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## Functional outcome of open surgical repair of full thickness rotator cuff tears using the double row suture anchorage technique

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### Abstract

**Introduction:** The arthroscopic method offers several advantages, including smaller incisions, access to the gleno-humeral joint for the inspection and treatment of intra-articular lesions, no need for detachment of the deltoid, and less soft-tissue dissection. However, these advantages must be considered against the technical difficulty of the method, which limits its application to surgeons who are skilled in both open and arthroscopic procedures on the shoulder.

**Methodology:** A total number of 49 repairs were performed in our institute of which 45 patients available for follow up were included in the study. All patients meeting the following inclusion and exclusion criteria had a pre-operative assessment which included the shoulder rating system of American Shoulder and Elbow Surgeons (ASES) and the Constant and Murley scoring questionnaires

**Results:** There was no significant difference in the outcome scores of American Shoulder and Elbow Surgeons and Constant and Murley between traumatic and degenerative tears at the latest follow-up visit.

**Conclusion:** There was significant difference in the mean improvement of scores post operatively between the two groups.

**Keywords:** Rotator Cuff Tears, Double Row Suture Anchorage Technique, Gleno-Humeral Joint

### Introduction

Rotator cuff disease is the commonest cause of shoulder pain <sup>[1]</sup>. Patients mostly present with an insidious onset of progressive pain and weakness, with concomitant loss of active motion <sup>[2]</sup>. Passive motion initially remains full until pain limits active motion enough to cause development of adhesive capsulitis <sup>[2]</sup>.

A cuff tear can occur after a single extreme overload, but typically it is the result of a degenerative process that compromises tendon integrity, starting with supraspinatus and progressing to the other cuff muscles <sup>[3]</sup>. It is now recognized that there is a spectrum of cuff disease ranging from reversible overuse, through partial thickness tears and impingement, leading on to full thickness tears and finally rotator cuff arthropathy <sup>[1]</sup>. The classic extrinsic theory of causation popularized by Neer has now been challenged and there is powerful evidence that intrinsic tensile tendon fibre failure is the root cause of cuff disease <sup>[1]</sup>.

Loss of continuity of the rotator cuff can be described in several ways, including acute and chronic, partial or full thickness, and traumatic or degenerative <sup>[2]</sup>. It is important to differentiate between the different types to plan appropriate treatment <sup>[2]</sup>. Full-thickness rotator cuff tears also are classified based on their size. The most common size classification, popularized by Cofield *et al.*, is based on the largest dimension of the tear: small tears measure less than 1 cm; medium tears, 1 to less than 3 cm; large tears, 3 to less than 5 cm; and massive tears, 5 cm or larger <sup>[4]</sup>.

MRI is extremely sensitive in detecting rotator cuff pathology. An altered signal pattern may be reported as 'tendinitis' but probably indicates the presence of an intra-tendinous tear. Joint or bursal side partial thickness tears can be more easily identified <sup>[3]</sup>. Full thickness tears are visualised accurately, with assessment of their size, degree of retraction and extent of involvement <sup>[3]</sup>.

Imaging and clinical studies have suggested that partial-thickness tears can progress. Yamanaka and Matsumoto arthrographically followed 40 articular-sided tears treated non-operatively and found tear progression in 80% over a 2-year period<sup>5</sup>. For partial-thickness rotator cuff tears, a non-operative program that includes activity modification, stretching and

strengthening exercises and anti-inflammatory medication is appropriate as initial treatment. Operative management is indicated if conservative management fails [5].

There are several key aims of stable surgical rotator cuff repair; restoration of tensile strength, creation of an environment that facilitates healing mediated by the bursa and prevention of bone/tendon gap formation [3].

The goals of surgical repair of the torn rotator cuff include pain relief, improved function and possibly prevention of rotator cuff arthropathy [1]. Neer in his report highlighted four important principles for open rotator cuff surgery: (1) use of anterior-inferior acromioplasty or reshaping rather than acromionectomy (2) meticulous repair of the deltoid origin and avoidance of procedures that may place this area at risk for injury (3) release, mobilization and repair of the torn rotator cuff tendons and (4) early restoration of passive motion through surgeon-directed and individualized rehabilitation [6].

