Arthroscopic assisted mini-open rotator cuff repair outcome measures

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Background
Rotator cuff injuries are considered the most common tendon injuries in adults, overall. Rotator cuff injury is a common cause of shoulder pain and disability and becomes more common with advancing age. Most symptomatic rotator cuff disease is seen between fifth and sixth decades. Rotator cuff tear are associated with pain and weakness and can result in significant disability, it is also known that asymptomatic rotator cuff tears exist in a large percentage of patients, and asymptomatic tears increases with increasing age
The primary advantage Arthroscopic assisted Mini-open repair of the rotator cuff tear is the avoidance of passing and tying complex techniques of arthroscopic suture, it creates less surgical trauma, facilitating early hospital discharge and decreasing postoperative pain. Thus, this study aimed to evaluate outcome measures and post operative complications of arthroscopic assisted mini open rotator cuff repair.
Patients and Methods
A prospective case series study was performed on 20 patients started may 2017 till may 2019. The technique is not technically demanding than all-arthroscopic repair while still having the advantages of arthroscopic repair. These include the ability to perform diagnostic arthroscopy, preservation of the origin of the deltoid, rapid hospital discharge, less postoperative pain, and accelerated rehabilitation. Mini-open repair seems to be equivalent to all-arthroscopic repair in multiple nonrandomized comparative studies, and a randomized trial is underway to formally address this question.
Results
A total of 20 patients 11 (55%) males and 9 (45%) females were included in this study with mean age of 58.00±9.17 years. There was high significant gradual improvement in Modified UCLA shoulder scale among the studied patients at 1, 3 and 6 months postoperative follow up compared to preoperative. Post operative complications were found in 6 patients. Three cases (15 %) had Stiffness, and the other 3 cases (15 %) had superficial wound infection. A were significant correlations between Modified UCLA shoulder scale with Age, operative time and postoperative complications. While, there were no significant correlations with gender or side. our study concluded that, surgery for rotator cuff tears improves self-reported patient outcomes and has a lasting and durable result at an average of fifteen years after surgery.
Conclusion
Arthroscopically assisted mini-open technique for rotator cuff repair is an excellent approach for repair of a torn rotator cuff. Surgery for rotator cuff tears improves self-reported patient outcomes and has a lasting and durable result.

Keywords:
Arthroscopic, cuff repair, miniopen, UCLA

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Introduction

Rotator cuff injuries are considered the most common tendon injuries in adults, overall. Rotator cuff injury is a common cause of shoulder pain and disability and becomes more common with advancing age [1]. Most symptomatic rotator cuff diseases are seen between fifth and sixth decades. Rotator cuff tears are associated with pain and weakness and can result in significant disability [2]. It is also known that asymptomatic rotator cuff tears exist in a large percentage of patients, and the prevalence of asymptomatic tears increases with increasing age [3]. The cause of a rotator cuff tear is most likely related to a combination of several factors including impingement against the subacromial arch, age-related degeneration, overuse, and following

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trauma [4,5]. Different types of rotator cuff tears are partial rotator cuff tears, which is a damaged rotator cuff tendon but is not torn all the way through [6]. This is also called a partial-thickness tear. Complete rotator cuff tear is when you have a soft tissue that tears into two different pieces. Often the tendons tear away from the upper arm bone. A full-thickness tear does not heal by itself, as the muscles pull the tear's edges apart. However, it is possible for a partial or full-thickness tear to stabilize and leave the shoulder with reasonable function and comfort [7]. Acute tear is caused by an injury when one lifts a heavy object or falls on outstretched hands. Shoulder injuries, such as a dislocated shoulder or broken collarbone, can also cause an acute rotator cuff tear [8]. Degenerative tear of the cuff is caused by genetics and specific health conditions like high cholesterol and diabetes. Because of this, the patients' dominant side is more likely to get a rotator cuff tear because he tends to use it more, and it experiences repetitive stresses. Degeneration also increases naturally with advancing age, increasing the chances of injury over time [9]. Cofield classified rotator cuff tears according to the tear size into small less than 1 cm, medium 1–3 cm, large 3–5 cm, and massive more than 5 cm. Full-thickness rotator cuff tears were classified by Ellman and Gartsman [10] according to the tear morphology into crescent reverse L, L shaped, trapezoidal, and massive tear full-thickness rotator cuff tears (Fig. 1).

