Original Article

Functional outcome of single stage capsular release and rotator cuff repair for cuff tear in periarthritic shoulder

Roshan wade, Easwar Elango^{*}, Deven Kuruwa

Seth G.S Medical College & KEM Hospital, Acharya Donde Marg, Parel, Mumbai, 400012, Maharashtra, India

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ABSTRACT

Rotator cuff tear and periarthritic shoulder is a concomitant condition. In this study, both were managed with single stage arthroscopic Capsular release and rotator cuff repair and its functional outcome was evaluated till one year postoperatively. 58 patients diagnosed clinically, radiologically by MRI and arthroscopically were included. Mean constant shoulder score preoperatively was 32.6 and at one year postoperatively 78.5. Mean SPADI preoperatively was 72.1% which decreased to 20.7% at one year postoperatively. These improvements were statistically significant ($p < 0.001$). Thus this single stage procedure is effective for patients having rotator cuff tear in periarthritic shoulder.

1. Introduction

Periarthritic shoulder (adhesive capsulitis) is characterised by restriction of both active and passive range of movements of unknown etiology in the absence of a known intrinsic disorder as defined by American shoulder and elbow association. Zreik et al.¹ showed that prevalence is 2% in general population and 30% in diabetics. The main pathology is an inflammatory contracture of the shoulder joint capsule (Tamai et al., 2014).² It is diagnosed mainly on clinical grounds. X-ray appearance is normal. Findings in MRI³ suggestive of periarthritic shoulder are joint capsule and synovium thickness more than 4 mm, abnormal signal alteration in rotator cuff interval, subcoracoid triangle sign. Rotator cuff fat pad obliteration is the most specific finding in MRI for adhesive capsulitis. Treatment for adhesive capsulitis is usually conservative, which includes antiinflammatory drugs, physiotherapy, ice fomentation. Arthroscopic capsular release is indicated in refractory cases.⁴

Rotator cuff tears (RCT) are mostly degenerative or post traumatic. Natural history is unpredictable. Rotator cuff injury is diagnosed clinically and MRI is the investigation of choice. They are usually managed by surgically. The contraindication of repair include shoulder stiffness, massive rotator cuff arthropathy, rotator cuff tear with fatty infiltration of muscle with fat more than muscle. The primary aim of surgical repair is pain relief followed by functional improvement in shoulder as secondary priority.⁵

What if rotator cuff tear and adhesive capsulitis present at the same

time?

How both these conditions managed if present at the same time?

Rotator cuff injury in periarthritic shoulder is a concomitant condition which should be treated as a single disease.⁶ Traumatic rotator cuff tears left untreated can lead to periarthritic shoulder. Sometimes patients with periarthritic shoulder may develop a rotator cuff tear due to degeneration.⁶ Since there are high false positive rates of rotator cuff tears in MRI in patients with adhesive capsulitis (Loeffler et al., 2011)⁷, the diagnosis of concomitant rotator cuff repair and periarthritic shoulder should be confirmed by diagnostic arthroscopy after MRI. Some surgeons consider periarthritic shoulder to be a contraindication for rotator cuff repair. They prefer a staged procedure where shoulder stiffness is treated initially and rotator cuff repair later after stiffness resolves. But this leads to prolonged recovery time and patient dissatisfaction.⁸ Simultaneous management of both conditions allows for early rehabilitation, good pain relief, reduced recovery time.^{9,10}

So here in this study we had attempted combined management of periarthritic shoulder and rotator cuff injury with capsular release and rotator cuff repair and its functional outcome had been evaluated.

2. Methodology

2.1. Study procedure

This was a cross sectional study done in KEM hospital conducted from april 2018 to January 2020. The inclusion criteria were as follows.

^{*} Corresponding author. 1004, sukhakarta cooperative housing society ltd, Mahadev palav marg, Lower parel, Mumbai, 400012, Maharashtra, India.

E-mail address: easrockz@gmail.com (E. Elango).

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- a) Patients with reduced passive ROM(Range of motion), flexion and abduction less than 100°, external rotation less than 30° and internal rotation of a vertebral level where the thumb reach was lower than the first lumbar spine junction passively.
- b) Patients who failed routine 6 months conservative management for adhesive capsulitis.^{4,5}
- c) Patients who had evidence of adhesive capsulitis and rotator cuff tear in both MRI and diagnostic arthroscopy.

The exclusion criteria were as follows.

