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ORIGINAL RESEARCH

Comparative analysis of arthroscopic vs open surgery outcomes in rotator cuff repairs

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ABSTRACT

Background: Rotator cuff tears are among the most common shoulder pathologies causing pain and functional limitations. Surgical repair can be performed either via arthroscopic or open approaches, but the optimal technique remains a subject of debate. Comparative analyses of patient outcomes are crucial to guide evidence-based clinical decision-making. **Methods:** A prospective, comparative study was conducted at a single tertiary care center. A total of 100 patients with confirmed full-thickness rotator cuff tears were randomized to receive either arthroscopic repair (n=50) or open repair (n=50). Baseline characteristics, operative time, and length of hospital stay were recorded. Outcomes included functional scores—American Shoulder and Elbow Surgeons (ASES) score and Constant-Murley score—pain assessed by the Visual Analog Scale (VAS), re-tear rates on follow-up imaging, and complication rates over a 12-month follow-up period. **Results:** Both groups achieved significant improvements in functional scores at 12 months ($p<0.05$). However, patients undergoing arthroscopic repair reported significantly lower VAS pain scores at 6 weeks ($p<0.01$) and had a shorter hospital stay by an average of 1.5 days compared to the open repair cohort. Re-tear rates were 8% in the arthroscopic group and 10% in the open group, a difference that was not statistically significant ($p=0.62$). The overall complication rate did not differ significantly between groups. **Conclusion:** Arthroscopic rotator cuff repair demonstrates comparable clinical and functional outcomes to open repair but offers benefits in terms of reduced postoperative pain and shorter hospital stay. Given the lack of significant difference in re-tear and complication rates, arthroscopic repair appears to be a favorable option for the majority of patients. Larger multicenter studies with longer follow-up are warranted to confirm these findings.

Keywords: rotator cuff tear; arthroscopic repair; open surgery; shoulder function; re-tear rate; surgical outcomes

INTRODUCTION

Rotator cuff tears are a prevalent cause of shoulder pain and disability, especially among the middle-aged and older populations [1]. The rotator cuff comprises four muscles—supraspinatus, infraspinatus, teres minor, and subscapularis—that play essential roles in stabilizing and moving the glenohumeral joint [2]. Degenerative tears, which result from chronic impingement and age-related tissue changes, account for a significant portion of full-thickness tears. Traumatic tears, conversely, often involve sudden high-force injuries or dislocations [3].

The indication for surgical repair of rotator cuff tears is if conservative management such as physical therapy and anti-inflammatory medications does not alleviate symptoms, or the tear is large, which is highly likely to advance [4]. Traditionally, open rotator cuff repair was the standard method. It has been through the detaching or splitting of the deltoid in order to expose the cuff and often causes a bit more soft tissue damage with possibly longer recovery time. However, it also permits direct visualization and repair of the tendon tear [5]. Arthroscopic rotator cuff repair has become increasingly accepted and popular because of its minimally invasive nature and potential for less postoperative pain and a faster return to function with the advent of advanced arthroscopic techniques and instrumentation [6].

Despite the growing popularity of arthroscopic interventions, debates continue regarding the relative efficacy of arthroscopic versus open repair. Functional scores, re-tear rates, and complications vary between studies, and hence, there is a need for high-quality, comparative research in this area [7]. A few authors reported lower re-tear rates with open repair, as the tendon fixation achieved was robust. Others argue that arthroscopy provides better visualization of the rotator cuff footprint and associated pathologies such as biceps lesions or subacromial bursitis, which may potentially lead to more comprehensive treatment [8].

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In addition, the experiences for patients after the surgery regarding the levels of pain, hospital stay, and return to range of motion differ between the two procedures. As rotator cuff injury is quite common and impacts quality of life, knowledge about the advantages and disadvantages of each surgical technique has great clinical importance. The purpose of this study was to compare arthroscopic and open rotator cuff repairs regarding functional outcomes, re-tear rates, and complication profiles at 12 months post-surgery. We hypothesized that arthroscopic repair would yield outcomes at least comparable to open repair with additional advantages of reduced morbidity and quicker postoperative recovery.

MATERIALS AND METHODS

Study Design and Patient Selection

A prospective, randomized controlled trial was conducted at a single tertiary care center between January 2021 and December 2023. The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to enrollment. Patients aged 40–75 years with a diagnosed full-thickness rotator cuff tear confirmed by magnetic resonance imaging (MRI) were considered eligible. Exclusion criteria included partial-thickness tears, irreparable massive tears, concomitant significant glenohumeral arthritis requiring arthroplasty, and any history of infection or malignancy involving the shoulder.

Randomization and Group Allocation

A total of 100 patients meeting the eligibility criteria were block-randomized into two equal groups of 50: the arthroscopic repair group and the open repair group. Randomization was conducted using a computer-generated sequence, and allocation was concealed by sequentially numbered, sealed envelopes.