The rationale for repairing the rotator cuff is derived from multiple published studies demonstrating functional improvement and pain reduction after rotator cuff repair and rehabilitation [11]. Although complete healing of the tendon does not occur in all cases, rotator cuff repair is a beneficial procedure for relieving pain, improving strength, and improving range of motion. The earliest report of rotator cuff repair comes from Codman [12]. Since then, many studies have demonstrated good outcomes with improved pain and function following formal open repair of the rotator cuff with subacromial decompression and acromioplasty [13]. The method by which the cuff is repaired has changed during the past two decades, with a movement toward minimally invasive techniques (arthroscopic assisted mini-open and arthroscopic repair). The arthroscopic assisted mini-open or deltoid-splitting approach to the rotator cuff is a well-characterized procedure with excellent outcomes and is a successful method of rotator cuff repair [14].

The ability to visualize the anatomy of the shoulder through the arthroscope inevitably led to strategies to treat rotator cuff tears by less-invasive techniques [15]. Before arthroscopy, rotator cuff tears were treated by open repair with approaches that violated the deltoid insertion on the acromion [16,17]. The deltoid was detached from the acromion to perform an acromioplasty and repaired to the acromion at the end of the procedure; this approach carried the risk of deltoid avulsion [18]. The primary advantage of arthroscopic assisted mini-open repair of the rotator cuff tear is the avoidance of passing and tying complex techniques of arthroscopic suture; it creates less surgical trauma, facilitates early hospital discharge, and decreases postoperative pain [19]. Thus, this study aimed to evaluate outcome measures and postoperative complications of arthroscopic assisted mini-open rotator cuff repair.

Figure 1

Classified rotator cuff tear according to the tear morphology [10].

Patients and methods

A prospective case series study was conducted that included 20 cases, comprising 11 (55%) males and nine (45%) females, with a mean age of 58.00 ± 9.17 years. Most of patients (80%) had right-side affection and the affected shoulder was dominant. The study was conducted from June 2019 till June 2020, with a mean follow-up period of 12 months after obtaining approval from the local ethics committee and gaining signed informed consent from individuals who agreed to participate after explanation the trial benefits and hazards. All cases had been treated in Health Insurance Hospital and Helwan University hospitals.

Operative procedure

All patients were placed supine on the operating table. Regional anesthesia was administered, typically an interscalene block or general anesthesia. Once adequate anesthesia was given, an examination under anesthesia was done to check full range of motion. Stiffness may develop in patients with rotator cuff tears, making it important to document adequate range of motion before the start of the procedure. If the patient had a stiff shoulder, a manipulation under anesthesia was performed to release adhesions. The patient was then ready for positioning in the beach chair position.

In this position, the buttocks were the most dependent position, ensuring that the patient was stable and did not slip down the table. The surgeon had adequate access to the posterior shoulder to the medial border of the scapula and the anterior shoulder to the mid-clavicle. The head was held in place with a head holder (Fig. 2). The shoulder was prepared and draped as for arthroscopy. A complete diagnostic arthroscopy was done, and the presence of a cuff tear was confirmed and associated pathology addressed. The lateral arthroscopy portal incision was then extended, and the deltoid was split, exposing the cuff tear. The shoulder is draped with care taken to ensure exposure of the widest area, especially posteriorly. A standard posterior portal is created. Finding the correct position of this portal in the medial-lateral direction may be done by feeling the notch in the spine of the scapula, which is usually about 2 cm medial to the posterolateral corner of the acromion. The portal was then placed about 2 cm inferior to this point (Fig. 3). A blunt trocar was used to penetrate the posterior capsule, and diagnostic arthroscopy was begun (Fig. 4).

A thorough diagnostic arthroscopy was then performed. The glenohumeral joint was examined for

Figure 2

Position of the patient in a semisitting position.

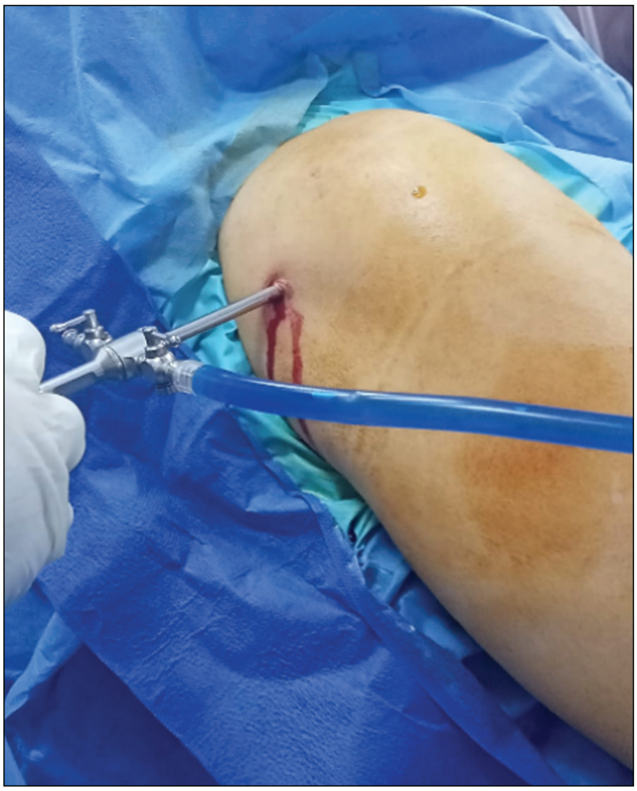
Figure 3

A standard posterior portal is created about 2 cm medial to the posterolateral corner of the acromion.

