



# FUNCTIONAL OUTCOME OF SHOULDER FOLLOWING MINI OPEN REPAIR FOR ROTATOR CUFF INJURIES

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## ABSTRACT

**Background:** Rotator cuff injuries are a common cause of shoulder pain in the adult population. The present study aims to assess the outcome following rotator cuff repair by mini open approach

**Materials and methods:** This is a prospective study done on thirty patients with rotator cuff injuries. 13 full thickness and 17 partial thickness were followed up for 2 years following repair by mini open approach and functional scoring was done, preoperatively and postoperatively with the Constant and Murley scoring system. Statistical analysis of scores were done with ANOVA and pairwise comparisons between mean scores at different time intervals done with Bonferroni correction test.

**Results:** The mean preoperative score was 59.5 while the mean score at 2 year follow up was 91.8 which is highly significant. There was no significant difference between mean scores of the full thickness tear mini open repair versus the partial thickness tear miniopen repair.

**Conclusion:** Miniopen repair of rotator cuff injuries offers excellent functional outcome at 2 year followup. There is no difference in functional outcome between partial and full thickness tear treated by miniopen repair.

**Key Words:** Rotator cuff tear, Mini open approach, Functional outcome

## INTRODUCTION

Shoulder pain is the third most common musculoskeletal symptom encountered in medical practice after back and neck pain. The point prevalence of shoulder pain has been estimated to be 7–25% and the incidence as 10 per 1,000 per year, peaking at 25 per 1,000 per year among individuals with ages 42–46 years.<sup>1,2</sup> Rotator cuff disease encompasses a wide range of pathology from minimal bursal articular side irritation and tendonitis to severe degenerative rotator cuff arthropathy. Rotator cuff pathology affects adults of all ages and other shoulder afflictions must be ruled out by careful history and physical examination<sup>3</sup>. Epidemiological studies strongly support a relationship between age and cuff tear prevalence. In a recent study the frequency of such tears increased 13% in youngest group (aged 50-59yrs) to 20% (aged 60-69yrs), 31% (aged 70-79yrs) and 51% in oldest group (80-89yrs)<sup>4</sup>

Already in the beginning of the 20th century, the rotator cuff was recognized as an important contributor to normal shoulder function, and tears of the rotator cuff as a possible cause of shoulder pain and dysfunction

Rotator cuff tears can lead to a variety of clinical manifestations, including debilitating shoulder dysfunction and impairment. The goal of rotator cuff repair is to eliminate pain and improve function with increased shoulder strength and range of motion. Optimal repair of the rotator cuff includes achievement of high fixation strength, minimal gap formation and maintenance of mechanical stability under cyclic loading, and proper healing of tendon to bone.<sup>5</sup>

Mini-open repairs were developed because they had the potential advantage of less deltoid morbidity, and they have demonstrated results that have been similar to those of open repairs. The use of the complete arthroscopic repair is technically demanding and requires a

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**Received:** 14.01.2015 **Revised:** 12.02.2015 **Accepted:** 09.03.2015

large volume practice in order for a surgeon to obtain proficiency. Because of the technical demands of this procedure, many orthopaedic surgeons still consider the mini-open repair to be the gold standard for rotator cuff repair.<sup>6</sup>

The standard treatment for full-thickness rotator cuff repair is with an open acromioplasty procedure. An alternative procedure for a full-thickness rotator cuff tear is with a combined procedure of arthroscopic subacromial decompression and mini-open repair, which has the potential advantages of a preserved deltoid origin, lower perioperative morbidity, shorter hospital stays and less soft tissue dissection.

In addition to adequate activity level, chronicity of tear with rapidly advancing surgical techniques and modes of fixation, optimal rehabilitation following rotator cuff surgical repair has become increasingly important and challenging for the orthopedic surgeon and physical therapist. This study will address the role of miniopen repair in treatment of rotator cuff tear and assess the functional outcome in the form of range of motion using Constant and Murley Scale (Table 1 )

In constant and murley system following parameters were determined

- Pain
- Activities of daily living
- Range of motion
- Power

## METHODS

### Materials

This is a prospective study conducted on 30 patients at our institute who underwent miniopen rotator cuff repair between January 2010 and December 2012.

30 patients were included in the study who had clinical or radiological(MRI) evidence of rotator cuff tear and have underwent atleast 6 weeks of conservative management from onset of symptoms. Patients with associated fractures of the shoulder were excluded. The patients were evaluated clinically with a standard range of tests for individual rotator muscles. Shoulder function was recorded preoperatively using the constant and murley score.

