# COMPARISON OF ALL ARTHROSCOPIC VS MINI OPEN ROTATOR CUFF REPAIR: A RETROSPECTIVE ANALYSIS OF TWO TECHNIQUES

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## ABSTRACT

**Background:** Shoulder pain is a common presenting complaint in orthopedic clinic and among the causes of pain, Rotator cuff (RC) tears is a major contributing factor.

**Objective:** Shoulder pain is a common presenting complaint in orthopedic clinic and among the causes of pain, Rotator cuff (RC) tears is a major contributing factor. Many studies have looked at numbers and in the United States alone, up to 250,000 Rotator Cuff Repairs (RCRs) are done annually. Regarding surgical management of RC tears, tradition open repair, mini-open repair and arthroscopic repair have been used by surgeons.

**Methods:** Once institutional review board approval was received, a retrospective study was performed. Convenience sampling technique was applied. After excluding the patients not meeting our study criteria, a final sample of 115 patients was analyzed: 60 combined arthroscopically assisted mini-open RCR (cRCR), and 55 all-arthroscopic RCR (aRCR).

**Results:** Our final study population was 115 patients which underwent either mini-open or arthroscopic RCR at our hospital. First cRCR (combined arthroscopic and mini-open) groups had 60 patients, 60%(n=36) male and 40%(n=24) female patients. In the three month post operative period there were total 2 complications, 4 re-do surgeries and 1 re-hospitalization.

**Conclusion**: Our study has clearly demonstrated that both techniques for RC repairs, cRCR and aRCR have comparable clinical outcomes Patients in aRCR group had higher cost of surgery and more time spent in theatre.

**Key words**: Rotator cuff repair, Arthroscopy, Mini-open technique

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## INTRODUCTION

Shoulder pain is a common presenting complaint in orthopedic clinic and among the causes of pain, Rotator cuff (RC) tears is a major contributing factor. Once diagnosed a tear in rotator cuff, repair is most commonly performed to regain full function and strength. Rarely conservative treatment is sufficient. With advancement in surgical techniques and quick rehabilitation protocols, number of surgical procedures for rotator cuff repair has been substantially increased over last few years.[1] Many studies have looked at numbers and in the United States alone, up to 250,000 Rotator Cuff Repairs (RCRs) are done annually.[2,3] Regarding surgical management of RC tears, tradition open repair, mini-open repair and arthroscopic repair have been used by surgeons. With latest advancements, traditional open repair has shifted towards mini-open RCR (mRCR) and all-arthroscopic RCR (aRCR).[4]

Every surgical approach has its own benefits vs. risk ratios proved through many research papers, but overall clinical results and complication are comparable between various techniques.[5,6]

With recent advancement in models of patient care based on patient reported outcome measures (PROMs) and cost effectiveness of any particular technique, a lot of research has been done to find out the ideal technique for RC repair which is both validates through PROMs and economically acceptable to healthcare providers. All-arthroscopic RCR (aRCR) is most acceptable cosmetically and quick rehabilitation is possible but it comes at the disadvantage of steep learning curves for surgeons, increased operating time, and increased cost of specialized equipment to perform all-arthroscopic RCR. These factors led to more focus on mini-open RCR (mRCR), where minimal specialized equipment needed, quick training of surgeons possible and cosmetically acceptable scar to patients.[7]

Many studies have performed comparison analysis of cost and outcomes of open, mini-open RCR, and arthroscopic RCR techniques. Most published papers agree on comparable results among three techniques but more financial burden of all-arthroscopic techniques.[9, 10]

Among complications analysis, researchers have looked at total expense of arthroscopic RCRs[11] complications such as infection, stiffness and need for reoperations due to failure of repair or inadequate repair within one month re-hospitalization for any reason related to surgery and expenses of rehabilitation after RCR[13, 14]

In developing countries and low-income areas, cost might be the single biggest challenge for accepting or refusing any particular technique and many patients may not receive appropriate care at the right time. Therefore, the purpose of our study was to look for best technique for RCR which has low cost, quick rehabilitation and acceptable to both patients and surgeons. We aim to compare the expenditure, complication rate within three months, need for re-do surgery or re-hospitalization between two RCR techniques, arthroscopic assisted mini-open and all arthroscopic over a 3-year span at two private health care facilities.