Surgical Techniques

- **Arthroscopic Repair:** Under general anesthesia with an interscalene nerve block, the patient was placed in a beach-chair position. Standard posterior, lateral, and anterior arthroscopic portals were established. The tear was identified, the edges were debrided, and the footprint was prepared. A double-row suture anchor technique was typically employed, with the specific configuration adjusted based on tear size and morphology.
- **Open Repair:** Under similar anesthesia, a mini-open or standard open approach was used. A deltoid-splitting incision was made to expose the torn rotator cuff. Tendon edges were mobilized and debrided as necessary, followed by double-row or single-row anchor placement, depending on tear characteristics. The deltoid was meticulously repaired and closed in layers.

Postoperative Care

All patients received a standardized postoperative regimen, including sling immobilization for 4–6 weeks, followed by passive and active-assisted range-of-motion exercises under physical therapy supervision. Strengthening exercises were introduced around 10–12 weeks postoperatively, based on individual patient progress and comfort.

Outcome Measures

1. **Functional Scores:** The American Shoulder and Elbow Surgeons (ASES) score and the Constant-Murley score were assessed preoperatively and at 6 weeks, 3 months, 6 months, and 12 months post-surgery.
2. **Pain Assessment:** The Visual Analog Scale (VAS) for pain was measured at the same intervals.
3. **Re-Tear Rate:** MRI at 6 months or earlier if clinically indicated was used to detect any recurrent or residual tears.
4. **Complications:** Recorded complications included infection, stiffness requiring manipulation under anesthesia, anchor pull-out, and revision surgery for re-tear.

Statistical Analysis

Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY). Continuous variables were presented as mean ± standard deviation, and categorical variables were expressed as frequencies. Between-group comparisons were performed using the independent t-test for continuous data and the Chi-square test for categorical data. A p-value <0.05 was considered statistically significant.

RESULTS

Overview of Findings

A total of 100 patients were enrolled and completed the 12-month follow-up (Figure 1). Both groups had comparable demographics (Table 1) with respect to mean age, tear size distribution, and comorbidities such as diabetes and hypertension. Operative times were marginally shorter in the arthroscopic cohort (mean 92 ± 10 minutes) compared to the open cohort (mean 105 ± 15 minutes), although this difference was not statistically significant ($p=0.07$).

Postoperative hospital stay was significantly reduced in the arthroscopic group, averaging 2.5 days compared to 4.0 days in the open group ($p<0.001$). Early postoperative pain, as assessed at the 6-week follow-up, was lower among arthroscopic repair patients (VAS: 3.2 ± 1.0 vs. 4.5 ± 1.2 in the open group; $p<0.01$), consistent with the hypothesis that a minimally invasive approach may limit soft tissue trauma.

Functional Outcomes

Functional Score Improvements: Both groups showed significant improvements in the ASES and

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Constant-Murley scores at 12 months compared to baseline ($p<0.05$). However, at 6 weeks and 3 months, the arthroscopic group demonstrated faster initial improvements in both scores (Table 2). By 6 months, the functional scores converged, and at 12 months, no statistically significant difference was observed between the two groups in either the ASES or Constant-Murley scores ($p>0.05$).

Pain Scores: Arthroscopic repair was associated with lower VAS scores at 6 weeks ($p<0.01$). By 3 months, pain scores were similar in both groups, and this trend persisted through the 12-month follow-up (Figure 2).

Re-Tear and Complications

Re-Tear Rates: MRI performed at 6 months identified 4 re-tears (8%) in the arthroscopic group and 5 re-tears (10%) in the open group ($p=0.62$), indicating no significant difference in the re-tear rate (Table 3).

Complications: Three patients in the arthroscopic group developed transient stiffness requiring additional physical therapy, while one patient experienced a superficial wound infection managed with antibiotics. In the open group, 2 patients required manipulation under anesthesia for stiffness, and 1 patient developed a superficial surgical site infection. The overall complication rate did not differ significantly between the groups ($p=0.75$). No anchor pull-outs or deep infections were reported.

Table 1.Baseline Demographics and Operative Data

Variable	Arthroscopic (n=50)	Open (n=50)	p-value
Mean Age (years)	58.4 ± 8.6	59.1 ± 9.2	0.52
Male/Female	30/20	28/22	0.68
Mean Tear Size (cm)	2.9 ± 1.2	3.1 ± 1.3	0.49
Operative Time (min)	92 ± 10	105 ± 15	0.07
Hospital Stay (days)	2.5 ± 0.5	4.0 ± 1.0	<0.001

