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Arthroscopic Vs Mini-open Rotator Cuff Repair: A Comparison of Clinical Outcomes

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Abstract
Purpose: This study compares the functional outcome of arthroscopic and mini-open rotator cuff repair in patients who underwent repair of full thickness rotator cuff tear in various size tears between 2006 and 2013with minimum 2 years follow-up. **Type of study**: prospective case series. **Method:** All patients were assessed clinically and by using UCLA (University of California, Los Angeles) score and Oxford score both preoperative and postoperative after 2 years. Patients have been divided into 2 groups; one have tears <3 cm and the other with tear >3cm. Exclusion criteria patients who had acromioclavicular arthritis, subscapularis tear, or instability. Repair was done using suture anchor. **Results:** Both *UCLA and Oxford scores* for both groups show significant improvement after 2 years with improvement in shoulder function but no difference between types of surgery with any tear size. **Conclusion**: There are improvement in both groups arthroscopic and arthroscopically assisted mini-open in both range of motion and scores of the shoulder, with no difference between two surgical methods. **Level of Evidence:** level III case comparative study.

Keywords: Rotator cuff tear-arthroscopic surgery-mini open- shoulder surgery.

1. Introduction
The all-arthroscopic rotator cuff repair has increased in popularity over the past several years, paralleling improvements in arthroscopic instrumentation and technique. The arthroscopic technique provides several potential advantages over the mini-open repair, which include decreased trauma to the deltoid, improved visualization and mobilization of large tears, and less postoperative patient discomfort, with decreased morbidity and earlier return of motion [1]. A major potential disadvantage is the technical difficulty of the procedure. Recent studies reporting good functional results after all-arthroscopic repair have validated the increasing popularity of the arthroscopic technique [1].
This study compares the clinical outcome after all-arthroscopic repair (AAR) and mini-open rotator cuff repair (MOR) in a series of patients after 2years of follow-up.

Material and methods
Patients with rotator cuff tear diagnosed by clinical evaluation and MRI for the affected shoulder were included in this study with exclusion of instability of the shoulder, acromioclavicualr arthritis, subscabularis tear and retracted atrophic muscle at glenoid rim in MRI. Function assessment of the flexion, abduction and external rotation range together with UCLA (University of California, Los Angeles) [2, 3] and Oxford [4] score preoperative and two years postoperative were done.

Surgical technique
After induction of general anesthesia and keep systolic blood pressure at 100 mmHg, arthroscopic pump at 60 mmHg, patient put in beach chair position, with protection of cervical spine and padding of bone prominence, posterior portal used at 2 cm below and medial to acromial angle, glenohumeral joint entered for diagnosing of intra-articular lesions, condition of the cartilage, biceps tendon and size of rotator cuff tear. After assessment of the cuff the scope changed to a posterolateral portal about 1 cm lateral to acromial angel to enter the sub-acromial space, next anterior portal about 1 cm lateral and inferior to acromial tip and another lateral portal about 1 cm below the acromial edge at a line just passing posterior to the acromiclavicular joint were done, bursectomy done to free the subacromial space from adhesions then assessment done for the shape of the acromion, cuff tear and mobility of the cuff, in large tears interval release either anterior alone or anterior and posterior together may be needed, if still no mobility present we usually shift for open procedure and repair it by open method, subacromial

decompression was done in all cases in this study, next the greater tuberosity was prepared at foot print of the rotator cuff using light shaving, the angel and point of insertion of the anchor assessed using spinal needle, in this study variety of anchors were used either metal one (fasten RC anchor from Mitek) or biodegradable one (Spiralock from Mitek) and usually one to two anchors used in tears <3 cm and two or more in tears >3cm.

In mini open the previous procedure used up to insertion of the anchor then open incision done longitudinal by extending the lateral portal 3 cm downward, split the deltoid fascia and muscle in direction of its fibers, with care not to injure of the axillary nerve, anchors inserted directly in the bone with repairing the rotator cuff tendon as usual as in arthroscopic technique. In closure of the wound, Vicryl used to repair the muscle and close the skin as usual. Portals injected with local anesthetic and no suction used in the joint. Patients have broad arm sling with the arm beside the patient no abduction Pillow needed.

Four patients had fried biceps tendon in this study and they were above 60 with large tear, biceps tenotomy was done with no consequences in all patients.

