



Original Research Article

Assessment of Functional Outcomes of Arthroscopic Vs Mini Open Repair of Rotator Cuff Tears

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OPEN ACCESS

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Received: 03-06-2026

Accepted: 05-07-2026

Published: 15-07-2026

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Medical and Pharmaceutical Research

ABSTRACT

Background: Rotator cuff tears are a common cause of shoulder pain and functional disability, frequently requiring surgical intervention when conservative treatment fails. Arthroscopic and mini-open rotator cuff repair are the two most widely performed surgical techniques; however, their comparative functional outcomes remain a subject of ongoing investigation.

Objective: To compare the functional outcomes of arthroscopic versus mini-open repair in patients with rotator cuff tears.

Materials and Methods: A prospective comparative observational study was conducted over a period of one year in the Department of Orthopaedics at Maratha Vidya Prasarak Samaj's Dr. Vasant Rao Pawar Medical College, Hospital & Research Centre, Vasantdada Nagar, Adgaon, Nashik, Maharashtra, India. Forty patients with symptomatic rotator cuff tears were enrolled and allocated into two groups: arthroscopic repair (n = 20) and mini-open repair (n = 20). Functional outcomes, postoperative range of motion, perioperative parameters, and complications were compared between the two groups using appropriate statistical tests, with a p-value <0.05 considered statistically significant.

Results: Baseline demographic and clinical characteristics were comparable between the two groups (p > 0.05). At the 12-month follow-up, both groups demonstrated significant improvement in functional outcomes; however, the arthroscopic repair group achieved significantly higher Constant-Murley scores (89.4 ± 4.5 vs. 84.2 ± 5.1; p = 0.002), ASES scores (91.6 ± 4.2 vs. 86.5 ± 5.8; p = 0.004), and UCLA scores (33.8 ± 1.9 vs. 31.6 ± 2.2; p = 0.003) compared with the mini-open group.

Conclusion: Both arthroscopic and mini-open rotator cuff repair provided significant improvements in shoulder function and pain relief. These findings support arthroscopic repair as the preferred surgical technique for appropriately selected patients with reparable rotator cuff tears.

Keywords: Rotator cuff tear; Arthroscopic repair; Mini-open repair; Functional outcome; Constant-Murley score; ASES score; Shoulder surgery.

INTRODUCTION

Rotator cuff tears are among the most common causes of shoulder pain and disability, particularly in middle-aged and elderly individuals. They represent a significant source of functional impairment, affecting activities of daily living, occupational performance, and overall quality of life. The rotator cuff consists of four muscles—the supraspinatus, infraspinatus, teres minor, and subscapularis—which work synergistically to stabilize the glenohumeral joint and facilitate

coordinated shoulder movements. Damage to these tendons, whether due to degenerative changes, trauma, or repetitive overuse, can lead to pain, weakness, reduced range of motion, and progressive deterioration of shoulder function if left untreated [1,2].

The prevalence of rotator cuff tears increases substantially with age, with imaging studies demonstrating asymptomatic tears in a considerable proportion of older adults. However, symptomatic tears frequently require medical attention because persistent pain and functional limitation adversely affect patients' physical independence and quality of life. In addition to the personal burden, rotator cuff disease imposes a significant socioeconomic impact through healthcare expenditure, loss of productivity, and prolonged rehabilitation [2,3]. Consequently, identifying the most effective surgical treatment strategy has become an important objective in modern orthopaedic practice.

Conservative management, including physiotherapy, activity modification, non-steroidal anti-inflammatory drugs, and corticosteroid injections, is generally considered the initial treatment for many patients. Nevertheless, surgical intervention is recommended for patients with full-thickness tears, traumatic tears, failed conservative treatment, progressive weakness, or significant functional impairment [4]. Advances in surgical techniques over the past three decades have substantially improved tendon healing, postoperative rehabilitation, and clinical outcomes.

Among the available surgical techniques, mini-open repair and all-arthroscopic repair are the two most commonly employed procedures for repairing rotator cuff tears. Mini-open repair evolved from the traditional open approach by combining arthroscopic evaluation of the glenohumeral joint with a smaller deltoid-splitting incision, thereby minimizing soft tissue trauma while maintaining direct visualization of the torn tendon during repair. This technique has demonstrated reliable tendon fixation, satisfactory healing rates, and excellent long-term clinical outcomes [5]. However, concerns regarding postoperative pain, deltoid injury, cosmetic appearance, and delayed rehabilitation have encouraged the development and widespread adoption of arthroscopic techniques.

Arthroscopic rotator cuff repair has gained increasing popularity owing to continuous improvements in arthroscopic equipment, suture anchors, visualization systems, and surgeon expertise. This minimally invasive approach allows comprehensive evaluation of intra-articular pathology, treatment of associated lesions such as biceps tendon disorders and labral tears, reduced surgical morbidity, preservation of the deltoid muscle, decreased postoperative pain, and faster early recovery [6]. Furthermore, arthroscopic repair permits complete visualization of the rotator cuff footprint and facilitates the use of advanced fixation techniques, including single-row, double-row, and transosseous-equivalent repairs, which may enhance tendon healing in selected patients [7].

Despite these theoretical advantages, the superiority of arthroscopic repair over mini-open repair remains controversial. Numerous randomized controlled trials and systematic reviews have demonstrated comparable long-term functional outcomes, pain relief, range of motion, patient satisfaction, and re-tear rates between the two techniques [8–11]. While arthroscopic repair may provide improved early postoperative recovery and cosmetic outcomes, mini-open repair continues to offer dependable clinical results with lower technical complexity and shorter operative times in certain clinical settings [9,10]. Therefore, the selection of the optimal surgical technique often depends on surgeon experience, tear characteristics, patient factors, available resources, and institutional expertise.