**Hypothesis**: Our hypothesis is that, there will be no significant variation among the three months complications, re-do surgery or re-hospitalization. But, a significant difference in cost of all arthroscopic technique is expected.

## METHODS

Patient selection: Once institutional review board approval was received, a retrospective comparative cohort study was performed. Institutional Review Board (letter no Kazi hospital/21/15A) approval was achieved. Convenience sampling technique was applied. All rotator cuff repairs (RCSs) performed by three orthopedic surgeons between March 2021 and March 2024 at two private healthcare facilities. Informed consent was taken from all patients on proposed proforma.

All patients who underwent arthroscopic assisted mini-open and all arthroscopic RCR between the age of 16 years to 70 years were included in the study. Any patient who needs graft augmentation for massive cuff tears, labra tear reapir, biceps tenotomy, subacromial decompression, if surgery converted to fully open RCR and advance rotator cuff arthropathy were excluded from the study.

During the proposed study period, 150 patients were diagnosed with a partial or complete RC tear on clinical examination. Diagnosis was confirmed via MRI scan before performing surgical intervention. To perform accurate cost analysis, a standardized invoice was generated for all patients including the two procedures in our study. Any variables were noted and removed from the analysis to keep the comparison accurate.

After excluding the patients not meeting our study criteria, a final sample of 115 patients was analyzed: 60 combined arthroscopically assisted mini-open RCR (cRCR), and 55 all-arthroscopic RCR (aRCR). Total number of patients were150 and after excluding the 35 patient as per exclusion criteria, Total 115 patient were included in the study for comparison.

None of the patient with massive tear was included in the study because all of these patients either needed open procedure or grafts augmentation which was beyond the scope of our current study.

Demographics and patient characteristics are detailed in Table I.

**Surgical techniques:** Both surgical techniques were carried out in general anesthesia. We always position the patient in beach-chair position and disposable sheet packs were used. As per our local protocol, each patient received a 1diluted Xyolcaine (10cc) with adrenaline (20cc total volume) injected ten minutes before start of surgery into gleno-humeral joint space and subacromial area to minimize bleeding and reduced post-operative pain.

In the combined arthroscopically assisted mini-open RCR (cRCR) cases, standardized two-portal technique used to create posterior visualization portal and antero-lateral portal for instrumentation. Diagnosis of RC Tear and pattern was confirmed. As soon this step was done, antero-lateral portal was converted into mini open deltoid splitting approach. This gave us direct access to the tear, which was debrided to fresh edges, mobilized if needed and bone bed prepared for insertion. A combination of fiber-wires, ethibond and knotless anchors were used to securely fix the tendon to bone. This was almost always single row repair with average

1±2 anchors used in each case. Long head of biceps tendon was evaluated in all cases and if tendon was inflamed or injured, biceps tenodesis was performed. Tendon was intact in 50 patients and tenodesis was performed in 10 cases.

In second technique all arthroscopic RCR, at least three portals were established. Posterior viewing portal and antero-lateral or lateral portal for suture passing and anchor insertion while anterior portal was used for retrieval of suture, biceps tenotomy and other instrumentation. After confirmation of cuff tear and pattern analysis, margins were freshened and single or double row repair was performed using a combination of simple and knotless anchor sutures. Average number of 2 ± 2 anchors was used for each case. If long head of biceps was in need for tenodesis, an additional anchor suture was used for trans-osseous fixation at humeral shaft via a separate incision. Biceps tendon was intact in 44 patients and tenodesis performed in 11 patients.

Outcome measures for both procedures were recorded at regular follow ups at two, weeks, six weeks, and three months, on a proposed proforma including cost analysis.

**Statistical analysis**: Descriptive statistical analysis was done for study variables, population demographics and patient reported outcomes. To accurately measure cost estimation, descriptive statistics was used: mean, median, and standard deviation. Because cost measurement data in hospital setups is skewed, the median cost was focused for our study analysis. All statistical tests were performed on both surgical technique groups and a P value less than .05 was considered statistically significant. The graphs were prepared using Microsoft excel software.

