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# A Comparative Study of Clinical Outcomes of Mini Open and Arthroscopic Rotator Cuff Repair

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**ABSTRACT**
Rotator cuff injury is one of the frequent problem encountered of the shoulder in the daily practice of orthopedic surgeons. To compare clinical outcomes in patients with rotator cuff tears undergoing Mini-open and Arthroscopic rotator cuff repair. This is a prospective observational study conducted in St Martha's Hospital, Bangalore, during the period extending from October 2016 to November 2018. 39 patients with Rotator cuff injury were included in the study. Preoperative and postoperative scoring, outcome of operative management was evaluated using University of California and Los-Angeles scoring system (UCLA) during 4th, 8th, 12th , 16th post op period. All demographic variables and preoperative baseline parameters of the 2 groups were equivalent. Out of 39 patients, 20 patients underwent mini-open cuff repair, 19 patients underwent arthroscopic cuff repair. At 4 months, 10 patients had excellent results (7 mini-open, 3 arthroscopy), 26 had good results (13 each in both groups), 3 patients had fair results (all 3 in arthroscopy group). In our study we found that the early functional outcomes of MOR and AR of small, medium and large sized rotator cuff tears are nearly equivalent. Functional outcome, pain, range of motion and satisfaction do not significantly differ between patients treated with Arthroscopic repair and those treated with Mini-open repair in four months after surgery.

## INTRODUCTION

A rotator cuff (RC) tear is one of the most common causes of pain and disability in the upper extremity. The RC may rupture as a result of direct trauma or it may be purely degenerative with no obvious relation to trauma. Most often, RC tears are a consequence of a combination of both trauma and degenerative changes i.e. following an acute on chronic situation. The risk of such tear is increased by age and advancing tendon degeneration[1]. Symptomatic RC tendon tears typically cause shoulder pain and limit movement. Usually the tear is located in the supraspinatus tendon and thus there is pain and impaired abduction and movement in the overhead positions.

The treatment of RC tear is generally operative since the tendon does not attach to bone spontaneously and the tear may enlarge by time. Recent studies have reported good results of conservative treatment of RC tears, but only one level I trial comparing conservative and operative treatment of RC tears has been published previously. Despite, traumatic event is often associated with the onset of shoulder symptoms[2].

The primary goal of operative management of rotator cuff tears is pain relief and this is accomplished with predictable results. Improvement of function is a secondary but important consideration. Functional improvement is not as predictable as pain relief and depends on the age of the patient, the age and size of the tear (which suggests the quality of the tissue and the condition of the muscle) and the postoperative rehabilitation program. For massive tears, they eventually lead to rotator cuff arthropathy were articular cartilage is degenerated.

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. Arthroscopic evaluation is required to determine the extent of the lesion and subacromial decompression is indicated when outlet impingement is present. The causes of the tear should be treated at the time of surgery. Debridement or repair of partial-thickness rotator cuff tears depends on the degree of the tear and the activity level and age of the patient.

## MATERIAL AND METHODS

This prospective comparative study was conducted on 39 patients who underwent surgical treatment on a rotator cuff injury, either as a mini open or as an arthroscopic procedure. The patients were divided into two groups: group I underwent mini open repair 20 patients and group II underwent arthroscopic repair 19 patients.

**Inclusion Criteria:**

- Patients suffering from symptomatic rotator cuff tears.
- Positive diagnostic imaging of the affected shoulder indicating a full-thickness rotator cuff tear, which may include ultrasound and MRI
- Patients willing for any type of surgery irrespective of costs involved.
- Aged >18 years.

**Exclusion Criteria:**

- Presence of extensive lesions (>5 cm).
- Previous surgery on the same shoulder.
- Presence of associated lesions (SLAP, Bankarts etc.).
- Presence of Glenohumeral arthrosis, Cuff tear arthropathy.
- Presence of Subscapular tears, Glenohumeral instability.
- Post-traumatic stiff shoulder.
- Follow-up of less than 4 months.
- Refusal to participate in the study.
- Non-adherence or incorrect adherence to the protocol established.

**Sample Size:** Considering a mean difference of 1.7 of two groups and standard deviations of group 1 and group 2-1.5 and 2.2 respectively, with 5% alpha error and 80% power, the minimum required sample size is 19 per group.

