

# Functional Outcomes of Mini-Open Rotator Cuff Repair Surgery: Retrospective, Observational Study

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## Abstract

This study aimed to investigate the functional outcomes of Mini-Open Rotator Cuff Repair compared to Arthroscopic rotator cuff repair surgery. The study included 20 patients, with an average age of 55 years, who underwent either open or arthroscopic rotator-cuff repair surgery. Our data showed that most patients started going back to work and engaging in regular daily activities three months after surgery. In both groups, the patients' range of motion (ROM) was 100% after three months. The CMS score responses increased after 6 months, and similarly, at 12 months, the CMS scores indicate good or excellent outcomes for both groups. Majority of the factors showed statistically insignificant p-values. However, the median ASES score increased as the follow-up months increased in both groups, with significant P-values (0.057, 0.016, and 0.016) for the scores at 3, 6, and 12 months.

**Keywords:** American Shoulder and Elbow Surgeons Score (ASES), Constant Murley Shoulder Score (CMS), Arthroscopic Rotator Cuff Repair (AR), Mini-Open Rotator Cuff Repair (MOR), Rotator Cuff Tear

## Introduction

Shoulder pain is one of the common causes of presentation to Orthopedic clinics. In most cases, the likely cause of this pain is subacromial impingement which incorporates a wide spectrum of pathology ranging from tendonitis and bursitis to rotator-cuff tears and eventually leading to cuff tear arthropathy in advanced cases if left untreated. Therefore, it warrants early diagnosis and proper treatment. [1]

Rotator cuff tears may present with a variety of clinical features including debilitating shoulder pain and decreased range of motion. The objective of rotator cuff repair is to alleviate pain and improve function and strength of the affected shoulder. Ideal repair of the rotator cuff enlists high fixation strength with none to minimal residual gap while conserving mechanical stability under cyclic loading, and allowing adequate healing of tendon on bone at the same time. [2]

First line of treatment for most tears is non-operative management, however, surgical repair is indicated when conservative management fails or in large tears. [3] Surgical repair for Rotator-cuff tears has been cited as a cost-effective treatment. The choice of surgical technique depends on the surgeon, with some preferring arthroscopic & many mini-open technique. Mini-open technique for rotator cuff repair has been the gold standard mode of treatment over the years, with a success rate of about 90% due to stronger suture fixation, potential advantage of decreased deltoid morbidity and a less steeper learning curve for the surgeon compared to the arthroscopic technique. On the other hand, Arthroscopic technique is a newer skill with development of specialized surgical equipment. [1]

The basic idea behind rotator cuff repair is to restore the anatomical foot print of the rotator cuff on the humerus. This principle governs the advances in recent years. Good to excellent results of open rotator cuff repair have been reported (70% to 95%) with pain relief (85% to 100%), when used to treat non-massive tears (<5cm).

On the downside, this procedure has been associated with morbidity such as severe early post-operative pain, detachment and/ or weakness of the deltoid and arthrofibrosis. In the last decade, with the development of less invasive surgical techniques & more specialized equipment, we have progressed towards the mini-open technique. Then with the emergence of arthroscopic technology, modern surgical methods were used to facilitate quicker return to functionality and aim to decrease the severity of immediate post-operative pain. However, surgeons are still stalling to switch to all-arthroscopic repairs, due to concerns about the integrity and strength of repair integrity, functional deterioration, and difficulty in mastering this technique. The basic idea behind rotator cuff repair is to restore the anatomical foot print of the rotator cuff on the humerus. [4, 5].

Many tools are applicable in assessment of shoulder function following rotator cuff repair, be it all arthroscopic, arthroscopic assisted or all open. Number of scoring instruments used to assess the functional outcomes following rotator cuff repair have been documented in literature, however, we will use 2 of these scoring systems in this study. The Constant–Murley Score (CMS) which is used to assess the shoulder function by means of patient reported findings and physical assessment of the range of motion and strength of the shoulder. The American Shoulder and Elbow Surgeons (ASES) Shoulder Outcome Score is yet another tool to assess shoulder function divided in physician and patient assessment domains which evaluates pain, instability, activities of daily living. [6]

## Methodology

The study comprised 20 patients in total, with an age range of 40 to 65 years. All patients who were included in this study came through the outpatient department. The study was a retrospective, observational study that was conducted at Dr. Ziauddin Hospital, Karachi, Pakistan, from July 2016 until June 2021. All patients included in the study had a minimum of 12 months of follow-up.