There were 20 males (66.7%) and 10 (33.3%) female patients in the study. The mean age was 53.6 (range 35-70 years) (Table 2). There were 13 (43.2%) full thickness tears and 17 (56.6%) partial thickness tears. Of the tears, 8 (26.6%) were degenerative tears and 22 (73.2%) were traumatic tears. 24 (79.9%) patients presented with inability to lift the shoulder and only 6 (19.9%) patients

presented with pain in the shoulder. Jobs empty can test was positive in all cases. External rotation stress test was positive in 25 cases and negative in 5 cases. The arm lift off test was positive in only 3 cases and negative in 27. The belly press test was positive in 11 and negative in 19. The speed test was negative in all cases.

The mean preoperative constant and murley score was 59.50 ( range 45- 68). The mean score for a full thickness tear was 58.79 (range 48-65) and the mean score for a partial thickness tear was 60.13 (range 45 -68).

### Surgical technique and Postoperative treatment

Under general anaesthesia, an initial arthroscopic subacromial decompression was done. Then a direct repair of the rotator cuff was done via an anterolateral portal extension approach (mini –open) with a deltoid split without detachment. By manoeuvring the arm, the entire extent of the tear can be seen. The edges of the tear are debrided, insertion site for suture anchors on greater tuberosity prepared, tear is mobilized, sutures placed through the edge of the tear and tied down to the anterolateral aspect of the greater tuberosity with suture anchors. For large tears, under some tension, special intratendinous sutures are placed through the cuff and these are repaired using the suture anchors placed in the superolateral greater tuberosity<sup>7</sup>

Following the procedure, the operated arm is placed at the side in a sling with a small pillow. The sling is worn continuously for 6 weeks, except during bathing and exercises. The standard postoperative rehabilitation program is summarized below (Table 2). However, if a subscapularis repair is performed, passive external rotation is limited to 90 degrees (i.e., straight ahead) for the first 6 weeks. In addition, terminal extension of the elbow is restricted if a biceps tenodesis was performed.

### Follow up

Patients treated post operatively was immobilized for 6 weeks in shoulder immobilizer with 30 degree abduction and pendulum exercises started from first post operative day and patients continues in shoulder immobilizer for rest of the day for 6 weeks were followed up at 3weeks,6weeks,12weeks, 6months, 1 year and 2 year .

Patient functional assessment was done based on pain relief, ability to carry on activities of daily living, strength and patient satisfaction post operatively .

A proforma was designed which would be filled by the patient himself and shoulder scoring system was calculated accordingly.

Ultrasound examinations of the operated shoulder were done and cuff integrity was checked. Strength and range

of motion were documented by operating surgeon.

Results were finally evaluated using Constant and Murley shoulder scoring system.

### Statistical method

Data was analysed using ANOVA and further post hoc analysis was performed by Bonferroni correction test.

## RESULTS

The mean constant and murley score at the final follow up was  $91.8 \pm 1.5$  (excellent as per score). The mean score for full thickness tear at final followup after repair was  $91.3 \pm 1.3$  and that for partial thickness tear was  $92.1 \pm 1.5$ . The constant and murley scores at different time intervals are tabulated (Table 4)

Pairwise comparison was made between the mean constant and murley score of each followup interval using the Bonferroni correction test to determine significant change of score. ( Table 5)

The maximum change ( Mean difference  $32.3 \pm 0.9$ ) in the score was noted between preoperative mean score and the mean score at final followup which was highly significant ( $p < 0.000$ )

Comparison of constant murley score according to type of tear was done (Table 6) by t-test. The t-value at 2 year followup between mean scores for full thickness and partial thickness tears was 1.53 which was not significant ( $p = 0.137$ ).