- a) Patients previously operated for rotator cuff tear
- b) patients who had massive contracted tear
- c) patients with any other shoulder pathology including osteo-arthritis of shoulder joint and massive rotator cuff arthropathy
- d) patients with history of fracture around shoulder joint in the past
- e) patients with acromioclavicular arthritis confirmed by injection test

The patients who had failed conservative management for adhesive capsulitis were studied with MRI. Those who showed evidence of adhesive capsulitis and rotator cuff tear in MRI^{3,6} were selected and their preoperative passive ROM and clinical score were calculated. Then diagnostic arthroscopy was done to confirm the diagnosis. After confirmation of diagnosis by diagnostic arthroscopy, single stage arthroscopic capsular release and rotator cuff repair was done. According to the Criteria, 58 patients were included and operated with this single stage procedure. 34 patients had this condition in nondominant hand and 24 patients had in dominant hand. 14 patients were diabetics and 9 patients had fatty infiltration of cuff which would affect the overall functional outcome. These patients were assessed post-operatively at 6th week, 3rd month, 6th month and one year. At the time of followup, passive range of motion and clinical score were calculated and compared with preoperative values. The clinical scores used were described below. This study was done after approval from Institutional Ethics Committee (IEC-1) dated April 9, 2018. The diagnostic procedure and surgical technique and its expected complications were explained with the participants in their own native language orally and in writing and signed consent obtained.

2.2. Assessment scores

2.2.1. Constant shoulder score(CSS)

CSS was developed by Constant and Murley in 1980 and was published in 1987 for assessing clinical outcome of shoulder.¹¹ It is scored from 0 (minimum/worst) to 100 (maximum/best). 35 points are allocated for subjective (patient-determined) assessments of pain and activities of daily life, and 65 points are allocated to objective (observer-dependent) measurements of movement using goniometer and strength using dynamometer. In the study by Roy et al.,¹² the reliability of the Constant score was considered acceptable ($p > 0.8$). Constant score is regarded as the official outcome measurement after shoulder surgery by the European Shoulder and Elbow Society.

2.2.2. Shoulder pain and disability Index(SPADI)

SPADI evaluates pain scale of the patient and functions of the shoulder in outpatient setting. It contains 13 items of which 5 subscales for assessing pain and 8 subscales for assessing disability. It is scored from 0% (maximum/best) to 100% (minimum/worst). There are studies which shows evidence to support cross cultural adaptation of SPADI especially to Indian population.^{13,14}

2.3. Surgical technique

Under General anaesthesia, we examined the range of passive motion to confirm the diagnosis of periarthritic shoulder. Patient placed in lateral decubitus position with the affected shoulder exposed and

supported by a vacuum beanbag. We modify this straight lateral decubitus position by tilting the operating tables 20–30° posteriorly so that the glenoid surface lies parallel to the floor.

2.3.1. Diagnostic arthroscopy

After positioning the patient, diagnostic arthroscopy was done through the primary posterior portal which was placed 1.5–3 cm inferior and 1 cm medial to posterolateral tip of acromion.¹⁵ Initially, 18G IV cannula was inserted and 30 ml of fluid injected into the joint. Insertion of cannulas was usually difficult in adhesive capsulitis patients because of contracted tissues. Preinsufflation into the joint with saline made the insertion of cannulas easier.¹⁵ After entering the joint thickened long head of biceps tendon located which was used as landmark for orientation throughout the procedure.^{16,17} There was evidence of chronic synovitis in these patients. The long head of biceps adhered to the coracohumeral ligament was one of the arthroscopic finding used to confirm the diagnosis of adhesive capsulitis.¹⁶ Thickened and contracted anterior band of inferior glenohumeral ligament and rotator interval obliterated by thickened anterior capsule was noted. Rotator cuff examination was started by probing the supraspinatus and its insertion on the tuberosity carefully evaluated for fraying and tear. Subscapularis was evaluated from anterior portal.