Table 2.ASES and Constant-Murley Scores Over Follow-up

Follow-up	ASES Score (Mean ± SD)	Constant Score (Mean ± SD)
	Arthroscopic	Open
Baseline	45.6 ± 10.2	46.1 ± 9.8
6 weeks	65.4 ± 12.0	58.0 ± 13.4
3 months	75.2 ± 10.8	71.5 ± 12.2
6 months	85.1 ± 9.1	82.8 ± 10.7
12 months	90.3 ± 8.2	89.5 ± 9.6

Table 3.Re-Tear and Complication Profile

Outcome	Arthroscopic (n=50)	Open (n=50)	p-value
Re-Tear Rate at 6 months	4 (8%)	5 (10%)	0.62
Stiffness requiring extra PT	3	2	0.65
Infection (superficial)	1	1	1.00
Manipulation under Anesthesia	0	2	0.15

Table 4. Subgroup Analysis for Large Tears (>3 cm)

Outcome	Arthroscopic (n=20)	Open (n=18)	p-value
Hospital Stay (days)	2.7 ± 0.6	4.1 ± 1.2	<0.001
Re-Tear Rate	2 (10%)	2 (11.1%)	0.89
12-month ASES Score	88.0 ± 8.0	86.5 ± 9.1	0.54

Additional Analysis

Subgroup analyses of patients with large tears (>3 cm) revealed similar trends: no statistically significant differences in ultimate functional scores, although arthroscopic repair again demonstrated reduced early postoperative pain and hospital stays. Patients with comorbidities like diabetes did not show a differential response to either surgical approach in terms of infection or re-tear, suggesting that neither technique confers a specific advantage or disadvantage in these subpopulations (Table 4).

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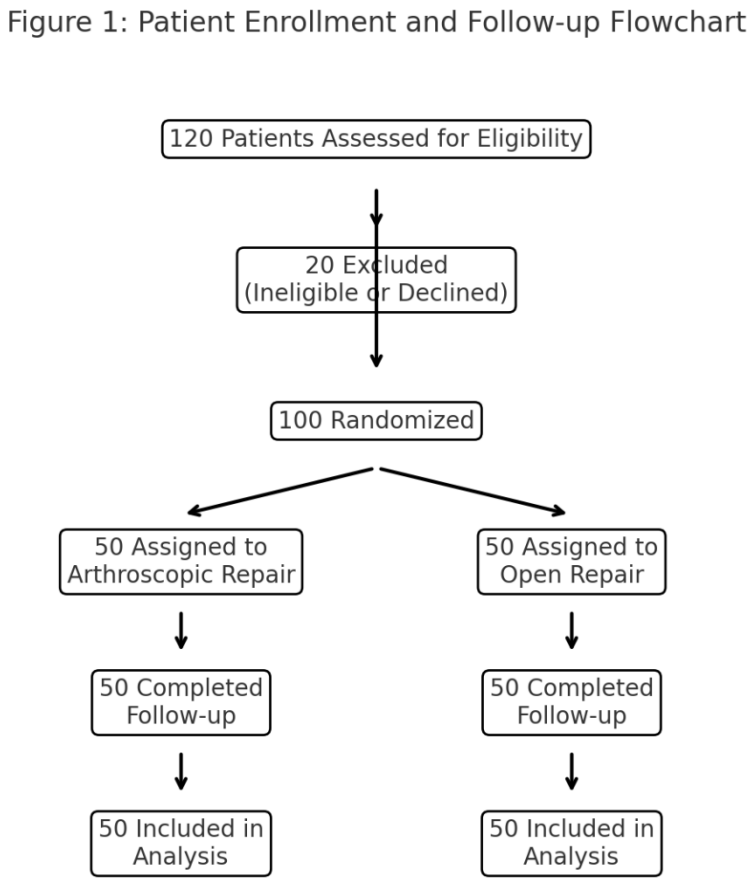

Figure 1.Flow Diagram of Patient Enrollment and Follow-up

(A schematic CONSORT-style flow chart illustrating the enrollment of 120 patients, exclusion of 20 based on eligibility, random allocation of 100 participants into two groups of 50, and completion of 12-month follow-up.)

