

Evaluation of the results of arthroscopic repair of rotator cuff tears: A prospective study

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Abstract: Background: Rotator cuff tear is most troublesome issue in shoulder surgery we tried to assess the functional outcome of arthroscopic repair of rotator cuff tears in patients and to evaluate the influence of a variety of factors on the outcome of rotator cuff repairs, including the age and sex of the patient, side affected, dominant shoulder and duration of symptoms.

Method: 30 cases of Rotator Cuff tear between the age of 18 and 70 years were primarily treated with arthroscopic repair from February 2009 to June 2011. Data was collected by direct observations as per the proforma prepared accordingly. Patient was assessed for UCLA score at pre-operative and post-operative 3, 6, 12, 18 and 24 months. Assessment of the final outcome was done at 24 months. Inclusion criteria : Presence of tear in any of the rotator cuff tendons, Patient between 18 and 70 years of age, Cuff repair performed solely with the use of arthroscopic techniques. We excluded Patients having associated shoulder lesions like SLAP etc, revision rotator cuff repair patients, irreparable tears, patients with associated symptomatic acromioclavicular arthritis and Patients with cuff tear arthropathy. Pre-operative and post-operative UCLA scores were compared using paired t-test. One way ANOVA was also used to compare more than two variables.

Results : There were 14 males (46.67%) and 16 females (53.33%) with average age was 52.43 (30- 68) years. 27 (90%) were right hand dominant and 3 (10%) were left hand dominant. There was involvement of right rotator cuff in 18 (60%) and left in 12 (40%). Average duration of symptoms was 8.4 months (3- 24 months). 22 (73.33%) patients had symptoms for less than 1 year and 8 (26.67%) had symptoms for more than 1 year. All patients were treated with arthroscopic debridement and repair with bone suture anchor. Subacromial decompression was done as and when required. Average pre-operative UCLA score was 14.60 (5- 25) and post-operative was 30.83 (28- 35). There was a 100% satisfaction in this study at the end of 24 months according to UCLA score with 25 (83.33%) patients having good and 5 (16.67%) having excellent scores. There were no complications in this study.

Conclusion: Arthroscopic rotator cuff repair offered good results and enabled the same reconstruction as with open technique and avoided the latter's complications. Advantages of arthroscopic rotator cuff repair include, a small cosmetic scar, the ability to perform the procedure on an outpatient basis, reduced early postoperative pain, availability to diagnose any intraarticular pathology that can affect the end results and deltoid muscle preservation that allows earlier and easy postoperative rehabilitation.

Keywords: Rotator cuff tear, arthroscopic, UCLA Score.

Thesis question : Whether arthroscopic repair of rotator cuff tears is functionally better than open repair. And to evaluate that age and sex of the patient, side affected, dominant shoulder and duration of symptoms influence the outcome of rotator cuff repairs.

Thesis answer : Arthroscopic rotator cuff repair offered good results and enabled the same reconstruction as with open technique and avoided the latter's complications. Age, sex, dominant arm and side involved do not affect the post-operative result.

THESIS SUMMARY

Introduction

Rotator cuff injuries or disease can be particularly troubling to patients by causing pain, weakness, and dysfunction of the shoulder. The Rotator Cuff undergoes progressive degenerative changes with increasing age and may lead to partial tear of cuff and finally to complete rupture of the rotator cuff. The spectrum of these disorder ranges from inflammation to massive tearing of the rotator cuff musculotendinous unit. Rotator cuff repair is one of the most frequent procedures performed in the shoulder joint. In 1911, Codman first did the open surgical repair of a supraspinatus tendon rupture that he identified as one of the major causes of the painful shoulder. Over the next three decades, operative treatment of rotator cuff tears became increasingly popular, with many different techniques being described. However, the results were variable and a high percentage of unsatisfactory results were reported in some series. The treatment of symptomatic rotator cuff tears has travelled a long way, starting with complete open repair, to arthroscopic assisted mini open techniques to complete arthroscopic repair. Neer reported the results of anterior acromioplasty in combination with cuff mobilization and repair in 1972. The surgical fundamentals emphasized in that report substantially improved the reliability of the outcomes of repairs of rotator cuff tears.