lesions and cartilage loss. The labrum was inspected and examined along with the biceps tendon (Fig. 5). The defect in the cuff was marked with a percutaneously placed spinal needle, especially for a partial-thickness tear. A suture was advanced through the needle into the glenohumeral joint, allowing easier identification during the subacromial portion of the procedure and during the open repair. The arthroscope was then removed from the glenohumeral joint (Fig. 6). Once in the subacromial space, an anterolateral portal was created 2 cm posterior and inferior to the anterolateral border of the acromion. The position of this portal may be modified to center it over the rotator cuff tear, which may be facilitated by the previously placed marking needle (Fig. 7).

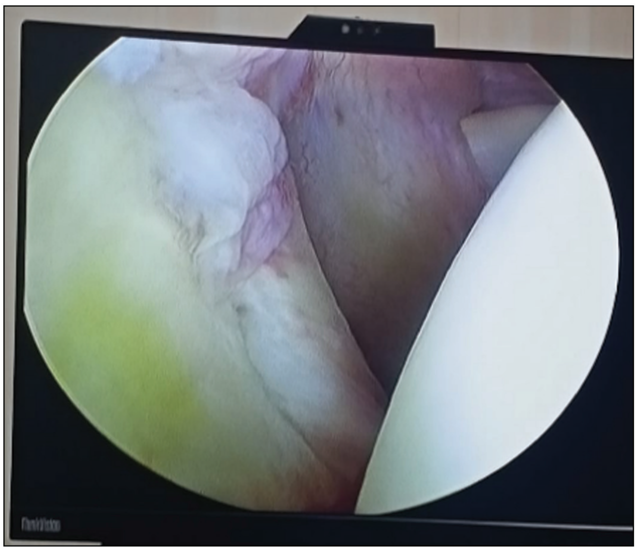
There has been some controversy about the necessity of performing a subacromial decompression in the presence of a rotator cuff tear. In this study, we routinely performed a subacromial decompression and performed an acromioplasty before cuff repair. Debridement was done to the edges of the tear in the subacromial space. Bursectomy, especially laterally, will facilitate visualization during the procedure. The tendon

Figure 4



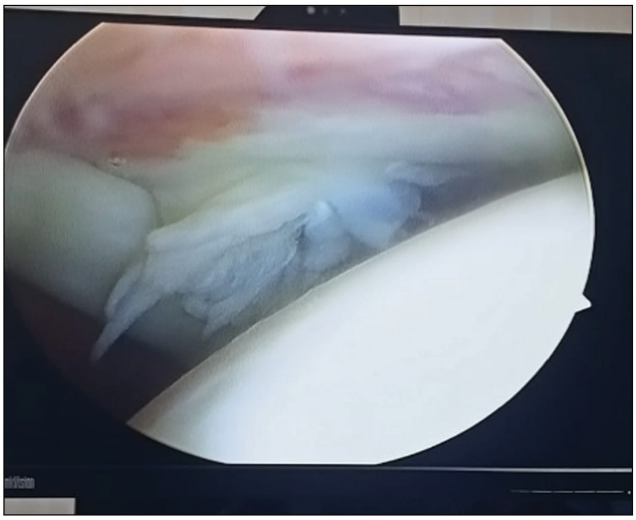
A blunt trocar is used to penetrate the posterior capsule.

Figure 5



The glenohumeral joint with intact labrum.

Figure 6



The arthroscope view of articular rotator cuff tear.

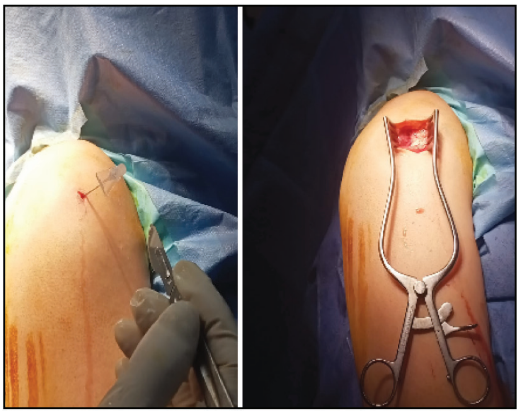
Figure 7

Marking needle in the rotator cuff tear.

edges are lightly debrided. At this point, a needle may be placed through the edge of the cuff, and attention turned to exposure of the rotator cuff. A 3–4 cm skin incision was made from the anterolateral edge of the acromion distally, and dissection was made to the raphe between the anterior and middle deltoid (Fig. 8).