95% of lesions of the rotator cuff i.e. both partial and complete were the end result of impingement by the anterior aspect of the acromion and therefore it is believed that an acromioplasty should be an integral part of a rotator cuff repair [7]. Most descriptions of rotator cuff repair have included subacromial decompression as part of the procedure [8]. However, other studies have shown substantial improvement in terms of shoulder pain and function following rotator cuff repair without acromioplasty or section of the coracoacromial ligament [8]. The current literature has not accurately defined when acromioplasty should be performed in the setting of rotator cuff repair [8].

Recent studies have investigated the outcomes of arthroscopic, mini-open and open rotator cuff repairs [8]. The goals of rotator cuff repair remain the same whether the repair is performed in an arthroscopic or open fashion, and most reports have shown no difference between open and arthroscopic rotator cuff repair in terms of long-term clinical outcomes [8].

The arthroscopic method offers several advantages, including smaller incisions, access to the gleno-humeral joint for the inspection and treatment of intra-articular lesions, no need for detachment of the deltoid, and less soft-tissue dissection [9]. However, these advantages must be considered against the technical difficulty of the method, which limits its application to surgeons who are skilled in both open and arthroscopic procedures on the shoulder [9]. Further, arthroscopic repairs were associated with a significantly longer surgical and operating-room time than open repairs were [10]. It also demands a high level of technical skill, which is associated with a steep learning curve [10].

**Methodology**

A retrospective and prospective study was conducted at hospital by recruiting patients who underwent open repair of full thickness rotator cuff tears with acromioplasty. A total number of 49 repairs were performed in our institute of which 45 patients available for follow up were included in the study. All patients meeting the following inclusion and exclusion criteria had a pre-operative assessment which included the shoulder rating system of American Shoulder and Elbow Surgeons (ASES) and the Constant and Murley scoring questionnaires. Surgery was indicated for patients with a clinical diagnosis and symptoms of a full-thickness rotator cuff tear. The diagnosis was confirmed by MRI preoperatively in all patients. The duration of follow-up ranged from 8 months to 38 months and the average was 20.9±9.6 months.

**Inclusion criteria**

1. Full thickness rotator cuff tears.
2. Availability of preoperative magnetic resonance imaging scans of the involved shoulder.

**Exclusion criteria**

1. Partial thickness tears.
2. Other coexisting pathologies in the shoulder like instability, SLAP lesions and associated fractures.
3. Rotator cuff arthropathy.
4. Retracted rotator cuff beyond the glenoid margin with fatty infiltration.

**Results**

**Table 1: Sex Distribution**

Sex	Frequency	Percent
F	21	46.7
M	24	53.3
Total	45	100.0

Twenty-four of the forty-five patients were men and the average age at the time of surgery was 55.09±10.34 years (range, 35 to 75 years). Thirty-seven tears involved the dominant shoulder.

**Table 2: Age Distribution**

Age (years)	Number of patients
<30	0
31- 40	5
41-50	10
51-60	17
61-70	9
71-80	4

Thirty patients had a history of trauma at the onset of symptoms. Twelve of these were in motor vehicular accidents and eighteen were domestic injuries. The fifteen patients who denied any history of trauma before the onset of symptoms were classified as degenerative tears.

**Table 3: Etiology of Tear**

Etiology	Frequency	Percent
Degenerative	15	33.3
Traumatic	30	66.7
Total	45	100.0

Intra-operative tear size was measured in all the forty-five shoulders and the tears were classified. There were twelve medium, twenty-two large and eleven massive tears. The surgical technique was constant but only for the type of suture anchors used. The deciding factor was the affordability of the patient. We used bio-absorbable anchors for the repair in ten shoulders and titanium anchors in thirty-five. The number of anchors used ranged from a minimum of one to a maximum of three depending on the width of the tear.