The fundamentals include

- (1) Preservation or meticulous repair of the deltoid origin.
- (2) Adequate decompression of the subacromial space by resection of any anteroinferior osteophytes.
- (3) Surgical releases as necessary to obtain freely mobile musculotendon units.
- (4) Secure fixation of the tendon to the greater tuberosity.
- (5) Closely supervised rehabilitation including early passive motion within a protected range.

The first arthroscopic cuff repairs were reported by Johnson using a staple technique in 1992. The treatment of Rotator Cuff tear has changed dramatically during the recent past as there is, progression towards less invasive procedures like arthroscopy to obtain equivalent or better results to the traditional open procedures. As of today, arthroscopic cuff repair is technically demanding as most of the patients are elderly and tissue quality is poor. It is still in its developmental phase, with innovative techniques and suture materials being designed such as double row anchors to overcome past inadequacies. Although the best procedure for repairing a full thickness Rotator Cuff tear is still controversial, results with most of the studies of complete arthroscopic Rotator Cuff repair have been promising and evolving as a future alternative to traditional open and mini open techniques. Arthroscopic rotator cuff repair has several advantages. With this technique it is possible to use a much smaller incision and to protect the deltoid muscle. It provides to diagnose and to treat the intraarticular lesions. Rotator cuff may be released and mobilized with this technique, soft tissue damage minimized, thus postoperative pain decreases and rehabilitation is facilitated decreasing the risk of adhesive capsulitis. In 2001, Burkhart SS, Danaceau SM, Pearce CE Jr. concluded that results of arthroscopic rotator cuff repair are independent of tear size, but most of the recent studies state that post repair, large and massive rotator cuff tears result in more postoperative weakness than small tears do. This study has been undertaken to assess the short term functional outcome of arthroscopic repair of rotator cuff tears by using the University of California, Los Angeles (UCLA)

score.

Aims and Objectives

1. To assess the functional outcome of arthroscopic repair of rotator cuff tears in patients.
2. Evaluate the influence of a variety of factors on the outcome of rotator cuff repairs, including the age and sex of the patient, side affected, dominant shoulder and duration of symptoms.

Methods

“Evaluation of the results of arthroscopic repair of rotator cuff tears: a prospective study” was conducted from February 2009 to June 2011 for a period of 29 months

SOURCE OF DATA:

The present study was conducted at Khorshedji Behramji Bhabha Municipal General Hospital, (K B Bhabha Municipal General Hospital-KBBH), Mumbai-400050, which is a secondary care multispecialty hospital under Municipal Corporation of Greater Mumbai and affiliated to Seth G S Medical college and King Edward Memorial hospital, Parel, Mumbai. It caters to a suburban population of the metropolitan area of Mumbai covering 4 suburban areas with total population of around 5-10 lakhs. These suburban areas are Santacruz, Khar road, Bandra, and Mahim.

STUDY POPULATION:

- 1) All male/female patients attending out-patient department between the age of 18 and 70 years.
- 2) All male/female patients admitted in in-patient ward between the age of 18 and 70 years.
- 3) Population includes both urban/rural/slum dwellers.

STUDY PERIOD: February 2009 to June 2011

SAMPLE SIZE: 30 cases of Rotator Cuff tear were primarily treated with arthroscopic repair.

TYPE OF STUDY: Prospective continuous and non-randomized study.

INCLUSION CRITERIA

1. Presence of tear in any of the rotator cuff tendons.
2. Patient between 18 and 70 years of age
3. Cuff repair performed solely with the use of arthroscopic techniques
4. Consent to participate and follow up in post-operative rehabilitation

EXCLUSION CRITERIA

1. Patients having associated shoulder lesions like SLAP etc.
2. Revision rotator cuff repair patients
3. Irreparable tears
4. Patients with associated symptomatic acromioclavicular arthritis.
5. Patients with associated biceps brachii tendon pathology.
6. Patients with cuff tear arthropathy.

DATA COLLECTION:

Data was collected by direct observations as per the proforma prepared accordingly.