## RESULTS

Our final study population was 115 patients which underwent either mini-open or arthroscopic RCR at our hospital. First cRCR (combined arthroscopic and mini-open) groups had 60 patients, 60%(n=36) male and 40%(n=24) female patients. While aRCR(all arthroscopic) groups had 55 patients, 71%(n=39) female and 29%(n=16%) male pateints. The mean age for cRCR group was 57±9 years old and for aRCR group was 46 ±6 years. Looking at the main pathlogy in both groups, 84%(n=50) patients in cRCR group and 80%(n=44) patients in aRCR group had Supraspinatus tendon tear only. Operative time was 55±15 minutes in cRCR grop and 75±10minutes in aRCR group. Length of stay was 1±0.5 days in cRCR group and 0.7±0.5 in aRCR group.

We used DeOrio and Cofield classification for RC tear and in cRCR group 70%(n=42) patients had large tears while 30%(n=18) had small to medium tears. In aRCR group 75%(n=41) patients had medium tears and 25%(n=14) had large tears.

Table 1: patient demographics

| Total Number (150) | 60 | 55 | Excluded 35 | |
|---|---|---|---|---|
| Variables | Arthroscopic mini-open repair (N=60) | Arthroscopic repair (N=55) | Total Repair (N=115) | P-value |
| Age (±SD) | 57±9 | 46 ±6 | | 0.2 |
| Sex | | | | |
| Male | 60%(n=36) | 29%(n=16) | 45%(n=52) | |
| Female | 40%(n=24) | 71%(n=39) | 55%(n=63) | |
| Side | | | | |
| Right | 58%(n=35) | 55%(n=30) | 56.5%(n=65) | |
| Left | 42%(n=25) | 45%(n=25) | 43.5%(n=50) | |
| Anchors used | 1±2 | 2±2 | 1.5±2 | 0.36 |
| Biceps Tendon Procedure | | | | |
| None | 83%(n=50) | 80%(n=44) | 81.7%(n=94) | |
| Tenodesis | 17%(n=10) | 20%(n=11) | 18.3%(n=21) | |
| Operation Time | 55±15 minutes | 75±10minutes | | 0.41 |
| Length of Stay | 1±0.5 days | 0.7±0.5 | | 0.39 |
| Pain score | | | | |
| 0-2weeks | 6±2 | 5±1 | 5.5±1 | 0.01 |
| 2-6weeks | 3±1 | 2.75±1 | 2.95±1 | 0.001 |

Rehabilitation protocol was similar for both groups. First two weeks complete immobilization in standard polysling. After removal of sutures at two weeks, active assisted self-taught rehab program was started which included forward flexion of 90degree, abduction up to 90 degree and external rotation of 10 degree only. Pendulum exercises were allowed as pain allowed. After four weeks, professional physiotherapists were engaged full range of movement allowed. Strength training was allowed at 10 to 12 weeks.

There was significant difference in the visual analogue score (VAS) pain score for first two weeks between the two groups

with cRCR group average pain VAS score was average 6±2 and in aRCR group average VAS score was 5±1.

Cost analysis of both groups revealed median standardized cost in cRCR group was 90,000PKR including arthroscopic equipment, cost of anchor suture implant and rehabilitation. Median standardized cost for aRCR group was 150,000PKR including arthroscopic equipment and cost of anchor suture implant. Main difference in cost was due to additional use of anchor sutures in arthroscopic double row repair of RC tear.

In the three month post operative period there were total 2 complications, 4 re-do surgeries and 1 re-hospitalization. Between the two group there was no difference in the three-month complications (p=0.26), re-do surgery (p=0.5) and re-hospitalization (p=0.26). complications included complex regional pain syndrome in one patient 1.5%(n=1) in cRCR group and stitch sinus in 1.8%(n=1) in aRCR group. Re-do surgery was performed in 1.5%(n=1) in cRCR group and 5.4%(n=3) in aRCR group due to partial re-tears in all patients. One re-hospitalization was in cRCR group for concern of poor adherence to rehabilitations program and supervised physiotherapy was offered.

