,[6] and currently, more than a quarter of a million RCRs are performed annually in the United States.[7] Over the past few decades, the surgical management of rotator cuff tears has transitioned from open to "mini-open" RCR to all-arthroscopic techniques.[8] Although arthroscopic techniques generally result in longer operative times and increased surgical charges,[9] reported benefits include decreased morbidity, faster recovery times, improved surgical visualization and tissue mobilization, greater patient acceptance, and less pain compared with open repairs, with both methods yielding similar outcomes.[10-23]

The economic impact of RCRs is undeniable, with an estimated lifetime societal savings of $3.44 billion annually.[7] Intimately linked with savings is an increased focus on value and cost of care. With the recent implementation of the Affordable Care Act, economic viability is increasingly being tied to costs and outcomes, as shown by policy reducing reimbursement for patients with hospital or surgical associated complications.[13,14] Despite this growing emphasis on early outcomes, there are limited data regarding early postoperative complications based on RCR technique.

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The purpose of this study was to provide a comparative 30-day postoperative analysis of complications and unplanned readmission rates, using the National Surgical Quality Improvement Program (NSQIP) database, after open or arthroscopic RCR. We hypothesized that arthroscopic RCR would be associated with lower risks of 30-day complications when compared with open RCR.

Methods

This study used the American College of Surgeons (ACS) NSQIP database as the source for all patient data. The ACS NSQIP database, an evolution from the US Department of Veterans Affairs NSQIP database, became a nationally validated, open subscription database in 2005.[24,25] By using a sampling strategy designed to represent a broad range of surgical procedures from multiple surgical subspecialties and drawing data from academic, community, military, and private hospitals, the ACS NSQIP database is a representative sample of both inpatient and outpatient surgical procedures.[26] Surgical procedures are entered according to their Current Procedural Terminology code and may be queried. Additional data from patients' medical charts are gathered, deidentified, and organized into over 135 variables. Such variables include patient demographic data, comorbidities, and intraoperative characteristics, as well as 30-day postoperative complications, reoperations, readmissions, and death; however, hospital and surgeon demographic information is not included.[24,27] The exclusion criteria are predetermined and are the same for all cases in the database; they exclude cases involving patients younger than 18 years, minor cases, cases involving patients with an American Society of Anesthesiologists classification of 6 (brain-dead organ donors), trauma cases, cases involving hyperthermic intraperitoneal chemotherapy, transplant cases, cases representing a return to the operating room (RTOR) related to an occurrence or complication of a prior procedure, and any case involving a patient who already underwent an NSQIP-assessed procedure in the prior 30 days.[24] We have maintained access to the database since 2014, and analysis for our study was performed on September 1, 2015. This study was exempt from institutional review board approval because all data are deidentified and publicly available.

The study population comprised adults (≥18 years of age) who underwent open RCR or arthroscopic RCR between January 1, 2007, and December 31, 2014. Cases with a Current Procedural Terminology code for open RCR (23,412 and 23,410) or arthroscopic RCR (29,827) for the main procedure were included in the sample. In open repair cases, there were unique codes for acute and chronic tears, but in arthroscopic repair cases, there was only a single code encompassing both types of injury. Additional variables used included patient demographic characteristics, preoperative comorbidities, operating theater characteristics, postoperative complications, all-cause mortality, and reoperation in the 30-day postoperative period. All variables were identified and queried based on their definition and variable number as given in the ACS NSQIP database user guide.[24]

Specific patient demographic characteristics included sex, age (grouped as ≤64 years of age, 65-74 years, 75-84 years, and ≥85 years), and race or ethnicity. Recorded comorbidities included hypertension requiring medication (HTN); cardiac disorders (including congestive heart failure within the preceding 30 days, myocardial infarction within the previous 6 months, previous percutaneous intervention, previous cardiac surgery, and a history of angina within the preceding 30 days); diabetes mellitus (DM); peripheral vascular disease; chronic pulmonary disorders; obesity (defined as body mass index ≥30); positive smoking status; and alcoholism. Operative characteristics included resident involvement, operative time, and total length of stay (LOS).

Postoperative complications included medical and surgical complications. Surgical complications were defined as follows: superficial, deep incisional, and organ space surgical-site infections (SSIs); wound disruption; bleeding requiring transfusion; peripheral nerve injury; and RTOR within 30 days. Medical complications comprised unplanned intubations, pneumonia, pulmonary embolism (PE), requirement of a ventilator for more than 48 hours, progressive renal insufficiency, acute renal failure, urinary tract infection (UTI), stroke, cardiac arrest, myocardial infarction, deep vein thrombosis, and sepsis. "Any adverse event" was defined as the occurrence of 1 or more of the aforementioned events.

The Fisher exact text was used to compare all categorical variables between the open and arthroscopic groups; analysis of variance was used for continuous variables. Poisson regression was used to estimate risk ratios and associated 95% confidence intervals (CIs) for the association between the surgery group and outcomes of interest. Statistical significance was set at $P < .05$.

Results

A total of 16,472 patients were identified as undergoing open or arthroscopic RCR from NSQIP years 2007 through 2014. Those undergoing arthroscopic RCR comprised 78.2% of the population (12,882 patients), whereas open RCR patients comprised 21.8% (3,590 patients). In the demographic analysis, the RCR group had a greater proportion of patients aged 65 years or older (34.2% vs 30.9%, $P < .0001$). In addition, a higher prevalence of many comorbidities was found in the open RCR group when compared with the