The study was conducted on 39 patients, all suffered from rotator cuff tears. In 20 cases mini open rotator cuff repair was done. Arthroscopic rotator cuff repair was performed in 19 cases. All patients were followed up clinically (using the modified University of California at Los Angeles score) and radiologically. The follow up period was 4 months.

**Procedure:** After finding the suitability, according to selection criteria, patients will be selected for the study and briefed about the nature of the study, the interventions used and written informed consent will be obtained. Further, descriptive data of the patients like name, age, sex, detailed history, will be collected. Later in the Post-op period the following parameters will be assessed to compare the efficacy of different surgeries are: 1. Pain 2. Function 3. Muscle power and Range of Motion 4. Patient satisfaction.

The above parameters are based on University of California and Los Angeles scoring systems (UCLA) which has a scoring of 55 points, which are assessed each time the patient comes for follow up,

**Excellent:** 43-55 points,

**Good:** 31-42 points,

**Fair:** 21-30 points,

**Poor:** 20 or less points.

**Statistical Assessment:** P values <0.005 were taken statistically significant and values <0.001 were taken as highly significant. The Mann-Whitney test was used for scalar variables, Fisher test for categorical variables and likelihood ratio for variations between groups.

## RESULTS AND DISCUSSIONS

In our study, the mean age in Mini-open repair group and Arthroscopic repair group was 54.3 and 48.95 years respectively.

In our study, Mini-open repair group had male and female of 55% and 45% respectively. In Arthroscopic repair group, male were 52.6% , females were 47.4% .

Out of 20 patients in Mini-open repair group, 13 patients had trauma history, 7 patients had degenerative cuff tear. Out of 19 patients in Arthroscopic repair group, 10 patients had trauma history, 9 patients had degenerative cuff tear.

The mean time of duration to present for Mini-open group, Arthroscopic group was 27.5 days and 28.4 days.

Of 20 patients in Mini-open group, 10 patients had large tears, 7 patients had medium tear and 3 patients had small tears.

Of 19 patients in Arthroscopic repair group, 11 patients had large tears, 4 patients had medium tears and 4 patients had small tears.

In our study, preoperative UCLA score of Mini-open repair and Arthroscopic group was 23.6 and 19.84 respectively.

'P' value was <0.05, hence it is significant.

Out of 20 patients in Mini-open repair group, 19 patients were classified as fair, 1 patient was classified as poor in UCLA preoperative classification

Out of 19 patients in Arthroscopic repair group, 10 patients were classified as fair, 9 patients were classified as poor.

'P' value was <0.05, hence it is significant.

Post-operative UCLA score in Mini-open repair and Arthroscopic repair group was 38.55 and 35.68.

Of 20 patients post operatively, in Mini-open repair group, 7 patients had excellent results, 13 patients had good results.

Out of 19 patients post operatively, in Arthroscopic repair group, 3 patients had excellent results, 13 patients had good results and 3 patients had fair results.

Out of 21 patients with large lesions, 18 patients, 10 in Mini-open repair, 8 in Arthroscopic group had good post op UCLA classification, 3 in Arthroscopic group had fair score.

Out of 11 patients with medium lesions, 4 patients in Mini-open repair group had excellent group, 3 patients in Mini-open group had good results, 4 Patients in Arthroscopic group had good results.

Out of 7 patients with small lesions, 3 patients in Mini-open repair, 3 patients in Arthroscopic group had

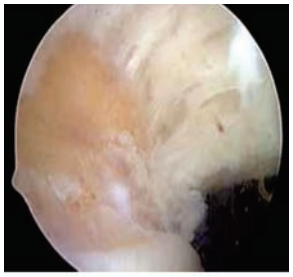
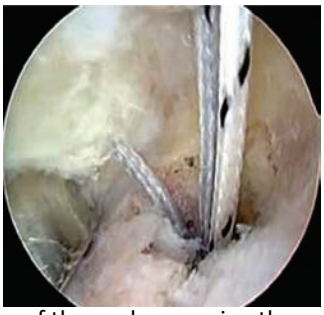