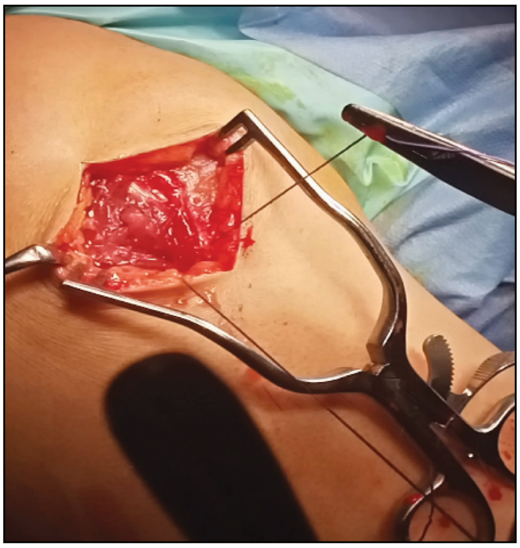
A stay suture was placed distally to prevent propagation of the deltoid split and potential injury to the axillary nerve (Fig. 9). Once the deltoid is split, the subacromial space is entered. Blunt self-retaining retractors may be helpful to hold the fibers of the deltoid apart, but care should be taken to avoid excess pressure and deltoid necrosis (Fig. 10). After assessing the adequacy of the acromioplasty by direct digital palpation, we placed a deltoid retractor for direct visualization of the rotator cuff and humeral head (Fig. 11). As the torn tendon was tagged by traction sutures after removing the hypertrophic bursal tissue around the split site to improve visualization (Fig. 12), we confirmed involvement and configuration of the torn tendon by rotating the arm and attempted anatomical reduction on the footprint of the greater tuberosity. After preparing the footprint using a ring curette or rasp (Fig. 13), the torn tendon was repaired by a single row technique using suture anchors (Fig. 14). If pathology of the long head of the biceps tendon was found, tenodesis was performed under direct visualization. Appropriate rotation of the arm is the key to positioning the cuff tear underneath the deltoid split. By varying the position of the arm, different parts of the tendon can be brought into view. If the tear is massive, one or multiple traction sutures

Figure 8



Skin incision of mini open procedure.

Figure 9



Stay suture was placed distally to prevent propagation of the deltoid split.

Figure 10

Blunt split of the deltoid.

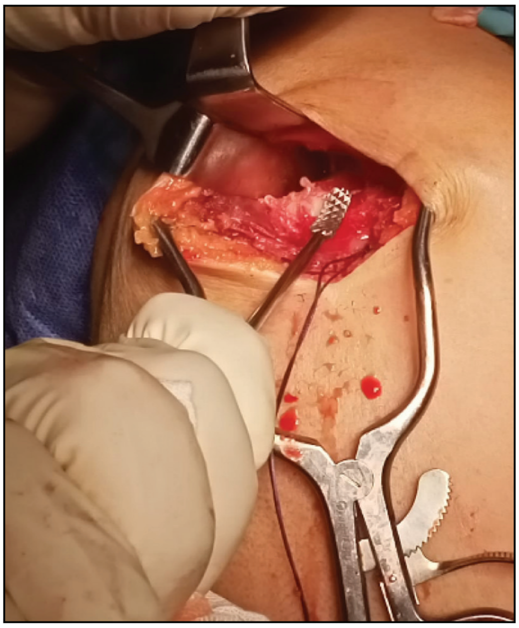
Figure 11

Retracted tendon of rotator cuff.

Figure 12

Removing the hypertrophic bursa.

Figure 13

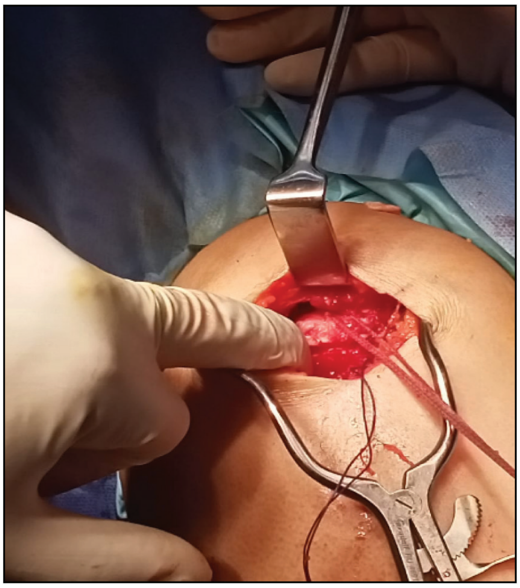


Preparing the footprint of greater tuberosity using a ring curette or rasp.

