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Original Article

Outcomes are favorable in Asian patients undergoing deltoid-on open rotator cuff repair without acromioplasty

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ABSTRACT

Background: To evaluate if rotator cuff repair without acromioplasty would result in improvement in outcomes without the risks associated with acromioplasty in Asian patients.

Methods: 38 primary repairs of tears of the rotator cuff were performed through a deltoid-on approach. The Simple Shoulder Test (SST) and UCLA shoulder rating scale were measured preoperatively and at 2 years post-operatively.

Results: There was a significant improvement in the SST 2 years post-operatively ($p < 0.001$). UCLA scores for pain control and function ($p < 0.001$) also significantly improved 2 years post-operatively.

Conclusion: Outcomes are favorable in Asians following deltoid-on open rotator cuff repair without acromioplasty.

Level of evidence: III.

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1. Introduction

Neer popularized the benefits of anterior acromioplasty for the chronically impinged shoulder in 1972.¹ Since then, many series of rotator cuff repairs have incorporated acromioplasty as an important adjunct procedure. This was based on the hypothesis that rotator cuff impingement and tears were due to extrinsic compression from the overlying acromial spur.¹

However, there is evidence that rotator cuff tears are also due to intrinsic factors such as muscle weakness, overuse of shoulder and degenerative tendinopathy.² Clinical and cadaveric studies suggest that up to 90% of partial rotator cuff tears were on the articular side and the pathogenesis of most tears of the rotator cuff is due to tendon degeneration.^{2,3}

In 1934, Codman defined the critical zone as the area located 1 cm medial to the insertion of the supraspinatus tendon on the greater tuberosity, where most degenerative

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changes occur.⁴ He also described the importance of the coracoacromial ligament's role in the maintenance of glenohumeral joint stability, which is disrupted in acromioplasty. Reviews of randomized-controlled studies as well as several case series have shown that patients with rotator cuff repairs without acromioplasty had outcomes comparable to those who had acromioplasty done as part of the procedure.^{5,6}

The objective of this study is to evaluate the functional outcomes of patients who have undergone deltoid-on open rotator cuff repair without acromioplasty in our institution. We hypothesized that Asian patients undergoing deltoid-on open rotator cuff repair without acromioplasty had favorable outcomes up to 2 years following surgery.

2. Method

From 2004 to 2009, the senior author of this study performed open rotator cuff repair without anterior acromioplasty on 38 patients with symptomatic full thickness supraspinatus tear. These 38 patients, comprising of 13 Males and 25 Females, aged from 42 to 74, were followed up for at least 2 years (ranging from 2 to 7 years post-operatively, mean duration 4.6 years). Inclusion criteria for surgery were as follows: (a) Patients who had full thickness supraspinatus tears, (b) who showed clinical weakness (using the Medical Research Council (MRC) Scale) and (c) who experienced pain to the extent that it affected their activities of daily living. All patients had radiographic evidence of a full thickness rotator cuff tear documented by either magnetic resonance imaging of the shoulder or ultrasound imaging of the shoulder. The Simple Shoulder Test (SST) scores and the UCLA shoulder scores were prospectively collected preoperatively and 2 years postoperatively.^{7,8}

The SST is a self-administered questionnaire to assess functional disability of the shoulder. It consists of 12 yes-no questions which relate to shoulder pain, range of motion and function, with a maximum score of 12 correlating with better shoulder comfort and function.⁹ SST was chosen as it has been used widely in numerous studies since its introduction in 1993. The SST is a self-evaluation of activities of daily living that is easy to administer in less than 3 min in a clinical setting. It has a high degree of reproducibility and is applicable to a wide range of causes for shoulder dysfunction.⁹ Although it received criticism for being too simple, when compared to other shoulder outcome measures such as the Shoulder Pain and Disability Index (SPADI) and the American Shoulder and Elbow Surgeons form (ASES), the SST showed better convergent validity and correlation to patient satisfaction.^{10–12} Its validated simplicity, practicality and reproducibility make it a popular and easily administered test.