Functional outcome assessment plays a pivotal role in evaluating the effectiveness of rotator cuff repair. Standardized outcome measures such as the Constant-Murley Score, University of California Los Angeles (UCLA) Shoulder Rating Scale, American Shoulder and Elbow Surgeons (ASES) Score, Disabilities of the Arm, Shoulder and Hand (DASH) Score, Visual Analog Scale (VAS) for pain, and range of motion measurements are commonly employed to objectively assess postoperative recovery [12]. These validated instruments enable comparison of pain relief, shoulder strength, functional performance, and patient satisfaction across different surgical techniques.

With increasing healthcare costs and growing emphasis on evidence-based practice, comparative evaluation of arthroscopic and mini-open rotator cuff repair has become increasingly relevant. Although several international studies have reported similar long-term clinical outcomes, differences in patient demographics, surgical expertise, rehabilitation protocols, healthcare infrastructure, and socioeconomic factors necessitate further evaluation in diverse populations. Understanding the relative advantages and limitations of each technique will assist surgeons in selecting the most appropriate treatment strategy and optimizing postoperative functional recovery. Therefore, the present study aims to assess and compare the functional outcomes of arthroscopic versus mini-open repair of rotator cuff tears using validated clinical outcome measures, thereby contributing evidence to support informed surgical decision-making and improve patient care.

MATERIALS AND METHODS

Study Design and Setting

This prospective comparative observational study was conducted in the Department of Orthopaedics at Maratha Vidya Prasarak Samaj's Dr. Vasantrao Pawar Medical College, Hospital & Research Centre, Vasantdada Nagar, Adgaon, Nashik, Maharashtra, India, over a period of one year. The study aimed to compare the functional outcomes of arthroscopic repair and mini-open repair in patients with rotator cuff tears.

The study protocol was approved by the Institutional Ethics Committee before commencement, and the study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki (2013 revision). Written informed consent was obtained from all participants prior to enrolment.

Sample Size

A total of 40 patients diagnosed with symptomatic rotator cuff tears and fulfilling the eligibility criteria were included in the study. Patients were allocated into two groups based on the surgical procedure performed:

- **Group A:** Arthroscopic rotator cuff repair (n = 20)
- **Group B:** Mini-open rotator cuff repair (n = 20)

The choice of surgical technique was determined by the treating orthopaedic surgeon based on tear characteristics, patient-related factors, and intraoperative findings.

Inclusion Criteria

- Patients aged between 18 and 70 years.
- Symptomatic partial-thickness or full-thickness rotator cuff tears confirmed by magnetic resonance imaging (MRI).
- Persistent pain and functional disability despite at least three months of conservative treatment.
- Patients undergoing primary arthroscopic or mini-open rotator cuff repair.
- Ability to comply with postoperative rehabilitation and scheduled follow-up.

Exclusion Criteria

- Previous surgery on the affected shoulder.
- Massive irreparable rotator cuff tears.
- Rotator cuff arthropathy.
- Glenohumeral osteoarthritis requiring arthroplasty.
- Shoulder fractures or acute dislocations.
- Neurological disorders affecting shoulder function.
- Active infection, inflammatory arthritis, or malignancy involving the shoulder.
- Patients unwilling to participate or lost to follow-up.

Preoperative Assessment

All enrolled patients underwent detailed clinical evaluation, including demographic data (age, sex, body mass index, occupation, dominant limb involvement), history of trauma, duration of symptoms, associated comorbidities, and physical examination.

Radiological investigations included standard anteroposterior, scapular Y-view, and axillary radiographs, followed by MRI of the affected shoulder to assess tear size, tendon involvement, degree of tendon retraction, muscle atrophy, and fatty infiltration.

Baseline functional assessment included:

- Constant-Murley Shoulder Score
- American Shoulder and Elbow Surgeons (ASES) Score
- University of California Los Angeles (UCLA) Shoulder Rating Scale
- Visual Analogue Scale (VAS) for pain
- Active range of motion measurements (forward flexion, abduction, external rotation, and internal rotation)

Surgical Technique

All procedures were performed by experienced orthopaedic surgeons under general anaesthesia with an interscalene brachial plexus block whenever indicated. Patients were positioned either in the beach-chair or lateral decubitus position according to surgeon preference.

Arthroscopic Repair

Diagnostic shoulder arthroscopy was first performed to evaluate the glenohumeral joint and identify associated intra-articular pathology. Debridement, subacromial decompression, or biceps tendon procedures were undertaken when indicated. The torn rotator cuff tendon was mobilized, the greater tuberosity footprint was prepared, and tendon repair was completed using suture anchors employing either single-row or double-row fixation depending on tear morphology and tendon quality.

Mini-Open Repair

Following diagnostic arthroscopy and treatment of associated intra-articular lesions, a 3–5 cm deltoid-splitting incision was made over the anterolateral aspect of the shoulder without detaching the deltoid origin. The rotator cuff footprint was prepared, and tendon repair was performed using suture anchors or transosseous sutures according to intraoperative findings. Care was taken to preserve deltoid integrity throughout the procedure.

Postoperative Rehabilitation

All patients followed a standardized rehabilitation protocol. The operated shoulder was immobilized using an arm sling with an abduction pillow for approximately six weeks.