Postoperative Rehabilitation

Rehabilitation of the patients start next day postoperative with active motion for wrist and elbow, pendulum motion for the shoulder, no active or active assisted motion allowed, then after 10 days stitches removed and passive motion allowed up to 90° abduction and forward flexion in tears <3 cm, 60° in tears >3 cm for 6 weeks, shift to gradual full abduction and flexion over next 3 months, we start active assisted motion after 2 months of operation and strengthening exercise start after 4 months for tears <3 cm, 6-8 months for tears >3 cm.

SPSS version 16 program was used to analyze results and Mann-Whitney test and Wilcoxon signed rank test for functional assessment of shoulder range of motion, UCLA and Oxford scores, statistical significance was determined at a *P* value less than 0.05.

Results

In this study seventy six patients were operated upon, five patients failed to continue the study for full two years. Seventy one patients (71 shoulders) have surgery from 2006 to 2013, 36 men and 35 women with mean age of 49.2 years (range 31 to 69 years)divided into 2 groups according to tear size to group I tears<3 cm (small to medium tear) and group II tears >3 cm (large to massive tear)with mean duration of complain 6 months for tears< 3 cm (range from 3-12 months) and for tears > 3 cm 9 months (range from 6-28 months).

We have 34 with full arthroscopic repair and 37 mini open, in arthroscopic repair group there are 18 crescent shape tear, 12 U- shape,3 L-shape and 1 complex tears. In mini open repair we have 17 crescent shape tear, 11 U-shape, 6 L-shape and 3 complex tear.

Preoperative data

For group I (tears <3 cm) preoperative flexion range for 20 patients repaired arthroscopic was 167.14°±15.4°,Abduction 166.2°±15.3° external rotation was 53°±1.6° and preoperative flexion range for 19 patients repaired with mini open was165.10°±15.4°,Abduction 166.10°±14.9° external rotation was 53°±1.6°. Preoperative UCLA score for arthroscopic and mini open was 8.75±2.12, 9.05±1.81 respectively. Preoperative Oxford score was 37.85±2.11, 37.42±1.07 respectively

For group II (tears >3 cm) Preoperative flexion range for 14 patients repaired arthroscopic was 80.20°±29.8, Abduction 80.10°±29.7° external rotation was 53°±1.4° and preoperative flexion range for 18 patients repaired with mini open was 82.41°±29.81°, Abduction 81.9°±29.79° external rotation was 53°±1.4°. Preoperative UCLA score for arthroscopic and mini open was 10.00±5.22, 9.22±2.10 respectively. Preoperative Oxford score was 38.36±4.96, 37±1.82 respectively. **Table 1**

Table 1: Preoperative Data

	All Arthroscopic repair	**Mini open repair**	**P value**
Tears< 3cm			
No.	20	19	
Flexion	167.14±15.4	165.10±15.4	0.330
Abduction	166.2±15.3	166.10±14.9	0.886
External rotation	53±1.6	53±1.6	0.509
UCLA[1]	8.75±2.12	9.05±1.81	0.348
Oxford	37.85±2.11	37.42±1.07	0.301
Tears > 3cm			
No.	14	18	
Flexion	80.20±29.8	82.41±29.81	0.368
Abduction	80.10±29.7	81.9±29.79	0.217
External rotation	53±1.4	53±1.4	0.052
UCLA	10.00±5.22	9.22±2.10	0.421
Oxford	38.36±4.96	37±1.82	0.452

Postoperative data

For *group I* flexion for arthroscopic and mini open was 170.30°±10.3°, 170.24°±9.8° *(P=0.078)*, Abduction 169.98°±10°, 169.97°±9.8° *(P=0.077)* and external rotation was 79.2°±2.0°, 78.9°±1.9° *(P=0.067)*.UCLA was 27.55±0.76, 27.16±0.37 *(P=0.006)*. Oxford score was 13.15±0.67, 13.68±0.67 *(P=0.581)*.

For *group II* flexion for arthroscopic and mini open was 167.14 ± 15.41°, 165.00 ± 15.43° (*P=0.693)*, Abduction 167.14 ± 15.41°, 165.00 ± 15.43° *(P=0.693)* and external rotation was 87.14 ± 4.69°, 80.00 ± 9.70° *(P=0.019)*.UCLA was 25.45±1.07, 25.17±1.1 *(P=0.006)*. Oxford score was 14.14±1.36, 14.44±1.54 *(P=0.064)*.