The UCLA shoulder rating scale, introduced since 1981, has been used in various studies for numerous shoulder conditions, including rotator cuff repairs.⁹ The UCLA score comprises five components that assess pain, function, range of motion, strength and patient satisfaction. With a maximum score of 35, a score of 34–35 is considered excellent, 29–33 good, 21–28 fair and <20 as poor function. As more than 50% of the scale is based on comfort (pain) and function, it can provide accurate data on patients who have undergone rotator cuff repair.^{3,9}

2.1. Statistical analysis

The Student t test was used to compare continuous data while the chi-square test was used to compare categorical, noncontinuous data.

2.2. Surgical procedure

All 38 patients, who had isolated supraspinatus tears, underwent a deltoid raphe-splitting open rotator cuff repair without acromioplasty as described by Codman in 1934.⁴ The surgical procedure began with a patient positioned supine with head raised at 30°. A 3-cm incision was made 1 cm distal to the anterolateral border of the acromion, parallel to the lateral border of the acromion. After dividing the subcutaneous fat layers, a split was made in the anterolateral raphe of the deltoid muscle near its origin at the acromion.¹³ The bursa was subsequently resected. In accordance to Codman's surgical goals, the coracoacromial ligament and acromion were preserved. The rotator cuff tear was then defined and debrided. The tendon was mobilized on both bursal and articular sides. The footprint on the greater tuberosity was prepared with 2 double-loaded bio-absorbable suture anchors inserted along the subchondral bone. The cuff repair was then done with arm in neutral position without tension.

Before wound closure, the shoulder was ranged to ensure that there was no subacromial impingement. The wound was subsequently closed in layers including repair of the deltoid split with absorbable sutures.

Post-operatively, the shoulder was put in a universal arm sling. Postoperative analgesia and rehabilitation was standardized for all patients. All patients were admitted on the day of surgery and discharged on the following day. On the day of discharge, patients were reviewed by the inpatient physiotherapist. For the first 6 weeks, patients underwent passive forward elevation of 140° and external rotation of 40° strictly. The subsequent 6 weeks involved active range of motion exercises. Patients were counseled to resume normal activities at 3 months. They were reviewed in the outpatient specialist clinic by the senior author at two weeks, six weeks, three, six and twelve and twenty-four months postoperatively.

None of our patients had any surgical or post-operative complications.

3. Results

3.1. Patient demographics

There were 13 (34.2%) males and 25 (68.8%) females. The average patient age was 56.7 ± 7.54 years old. The average duration of follow-up was 4.6 ± 2.3 years. All patients reviewed had supraspinatus tendon tears, which were repaired with bioabsorbable suture anchors.

3.2. Simple shoulder test

Preoperatively, the patients scored a mean of 1.08 ± 1.60 . This improved to a mean of 9.97 ± 2.79 at 2 years postoperatively ($p < 0.0005$).

3.3. UCLA shoulder rating scale

Preoperatively, the patients scored a mean of 10.0 ± 4.17 . This improved to 29.6 ± 5.68 at 2 years postoperatively ($p < 0.0005$). The average strength also improved significantly from 3.0 to 4.3 on the MRC grading scale ($p < 0.0005$). Shoulder forward elevation range of motion showed similar improvements with a score of 1.17 ± 0.6 preoperatively to 3.13 ± 0.4 postoperatively ($p < 0.001$).

4. Discussion

When Neer described anterior acromioplasty in the chronically impinged shoulder in 1972, he mentioned that ‘anterior acromioplasty may offer better relief of chronic pain in carefully selected patients with mechanical impingement’.¹ Patients who had rotator cuff disease were observed to have variations of the architecture in the acromion. A classification of acromion types was refined in 1991 and it showed how differing acromion morphologies led to varying degrees of extrinsic impingement of the rotator cuff muscles.¹⁴ Thus it was hypothesized that subacromial decompression would remove the potential cause of tendinopathy which led to the suggestion for acromioplasty to be included along with bursectomy and coracoacromial ligament sectioning for adequate decompression. This was substantiated in studies, which showed good results when rotator cuff tears were treated with acromioplasty as part of the procedure.^{15,16} However, acromioplasty is not without its complications. Bleeding, scar formation leading to reduction in range of motion, chronic pain, anterosuperior instability and even deltoid avulsions have been described in literature.^{1,17–19} There is also evidence that reoperations in patients with acromioplasty done previously fared worse than patients who had an intact acromion and intact origin of the deltoid insertion postoperatively.⁶ Morrison hypothesized that it was due to muscle imbalances between the deltoid and rotator cuff that causes superior migration of the humeral head during elevation of the arm, leading to rotator cuff impingement and subsequent tears.¹⁴ One might hypothesize that in disrupting the coracoacromial arch; the glenohumeral instability might result in additional proximal migration of the humeral head, giving rise to recurrent tears of the rotator cuff. With this in mind, the authors feel that routine acromioplasty is not necessary as an adjunctive procedure in the surgical repair of the rotator cuff as evidenced by findings in current literature.^{5,18} We hypothesized that patients undergoing deltoid-on open rotator cuff repair without acromioplasty have favorable outcomes.