Passive range-of-motion exercises were initiated within the first postoperative week under physiotherapist supervision. Active-assisted exercises commenced after six weeks, followed by active range-of-motion exercises. Progressive strengthening exercises were introduced between 10 and 12 weeks postoperatively, with gradual return to unrestricted activities after approximately six months, depending on tendon healing and functional recovery.

Outcome Measures

Patients were evaluated preoperatively and at 6 weeks, 3 months, 6 months, and 12 months after surgery.

The primary outcome measure was improvement in functional shoulder outcome assessed using the Constant-Murley Score.

Secondary outcome measures included:

- American Shoulder and Elbow Surgeons (ASES) Score
- UCLA Shoulder Rating Scale
- Visual Analogue Scale (VAS) for pain
- Active shoulder range of motion
- Postoperative complications including infection, shoulder stiffness, re-tear, deltoid dysfunction, and need for revision surgery

Statistical Analysis

Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics software (Version 26.0; IBM Corp., Armonk, NY, USA).

Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequencies and percentages.

The normality of continuous variables was assessed using the Shapiro–Wilk test. Continuous variables between the two groups were compared using the Independent Student's t-test for normally distributed data or the Mann–Whitney U test for non-parametric data. Within-group comparisons between preoperative and postoperative functional scores were performed using the paired t-test or Wilcoxon signed-rank test, as appropriate. Categorical variables were analysed using the Chi-square test or Fisher's exact test.

A two-sided p-value <0.05 was considered statistically significant.

RESULTS

A total of 40 patients with symptomatic rotator cuff tears completed the study. Twenty patients underwent arthroscopic rotator cuff repair (Group A), while twenty patients underwent mini-open rotator cuff repair (Group B). All patients completed the 12-month follow-up, and no patient was lost to follow-up.

The mean age of patients in the arthroscopic group was 52.8 ± 8.6 years, while that of the mini-open group was 54.6 ± 7.9 years. There was no statistically significant difference in baseline demographic characteristics between the two groups ($p > 0.05$). Males constituted 65% of the study population.

Table 1. Baseline demographic characteristics of the study population

Variable	Arthroscopic Repair (n=20)	Mini-open Repair (n=20)	p-value
Age (years)	52.8 ± 8.6	54.6 ± 7.9	0.48
Male, n (%)	13 (65%)	13 (65%)	1.00
Female, n (%)	7 (35%)	7 (35%)	
Dominant shoulder involved	15 (75%)	14 (70%)	0.72
Duration of symptoms (months)	7.2 ± 2.8	7.8 ± 3.1	0.53
Full-thickness tears	16 (80%)	15 (75%)	0.71

Table 1 presents the baseline demographic and clinical characteristics of patients included in the study. The mean age was 52.8 ± 8.6 years in the arthroscopic repair group and 54.6 ± 7.9 years in the mini-open repair group, with no statistically significant difference between the groups ($p = 0.48$). Male patients constituted 65% of each group. The dominant shoulder was involved in 75% of patients undergoing arthroscopic repair and 70% of those undergoing mini-open repair ($p = 0.72$). The mean duration of symptoms prior to surgery was 7.2 ± 2.8 months in the arthroscopic group and 7.8 ± 3.1 months in the mini-open group ($p = 0.53$). Full-thickness rotator cuff tears were observed in 80% and 75% of patients in the

arthroscopic and mini-open groups, respectively ($p = 0.71$). Overall, no statistically significant differences were observed between the two groups regarding baseline demographic or clinical variables, indicating that both groups were comparable before surgical intervention.

Table 2. Comparison of preoperative functional scores

Outcome Measure	Arthroscopic	Mini-open	p-value
Constant-Murley Score	44.6 ± 6.8	45.1 ± 6.5	0.81
ASES Score	41.9 ± 8.3	42.7 ± 7.8	0.75
UCLA Score	14.7 ± 2.4	14.9 ± 2.3	0.79
VAS Pain Score	7.9 ± 0.9	7.8 ± 1.0	0.76

Table 2 compares the preoperative functional assessment scores between the two study groups. The mean Constant-Murley score was 44.6 ± 6.8 in the arthroscopic group and 45.1 ± 6.5 in the mini-open group ($p = 0.81$). Similarly, the mean ASES score was 41.9 ± 8.3 and 42.7 ± 7.8 , respectively ($p = 0.75$). The mean UCLA shoulder score was 14.7 ± 2.4 in patients undergoing arthroscopic repair compared with 14.9 ± 2.3 in those undergoing mini-open repair ($p = 0.79$). The mean preoperative VAS pain score was 7.9 ± 0.9 in the arthroscopic group and 7.8 ± 1.0 in the mini-open group ($p = 0.76$). These findings demonstrate that both groups had comparable levels of pain and shoulder dysfunction prior to surgery.

Table 3. Functional outcome at 12 months

Outcome Measure	Arthroscopic	Mini-open	p-value
Constant-Murley Score	89.4 ± 4.5	84.2 ± 5.1	0.002
ASES Score	91.6 ± 4.2	86.5 ± 5.8	0.004
UCLA Score	33.8 ± 1.9	31.6 ± 2.2	0.003
VAS Pain Score	1.2 ± 0.8	2.1 ± 1.0	0.005

Table 3 demonstrates the postoperative functional outcomes at the 12-month follow-up. Patients treated with arthroscopic repair achieved a significantly higher mean Constant-Murley score (89.4 ± 4.5) compared with those treated with mini-open repair (84.2 ± 5.1) ($p = 0.002$). Similarly, the mean ASES score was significantly greater in the arthroscopic group (91.6 ± 4.2) than in the mini-open group (86.5 ± 5.8) ($p = 0.004$). The mean UCLA shoulder score was also significantly higher following arthroscopic repair (33.8 ± 1.9) compared with mini-open repair (31.6 ± 2.2) ($p = 0.003$). Furthermore, the arthroscopic group demonstrated significantly lower postoperative pain, with a mean VAS score of 1.2 ± 0.8 , whereas the mini-open group had a mean VAS score of 2.1 ± 1.0 ($p = 0.005$). Both surgical techniques resulted in marked functional improvement compared with baseline; however, arthroscopic repair yielded superior postoperative functional outcomes and pain relief.