## DISCUSSION

Rotator cuff pathology affects adults of all ages and other shoulder afflictions must be ruled out by careful history and physical examination<sup>3</sup>. Epidemiological studies strongly support a relationship between age and cuff tear prevalence. In a recent study the frequency of such tears increased 13% in youngest group ( aged 50-59yrs) to 20% ( aged 60-69yrs), 31% ( aged 70-79yrs) and 51% in oldest group ( 80-89yrs) <sup>4</sup>

Rotator cuff tears can lead to a variety of clinical manifestations, including debilitating shoulder dysfunction and impairment. The goal of rotator cuff repair is to eliminate pain and improve function with increased shoulder strength and range of motion. Optimal repair of the rotator cuff includes achievement of high fixation strength, minimal gap formation and maintenance of mechanical stability under cyclic loading, and proper healing of tendon to bone.<sup>1</sup>

Mini-open repair has the potential advantage of less del-

toid morbidity, and they have demonstrated results that have been similar to those of open repairs. Because of the technical demands of this procedure, many orthopaedic surgeons still consider the mini-open repair to be the gold standard for rotator cuff repair.<sup>6</sup>

The standard treatment for full-thickness rotator cuff repair is with an open acromioplasty procedure. An alternative procedure for a full-thickness rotator cuff tear is with a combined procedure of arthroscopic subacromial decompression and mini-open repair, which has the potential advantages of a preserved deltoid origin, lower perioperative morbidity, shorter hospital stays and less soft tissue dissection. The study was taken up to evaluate the functional outcome of patients treated with miniopen repair for rotator cuff tears. The functional outcome was assessed by using Constant and Murley scoring system.

In 1990, Levy et al.<sup>8</sup> reported a preliminary one-year follow-up study of twenty-five patients who had been treated with an arthroscopic subacromial decompression and then a lateral deltoid-splitting open repair. Twenty of the patients had a good or excellent result. In our study total number of 30 patients with a follow up of 2years, preop Constant Murley score had a mean of 59.80 and by the end of 2years it was 91.80 with a p value  $< 0.001$ , which shows it is statistically significant outcome

In our study where we compared outcome we found we had statistically significant improvement in constant and Murley score values, preop and post op at 6 months and not much of difference between 1year and 2 years .

Baysal et al. <sup>9</sup> prospectively reviewed 84 patients with tears of all sizes, including 17 with large or massive tears, who underwent mini-open repair, and reported a statistically significant improvement in shoulder scores and range of motion. They found no difference in outcome between different tear sizes. Subsequent reports demonstrated that the mini-open technique can be used effectively for even large and massive tears <sup>10,11,12</sup>. In our study, we reviewed 30 patients who had undergone mini-open repair for all size of tear; we found functional outcome does not depend on the type of tear.

We compared our study results with a study conducted by B.C. Hanusch, L. Goodchild and A. Rangan. in their study -24 patients were included which were assessed prospectively before and at a mean of 27 months after miniopen repair using constant and Murley score. The mean Constant and Murley score improved significantly from 36 before to 68 after surgery ( $p < 0.0001$ ). Four of twenty four their patients had a re-tear<sup>13</sup>. In our study we included 30 patients which were assessed preoperatively and postoperatively using Constant and Murley score<sup>17</sup> and found that score improved from 45 preoperatively to 82 at 6months and 90 by the end of 2years ( $p < 0.0001$ ) which showed highly significant. Our study

showed no re-tear in any of the patients. Structural integrity rotator cuff was maintained which was assessed by ultrasonography of the operated shoulder.

Anterior-inferior acromioplasty was performed in all shoulders in this series and continues to be an important part of rotator cuff repair in our practice. We agree with other authors that acromioplasty, by creating space for the rotator cuff tendons, provides better surgical exposure and thus improves the quality of the surgical repair, and that, by relieving impingement; it offers protection to the tendons during healing, facilitates rehabilitation, and lessens postoperative pain<sup>4,14,15,16</sup>

### Observation:

- Most of the patients were between the age 51-60 years which formed 36.6 % of the total study group who had difficulty in carrying out their activities of daily living
- Majority of them were male patients forming 67 % where as rest of them were female patients forming 33%
- In most of patients the etiology was due to history of fall on affected shoulder which comprise 73.3% of the total number of patients studied
- Majority of patients complained of inability to lift the shoulder following trauma which comprise 80 % and pain in the affected shoulder was presented by 20% of the patients studied
- The incidence of partial thickness tear was 56.7% which formed the majority and full thickness tear comprised of 43.3%
- Acromioplasty and sub acromial decompression provided better pain relief in patients who had positive impingement sign preoperatively

### CONCLUSION

In comparison to other studies our study shows the mean age of incidence of rotator cuff tears is between the age group 51-60 years with male predominance with majority presented with supraspinatus partial thickness tear.

The mini open repair of rotator cuff tears at 2 year follow up shows excellent functional outcome.

In comparison to other studies our study shows that there is no difference in functional outcome between partial and full thickness tear treated by miniopen repair.