Table **2**

Table 2 : Postoperative data

	All Arthroscopic repair	**Mini open repair**	***P* value**
Tears < 3 cm			
Flexion	170.30±10.3	170.24±9.98	0.078
Abduction	169.98±10	169.97±9.8	0.077
External Rotation	79.2±2.0	78.9±1.9	0.067
UCLA	27.55±0.76	27.16±0.37	0.006
Oxford	13.15±0.67	13.68±1.67	0.581
Tears > 3 cm			
Flexion	167.14 ± 15.41	165.00 ± 15.43	0.693
Abduction	167.14 ± 15.41	165.00 ± 15.43	0.693
External Rotation	87.14 ± 4.69	80.00 ± 9.70	0.019
UCLA	25.45±1.07	25.17±1.1	0.006
Oxford	14.14±1.36	14.44±1.54	0.064

Complications

Stiffness present in three patients with tears >3 cm after 6 months of mini-open reapir which were treated by

manipulation under anesthesia. One patient with retear occur due to early weight lefting after 5 months of arthroscopic repair of large tear, he had re-repaired using arthroscopy with close follow up with good out-come after 2 years.

Discussion

Several studies [5-16] were done to compare the outcome of all arthroscopic and mini-open surgery on full- thickness rotator cuff tear with no significance in function outcome of shoulder joint, however in some studies, for example Kim *et al* [5]. found that patients with large tears showed lower shoulder scores and less predictable recovery of strength and function in comparison with medium size tears regardless type of operation done.

Also Severud *et al* [6]. found improvement of motion in arthroscopic group early than mini-open group at 6 and 12 weeks postoperative but at final follow-up (2 years) no difference of motion at end of study between the two operation.

Thomas *et al* [11]. have four patients with revision surgery (one in arthroscopic group and 3 in mini-open group) and 2 require manipulation under anesthesia in arthroscopic repair.

Warner *et al* [10]. found improvement in strength in arthroscopic group than the mini-open group, but no patient had less than 4/5 strength in mini-open group.

Ide *et al* [8]. found that patients with large- massive tear were significantly lower in scores than patients with small-medium size tear with no difference between arthroscopic and mini-open. Patient satisfaction, in small-medium tear was higher in arthroscopic than mini-open 97% and 94.6% respectively. Patients with large- massive tear satisfaction was 82.4% and 76.9% for arthroscopic and mini-open respectively.

Andreas *et al* [9]. found maximum improvement occurs in the first year in arthroscopic group with no difference after 2 years between the 2 types of operations.

Bishop *et al* [12]. assessed postoperative integrity and outcome of arthroscopic repair with open repair after 1 year of operation. In arthroscopic group patients with intact repair had significant greater strength in elevation and external rotation, with twice retear in large tear after arthroscopic repair. Also external rotation was more powerful in open repair of large tear.

Eduard *et al* [7]. show that both groups have improvement postoperative, with arthroscopic group show more pain relief, and high patient satisfaction rate of 92.4% versus 80% in open group.

Verma *et al* [13]. found patients with tear larger than 3 cm there were 7 times more likely to have a recurrent defect on ultrasound follow-up. Although patients with persistent defect had statistically significant deficits in strength on forward elevation and external rotation when compared with those with a normal shoulder, there was no difference regarding pain or outcome scores.

Kang *et al* [14]. showed improvement in both groups but pain score at 6 months were better for arthroscopic repair.

Philip *et al* [15]. MRI show 3 patients with discontinuity of the tendon in both groups, 9 patients in arthroscopic group have thinning of the tendon while 6 patients in mini-open have thinning of the tendon which does not affect the outcome or function of the patients.

Peer *et al* [16]. studied patients with small-medium tears and show improvement in pain and forward flexion in arthroscopic group at 6 week follow up with retear seen using ultrasound in 8 patients in arthroscopic group (17%) and in 6 patients with mini-open (13%). Adhesive capsulitis present in 5 patients with arthroscopic repair (11%) and in 6 patients with mini-open (13%).

Drawbacks

Some drawbacks present in this study which is:

- No randomizations present, selection of operation occur when surgeon was able to do full arthroscopic repair or change to mini-open when facing difficulties in handling the suture in arthroscopy.
- No muscle strength measurement present in this study.
- MR arthrography and ultrasound were not used to assess the integrity of rotator cuff repair, or at follow up.

Conclusion

Our study showed that patients with full thickness tear have improvement in functional outcome after surgical repair using either full arthroscopic or mini-open, with statistical improvement in external rotation in tears >3 cm with full arthroscopic repair, but no significant functional difference between types of surgery.

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