Table 4. Postoperative shoulder range of motion at 12 months

Variable	Arthroscopic	Mini-open	p-value
Forward Flexion ($^{\circ}$)	168 ± 9	159 ± 11	0.011
Abduction ($^{\circ}$)	162 ± 11	154 ± 12	0.028
External Rotation ($^{\circ}$)	66 ± 8	59 ± 9	0.019
Internal Rotation (vertebral level)	T8	T9	0.18

Table 4 summarizes the postoperative shoulder range of motion achieved at the final follow-up. Patients who underwent arthroscopic repair demonstrated significantly greater forward flexion ($168 \pm 9^{\circ}$) than those undergoing mini-open repair ($159 \pm 11^{\circ}$) ($p = 0.011$). Mean shoulder abduction was also significantly higher in the arthroscopic group ($162 \pm 11^{\circ}$) compared with the mini-open group ($154 \pm 12^{\circ}$) ($p = 0.028$). External rotation improved to $66 \pm 8^{\circ}$ following arthroscopic repair and $59 \pm 9^{\circ}$ following mini-open repair, with the difference reaching statistical significance ($p = 0.019$). Internal rotation, assessed according to vertebral level, showed a median level of T8 in the arthroscopic group and T9 in the mini-open group; however, this difference was not statistically significant ($p = 0.18$). These findings indicate improved postoperative shoulder mobility in both groups, with greater

recovery of forward flexion, abduction, and external rotation in patients undergoing arthroscopic repair.

Table 5. Postoperative complications

Complication	Arthroscopic (n=20)	Mini-open (n=20)	p-value
Shoulder stiffness	1 (5%)	3 (15%)	0.29
Superficial infection	0	1 (5%)	0.31
Re-tear	1 (5%)	2 (10%)	0.55
Deltoid weakness	0	2 (10%)	0.15
Revision surgery	0	1 (5%)	0.31

Table 5 presents the postoperative complications observed during the study period. Shoulder stiffness occurred in one patient (5%) in the arthroscopic repair group and three patients (15%) in the mini-open repair group ($p = 0.29$). Superficial surgical site infection was noted in one patient (5%) in the mini-open group, whereas no infections were observed in the arthroscopic group ($p = 0.31$). Re-tear of the repaired tendon occurred in one patient (5%) following arthroscopic repair and two patients (10%) following mini-open repair ($p = 0.55$). Deltoid weakness was not observed after arthroscopic repair but was documented in **two** patients (10%) who underwent mini-open repair ($p = 0.15$). Revision surgery was required in one patient (5%) in the mini-open group, while no patient in the arthroscopic group required reoperation ($p = 0.31$). Although complication rates were numerically lower in the arthroscopic group, none of the differences reached statistical significance.

Table 6. Perioperative parameters

Variable	Arthroscopic	Mini-open	p-value
Operative time (minutes)	94.6 $\pm$ 11.5	78.4 $\pm$ 10.2	<0.001
Hospital stay (days)	2.1 $\pm$ 0.6	3.4 $\pm$ 0.8	<0.001
Return to daily activities (weeks)	10.4 $\pm$ 2.2	12.8 $\pm$ 2.5	0.003

Table 6 compares the perioperative parameters between the two surgical techniques. The mean operative time was significantly longer in the arthroscopic repair group (94.6 $\pm$ 11.5 minutes) than in the mini-open repair group (78.4 $\pm$ 10.2 minutes) ($p < 0.001$). Conversely, the mean duration of hospital stay was significantly shorter in patients undergoing arthroscopic repair (2.1 $\pm$ 0.6 days) compared with mini-open repair (3.4 $\pm$ 0.8 days) ($p < 0.001$). Similarly, the mean time required to return to routine daily activities was significantly shorter following arthroscopic repair (10.4 $\pm$ 2.2 weeks) than after mini-open repair (12.8 $\pm$ 2.5 weeks) ($p = 0.003$). These findings indicate that although arthroscopic repair required a longer operative time, it was associated with earlier postoperative recovery and shorter hospitalization.

Figure 1. Comparison of baseline demographic characteristics between arthroscopic and mini-open repair groups