Figure 14

The torn tendon was repaired by single row technique.

Figure 15



Traction sutures.

using simple stitches can be placed to help mobilize the cuff and allow easier repair (Fig. 15).

Traction on the tendon allows easy release and better excursion of the tendon, Extra-articular adhesions are released, allowing full mobilization of the tendon. The goal is to repair the tendon to bone with no tension while the arm is at the side. Intra-articular adhesions deep to the cuff as well as the coracohumeral ligament may need to be addressed case by case, and they can be transected as necessary. Once adequate mobilization is obtained, the size and shape of the tear are again evaluated. U-shaped tears can be repaired with a combination of side-to-side sutures and bone fixation, whereas crescent-shaped tears are generally repaired directly to the bone. Once side-to-side sutures are placed, a smaller cuff edge was attached to the bone (Fig. 16). Bony fixation can be accomplished either through transosseous tunnels or anchors. Anchors are placed in the 'footprint' of the cuff or anatomic insertion, and their position is chosen to allow an even repair of the tendon edge without excessive tension on one portion of the cuff (Fig. 17). Once the cuff has

Figure 16

Cuff sutures.

Figure 17

Anchors are placed in the "footprint" of the cuff or anatomic insertion.

been repaired, the shoulder range of motion is checked to demonstrate the safe range for rehabilitation. The wound is thoroughly irrigated and the deltoid fascia is meticulously repaired. A subcutaneous and subcuticular closure is performed, and dressings are applied.

All of the 20 patients are discharged on the same day of surgery. They received the same postoperative analgesia and were followed for Constant-Murley score

Figure 18

The cuff has been repaired.

preoperatively, 1 month postoperatively, and 3 months postoperatively. The cuff is repaired with transosseous sutures securely down to the bone. The wound was thoroughly irrigated, and the deltoid fascia was meticulously repaired. A subcutaneous and subcuticular closure was performed, and dressings were applied.

Postoperative protocol

The patient was discharged from the hospital on the day of surgery. The patient was placed in a sling and was allowed out of the sling only for physical therapy and exercises. Passive range-of-motion exercises were begun, and then forward elevation, external rotation, and pendulum exercises were started. Internal rotation was not allowed until healing of the cuff was completed. Elbow and hand exercises were also begun. The patient performed pendulum, elbow, and wrist exercises at home several times a day, whereas passive motion exercises were performed either at home or with physical therapy many times a week. The goal of early rehabilitation was to minimize stiffness without putting tension on the cuff repair. At 6 weeks postoperatively, the sling was removed and active-assisted range-of-motion exercises are added.

Strengthening exercises were begun at 6–8 weeks postoperatively, depending on the size of the tear. A strengthening and stretching program was continued until 6–8 months postoperatively.

Modified University of California, Los Angeles shoulder scale

The patients were assessed postoperatively with the University of California, Los Angeles (UCLA), score. The questionnaire was adapted for self-assessment,

Table 1 Descriptive data of the studied patients (*N*=20)

Descriptive data	Median	Minimum–maximum	Mean±SD
Age (years)	42.00	26.00–68.00	58.00 ± 9.17
	n	%	
Sex			
Males	11	55	
Females	9	45	
Side			
Right	16	80.0	
Left	4	20.0	
Dominance of affected shoulder			
Dominant	16	80.0	
Nondominant	4	20.0	
Operative time (min)	50.00	50.00–100.00	69.95 ± 14.32

Table 2 Modified University of California, Los Angeles shoulder scale of the studied patients (*N*=20)

UCLA shoulder scale	Preoperative	Postoperative follow-up [*n* (%)]			Total
		1 month	3 months	6 months	
Poor (< 21)	15 (75.0)	1 (5.0)	0	0	16 (20.0)
Fair (22–27)	5 (25.0)	17 (85.0)	10 (50.0)	0	32 (40.0)
Good (28–33)	0	2 (10.0)	10 (50.0)	14 (70.0)	26 (32.5)
Excellent (34–35)	0	0	0	6 (30.0)	6 (7.5)
P[#]	–	<0.001**	<0.001**	<0.001**	–

UCLA, the University of California, Los Angeles score.
[#]*P value* compared 1, 3, and 6-month follow-up versus preoperative using χ^2 test.
**Significant.