*Evaluation:* In order to rule out neurological explanations for the observed weakness, the study concentrated on clinically evaluating patients who presented with weakness and shoulder pain. The patient cohort was split into two groups: eight patients in the Arthroscopic repair (AR) group and twelve patients in the mini- open repair (MOR) group. Per-operative findings were noted and recorded, and pictorial evidence was saved.

*Post-surgical Evaluation:* Post-procedure, patients were evaluated at 3-month, 6-month, and 12-month follow-ups via the Constant Murley Shoulder Score (CMS) and American Shoulder and Elbow Surgeons Score (ASES). The surgical procedure used was the same for both groups (MOR and AR), which was a "Double-row technique".

Patients included in this study were those who were diagnosed with small to medium-sized Rotator cuff tears, aged 40 to 65 years, and had undergone a surgical procedure, which was either mini-open rotator cuff repair (MOR) or Arthroscopic rotator cuff repair (AR) procedures at our institute. Patients with massive rotator cuff tears (>5cm), Goutallier (Stages III & IV), revision rotator cuff repair surgery, associated cervical spine pathology requiring surgery, or those patients who had psychiatric issues or were aged over 65 years, and those who were lost to follow-up up to 12 months, were all excluded from the study.

Images marked as (Figures 1-5) are per-operative images for the arthroscopic repair procedure (AR) of our patient, demonstrating patient position with markings, equipment, and per-operative findings along with steps followed. Images marked as (Figures 6-11) are per-operative procedure images of the mini-open Repair group (MOR) demonstrating the steps followed.

### Arthroscopic Repair Procedure

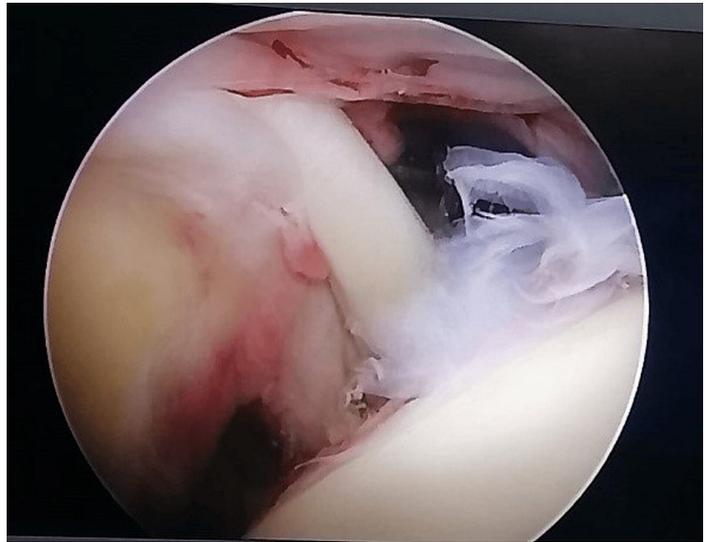
*Patient Position and markings for arthroscopic repair*