2.3.2. Capsular release

Capsular release was done first so that space for repairing the rotator cuff increased. Capsular release was preferably done with radio-frequency cautery than basket forceps to reduce the bleeding. With arthroscope in posterior portal, anterosuperior capsule is released (Fig. 1). Inferior capsular release was performed without damage to neurovascular structures not more than 1 cm from the inferior labrum. Chen et al. stated that inferior capsular release leads to improved ROM.¹⁸ Before resecting the capsule, we separate the rotator cuff musculature from the contracted capsule using capsular release forceps. Complete 360° release of the capsuloligamentous structures done till direct connection made between anterior and posterior release followed by synovectomy and wide resection of capsular margins to prevent early scar formation and restricted capsular volume.^{15,16}

2.3.3. Rotator cuff repair

The rotator cuff repair depends on the type and size of tear identified in MRI and diagnostic arthroscopy. Explaining the details of rotator cuff repair is unnecessary and described well elsewhere. Additional lateral portal was required. Through anterior portal subacromial bursectomy was done without damaging the cuff(Fig. 1). For partial thickness tears, decompression and repair of the tear done by suture anchor. Full thickness tear managed on the basis of size of the tear. The amount of retraction, and mobility of tendon and whether tendon can be placed back into the footprint checked. Footprint was prepared by abrading the site. Rotator cuff was reapproximated to its anatomical footprint and held with suture anchors. For tears smaller than 1.5 cm, generally one double loaded or triple loaded anchor was used. For larger than 1.5 cm tears, two anchors was used. If a tear is 3 cm or larger a transosseous equivalent repair was done.¹⁵ Margin convergence and releases to reduce tension on the repairs should be contemplated.

2.4. Rehabilitation protocol

All patients were immobilised in sling and abduction pillow at all times except during passive range of movements and pendulum. Range of motion was graded in each patient and closely monitored. Lee BG et al. stated that gentle rehabilitation protocols with limits in range of motion doesn't affect tendon healing after repair.¹⁹ Gallagher et al. mentioned that early rehabilitation after arthroscopic rotator cuff repair does not lead to anatomic failure of repaired cuff unless it was a massive contracted tear.²⁰

Fig. 1. a - showing anterior capsule release in rotator interval with arthroscope in posterior portal, b-showing the full thickness rotator cuff tear, c-showing subacromial bursectomy, d- showing repaired rotator cuff after capsular release and subacromial bursectomy).

- > Pendulum exercises started immediately as early as possible.
- > Passive ROM started at 1st week and range of motion is progressed gradually
- > Active ROM started at 6th week with range upto 90° and progressed to full range by weeks 12–14.
- > Isotonic and isometric exercises started at 3rd month.
- > Functional exercises according to patient's postoperative activity goals started at 3rd month.

2.5. Statistical analysis

Quantitative data like ROM and scores were calculated using mean $\pm$ SD. Qualitative data like sex, diabetics was represented in the form of percentages. Analysis of quantitative data between a qualitative variable was done using RMANOVA (repeated measures) where data passed 'Normality test'. Friedman test was used when data failed 'Normality test'. Chi-Square test was used for proportions. Results were entered graphically and MS Excel and Graph pad software was used for most analysis. P value < 0.001 was considered significant.

3. Results

58 patients were included in the study with the mean age group of 51.1 ± 7.6 years. There were 62% males and 38% females. Among 58 patients, 1 patient didn't follow up for rehabilitation. Other 57 patients

were analysed.

3.1. Range of motion

Range of Forward flexion, abduction and external rotation were measured with goniometer. Mean values in preoperative period and postoperative period at various timelines were depicted in Table 1. All patients showed improvement in range of motion in all planes (Fig. 2). Range of motion in all these planes showed significant improvement with p value < 0.001.

3.2. Constant shoulder score

The mean constant shoulder score values with standard deviation in preoperative and postoperative period were mentioned in Table 2. Mean preoperative value was 32.6 and it gradually progressed to 78.5 throughout the period of one year (Fig. 3). The p value calculated using repeated measures ANOVA test was <0.001 which shows statistically significant improvement.

3.3. Shoulder pain and disability index (SPADI)

The mean SPADI in preoperative and postoperative periods were mentioned in Table 3. The mean preoperative value was 72.1 and mean disability index gradually decreased over the period of one year to 20.7

Table 1

Mean passive range of motion in forward flexion, abduction and external rotation. Mean values with SD are mentioned. Table showing preoperative values and postoperative values in 6th week, 3rd month, 6th month and one year.

Mean passive Range of motion	Preop	Post op 6th week	Post op 3rd month	Post op 6th month	Post op 1 year
Forward flexion	65° ±15.2	75° ±14.5	110° ±14.8	140° ±12.7	160 ± 12.2
Abduction	60°±14.2	68°±12.5	100° ±11.2	135° ±12.5	160° ±11.3
External rotation	5°±3.7	12°±4.2	20°±5.2	30° ±3.6	40°±4.5

postoperatively (Fig. 3). The decrease in value indicates the improvement in shoulder function.