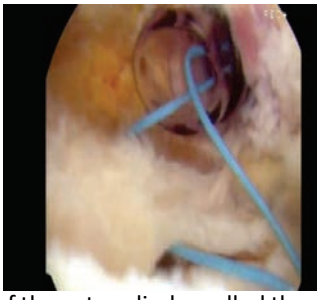
Fig.1: Steps of Arthroscopic Repair of Partial Thickness Rotator Cuff Tear

A. Partial thickness tears of the articular surface of the rotator cuff B. Foot-print preparation for the reattachment of the rotator cuff

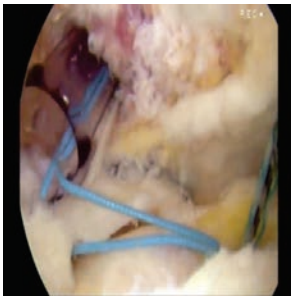
A: Anchor insertion through the tendon at dead man's angle



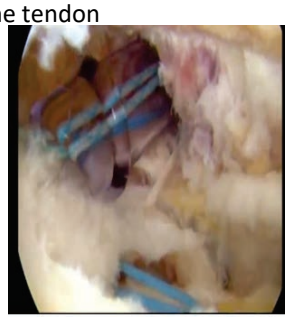
B: Sutures of the anchor passing through into the foot print



A: One of the suture limbs pulled through healthy part of the rotator cuff



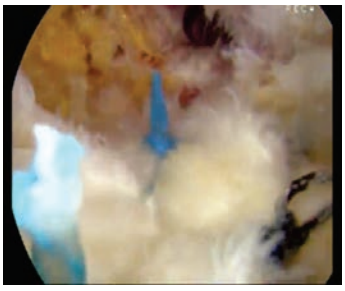
B: Subacromial view showing the sutures passing through the tendon



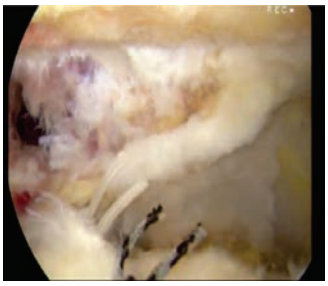
A: Other 2 suture limbs were pulled to completion of exit through the lateral portal

B: Subacromial view after the knot tying

C: Glenohumeral view showing rotator cuff repair and reconstruction of the footprint up to the articular surface of the humeral head



A: Posterior subacromial view showing the repair



B: Posterior glenohumeral view showing rotator cuff repair and restoration of the foot-print up to the articular surface of the humeral head

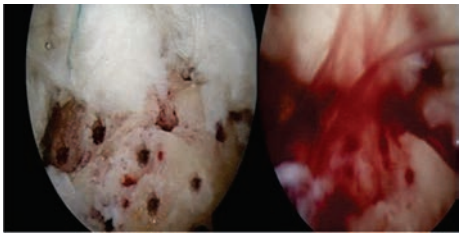


Fig: 2 "Crimson Duvet" micro fracture of the tuberosity creates vascular access channels

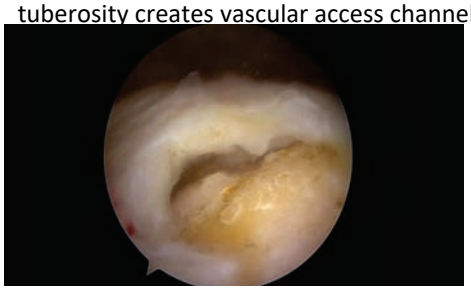
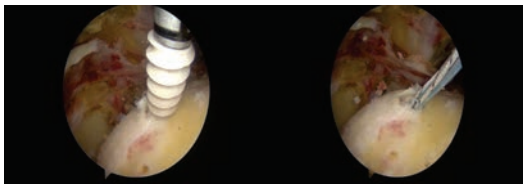


Fig: 3 STEPS OF FULL THICKNESS ARTHROSCOPIC ROTATOR CUFF REPAIR



Full thickness rotator cuff tears
excellent results, 1 patient in Arthroscopic group had good results.

In Mini-open group, there was a change of 14.95 in UCLA score from pre-op to post op. In Arthroscopic group, there was a change of 15.84 in UCLA score from pre-op to post op.