Patient was assessed for UCLA score at pre-operative and post-operative 3, 6, 12, 18 and 24 months.

Assessment of the final outcome was done at 24 months.

DATA ANALYSIS:

Arithmetic mean, standard deviation, chi square test, Pearson's correlation and t-tests were used to examine continuous variables. Pre-operative and post-operative UCLA scores were compared using paired t-test. One way ANOVA was also used to compare more than two variables.

PATIENTS

History was elicited from patients regarding age, sex, duration of pain, involved side, hand dominance and loss of function. Patients were clinically examined for range of movement, strength of rotator cuff muscles, etc. Pre-operative UCLA score was documented of all the patients.

Physical Examination

Physical examination consisted of measurements of the range of motion and a manual muscle-strength test. The range-of-motion assessment included measurement of forward flexion in sagittal plane and strength of forward flexion.

JOBE' S Empty can test was used for assessment of Supraspinatus.

In this test the arm is placed in 30 degrees of forward flexion and 90 degrees of abduction in the plane of the scapula with the elbow fully extended and thumb pointing down (Empty can test) towards the floor. The patient is asked to raise the arm against resistance applied by the examiner over the forearm. If the arm flops down with pain, it is indicative of a rotator cuff tear. This is often referred to as Drop arm sign and though diagnostic of a full thickness cuff tear, it can be occasionally seen in the presence of severe cuff inflammation or large partial tears. The empty can position eliminates most of the deltoid action but patients with weak supraspinatus may recruit the biceps by flexing the elbow.

JOBE'S Full can test was also used for assessment of Supraspinatus.

In this the same test is repeated with the thumb pointing up towards the ceiling. The deltoid shares the load of the Supraspinatus and it is performed with ease. In the presence of a full thickness tear both the empty can and the full can tests will be positive. In Supraspinatus tendonitis, calcific tendonitis or partial tears of the rotator cuff the full can test will be negative whereas the empty can test may be positive. The full can test is more specific for the diagnosis of a full thickness tear.

Resisted external rotation tests were used for the Infraspinatus and the Teres minor together. In this test the patient is asked to tuck the elbow near his waist in 90 degrees of flexion at the elbow and rotate the forearm externally against resistance.

Napoleon or Belly Press test.

It is a new test for Subscapularis. With both palms resting on the abdomen, when patients exerted pressure on the abdomen, patients were not able to maintain the elbow anterior to the midline of the trunk, as viewed from the side, instead, the elbow

dropped back behind the trunk. The test can be performed with the examiner's hand inserted between the patient's hand and stomach to assess the pressure exerted on the stomach compared with that exerted by the hand on the uninjured side.

Radiological evaluation

Pre-op radiological evaluation involved true AP views and MRI of involved shoulder. Final diagnosis was done on the basis of intra-op findings.

Patients were investigated pre operatively for fitness for undergoing surgery under general anesthesia.

Patients were properly counseled and explained regarding the operative procedure and post-operative rehabilitation protocol.

SCORING SYSTEM

UCLA⁵⁴ scoring system was used in this study to evaluate the patients. It evaluates the pain, function, range of active forward flexion, strength of active forward flexion and patient satisfaction. Pain and function have a maximum value of 10 and the other components have a maximum value of 5. The UCLA score has almost a 15% component related to patient satisfaction and it is either yes or no – meaning if patient is satisfied full 5 points are added to the score. If the patient is not satisfied then the contribution to the score is zero. The component values are added to achieve the total score, which has a maximum of 35. In this case, a higher score indicates better shoulder function

PRE-OPERATIVE MANAGEMENT

Pre-operatively all necessary routine investigations pertaining to anesthesia fitness were done and specific investigations of all associated medical illness were carried out.

The routine investigations done were –

- Haemogram (Hb,TLC,DLC)
- Bleeding time \ Clotting time.
- Serum creatinine
- Serum Bilirubin (direct and indirect)
- Random blood sugar level.
- HIV \ HBsAg.
- Radiograph of the chest.

Pre-operative anesthesia fitness was obtained and a minimum fasting period of eight hours was taken into account, before taking up the patient for surgery.