**Table 4: Size classification**

Tear Size	Frequency	Percent
Large	22	48.9
Massive	11	24.4
Medium	12	26.7
Total	45	100.0

**Table 5:** Type of suture anchor used

Anchor Type	Frequency	Percent
Bio-Anchors	10	22.2
Titanium	35	77.8
Total	45	100.0

There was no significant difference in the outcome scores of American Shoulder and Elbow Surgeons and Constant and Murley between traumatic and degenerative tears at the latest follow-up visit. However, there was significant difference in the mean improvement of scores post operatively between the two groups. The shoulder index of American Shoulder and Elbow surgeons improved 45.3 points in degenerative tear group and 50.3 points in the traumatic tear group. With the system of Constant and Murley the mean postoperative improvement was 38.3 and 46 points for degenerative and traumatic tears respectively.

**Table 6:** Outcome Scores- Traumatic Tears

Outcome Score	N	Pre OP		Post OP		p value
		Mean	SD	Mean	SD	
Ases Score	30	26.5	6.44	77.3	9.38	0.0000
Constant Score	30	25.3	7.22	71.3	7.97	0.0000

**Table 7:** Outcome Scores- Degenerative Tears

Outcome Score	N	Pre OP		Post OP		p value
		Mean	SD	Mean	SD	
Ases Score	15	32.2	8.38	77.5	9.33	0.0000
Constant Score	15	31.5	6.73	70.8	6.50	0.0000

## Discussion

We prospectively assessed the clinical outcomes of the open double-row suture anchor repair of rotator cuff tears. Open repair has been the gold standard for treatment of symptomatic full thickness rotator cuff tear historically as pioneered by Codman. Other authors have documented the validity and reproducibility of this procedure. Good clinical outcomes using either open or arthroscopic techniques for rotator cuff tears are well documented. In the recent years considerable number of publications have studied the short and medium term results of arthroscopic and open rotator cuff repairs and most have similar outcome<sup>[11, 12]</sup>.

In our study, we have compared pre and postoperative pain scores, range of motion, and shoulder function in terms of extensively validated scoring systems. Both the Shoulder index of American Shoulder and Elbow surgeons and the rating system of Constant and Murley have shown statistically significant improvement in all the parameters. The ASES and the Constant scoring systems allowed comparability of our results with those available in the literature<sup>[13]</sup>.

The average pain score on the visual analog scale of the shoulder index of American Shoulder and Elbow Surgeons improved by 6.5 points. Sarena *et al*<sup>[14]</sup> reported an improvement by 5 points for traumatic anterosuperior tears and Galatz *et al* reported an improvement of 4.9 points for large and massive tears repaired arthroscopically. In our study, thirty-four patients (76 per cent) had no or minimum pain, eleven (24 per cent) had moderate pain (3 or 4 points) on final follow up. All the patients appreciated the significant pain relief obtained. Of the eleven patients who reported moderate pain on follow up five had repaired large tears, four had massive tears and only two had medium tears. Also all these patients had significantly lower range of motion attained at final follow up with a mean forward elevation of 120°

and a mean abduction of 110°.

The active range of motion improved in all planes at the final follow up. The mean absolute improvement in forward elevation, abduction and external rotation was 92.5°, 99.6° and 23.6° respectively. At the final follow up, the amount of internal rotation achieved was up to T7 in twenty-one shoulders, T12 in twenty and L3 in four shoulders. The four patients who achieved a final internal rotation of only up to L3 level had a preoperative internal rotation of S1. Two of these patients had a massive tear and one patient had a large traumatic tear. The other patient had a medium size degenerative tear and showed poor adherence to physiotherapy protocol. Complete recovery of forward flexion and abduction (160°-180°) was achieved in 19 patients. 15 of these were in large and massive tears and in 13 cases the tears were traumatic. Better recovery of range of motion was seen predominantly in large and massive traumatic tears.

## Conclusion

- Open double row rotator cuff repair shows good to excellent results after medium term follow up.
- Repair performed in combination with acromioplasty for full thickness tears of rotator cuff resulted in significant pain relief at final follow up.
- The Range of Motion and rotator cuff strength at final follow up improved in all planes.

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