**Figure 1:** Patient Position & Markings for Arthroscopic Repair





**Figure 2:** Position of Shoulder Ports During Arthroscopic Repair



**Figure 3:** Arthroscopic View of Rotator Cuff Tear



**Figure 4:** Arthroscopic Insertion of the Screw.



**Figure 5:** Arthroscopic View of the Repair With Threads Insitu.



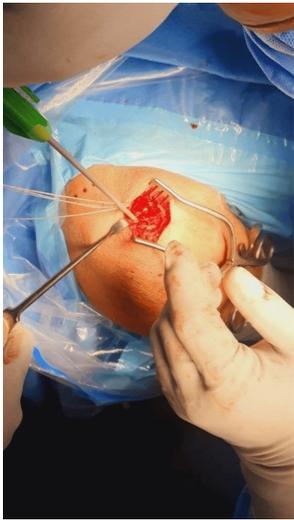
**Figure 6:** MOR U Shaped Tear



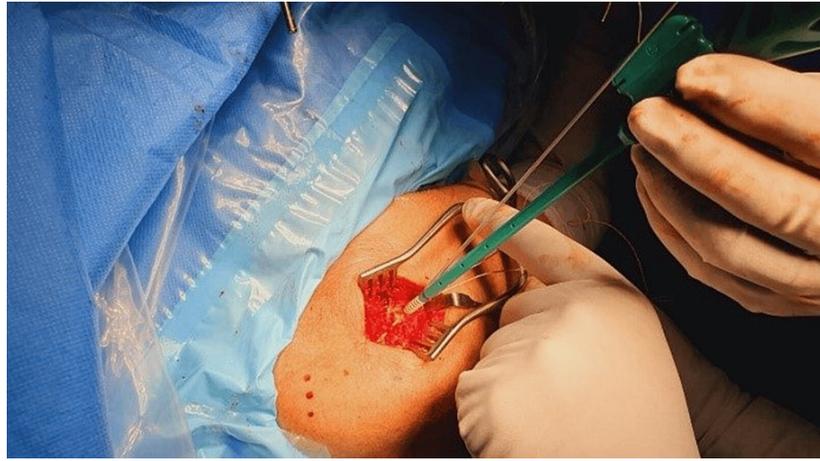
**Figure 7:** MOR Assessment of Tendon Mobility



**Figure 8:** MOR Anterior Anchor Lateral Row.



**Figure 9:** MOR Deployment of Medial Row Anchor.



**Figure 10:** MOR Posterior Anchor Lateral Row.



**Figure 11:** MOR After Medial Row.



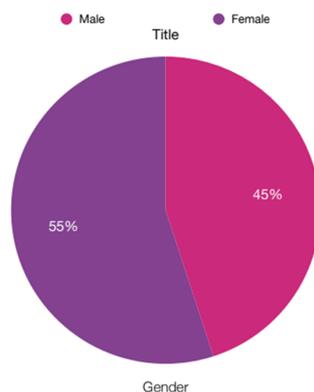
**Figure 12:** Final Repair.

## Results

Nine out of the 20 patients were males and 11 were females, 15 patients were right hand dominant & 5 patients were left handed. Among the operated shoulders 13 were right and 7 were left (Table 1).

Gender n(%)		Dominant Hand n(%)		Surgical Site n(%)	
Male	Female	Right	Left	Right	Left
9 (45%)	11(55%)	15 (75%)	5 (25%)	13 (65%)	7 (35%)

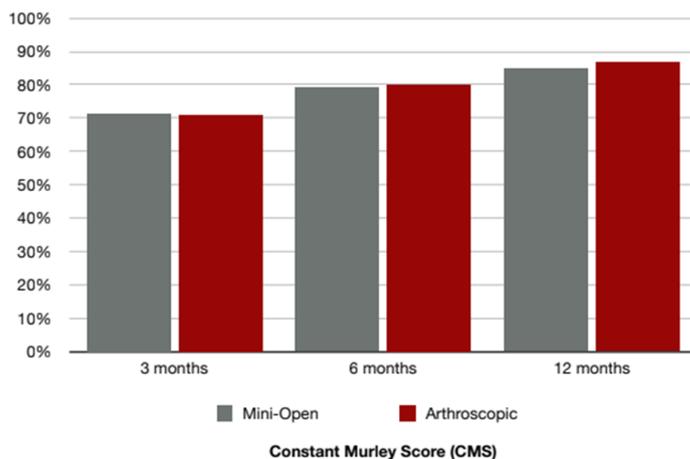
**TABLE 1: Demographics**



**Table 2:** Mean CMS score was similar for both groups at 3 months & slightly higher for Arthroscopic group at 6 & 12 months.