On the day of surgery patients were prepared with shaving of local parts and scrubbing with chlorhexidine for two minutes. Third generation cephalosporin (ceftriaxone 1 gm) and aminoglycoside (amikacin 500 mg) was administered intravenously about 30 min prior to surgery.

OPERATIVE TECHNIQUE

Arthroscopic rotator cuff repair was performed using the suture anchor technique of repair with subacromial decompression.

The technique performed in our study was as follows:

Anaesthesia: General anaesthesia

Position: Lateral position

Procedure:

The arm was left free on a draped support. Hypotensive

anaesthesia was used to facilitate intra-operative visualization. Four portals were used. Posterior and lateral portals were used mainly for standard 4 mm arthroscope (the viewing portals), while anteromedial and anterolateral portals were used for the instruments (the working portals). The subacromial space was cleared of adhesion, bursal tissue and reactive synovitis. Tendon mobility was improved by releasing superficial adhesions between the cuff and acromial arch. A superior capsular release and rotator interval-coracohumeral ligament release were performed when needed to allow a low tension reduction of supraspinatus tendon to its anatomical position. Limited debridement of degenerated tendon margins was performed with the use of the shaver or a basket punch. After adequate visualization, preparation and release of tendon, upper surface of Greater Tuberosity was abraded with a burr, removing all soft tissue and cortical bone, to create a bleeding cancellous bone bed. However trough was not created.

In order to perform a tendon to bone repair, tension band suture technique using inverted horizontal mattress sutures and placing the anchor's in the lateral cortex of the humerus was done. The anterolateral portal was used to drill the anchor holes approximately 10 mm distal to the tip of greater tuberosity and at 5mm to 7mm intervals. Drill was kept perpendicular to the lateral humeral cortex. An arthroscopic clamp was then inserted through the same anterolateral portal in order to grasp the tendon and allow the assistant to place it under tension by pulling laterally on the clamp. A suture hook was inserted through the anteromedial portal and was used to pass the suture some distance medial to the tendon edge, close to the musculotendinous junction in an inverted mattress fashion.

A grasping clamp was used to retrieve one of the suture limbs through the anterolateral portal. The anchor was threaded onto the retrieved limb of the suture and was inserted back through the anterolateral cannula and the previously drilled anchor hole. Sutures were tied immediately with the use of simple sliding knot with three reversed additional half hitches. Two or three such horizontal mattress sutures were used in most of the patients.

A subacromial decompression with acromioplasty was performed as needed, such as patients with evidence of anterosuperior impingement of cuff with the acromial arch. Biceps tenotomy was performed as per requirement.

POST OPERATIVE MANAGEMENT

All patients were given shoulder arm pouch. Immediate post op. I.V antibiotics would be given for 2 days i.e on the day of the surgery and 1st post op day. They were discharged on the next day after dressing.

Rehabilitation

Physiotherapy was started on post op day 1 or 2. Elbow, wrist movement, scapular retraction and finger grip was started at post op. day 2. Passive pendulum exercise was started at 3- 4 weeks. Passive extension and abduction was started at 4- 6 weeks. At 6- 7 weeks forward flexion with wall support was started. Abduction with wall support was started at 7- 8 weeks. Active assisted forward flexion and abduction were started at 8- 12 weeks. Full range of motion was initiated at 12 weeks.

Observation and Results

46.67% of cases were male and 53.33% were female in study group.

53.33% of study cases were maximum in age group of 40- 60 years followed by 30% cases in age group of >60 years and the remaining minimum cases of 16.67% in age group of 20- 40 years. Range is from 30 to 68 years.

In this study, the percentage of cases with right shoulder involved was 60% and with left shoulder involved was 40%.

Pre operatively, 93.33 % had poor, 6.67 % fair, 0 % good and 0 % excellent scores.

At 3 months post-operative, 50 % had poor, 46.67 % fair, 3.33 % good and 0 % excellent scores.

At 6 months post-operative, 13.33 % had poor, 70 % fair, 16.67 % good and 0 % excellent scores.

At 12 months post-operative, 0 % had poor, 46.67 % fair, 53.33 % good and 0 % excellent scores.