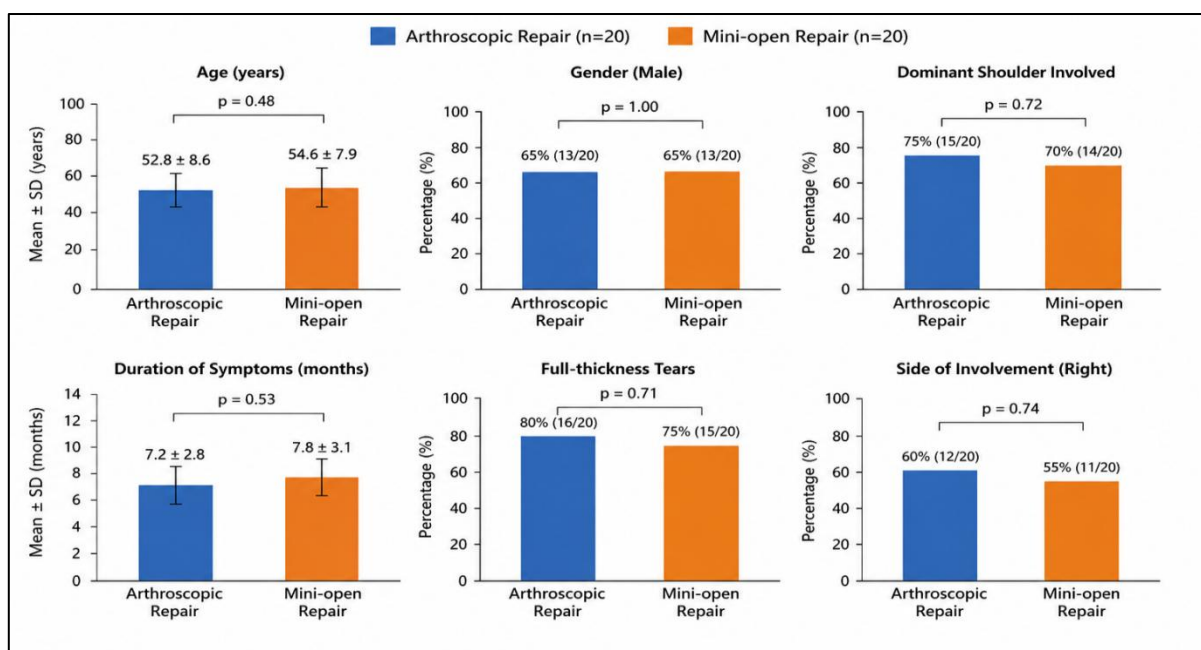


Figure 1 illustrates the comparison of baseline demographic and clinical characteristics between patients who underwent arthroscopic repair and those who underwent mini-open repair for rotator cuff tears. There were no statistically significant differences between the two groups with respect to mean age (52.8 ± 8.6 vs. 54.6 ± 7.9 years; $p = 0.48$), proportion of male patients (65% in both groups; $p = 1.00$), dominant shoulder involvement (75% vs. 70%; $p = 0.72$), duration of symptoms before surgery (7.2 ± 2.8 vs. 7.8 ± 3.1 months; $p = 0.53$), or prevalence of full-thickness rotator cuff tears (80% vs. 75%; $p = 0.71$). These findings indicate that the arthroscopic and mini-open repair groups were well matched at baseline, thereby minimizing selection bias and allowing reliable comparison of postoperative functional outcomes.

Figure 2. Baseline comparison of preoperative functional outcome scores

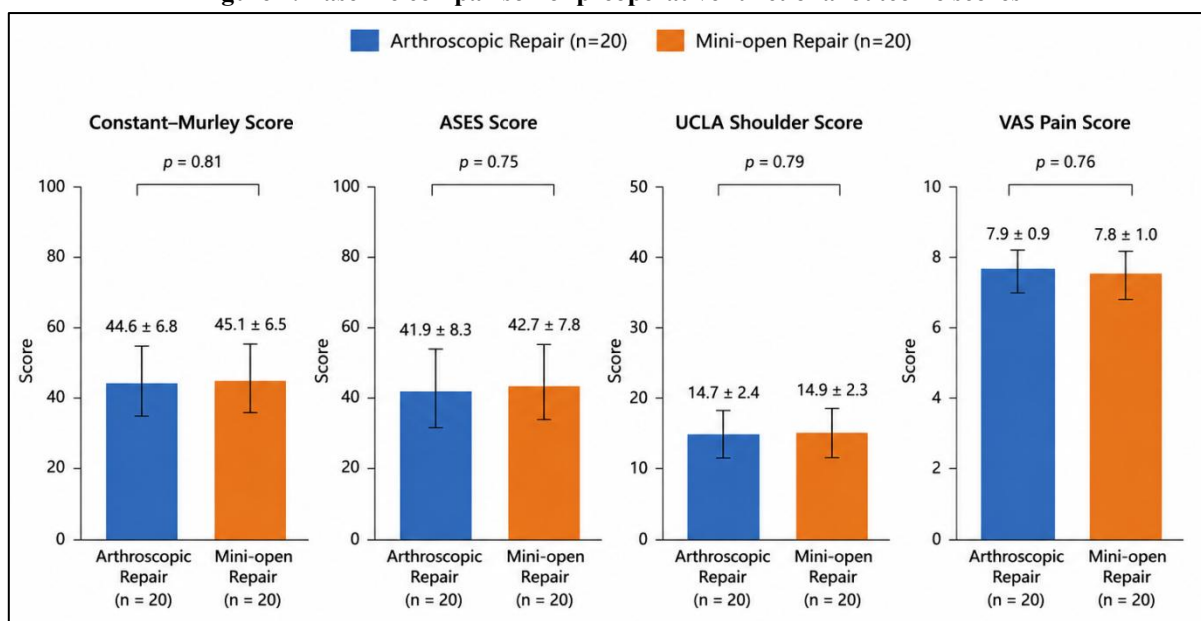


Figure 2 compares the preoperative functional outcome scores between patients undergoing arthroscopic repair and those undergoing mini-open repair for rotator cuff tears. Baseline assessment demonstrated no statistically significant differences between the two groups across all evaluated functional parameters. The mean Constant-Murley score was 44.6 ± 6.8 in the arthroscopic group and 45.1 ± 6.5 in the mini-open group ($p = 0.81$). The mean ASES score was 41.9 ± 8.3 and 42.7 ± 7.8 , respectively ($p = 0.75$). Similarly, the mean UCLA Shoulder Score was 14.7 ± 2.4 in the arthroscopic group compared with 14.9 ± 2.3 in the mini-open group ($p = 0.79$). The mean preoperative VAS pain score was 7.9 ± 0.9 in patients undergoing arthroscopic repair and 7.8 ± 1.0 in those undergoing mini-open repair ($p = 0.76$). These findings indicate that both treatment groups had comparable baseline pain levels and shoulder function before surgical intervention, ensuring that postoperative differences in functional outcomes could be attributed primarily to the surgical technique rather than pre-existing disparities.