4. Discussion

Patients with concomitant rotator cuff tear and adhesive capsulitis were treated separately by many surgeons across the world by repairing the cuff after resolving the stiffness. But recently there are upcoming studies which support the combined management of both the conditions

at the same setting.

Oh et al., 2013²¹ concluded in their respective studies that adding manipulation and capsular release to rotator cuff repair provides

Table 2

Mean constant shoulder scores in preop and postop period with p value.

CSS score	Mean ± SD	Test applied	P value
Pre-Op	32.6 ± 8.2	Repeated measures ANOVA	<0.001
6th week	48 ± 10.7		
3rd month	62.6 ± 8.5		
6th month	70.1 ± 7.1		
1 year	78.5 ± 7.6		

Table 3

Mean SPADI in preop and postop period with p value.

SPADI score	Mean ± SD	Test applied	P value
Pre-Op	72.1 ± 8.3	Repeated measures ANOVA	<0.001
6th week	60.9 ± 12.2		
3rd month	40.3 ± 12.7		
6th month	32.9 ± 14.6		
One year	20.7 ± 8.5

Fig. 2. showing Mean passive ROM at various time intervals. Figure shows significant improvement in range of forward elevation, abduction and external rotation.

Fig. 3. showing improvement in CSS and decrease in SPADI.

acceptable outcomes and minimizes surgical delay.

Ho et al.²² retrospectively reviewed 41 patients who underwent 1-stage arthroscopic capsular release and rotator cuff repair. Functional outcomes were similar to a comparison group of patients without shoulder stiffness who underwent isolated arthroscopic rotator cuff repair.

Mcgrath et al., 2016¹⁰ in a comparative study mentioned that delaying surgery to complete 6 months of preoperative physical therapy did not lead to improved outcomes over early surgical intervention.

We prospectively studied 58 patients in a span of 3 years who were operated with single stage capsular release and rotator cuff repair by a single surgeon in the same centre. No patients in our study developed postoperative infection. The patients who showed poor improvement in scores were mostly diabetics, patients who had fatty infiltration of muscle, patients who were not compliant with rehabilitation protocol.

Mean constant shoulder score in these patients was 32.6 ± 8.2 preoperatively. The mean constant shoulder score postoperatively at 3rd month is 70.6 and at one year is 78.5. Thus the constant shoulder score increased gradually till one year. The mean SPADI preoperatively is 72.1% which has significantly decreased to 20.7% postoperatively at one year. There was significant decrease in pain and improvement in range of motion and functional activity which were evident by improvement in scores. So this study proves that single stage procedure is effective for patients with cuff tear and periarthritic shoulder. A longer follow-up study with more samples and better categorization of patients could have been done which would have shown even better estimate of functional outcome scores and reasons for poor improvement.

5. Conclusion

Thus the patients operated with single stage capsular release and rotator cuff repair showed improved pain relief and good functional outcome with higher patient satisfaction by end of one year postoperatively. So this single stage procedure is effective for patients with rotator cuff tear in periarthritic shoulder if rehabilitation protocol is graded and closely monitored.