Out of 29 patients who had fair classification pre-operatively, 10 patients (7 in MOR and 3 in AR) had excellent post op classification. 18 patients (12 in MOR, 6 in AR) had good post op classification. 1 patient in Arthroscopic group had fair result. Out of 10 patients who had poor classification preoperatively, 8 patients (1 in MOR, 7 in AR) had good post op classification, 2 patients had fair results. There was a significant

**Table 1: Mean Age Distribution of the Subjects in the two Groups.**

| Group | Mean Age (in years)±Standard deviation | p-value | Statistical Significance |
|---|---|---|---|
| Mini Open Repair | 54.3±13.76 | 0.21 | NS |
| Arthroscopic Repair | 48.95 ± 12.35 | | |

**Table 2 : Trauma History Between the two Groups.**

| Trauma | Mini Open repair (n) | Arthroscopic Repair (n) | p-Value | Statistical significance |
|---|---|---|---|---|
| Yes | 13 | 10 | 0.1 | NS |
| No | 7 | 9 | | |
| Total | 20 | 19 | | |

**Table 3: Time in Days to Presentation in the two Groups.**

| Group | Mean Time (in days)±Standard deviation | p-value | Statistical Significance |
|---|---|---|---|
| Mini Open Repair | 27.5±13.5 | 0.8 | NS |
| Arthroscopic Repair | 28.4±11.69 | | |

**Table 4: Size of Lesion in the two Groups.**

| Size of lesion | Mini Open repair (n) | Arthroscopic Repair (n) | p-Value | Statistical significance |
|---|---|---|---|---|
| Large | 10 | 11 | 0.68 | NS |
| Medium | 7 | 4 | | |
| Small | 3 | 4 | | |
| Total | 20 | 19 | | |

**Table 5: UCLA Preoperative Score.**

| Group | UCLA Pre-op score±Standard deviation | p-value | Statistical Significance |
|---|---|---|---|
| Mini Open Repair | 23.6±2.66 | <0.05 | Significant |
| Arthroscopic Repair | 19.84±3.8 | | |

**Table 6: UCLA Preoperative Classification**

| UCLA Classification | Mini Open repair (n) | Arthroscopic Repair (n) | p-Value | Statistical significance |
|---|---|---|---|---|
| Fair | 19 | 10 | < 0.05 | Significant |
| Poor | 1 | 9 | | |
| Total | 20 | 19 | | |

**Table 7: UCLA Post-Operative Score**

| Group | UCLA Postop score±Standard Deviation | p-value | Statistical Significance |
|---|---|---|---|
| Mini Open Repair | 38.55±5.31 | 0.07 | NS |
| Arthroscopic Repair | 35.68±5.82 | | |

**Table 8: UCLA Post-Operative Classification**

| UCLA Classification | Mini Open repair (n) | Arthroscopic Repair (n) | p-Value | Statistical significance |
|---|---|---|---|---|
| Excellent | 7 | 3 | 0.13 | NS |
| Good | 13 | 13 | | |
| Fair | 0 | 3 | | |
| Total | 20 | 19 | | |

**Table 9: Comparison Between Size of Lesion and UCLA Postoperative Classification.**

| Size of lesion | Excellent (n) | | Good (n) | | Fair (n) | | p-Value | Statistical significance |
|---|---|---|---|---|---|---|---|---|
| | MOR | AR | MOR | AR | MOR | AR | | |
| Large | 0 | 0 | 10 | 8 | 0 | 3 | 0.68 | NS |
| Medium | 4 | 0 | 3 | 4 | 0 | 0 | | |
| Small | 3 | 3 | 0 | 1 | 0 | 0 | | |
| Total | 10 | 26 | 3 | | | | | |

**Table 10: Change in UCLA Score by Group.**

| Group | Pre-op UCLA Score | Post-op UCLA Score | UCLA Difference | P Value | Statistical significance |
|---|---|---|---|---|---|
| Mini-open | 23.6 | 38.55 | 14.95 | 0.52 | NS |
| Arthroscopic | 19.84 | 35.68 | 15.84 | | |

association between Pre-op and Post op UCLA score

In our study, the mean pain score for MOR, AR was 2.6 and 2.3, the mean function score was 2.45 and 2.2, the mean flexion score was 2.65 and 2.5, the mean abduction score was 2.15 and 2.15, the mean external rotation score was 2.2 and 2.26, the mean strength score was 11.3 and 8.3 respectively.