At 18 months post-operative, 0 % had poor, 23.33 % fair, 66.67 % good and 10 % excellent scores.

At 24 months post-operative, 0 % had poor, 0 % fair, 83.33 % good and 16.67 % excellent scores.

The average age of the males was 54.35 and that of the females was 50.75 and they were not significantly different. The average duration of symptoms among men was 10 months and among women was 7 months; this difference was also not statistically significant. Similarly, the pre-operative and post-operative UCLA scores at 3,6,12, 18, and 24 months did not show any statistical differences. Mean 24 months UCLA score had no significant relation with sex of patient. Among men, duration of symptoms shows a statistically significant ($p < 0.05$) negative correlation with post-operative UCLA scores while pre-operative UCLA scores show a statistically significant positive correlation with post-operative UCLA scores. Age is negatively correlated with post-operative UCLA scores, but the correlation is not significant. On the other hand among women, none of the correlations acquired statistical significance.

The involvement of right or left arms did not affect the post-operative UCLA scores. In both men and women pre and post-operative UCLA scores were significantly different from each other ($p < .0001$).

There is 100% satisfaction at post operative 24 months in the 30 patients in our study.

There is no statistically significant difference in pre operative and post operative UCLA score across the various age groups in either men or women.

There is no statistically significant relation between hand dominance and mean post-operative UCLA score at 24 months.

There were no complications in this study.

Discussion

Rotator cuff tears are among the most common conditions affecting the shoulder. Despite their ubiquity, there is substantial debate concerning their management.

Arthroscopic repair of rotator cuff tears is technically demanding and is still in the developmental phase, with only short and intermediate-term studies available. The results of arthroscopic repair have not been as thoroughly studied as those

after open repair.

Despite its prior reputation as an impractical operative technique, recent reports of arthroscopic rotator cuff repair have shown promising results that appear to be as good as, if not superior to, the results of open rotator cuff repair.

The clinical success rate in patients included in our study was 100%. Rebuzzi et al. showed satisfactory results of 81.4 %, whereas, Boileau et al. showed satisfactory results of 92 %. The clinical results reported in our study are similar to those of previously published reports on open and mini-open techniques. Outcome studies after open repair of the rotator cuff showed an 88% to 90% success rate¹⁴. In 1990, Levy et al. reported a preliminary one-year follow up study of twenty five patients with rotator cuff tears who had been treated with an arthroscopic subacromial decompression and then a mini-open lateral deltoid-splitting repair. Twenty of the patients (80%) had a good or excellent result according to the shoulder-rating system of the University of California at Los Angeles. Youm et al. performed a comparison of clinical outcomes and patient satisfaction following arthroscopic and mini-open rotator cuff repair. They found that, at greater than two years of follow-up, arthroscopic and mini-open rotator cuff repairs produced similar results for small, medium, and large rotator cuff tears with equivalent patient satisfaction rates. Similarly Ide et al. performed a comparison between arthroscopic and open rotator cuff repairs in 100 cases. They concluded that the arthroscopic repair of small-to-massive tears had outcomes equivalent to those of open repair.⁶³ In the study published by Boileau et al, they concluded that the results of arthroscopic repairs were comparable with those obtained with open or mini-open techniques, and that has given them the confidence to continue performing arthroscopic cuff repair. In a long-term follow-up study (2-14 years) of rotator cuff tears repaired arthroscopically, Wilson et al. concluded that the arthroscopic techniques for rotator cuff repair achieved results comparable to the results of traditional open repair. Similarly Jones and Savoie showed success rate of 88% in cases with arthroscopic repair of large and massive cuff tears. They concluded that the arthroscopic management of such tears could obtain results comparable to the reported outcomes following open repairs. Moreover, Buess et al. performed a comparative study between open versus arthroscopic repair of rotator cuff tears in 96 cases. The authors reported that the arthroscopic repair had yielded equal or better results than open repair, even at the beginning of the learning curve. They found that the patients with an arthroscopic repair had a significantly better decrease in pain and a better functional result concerning mobility. The authors concluded that the arthroscopic repair is successful for large and small tears and biomechanically, large tears might even benefit more than small ones.