Follow-up Duration (Months)	Mini-Open (Mean score)	Arthroscopic (Mean score)	P-Value
3	71.4	71.1	0.264
6	78.8	80	0.665
12	84.6	86.8	0.068

**TABLE 2: Follow-up CMS Score of MOR vs AR**



At 3 months follow-up, 75% of the patients in Arthroscopic group scored good on CMS compared to 50% in mini-open group. At 6 months, 25% patients in Arthroscopic group scored excellent and 75% scored good. Compared to 16% patients in mini-open group who scored excellent and 83% who scored good. No patient scored poor or fair scores. At 12 months, 87% of patients in Arthroscopic group scored excellent as opposed to 75% in mini-open group. No patient scored poor or fair scores. (Table-3)

	Mini-Open (n=12) (percentage)	Arthroscopic (n=8) (percentage)
CMS at 3 months		
poor	-	-
fair	6 (50%)	2 (25%)
good	6 (50%)	6 (75%)
excellent	-	-
CMS at 6 months		
poor	-	-
fair	-	-
good	10 (83.3%)	6 (75%)
excellent	2 (16.6%)	2 (25%)
CMS at 12 months		
poor	-	-
fair	-	-
good	3 (25%)	1 (12.5%)
excellent	9 (75%)	7 (87.5%)

**TABLE 3: Descriptive CMS Scores for Both MOR & AR**

At 3, 6 & 12 months, median ASES score for patients in Arthroscopic group remained slightly higher than Mini-open group demonstrated in Bar chart-2 and in Table 4.

Follow-up Duration (Months)	Mini-open (n=12) (Median Score)	Arthroscopic (n=8) (Median Score)	P-value
3	82.4	86.6	0.057
6	87.4	94.1	0.016
12	94.9	99.2	0.016

**TABLE 4: Follow-up ASES Scores of MOR & AR**

At 3 months post-op, over 85% of the patients in Arthroscopic group were able to return to work compared to over 80% in Mini-open group. At 6 months, 90% of patients in Bankart group were able to return to work compared to 100% in Arthroscopic group. By 12 months, all patients in both groups were able to return to work. 10 out of 12 patients which was 83% at 3 months in Mini-open group which improved to 91.6% with 11 out of the 12 patients at 6 months. Whereas in arthroscopic group it was 87.5% with 7 out of 8 patients at 3 months and then 100% at 6 months (Table – 5).

Follow-up Duration Duration in Months	Return to work / Able to do their usual work	
	Mini-Open (n=12)(percentage)	Arthroscopic (n=8)(percentage)
3	83.3%	87.5%
6	91.6%	100%
12	100%	100%

**TABLE 5: Comparison of Return to work in both MOR vs AR**

At 3 months post-op, over 90% of the patients in Mini-open group were fully able to carry out activities of daily living compared to over 85% in Arthroscopic group. At 6 months, 90% of patients in Mini-open group were able to carry out activities of daily living compared to 100% in Arthroscopic group. By 12 months, all patients in both groups were able to carry out activities of daily living. 91.6% = 11/12 patients, 87.5% = 7/8 patients. (Bar chart- 4 & Table – 6)

Follow-up Duration (Months)	Fully able to carry out activities of daily living	
	Mini-Open (n=12) (percentage)	Arthroscopic (n=8)(percentage)
3	91.6%	87.5%
6	91.6%	100%
12	100%	100%

**TABLE 6: Comparison of Activity of Daily Life of Patients Between Both Groups**

At 3 months post-op, over 90% of the patients in MOR group were fully able to achieve complete range of motion compared to over 85% in Arthroscopic group. At 6 months, 90% of patients in Mini-open group were able to achieve full range of motion compared to 100% in Arthroscopic group. By 12 months, all patients in both groups achieved complete range of motion at the affected shoulder 91.6% = 11/12 patients, 87.5% = 7/8 patients. (Bar chart 5 & Table 7)

Follow-up Duration	Achieved Complete ROM	
	Mini-Open (n=12)(percentage)	Arthroscopic (n=12)(percentage)
Duration in Months		
3	91.6%	87.5%
6	91.6%	100%
12	100%	100%

**TABLE 7: Comparing The Postoperative Range of Motion Between the Two Groups**

## Discussion

Our study corroborates that the double-row suture technique may lead to higher rates of tendon healing, according to Lafosse et al. At 12-month follow-up, none of the patients developed a re-tear. Consistent with previous findings, significantly higher CMSs after repair of small-size tears were observed, confirming the theory that repair of smaller rotator cuff tears results in a better outcome [7].