Figure 3. Comparison of postoperative shoulder range of motion between study groups

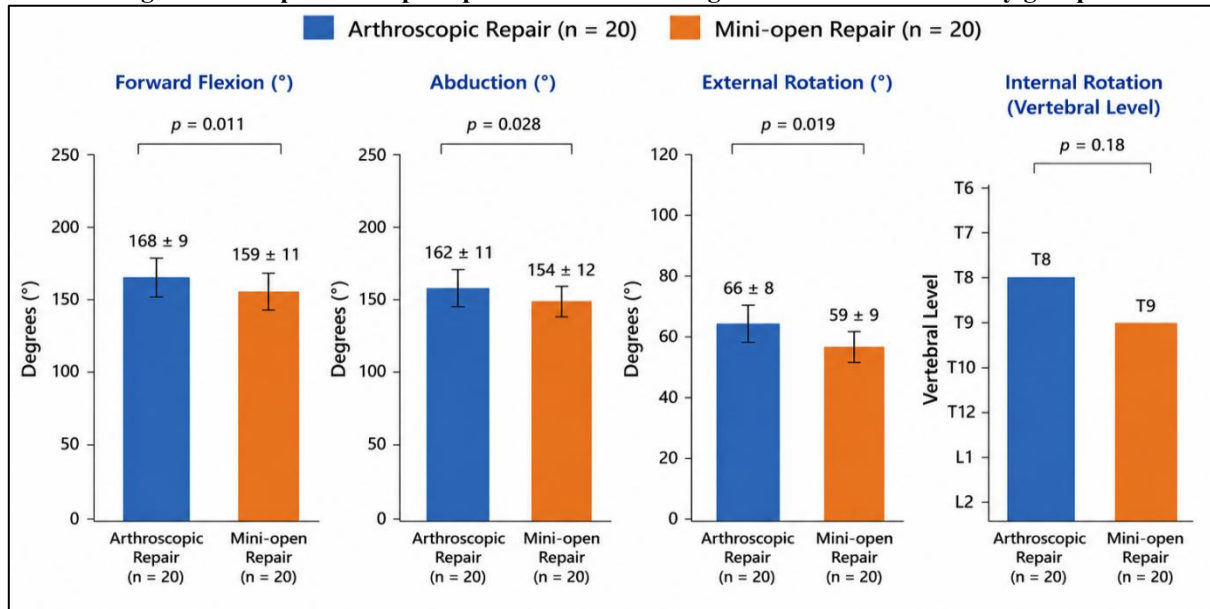


Figure 3 illustrates the comparison of postoperative shoulder range of motion between patients who underwent arthroscopic repair and those treated with mini-open repair at the 12-month follow-up. Patients in the arthroscopic repair group demonstrated significantly greater postoperative forward flexion ($168 \pm 9^\circ$) compared with the mini-open repair group ($159 \pm 11^\circ$; $p = 0.011$). Similarly, the mean shoulder abduction was significantly higher following arthroscopic repair ($162 \pm 11^\circ$) than mini-open repair ($154 \pm 12^\circ$; $p = 0.028$). External rotation also showed superior recovery in the arthroscopic group, with a mean of $66 \pm 8^\circ$, compared with $59 \pm 9^\circ$ in the mini-open group ($p = 0.019$). In contrast, internal rotation, assessed according to vertebral level, reached a median level of T8 in the arthroscopic group and T9 in the mini-open group, with no statistically significant difference between the two techniques ($p = 0.18$). Overall, the figure demonstrates that although both surgical approaches resulted in substantial improvement in shoulder mobility, arthroscopic repair provided significantly better recovery of forward flexion, abduction, and external rotation, while internal rotation remained comparable between the two groups.

Figure 4. Comparison of operative time, hospital stay, and return to daily activities between arthroscopic and mini-open repair