Our results showed that patients who underwent deltoid-on open rotator cuff repair without acromioplasty have favorable outcomes with significant improvement from their preoperative scores. Our results mirror those reported by McCallister et al where preoperatively, their patients could perform a mean of 5 functions in the Simple Shoulder test, which improved to a mean of 9 functions post-operatively ($p < 0.0001$).¹⁹ In our review, all participants were Asian by ethnicity and they improved from a mean of 1 function preoperatively to a mean of 9 functions postoperatively. The surgical approach used by McCallister et al is similar to that used in our study which

makes the comparison more meaningful. In another recent level I multicenter, randomized controlled trial by MacDonald et al⁶ they examined 86 patients who had arthroscopic rotator cuff repair with and without acromioplasty performed and found no difference between the two groups in WORC and ASES scores. Macdonald included acromion morphologies in this study method and found no significant difference in improvement between the subgroups even when subacromial decompression was omitted. Budoff et al examined 79 cases that had undergone arthroscopic debridement without acromioplasty and reported that 89% of patients had good to excellent short-term results while 81% of patients had good to excellent long-term results postoperatively.³

We agree that there have been good outcomes reported by surgeons performing rotator cuff repair with acromioplasty. Most of these studies have been performed on Western patients. Morphometric and anatomic variations of the acromion between Western and Asian patients could have an impact on the outcomes after surgery. With the limited evidence in current literature, it seems that the Asian acromion could have smaller dimensions as opposed to the Western one.^{20,21} While this has not been evaluated in our study, we postulate that it could be a reason for the excellent outcomes seen in our patients following rotator cuff repair without acromioplasty. Blevins et al reported that fifty-seven (89%) of sixty-four patients were satisfied with the result of a mini-open method of rotator cuff repair that included an arthroscopic acromioplasty and resection of the coracoacromial ligament.²² In our relatively smaller study, 100% of patients reported excellent results on the UCLA shoulder rating scale. None of them reported with signs and symptoms of impingement, needing subsequent acromioplasty, up to 2 years postoperatively. They also avoid the risks associated with acromioplasty as discussed earlier. In contrast to these findings in our study, MacDonald et al had an observation that 4 out of the 45 patients (9%) who had undergone the procedure without acromioplasty eventually required an acromioplasty within the first 2 years due to ongoing pain, reduced range of motion and decreased strength.⁶

The strengths of our study lie in the fact that the same surgeon operated on all the patients, using the same surgical technique and post-operative rehabilitation orders, thus ensuring uniformity. We did not include acromion morphology as a criterion in selecting patients for this procedure, thus reducing selection bias. The results of our study must be interpreted in light of its limitations. These include a relatively small sample size. While our data was collected prospectively, analysis was done retrospectively and the effect of confounders cannot be negated. Another limitation of our study were the short-term follow-up but this is largely due to institutional practice as patients who are well 2 years post-operatively are discharged from specialist care. Despite these limitations, we were still able to answer our primary research question. Many of the limitations inherent to this study can be addressed with a well-designed comparative cohort study.

5. Conclusion

Outcomes are favorable and patients have significant improvement in shoulder comfort and function following

deltoid-on open rotator cuff repair without acromioplasty. When comparing with current literature, our outcomes are comparable to that of patients who had undergone rotator cuff repairs with acromioplasty. There is a need to relook the practice of routine acromioplasty in surgically treated rotator cuff tears.

Conflicts of interest

All authors have none to declare.

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