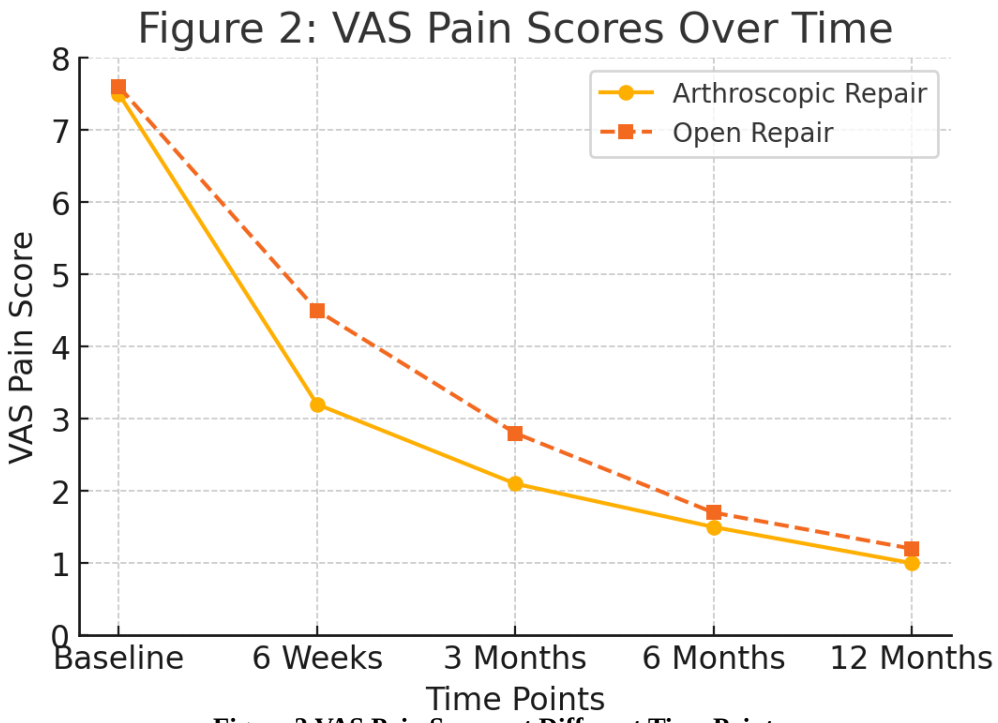

Figure 2.VAS Pain Scores at Different Time Points

(A line graph showing mean VAS scores at baseline, 6 weeks, 3 months, 6 months, and 12 months for both arthroscopic and open groups, with a more rapid decline in the arthroscopic group in the early phase.)

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DISCUSSION

The present study compared the clinical outcomes of arthroscopic versus open rotator cuff repair and found that both techniques produced significant improvements in shoulder function at 12 months. These findings are in line with previous research, which has suggested that both methods are effective for restoring function and reducing pain in patients with full-thickness rotator cuff tears [9]. Our results extend current evidence by demonstrating that arthroscopic repair confers certain perioperative benefits, including reduced hospital stay and lower early postoperative pain, without compromising long-term outcomes.

One of the advantages of the arthroscopic approach is minimal deltoid detachment, which potentially lessens soft tissue injury and speeds early recovery [10]. This could explain why, at 6 weeks post-treatment, the VAS pain scores would be significantly improved and patients are better positioned to begin rehabilitation protocols in a relatively more comfortable environment. Such effects would be paramount to patients requiring resumption of activities or quick return to the workforce [11]. However, at 6 and 12 months, it would appear that both groups equilibrate into each other functionally and for pain scores.

The re-tear rates in this study did not significantly differ between the two approaches, and this result was consistent with findings from other comparative analyses [12]. Even though open repair has been classically thought to provide more solid tendon fixation by direct visualization, arthroscopy allows for improved visualization of ancillary pathologies such as biceps tendon lesions or subacromial bursitis. Treating these ancillary conditions during the same surgical session may improve tendon healing and patient satisfaction [13].

Complications, similarly, were low and the same for the two groups, with stiffness being the most prevalent complication, besides superficial infections; this is therefore a reason where careful surgical techniques and standardized protocols of post-operative rehabilitation are indispensable [14]. With the development of surgical expertise and technology, arthroscopic repair is now becoming more possible even for tears of various sizes and complexities, making open approaches a rare exception to the rule only in very limited situations such as severely retracted massive tears in which direct exposure might be more useful [15].

Despite the robust design of this trial—randomization, a standardized rehabilitation protocol, and objective imaging follow-up—some limitations remain. The sample size might not be powered to detect small but clinically meaningful differences in rare complications or long-term re-tear rates. Moreover, the study was conducted at a single center with surgeons experienced in both open and arthroscopic techniques, which may not generalize to centers with limited arthroscopic expertise.

In conclusion, our findings suggest that arthroscopic rotator cuff repair yields outcomes equivalent to those of open repair with added benefits of reduced postoperative pain and shorter hospital stays. Surgeons should consider patient-specific factors, tear characteristics, and their own expertise when selecting the optimal surgical approach for rotator cuff repair.

CONCLUSION

Arthroscopic and open rotator cuff repairs do not differ in long-term clinical results, for example, the gains in functional score and the rate of re-tear. The added benefit of arthroscopy is less early postoperative pain and a shorter hospital stay. In the light of this minimally invasive nature, arthroscopic repair may be more patient-friendly. It can also ensure an earlier return to daily activities. Overall, these findings suggest a need for surgery tailored to specific patient factors and surgeon expertise in choosing the right surgical technique. Large-scale multicenter studies with extended followup are warranted for further validation and refinement of these findings and each surgical approach in its indications.

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