In our study, the mean pain post op score in MOR and AR group was 6.6 and 5.3, the mean function score was 5 and 4.8, the mean flexion score was score was 3.3 and 3.15, the mean abduction score was 3.15 and 3.31, the mean external rotation score was 3.25 and 2.89, the mean strength score was 12.75 and 11.6, the mean patient satisfaction score was 4.5 and 4.47 respectively.

In our study, preoperatively there was significant p value in strength and overall preoperative UCLA score between MOR and AR group. This association had no significance postoperatively.

In our study, the mean age in Mini-open repair group and Arthroscopic repair group was 54.3 and 48.95 years respectively. Similar to our study Zhang[3] reported a mean age of 54.2 and 53.9 in Mini-open and Arthroscopic group respectively.

In our study, Mini-open repair group had male and female of 55% and 45% respectively. In Arthroscopic

repair group, male were 52.6%, females were 47.4%. Zhang[3] studied 53 in Mini-open, of which 49.1% were female, 50.9 were male, In Arthroscopic group of 55 patients, 49% were female, 51% were male.

Out of 20 patients in Mini-open repair group, 13 patients (65%) had trauma history, 7 patients (35%) had degenerative cuff tear. Out of 19 patients I Arthroscopic repair group, 10 patients (52%) had trauma history, 9 (48%) patients had degenerative cuff tear. In a study by Dennis Liem[4], trauma history was present in 31% in Mini-open, 52.6% in arthroscopic group. The mean time of duration to present for Mini-open group, Arthroscopic group was 27.5 days and 28.4 days. Overall, time period was between 8 days to 58 days. In a study conducted by Dennis[4], average duration of symptoms for Mini-open group was 5 months and 6.6 months for Arthroscopic group. Of 20 patients in Mini-open group, 10 (50%) patients had large tears, 7 (35%) patients had medium tear and 3 (15%) patients had small tears. Of 19 patients in Arthroscopic repair group, 11 (57%) patients had large tears, 4 (21%) patients had medium tears and 4 (21%) patients had small tears. In a study by E. Buess[5], in Mini-open 37% were small tears, 30% were medium, 30% were large size, in Arthroscopic group, 35 % were small, 26% were medium, 37% were large size tears.

In our study, preoperative UCLA score of Mini-open repair and Arthroscopic group was 23.6 and 19.84 respectively. 'P' value was <0.05, hence it is significant. Severud[6], in a study had preoperative UCLA score of Mini-open and 14.9 in Arthroscopy group.

Out of 20 patients in Mini-open repair group, 19 patients were classified as fair, 1 patient was classified as poor in UCLA preoperative classification Out of 19 patients in Arthroscopic repair group, 10 patients were classified as fair, 9 patients were classified as poor. 'P' value was <0.05, hence it is significant.

Post-operative UCLA score in Mini-open repair and Arthroscopic repair group was 38.55 and 35.68. Severud 6 in a study had post-operative UCLA score of 42 in Mini-open and 39 in Arthroscopy group. It is found similar to our study.

Of 20 patients post operatively, in Mini-open repair group, 7 (35%) patients had excellent results, 13 (65%) patients had good results. Out of 19 patients post operatively, in Arthroscopic repair group, 3 (15%) patients had excellent results, 13 (68%) patients had good results and 3 (15%) patients had fair results. In a study by Burkhart 7 91% patients had excellent to good results in Mini-open group and 84% patients got excellent to good results in Arthroscopy.

In Mini-open group, there was a change of 14.95 in UCLA score from pre-op to post op. In Arthroscopic group, there was a change of 15.84 in UCLA score from pre-op to post op. In a study conducted by Junji Ide[8] there was a change of 15.9 in Mini-open group, there was a change of 16.1 in Arthroscopic group.