Karakoc et al. reported less post-operative pain in the first week after an arthroscopic repair of a rotator cuff tear, and better shoulder flexion and function in the long term followed with no post-operative complications [8]. Whereas our results similarly showed better results with shoulder range of motion compared to the MOR. At 12 months post-op, both the MOR and AR groups had excellent outcomes.

The incidence and extent of a recurrent cuff tear at the final clinical outcome are negatively impacted by the size of the first tear and the patient's age. Even so, despite a high likelihood of re-tear, huge and major injuries treated with a tendon-grasping suture utilizing a mini-open approach have a very excellent clinical outcome [9]. Smoking has been reported to have a negative influence in the long term after an arthroscopic rotator cuff repair and is also a risk factor for rotator cuff tears [10, 11].

Clinical results from mini-open and arthroscopic rotator cuff repairs are comparable. While longer surgery times were linked to a higher incidence of adhesive capsulitis, male gender and older age were associated with higher risks of rotator cuff retears [12]. Bond et al. reported a 2-year follow-up and found that rotator cuff surgery results in good to exceptional pain and function improvement. At 24 months, they did not see any difference in pain or functional outcome between the mini-open, open, and arthroscopic methods for rotator cuff repair [13].

In comparison to MOR for certain functional outcomes and follow-up duration, patients with AR for rotator cuff injuries had better postoperative outcomes and greater retear rates. Nevertheless, no discernible variations were found in the subgroup analysis of arthroscopic double row repair and MOR for re-tear rates [14].

Nazari et al., in their systematic review of meta-analyses, reported that the data comparing the clinical results of mini-open versus arthroscopic rotator cuff repair methods. For the majority of the clinical outcomes that were included, they were able to draw firm conclusions because they rated the quality of the evidence across all outcomes using the GRADE guidelines, included two more large trials, and provided an analysis of precision by comparing the MCID thresholds with the 95% confidence intervals. But they were unable to make firm conclusions about whether an arthroscopic approach could result in better external rotation range of motion at three and twelve months because the 555 and 462 patients, respectively, in their analysis did not meet the requirements for the calculated optimal information size of 754. As a result, the effects of arthroscopic compared to mini-open rotator cuff repair on function, pain, and range of motion were considered to be too small to be clinically important at 3-, 6-, and 12-month follow-ups [15].

The structural integrity being high, along with the functional outcome being reported as good for the majority of patients 11.3 years after repair of small- to medium-size rotator cuff lesions [16], When it comes to immediate expenditures, mini-open repair of rotator cuff injuries is far less expensive than arthroscopic treatment. The cost of consumables and implants accounts for the majority of the disparity [17].

With the exception of the arthroscopic repair group's greater rate of re-tearing, both mini-open and arthroscopic rotator cuff repairs produce good subjective results and objective stability. In comparison to mini-open rotator cuff surgery, arthroscopic rotator cuff repair demonstrated a considerably greater re-tearing rate and improved shoulder strength when the analysis was restricted to patients with full- thickness tears [18].

The limitations of our study were that the sample size was only 20 patients, and patient follow-up was up to 12 months. To further strengthen our findings, a larger sample size is required with a longer duration of follow-up.

## Conclusion

Despite advances in arthroscopic techniques which requires considerable expertise & increase in financial loads, along with increased risk of anesthesia-related complications, whereas mini-open technique for rotator cuff repair is a feasible cost-effective option yielding comparable functional outcomes. We recommend further comparative studies with larger sample size and also to assess long term follow-ups.

## Conflict of Interest

The authors declare that there are no conflicts of interest.

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