Table 3 Postoperative complications among the studied patients (*N*=20)

Postoperative complications	*n*	%
Stiffness 3 cases	3	15.0
Superficial wound infection	3	15.0

and we have previously described the reliability of the UCLA score as a self-assessment tool following rotator cuff surgery. In this scoring system, a maximum of 35 points is possible. A maximum of 10 points is allocated for pain; 10, for function; 5, for active range of motion; 5, for strength of forward flexion; and 5, for overall satisfaction with the operation. Satisfaction with the operation is scored as 5 for satisfied or better and as 0 for dissatisfied or worse. This satisfaction score was used in the final analysis of overall satisfaction. The outcome results are categorically reported as excellent (34–35 points), good (28–33 points), fair (21–27 points), or poor (≤20 points).

Outcome of the study

Overall, three cases experienced stiffness, which were dealt with manipulation under excellent results, and three cases had superficial wound infection, where regular dressing was done for 3 weeks.

Statistical analysis

Results were tabulated and statistically analyzed using SPSS, V.25 program (Armonk, NY: IBM Corp.), and two types of statistics were done: descriptive statistics, which included description of data in the form of mean±SD for quantitatively data, and frequency and proportion for qualitative data, and analytical statistics, which included the standard Student *t* test, Fisher's exact test, χ^2 test, and Pearson correlation (r). *P* value less than 0.05 was considered statistically significant.

Results

A total of 20 patients, comprising 11 (55%) males and nine (45%) females, were included in this study, with a mean age of 58.00 ± 9.17 years. Most patients (80%) had right-side affection, and the affected shoulder was dominant. The mean operative time was 69.95 ± 14.32 min (Table 1).

There was a highly statistically significant gradual improvement in the modified UCLA shoulder scale among the studied patients at 1-, 3-, and 6-month postoperative follow-ups compared with preoperatively (P<0.001) (Table 2).

Postoperative complications were found in six patients. Three (15%) cases had stiffness, and the other three (15%) cases had superficial wound infection (Table 3).

Age, sex, operative time, modified UCLA shoulder scale preoperatively and postoperatively, and postoperative complications did not show any significant relations with the dominant side of the affected shoulder (P>0.05) (Table 4).

Table 4 Relation between dominance sides of affected shoulder with demographic data, University of California, Los Angeles shoulder scale before and after operation, and postoperative complications

	Dominance of affected shoulder				FET	*P* value	95% CI
	Dominant side (right) (*N*=16)		Nondominant side (left) (*N*=4)				
Age (years)							
Mean±SD	57.75±9.73		59.0±7.62		*U*=0.277	0.792	–12.42 to 9.92
Sex [*n* (%)]							
Male	8	50.0	3	75.0	0.768	0.381	–
Female	8	50.0	1	25.0			
Operative time (min)							
Mean±SD	69.813±14.33		70.50±16.53		*U*=0.076	0.943	–25.22 to 23.84
Modified UCLA shoulder scale preoperative [*n* (%)]							
Poor (<21)	13	81.25	2	50.0	1.58	0.208	–
Fair (22–27)	3	18.75	2	50.0			
After 1 month [*n* (%)]							
Poor (<21)	1	6.25	0	0.0			
Fair (22–27)	14	87.5	3	75.0	1.28	0.256	–
Good (23–33)	1	6.25	1	25.0			
After 3 months [*n* (%)]							
Fair (22–27)	8	50.0	2	50.0	0.00	1.00	–
Good (23–33)	8	50.0	2	50.0			
After 6 months [*n* (%)]							
Good (23–33)	10	62.5	4	100.0	2.036	0.154	–
Excellent (34–35)	6	37.5	0	0.0			
Postoperative complications [*n* (%)]							
Stiffness	2	12.5	1	25.0	0.00	1.00	–
Superficial wound infection	2	12.5	1	25.0			

CI, confidence intervals; FET, Fisher exact test; *U*, Mann–Whitney test; UCLA, the University of California, Los Angeles score.
*no significance

Table 5 Relation between sex and demographic data, University of California, Los Angeles shoulder scale before and after operation, and postoperative complications