Factors affecting the results of surgery

The outcome of rotator cuff repairs may be influenced by a variety of factors.

1. Age:

The average age of the patients in our study was 52.43 years. Although in this study there was no limitation concerning the age, we found no statistical significant relation between the age of the patient and the postoperative net results. Similarly, Bennet

reported no difference in the outcome based upon the age as a variable. Stollsteimer and Savoie showed also no difference in the outcome noted among patients of different ages, suggesting that the arthroscopic repair is equally effective in all age groups. On the other hand, Boileau et al. reported that the age was clearly a factor influencing tendon healing. They found that the patients who had a healed tendon were, on the average, ten years younger than those in whom the tendon did not heal. They concluded that the chance of tendon healing decreased to 43% when the patient was more than sixty five years old. However, they stated that the absence of tendon healing (or only partial healing) did not necessarily compromise pain relief and patient satisfaction.

2. Sex:

There is little commentary in the literature with respect to sex for outcomes of rotator cuff disease. This study included 14 males and 16 females. The almost equal sex distribution was also shared between this study and other studies carried out by Kim, Boileau, and Galatz. They also shared that there was no significant relation between the sex of the patient and the postoperative net results. On the other hand, in the study performed by Watson et al, they identified a small, but statistically significant difference between male and female patients with regard to overall satisfaction, improvement in the functions of activity of daily livings (ADLs) and performance of usual work. However they stated that "what does exist does not support a sex difference". Harryman et al evaluated patient satisfaction, functional outcome, and ultrasonographic cuff integrity after 105 rotator cuff repairs and found no significant correlation of patient sex with the outcomes.

3. Dominant shoulder & Side involved:

In the present study we found no significant relation between the dominant shoulder or side involved and the postoperative outcome. Cofield et al reported similar result.

4. Duration of symptoms:

Our study showed that the earlier the timing of the rotator cuff repair, the better was the postoperative net results as there was a statistically significant negative correlation between duration of symptoms and post-operative result in men but not significant in women. Clinical data from studies by Goutallier et al. supported the concept that the longer a patient had symptoms of a rotator cuff tear, the more extensive the fatty degeneration of the torn rotator cuff muscle. The authors also reported that surgical intervention when there is minimal fatty degeneration of the muscle reduces the rate of retears. These data suggest that early operative intervention would facilitate improved outcomes for patients. Additional support for this statement was reported in the study done by Harryman et al. In contrast, Cofield et al. reported that the time from the beginning of symptoms to surgery did not have a significant effect on the outcome. Similarly, Burkhart et al reported that the delay from injury to surgery, even of several years, did not adversely affect the surgical outcome and was not a contraindication to arthroscopic rotator cuff repair.

Conclusion

1. Arthroscopic rotator cuff repair offered good results and enabled the same reconstruction as with open technique and avoided the latter's complications.

2. Advantages of arthroscopic rotator cuff repair include, a small cosmetic scar, the ability to perform the procedure on an outpatient basis, reduced early postoperative pain, availability to diagnose any intraarticular pathology that can affect the end results, and deltoid muscle preservation that allows early and easier postoperative rehabilitation.
3. Every cuff tear is unique and requires individual planning.
4. Diagnosis of rotator cuff tears is made mainly by history, clinical examination and confirmed by ultrasonography or magnetic resonance imaging.
5. The potential for structural failure should not be considered to be a formal contraindication to an attempt of rotator cuff repair if optimal functional recovery is the goal of treatment.
6. Age, sex, dominant arm and side involved do not affect the post-operative result, but a larger clinical trial would be needed to prove the same.

Clinical Message

1. Arthroscopic rotator cuff repair is technically demanding procedure that needs prerequisite skills such as diagnostic shoulder arthroscopy, arthroscopic subacromial decompression and arthroscopic knot tying.
 2. Thorough debridement of the tear should be done arthroscopically.
 3. A subacromial decompression must be done in indicated cases.
 4. Bone anchor suture technique is a good and proven technique for successful repair of rotator cuff tear.
- A planned and well monitored post-operative physiotherapy protocol is essential for best optimization of the surgery.

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