In AR group there was initial low pre-operative UCLA score, long history of symptoms, more degenerative tears when compared to MOR group. Post-operatively the overall the increase in UCLA score was more when compared to MOR. In a study the patients with bad results also all had a long history of symptoms, which may point to tendinous degeneration. This finding is supported by Cofield[9], who demonstrated that early surgical intervention (within 3 weeks) following the initial trauma gives better clinical results when compared with the patients who underwent late intervention (6-12 weeks).

In a similar study by Severud[6], AR group was 32.6 and in the MOR group was 31.4. In the Arthroscopic group, 32 of 35 (91%) had an excellent or good result (UCLA scores, 28- 35) i.e, satisfactory, 3 (9%) patients had fair results, unsatisfactory. In the mini-open group 27 of 29 (93%) had an excellent or good result, satisfactory, 2 patients (7%) had unsatisfactory.

The clinical success rate in patients included in our study was 92%. It is more or less comparable to the other similar published studies. Rebuzzi[10] showed satisfactory results of 81.4 %, whereas, Boileau[11], showed satisfactory results of 92 %.

Several authors have noted that the rotator cuff surgery appears to be more effective for pain relief than for improvement in strength and function Bigliani[10]. The pain score in our study was improved significantly in MOR and AR group from a mean of 2.6 and 2.3 points preoperatively to a mean of 6.6 and 5.3 points postoperatively. The improvement of the pain score in our study was nearly similar to that reported by Boileau[11], where the pain was also improved significantly from a mean of 2.1 points preoperatively to a mean of 9.1 points postoperatively.

The function score in our study was improved significantly in MOR and AR group from a mean of 2.45 and 2.2 points preoperatively to a mean of 5 and 4.8 points postoperatively. Similar reports of significant functional improvement following arthroscopic repair of cuff tears were published by Boileau[11].

The range of forward flexion, Abduction, External rotation and Strength was significantly increased in MOR and AR group from a mean of 2.65,2.5 points, 2.15,2.15 points, 2.5,2.2 points, 11.3, 8.3 preoperatively to a mean of 3.3, 3.15 points, 3.15, 3.3 points, 3.25, 2.89 points, 12.7, 11.6 points postoperatively respectively. Similarly, Gartsman[12] reported significant improvement in the forward flexion which improved from a mean of 3.7 points preoperatively to a mean of 4.9 points postoperatively. On the other hand, although Boileau[11] reported

improvement in the forward flexion, however, this improvement was not statistically significant.

In the present study 90% of the patients in MOR group, 89.1% were satisfied at the time of the follow-up. The patient's satisfaction published by Gartsman[13], was 90%.

In analysis of preoperative and postoperative UCLA score in both groups, revealed a mean pre-operative score of 23.6±2.66 in the MOR and 19.84±3.8 in the AR group. Postoperatively, both groups had an increase with a mean score of 38.55±5.31 in the MOR and 35.6±5.82 in the AR group. There was significant p value in overall preoperative UCLA score between MOR and AR group. This association had no significance postoperatively between both groups. Similar results in a study done by Köse[13] were UCLA shoulder evaluation revealed a mean pre-operative score of 10.6±4.5 in the MOR and 11.2±5.6 in the AR group. Postoperatively, both groups had an increase with a mean score of 28.8±3.4 in the MOR and 29.76±4.5 in the AR group. The pre and postoperative UCLA scores were not significantly different between groups but the difference was statistically significant within each group ($P<0.01$).

## CONCLUSION

The repairs on rotator cuff injuries presented good results by means of both Mini-open surgery and Arthroscopy, independent of the size of the lesion (small, medium or large) with similar functional results in the two groups after a minimum follow-up of 4 months. There is statistically no significant difference in functional outcome amongst males and females undergoing Arthroscopic and Mini-open rotator cuff repair.

Advantages of Mini-open rotator cuff repair, the tears could be easily visualized and repaired appropriately. The quality of repair is good especially large tear. Low cost of surgery. Easy to master and reproduce at multiple centers. Involves less surgical time.

Advantages of arthroscopic rotator cuff repair include, we can see both sides of cuff, diagnose any intra-articular pathology-labral tears, biceps, OA etc. that can affect the end results, a small cosmetic scar, reduced early postoperative pain and deltoid muscle preservation that allows early and easier postoperative rehabilitation.

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