	Gender				χ^2	*P* value	95% CI
	Males (*N*=11)		Females (*N*=9)				
Age (years)							
Mean±SD	58.91±5.59		56.89±12.57		*t*=0.447	0.664	–7.97 to 12.01
Operative time (min)							
Mean±SD	71.64±17.57		67.89±10.13		*t*=0.602	0.555	–9.42 to 16.92
Modified UCLA shoulder scale preoperative [*n* (%)]							
Poor (<21)	9	81.82	6	66.67	0.606	0.436	–
Fair (22–27)	2	18.18	3	33.33			
After 1 month [*n* (%)]							
Poor (<21)	1	9.09	0	0.0			
Fair (22–27)	8	72.73	9	100.0	2.88	0.236	–
Good (23–33)	2	18.18	0	0.0			
After 3 months [*n* (%)]							
Fair (22–27)	5	45.45	5	55.56	0.202	0.653	–
Good (23–33)	6	54.55	4	44.44			
After 6 months [*n* (%)]							
Good (23–33)	9	81.82	5	55.56	1.626	0.202	–
Excellent (34–35)	2	18.18	4	44.44			
Postoperative complications [*n* (%)]							
Stiffness	2	18.18	1	11.11	0.667	0.414	–
Superficial wound infection	1	9.09	2	22.22			

χ^2, χ^2 test; CI, confidence intervals; *t*: independent *t* test; UCLA, the University of California, Los Angeles score.

Table 6 Modified University of California, Los Angeles shoulder scale in relation to clinical data of the studied patients

	Modified UCLA shoulder scale	
	r	*P*
Sex	0.174	0.463
Age (years)	0.392*	0.008
Side	0.289	0.217
Operative time (min)	0.652**	0.002
Postoperative complications	0.707**	0.001

r, correlation coefficient; UCLA, the University of California, Los Angeles score.
*no significance

Age, operative time, modified UCLA shoulder scale preoperatively and postoperatively, and postoperative complications did not show any significant relations with sex (P>0.05) (Table 5).

There were significant correlations between the modified UCLA shoulder scale and age, operative time, and postoperative complications (P<0.05). However, there were no significant correlations with sex or side (P<0.05) (Table 6).

Discussion

Rotator cuff tears are a common pathology associated with degenerative changes in the shoulder joint. They cause significant disability, pain, and poor health status, and their prevalence is increasing within an aging population. Many studies have documented excellent outcomes following rotator cuff repair surgery; however, complications can occur [20]. In the current study, 20 patients, comprising 11 (55%) males and nine (45%) females, were included, with a mean age of 58.00 ± 9.17 years. Most patients (80%) had right-side affection, and the affected shoulder was dominant. The mean operative time was 69.95 ± 14.32 min. In agreement with our results, Shinners *et al.* [21] found an average age of the study group was 51 years (range, 31–72 years) at the time of surgery. There were 29 men and 11 women. The dominant shoulder was involved in 28 (68%) of the 41 cases. Moreover, Eid *et al.* [22] studied eight (66.7%) males and four (33.3%) females, with an average age of 52.3 ± 2.6 years (range, 47–62 years). The right shoulder was involved in 12 (100%) patients, and also the dominant side was involved in 12 (100%) shoulders. Additionally, Kelly *et al.* [23] reported a response rate of 81%. Of those who completed follow-up, 122 (84.7%) patients were right handed and 22 (15.3%) patients were left handed. Overall, 92 (63.9%) patients had surgery on their dominant side, whereas 52 (36.1%) patients had surgery on their nondominant side. No participant had bilateral rotator cuff repair within the study period.

In this study, there was a highly statistically significant gradual improvement in the modified UCLA shoulder scale among the studied patients at 1-, 3-, and 6-month postoperative follow-ups compared with preoperatively. In agreement, Eid *et al.* [22] revealed that using the UCLA scoring system, the final assessment (at a mean of 27.4 months postoperatively; range, 25–42 months) revealed poor results in one (8.3%), good results in seven (58.3%), and excellent results in four (33.4%) patients. As a result, the final overall results were satisfactory (good and excellent) in 11 (91.7%) and unsatisfactory (poor) in one (8.3%) patient. Moreover, the mean value of overall UCLA score, pain score, function score, active forward flexion score, and strength of active forward flexion score significantly improved from 8.8 ± 1.2, 2.1 ± 0.5, 1.8 ± 2.1, 2.4 ± 1.1, and 2.3 ± 2.3 preoperatively to 32.4 ± 2.4, 9.3 ± 2.8, 9.1 ± 4.1, 4.6 ± 3.2, and 4.4 ± 1.6 postoperatively (P<0.05), respectively. In addition, Levy *et al.* [24] reported that 80% of 25 patients (N=20) who underwent arthroscopically assisted, mini-open rotator cuff repair and were monitored for a minimum of 1 year had good or excellent objective clinical results and 96% (N=24) were subjectively satisfied. Shinners *et al.* [21] suggested that an arthroscopically assisted mini-open technique of rotator cuff repair is an excellent alternative to standard open techniques.