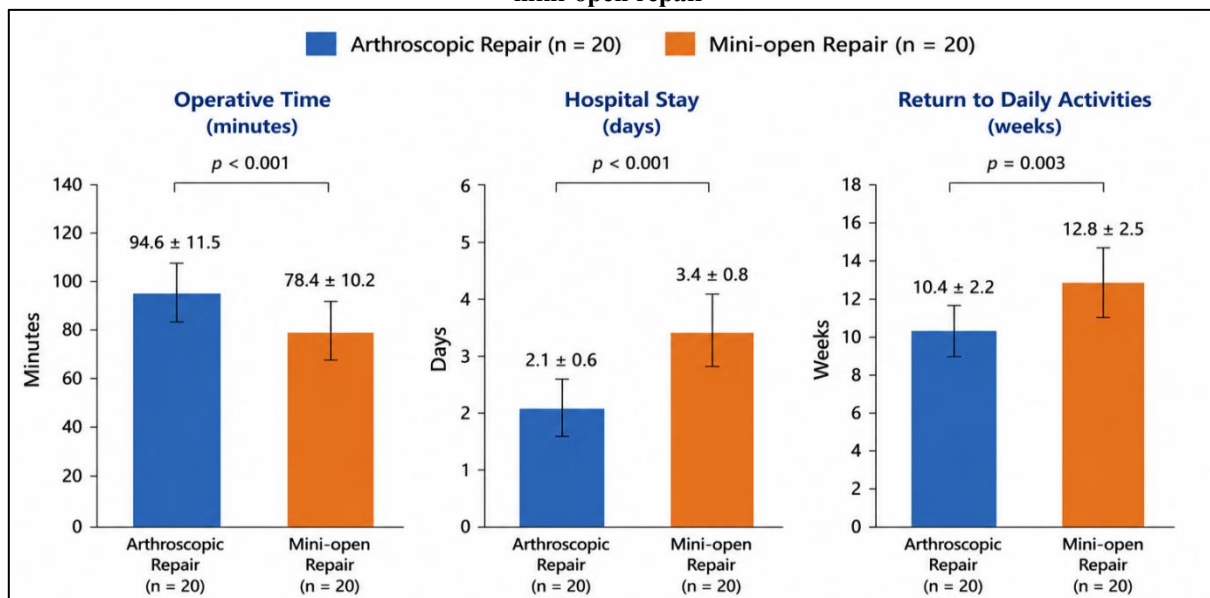
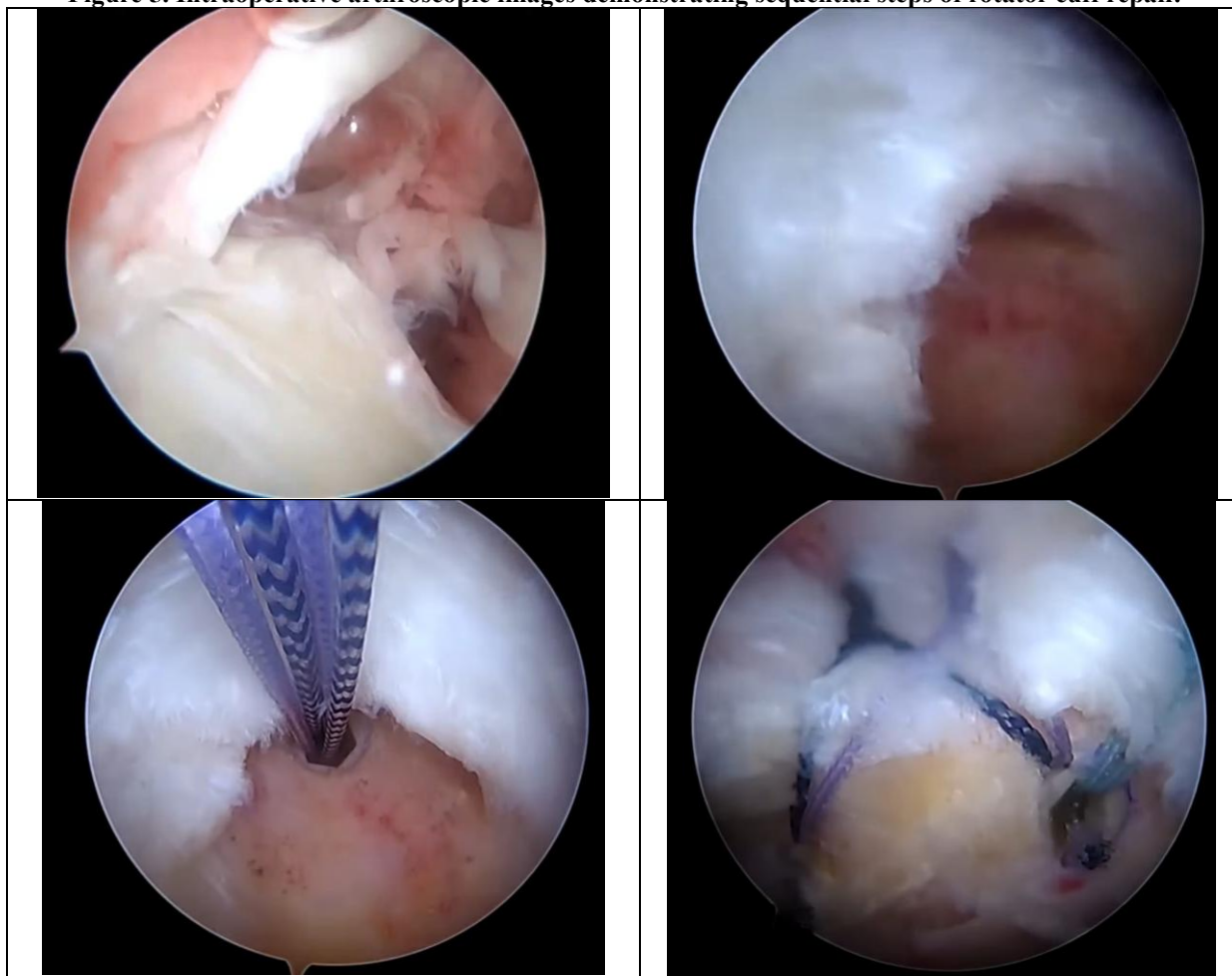


Figure 4 compares the perioperative parameters between patients undergoing arthroscopic repair and those treated with mini-open repair for rotator cuff tears. The mean operative time was significantly longer in the arthroscopic repair group (94.6 ± 11.5 minutes) compared with the mini-open repair group (78.4 ± 10.2 minutes; $p < 0.001$). Despite the longer surgical duration, patients who underwent arthroscopic repair experienced a significantly shorter hospital stay, with a mean duration of 2.1 ± 0.6 days, compared with 3.4 ± 0.8 days in the mini-open repair group ($p < 0.001$). Furthermore, the mean time required to return to routine daily activities was significantly shorter following arthroscopic repair (10.4 ± 2.2 weeks) than after mini-open repair (12.8 ± 2.5 weeks; $p = 0.003$). These findings indicate that although arthroscopic repair requires

a longer operative time, it is associated with enhanced postoperative recovery, reflected by reduced hospitalization and earlier return to normal daily activities compared with the mini-open repair technique.