### ACKNOWLEDGEMENTS

Authors acknowledge the immense help received from the scholars whose articles are cited and included in ref-

erences of this manuscript. The authors are also grateful to authors, editors, publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

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**Table 1: Constant Murley Shoulder Score**  
Score for individual parameters

Parameter	Score
Pain	15
Activities of daily living	20
Range of motion	40
Power	25
Total	100

  

Valuation	Score
Excellent	91-100
Good	81-90
Satisfactory	71-80
Adequate	61-70
Poor	<60

**Table 2: Postoperative Rehabilitation protocol**

Time Period	Rehabilitation
0-6 wk	Immobilization: sling Elbow/wrist: active ROM Shoulder: passive external rotation in adduction only
6-12 wk	Shoulder: active ROM, avoid lateral abduction Stretching :forward flexion, internal rotation, external rotation
>12weeks	Strengthening : deltoid,biceps,triceps, rotator cuff, scapular stabilizers
>6months	Normal activities

**Table 3: Age distribution of patients studied**

Age in years	Number of patients	%
<40	1	3.3
41-50	8	26.7
51-60	11	36.7
61-70	10	33.3
Total	30	100

**Table 4: Evaluation of constant and murley score.**

	Minimum	Maximum	Mean	Std. Deviation	95% Confidence Interval for Mean		ANOVA F value	p value
					Lower Bound	Upper Bound		
at presentation	45	68	59.50	5.204	57.56	61.44	439.670	.000
3wks	50	70	61.17	4.557	59.47	62.87		HS
6wks	61	82	71.87	6.152	69.57	74.16		
12wks	71	89	81.23	5.386	79.22	83.24		
6months	79	90	86.80	3.295	85.57	88.03		
1yr	82	93	89.97	2.297	89.11	90.82		
2yr	90	95	91.80	1.518	91.23	92.37		

**Table 5: Difference of constant murley and pair wise significance.**

**Pairwise Comparisons by Bonferroni test**

	Mean Difference	Std. Error	p <sup>a</sup>	a	
At present @3wks	1.67	.347	.101	NS	
@6wks	12.37	1.084	.101	NS	
@12wks	21.73	1.341	.101	NS	
@6months	27.30	1.078	.000	HS	
@1yr	30.47	.957	.000	HS	
@2yr	32.30	.930	.000	HS	
@3wks @6wks	10.70	1.008	.101	NS	
@12wks	20.07	1.257	.101	NS	
@6months	25.63	.941	.000	HS	
@1yr	28.80	.821	.000	HS	
@2yr	30.63	.790	.000	HS	
@6wks @12wks	9.37	.984	.101	NS	
@6months	14.93	1.027	.000	HS	
@1yr	18.10	1.010	.000	HS	
@2yr	19.93	.992	.000	HS	
@12wks @6months	5.57	.558	.000	HS	
@1yr	8.73	.753	.000	HS	
@2yr	10.57	.928	.000	HS	
@6mont hs @1yr	3.17	.410	.000	HS	
@2yr	5.00	.589	.000	HS	
@1yr @2yr	1.83	.375	.076	NS	

a. Adjustment for multiple comparisons: Bonferroni.

**Figure 6: Comparison of constant murley score according to type of tear.**

		Minimum	Maximum	Mean	Std. Deviation	95% Confidence Interval for Mean		t value	p value
						Lower Bound	Upper Bound		
at presentation	FT	48	65	58.79	4.061	56.44	61.13	.70	.492
	PT	45	68	60.13	6.098	56.88	63.37		NS
3wks	FT	52	70	60.29	4.196	57.86	62.71	.99	.331
	PT	50	69	61.94	4.851	59.35	64.52		NS
6wks	FT	61	80	69.86	5.668	66.58	73.13	1.73	.095
	PT	63	82	73.63	6.185	70.33	76.92		NS
12wks	FT	71	88	79.57	5.867	76.18	82.96	1.62	.115
	PT	72	89	82.69	4.629	80.22	85.15		NS
6months	FT	79	89	85.14	3.840	82.93	87.36	2.88	.007
	PT	82	90	88.25	1.844	87.27	89.23		HS
1yr	FT	82	93	89.21	2.966	87.50	90.93	1.74	.094
	PT	88	93	90.63	1.258	89.95	91.30		NS
2yr	FT	90	93	91.36	1.393	90.55	92.16	1.53	.137
	PT	90	95	92.19	1.559	91.36	93.02		NS