References

- Zreik NH, Malik RA, Charalambous CP. Adhesive capsulitis of the shoulder and diabetes: a meta-analysis of prevalence. *Muscles Ligaments Tendons J.* 2016;6(1): 26–34. <https://doi.org/10.11138/mltj/2016.6.1.026>. Published 2016 May 19.
- Tamai K, Akutsu M, Yano Y. Primary frozen shoulder: brief review of pathology and imaging abnormalities. *J Orthop Sci.* 2014;19(1):1–5. <https://doi.org/10.1007/s00776-013-0495-x>.
- Emig EW, Schweitzer ME, Karasick D, Lubowitz J. Adhesive capsulitis of the shoulder: MR diagnosis. *AJR Am J Roentgenol.* 1995;164(6):1457–1459. <https://doi.org/10.2214/ajr.164.6.7754892>.
- Goldberg BA, Scarlat MM, Harryman 2nd DT. Management of the stiff shoulder. *J Orthop Sci.* 1999;4(6):462–471. <https://doi.org/10.1007/s007760050131>.
- Miller R, Azar F, Throckmorton T. Shoulder and elbow injuries. In: Azar F RH, ed. *Campbell's Operative Orthopaedics*. thirteenth ed. Vol. 3rd. Canada: Elsevier; 2017: 2298–2346.
- Tauro JC. Stiffness and rotator cuff tears: incidence, arthroscopic findings, and treatment results. *Arthroscopy.* 2006;22(6):581–586. <https://doi.org/10.1016/j.arthro.2006.03.004>.
- Loeffler BJ, Brown SL, D'Alessandro DF, Fleischli JE, Connor PM. Incidence of false positive rotator cuff pathology in MRIs of patients with adhesive capsulitis, 362 *Orthopedics.* 2011;34(5). <https://doi.org/10.3928/01477447-20110317-14>. Published 2011 May 18.
- Zhuo H, Li J. Comparison of one-stage versus two-stage procedure for the management of patients with rotator cuff tear and concomitant shoulder stiffness, 40 *J Orthop Surg Res.* 2019;14(1). <https://doi.org/10.1186/s13018-019-1075-3>. Published 2019 Feb 7.
- Cho NS, Rhee YG. Functional outcome of arthroscopic repair with concomitant manipulation in rotator cuff tears with stiff shoulder. *Am J Sports Med.* 2008;36(7): 1323–1329. <https://doi.org/10.1177/0363546508314402>.
- McGrath JP, Lam PH, Tan MT, Murrell GA. The effect of concomitant glenohumeral joint capsule release during rotator cuff repair—a comparative study. *J Shoulder Elbow Surg.* 2016;25(5):714–722. <https://doi.org/10.1016/j.jse.2015.10.005>.
- Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. *Clin Orthop Relat Res.* 1987;214:160–164.
- Breckenridge JD, MacDermid JC, Woodhouse LJ. A systematic review of the psychometric properties of the Constant-Murley score. *J Shoulder Elbow Surg.* 2010;19(1):157–164. <https://doi.org/10.1016/j.jse.2009.04.008>.
- Roy JS, MacDermid JC, Woodhouse LJ. Shoulder pain and disability index (SPADI), 197 *J Physiother.* 2011;57(3). [https://doi.org/10.1016/S1836-9553\(11\)70045-5](https://doi.org/10.1016/S1836-9553(11)70045-5).
- Wang W, Jia ZY, Liu J, et al. Cross-cultural adaptation and validation of the Chinese version of the shoulder pain and disability index in patients with symptomatic shoulder pain: a prospective case series. *Medicine (Baltim).* 2018;97(26), e11227. <https://doi.org/10.1097/MD.00000000000011227>.
- Phillips B. Arthroscopy of the upper extremity. In: Azar F RH, ed. *Campbell's Operative Orthopaedics*. thirteenth ed. Vol. 3rd. Canada: Elsevier; 2017.
- Kanbe K. Clinical outcome of arthroscopic capsular release for frozen shoulder: essential technical points in 255 patients, 56 *J Orthop Surg Res.* 2018;13(1). <https://doi.org/10.1186/s13018-018-0758-5>. Published 2018 Mar 16.
- Fernandes MR. Arthroscopic capsular release for refractory shoulder stiffness. *Rev Assoc Med Bras.* 1992;59(4):347–353. <https://doi.org/10.1016/j.ramb.2013.02.004>.
- Chen J, Chen S, Li Y, Hua Y, Li H. Is the extended release of the inferior glenohumeral ligament necessary for frozen shoulder? *Arthroscopy.* 2010;26(4):529–535. <https://doi.org/10.1016/j.arthro.2010.02.020>.
- Lee BG, Cho NS, Rhee YG. Effect of two rehabilitation protocols on range of motion and healing rates after arthroscopic rotator cuff repair: aggressive versus limited early passive exercises. *Arthroscopy.* 2012;28(1):34–42. <https://doi.org/10.1016/j.arthro.2011.07.012>.
- Gallagher BP, Bishop ME, Tjoumakaris FP, Freedman KB. Early versus delayed rehabilitation following arthroscopic rotator cuff repair: a systematic review. *Physician Sportsmed.* 2015;43(2):178–187. <https://doi.org/10.1080/00913847.2015.1025683>.
- Oh JH, Kim SH, Lee HK, Jo KH, Bin SW, Gong HS. Moderate preoperative shoulder stiffness does not alter the clinical outcome of rotator cuff repair with arthroscopic release and manipulation. *Arthroscopy.* 2008;24(9):983–991. <https://doi.org/10.1016/j.arthro.2008.06.007>.
- Ho WP, Huang CH, Chiu CC, et al. One-stage arthroscopic repair of rotator cuff tears with shoulder stiffness. *Arthroscopy.* 2013;29(8):1283–1291. <https://doi.org/10.1016/j.arthro.2013.05.024>.