Table 2: complications profile between 2 groups

| Complications | cRCR (n=60) | Arcr (n=55) | Total n=115 | P value |
|---|---|---|---|---|
| CRPS | 1.5% | 0 | 0.86% | 0.001 |
| Stitch Sinus | 0 | 1.8%(n=1) | 0.86% | 0.001 |
| Re-Do surgery | 1.5% | 5.4%(n=3) | 3.5%(N=4) | 0.5 |
| Re-Hospitalization | 1.5% | 0 | 0.86% | 0.26 |

## DISCUSSION

RCRs are a common procedure performed as part of elective orthopedics and several techniques are available to achieve optimal patient outcome. Challenge remains to decide best technique, economical and faster recovery. Patients' expectations to achieve full strength, quick recovery and return to job/sports are additional factors need to be addressed by the treating physician[1,3].

In this study we compared the outcome, complications and cost between two techniques. Looking at the results there is no significant difference in complications rate of two techniques cRR vs aRCR. Although initial pain score, hospital stay and operation time was better in aRCR technique although p value was not significant. Pain score also becomes same for both groups after 2 weeks[4, 6]. Arthroscopic RCR is gaining popularity and as surgeons training and equipment is getting, next generation of orthopedic surgeons will be better at performing aRCR but economic burden remains a challenge especially in developing and third world countries where patient get neglected for the lack of finances to perform elective surgical procedures. There is a strong need to establish an economical alternative to aRCR. Recently there is lot of literature that takes interest in health economics in surgical field and orthopedics particularly. But only few researches have compared the costs between cRCR and aRCR. Literature shows that cRCR is less expensive, less time in theater, similar complications rate. Research shows increased number of cases in one setup, improves the efficiency, results and more cost effective as well[9, 10].

Hui et al12 looks at the hospitalization costs of mini-open repair and aRCR, in Singapore and clearly proves less expenses with mini-open repairs. They also find out that most of the price variation comes from cost of extra anchor suture and disposable equipments such shavers, burrs, diathermy and suture passing needles. [6,12]

Among other study variable, it is notable that aRCR repair was more aptly taken by female patients, younger population and cRCR technique has more male population. This finding has no statistically significant difference but patient choice might have an impact on clinical decision-making process. [10,13,16]

In this study, complication rate was up to 3% which is comparable with international literature. [2,8,28]. Regarding hospital stay, most of the patients in aRCR group went home on same day but a small number of patients do stay wether due to pain or if surgery ended later in the day or patient choice. Among cRCR group average hospital stay was 1±0.5 days.

One study by Zhang et al find out that in the comparison between cRCR and aRCR, retear rate is higher among aRCR group. Our study also finds higher re-tear among this griup but many studies have failed to find this finding. This could be related to surgeon experience and personal technique rather than arthroscopic repair itself.

Our study has limitations of small sample size, and retrospective design.

## CONCLUSIONS

Our study has clearly demonstrated that both techniques for RC repairs, cRCR and aRCR have comparable clinical outcomes with no statistically significant differences in the complication rate, rehabilitation protocol and surgical site infection. Patients in aRCR group had higher cost of surgery and more time spent in theatre, this proved our hypothesis that all arthroscopic rotator cuff repair aRCR has higher cost and comparable complications profile.

Further studies are needed in the future to look at outcome of prospective randomized trial of these two techniques

## ETHICAL APPROVAL

Ethical approval of article was granted by the Institutional Review Board of Kazi Hospital, Lahore vide reference No. kazi/Hospital/21/15A dated 11 March, 2021.

## CONFLICT OF INTEREST

Authors declare no conflict of interest.

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## AUTHOR'S CONTRIBUTIONS

**MB:** Conceived idea, Data collection, statistical analysis, manuscript writing
**AH, MSB:** Data collection, manuscript writing
**MAA, MA:** Data collection
**SAB:** Data collection, manuscript writing, statistical analysis
**All Authors:** Approval of the final version of the manuscript to be published

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