On the contrary, Kang *et al.* [18] reported, in a retrospective study of 63 patients treated with mini-open rotator cuff repair and 65 treated with arthroscopic rotator cuff repair, no statistically significant improvements at 6 months in SF-36 general health, role-emotional, and mental health. Moreover, Pearsall *et al.* [25] reported that although there was a significant improvement in clinical outcome from preoperative (UCLA score) to the latest follow-up, the SF-36 was not significantly different postoperatively. These different findings may be related to the size of the tear, which seems to be a determining factor in the functional outcome. Small and medium tears did better than large tears.

Regarding postoperative complications, the present study found postoperative complications in six patients. Three (15%) cases had stiffness, and the other three (15%) cases had superficial wound infection. In this line, Eid *et al.* [22] reported that the postoperative complications included scar at the site of deltoid-split approach in one (8.3%) patient, superficial infection in one (8.3%) patient, who was managed by antibiotics and regular dressings, and finally, postoperative shoulder stiffness in one (8.3%) patient. Moreover, Blevins *et al.* [26] found one patient of the three patients who required further surgery required a revision cuff repair (following a fall onto the operated shoulder), and two required revisions arthroscopic subacromial decompression of soft tissue. All three did well following the second procedure. One additional patient complained of impingement symptoms but declined further surgery. This patient responded moderately well with two subacromial steroid injections.

Age, operative time, modified UCLA shoulder scale preoperatively and postoperatively, and postoperative complications did not show any significant relations with sex or dominance sides of the affected shoulder. In agreement, Kelly *et al.* [23] found a mean age of 63 ± 10.1 years in the dominant group and 62 ± 8.6 years in the nondominant group. There were 48 females and 44 males in the dominant group, with 27 females and 25 males in the nondominant group. The mean overall outcome score was marginally higher in the dominant surgery group, with a mean of 89.8 ± 14.2, compared with a mean of 87.4 ± 17.5 in the nondominant group. Multivariate analysis including age, sex, tear location, tear retraction, assessment to surgery time, and surgery to follow-up time as individual input variables revealed this difference to be nonsignificant (P=0.4). They found no difference in patient-reported outcome measures between dominant and nondominant hand rotator cuff repair at 3-year follow-up. Moreover, Eid *et al.* [22] found no statistically significant difference in the final results among the different age groups (as categorized into decades) (P>0.05), between the male and female patient groups (P>0.05), among the patient groups of different durations of preoperative complaint (as divided into 6-month intervals) (P>0.05), and also, among the patient groups of different mechanisms of injury (P>0.05).

On the contrary, Kelly *et al.* [23] showed that hand dominance was significantly associated with the side of rotator cuff tear (P=0.005). Moreover, Sahni and Narang [27] found that factors such as age, sex, and time for tear to surgery are more consistently cited as having an effect on outcomes. The different results could be explained by the small number of patients included in the different groups of age, sex, duration of preoperative complaint, and mechanism of injury.

The present findings showed significant correlations between the modified UCLA shoulder scale and age, operative time, and postoperative complications. However, there were no significant correlations with sex or side. This is consistent with Kelly *et al.* [23], as univariate analysis found no effect of age, sex, tear location, retraction, assessment to surgery time, or assessment to follow-up time on outcome. Sex did have a significant effect on the outcome score (P=0.03). Moreover, Wolf *et al.* [28] and Montgomery *et al.* [29] compared the results of 50 patients (average age, 58 years) with open repairs with those of 38 patients (average age, 66) with arthroscopic decompression alone at an average 2–5-year follow-up times and found 78 versus 61% satisfactory results. No correlation was identified among size of tear, patient age or activity level, and results achieved with arthroscopic decompression. Moreover, Ogilvie-Harris and Demaziere [30] prospectively studied 45 patients with arthroscopic subacromial decompression versus open rotator cuff repair and found pain relief with both, but better functional scores with cuff repair, although recovery was longer.

A possible explanation is that, as these patients become older, their functional and physical demands decrease, leading to a result perceived by the patient as a satisfactory outcome. Older patients may be able to compensate satisfactorily in the presence of a recurrent or persistent defect in the rotator cuff.

Limitations

A limitation of this study is the short follow-up period of our patients. A second weakness of the study is the lack of imaging to determine cuff integrity, which could provide a better understanding of the natural history of rotator cuff repairs.

Conclusions

Arthroscopically assisted mini-open technique for rotator cuff repair is an excellent approach for repair of a torn rotator cuff. Surgery for rotator cuff tears improves self-reported patient outcomes and has a lasting and durable result. There was high statistically significant gradual improvement in the modified UCLA shoulder scale among the studied patients at 1-, 3- and 6-month postoperative follow-ups compared with preoperatively. Further studies including a larger sample are required to enhance the current findings.

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Conflicts of interest

There are no conflicts of interest.

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