Figure 5. Intraoperative arthroscopic images demonstrating sequential steps of rotator cuff repair.



DISCUSSION

The present prospective comparative study evaluated the functional outcomes of arthroscopic and mini-open repair in patients with rotator cuff tears over a one-year follow-up period. Both surgical techniques resulted in significant improvement in pain relief, shoulder function, and range of motion. However, patients undergoing arthroscopic repair demonstrated superior postoperative functional scores, greater recovery of shoulder motion, shorter hospital stay, and earlier return to daily activities, although the procedure required a longer operative time. These findings are consistent with the growing body of evidence supporting arthroscopic repair as an effective minimally invasive technique for the management of rotator cuff tears.

The baseline demographic and clinical characteristics of patients were comparable between the two groups, with no statistically significant differences in age, sex distribution, duration of symptoms, dominant shoulder involvement, or tear characteristics. Such homogeneity minimizes selection bias and strengthens the validity of postoperative comparisons. Similar baseline comparability has been reported in randomized controlled trials comparing arthroscopic and mini-open rotator cuff repair, thereby ensuring that postoperative differences are attributable primarily to the surgical technique rather than pre-existing patient characteristics [13,14].

Both treatment groups exhibited substantial improvement in shoulder function after surgery, confirming that rotator cuff repair effectively restores shoulder biomechanics irrespective of the surgical approach. Nevertheless, patients treated arthroscopically achieved significantly higher Constant-Murley, ASES, and UCLA scores at the final follow-up. These findings are consistent with the systematic review by Ji et al., which concluded that arthroscopic repair provides excellent clinical outcomes with improved early functional recovery while maintaining tendon healing comparable to mini-open repair [15]. Likewise, Huang et al. demonstrated that arthroscopic repair resulted in superior functional scores during the early postoperative period, although long-term outcomes gradually became comparable between the two techniques [16].

Pain reduction represents one of the primary objectives of rotator cuff surgery. In the present study, postoperative VAS pain scores were significantly lower in the arthroscopic repair group than in the mini-open repair group. The reduced postoperative pain associated with arthroscopic repair may be explained by preservation of the deltoid muscle, minimal

soft-tissue dissection, and lower surgical trauma. Millett et al. similarly reported that arthroscopic repair facilitates earlier pain relief and patient comfort owing to its minimally invasive nature [17]. Improved pain control may also contribute to earlier initiation of rehabilitation and better restoration of shoulder mobility.

Recovery of shoulder range of motion is another critical determinant of successful surgical outcome. The present study demonstrated significantly greater postoperative forward flexion, abduction, and external rotation in the arthroscopic group, whereas internal rotation was comparable between the two techniques. Preservation of the deltoid origin and reduced postoperative soft-tissue inflammation following arthroscopic repair may facilitate earlier mobilization and improved functional recovery. Similar observations have been reported by Lindley and Jones, who found superior early postoperative shoulder mobility following arthroscopic repair without compromising tendon healing [18].

Although arthroscopic repair required a significantly longer operative time than mini-open repair, patients experienced shorter hospitalization and returned to routine activities earlier. The increased operative duration is likely related to the technical complexity of arthroscopic procedures, portal placement, intra-articular evaluation, and suture management. However, the minimally invasive nature of arthroscopy reduces postoperative pain and soft-tissue injury, thereby accelerating rehabilitation and hospital discharge. Comparable findings have been reported by Nho et al., who demonstrated that despite longer operative time, arthroscopic repair offers faster functional recovery and earlier return to work and recreational activities [19].

The incidence of postoperative complications in the present study was low in both groups. Although shoulder stiffness, superficial infection, deltoid weakness, and tendon re-tear occurred more frequently in the mini-open group, these differences were not statistically significant. The absence of major neurovascular injury or deep infection reflects the overall safety of both procedures when performed by experienced surgeons. Similar complication profiles have been described in previous comparative studies, which reported no significant differences in re-tear rates or overall complication rates between arthroscopic and mini-open repair [20,21]. Improvements in arthroscopic instrumentation, suture anchor technology, and rehabilitation protocols have further contributed to the excellent safety profile of modern arthroscopic repair.

The superior functional outcomes observed after arthroscopic repair in the present study may be attributed to several technical advantages. Arthroscopy permits comprehensive visualization of the glenohumeral joint and subacromial space, facilitates simultaneous management of associated lesions such as biceps pathology and labral injuries, preserves the deltoid muscle, minimizes surgical morbidity, and enables anatomical restoration of the rotator cuff footprint. These advantages collectively contribute to improved shoulder biomechanics and enhanced postoperative rehabilitation [22].

Despite these encouraging findings, the present study has certain limitations. The sample size was relatively small, and patients were recruited from a single tertiary care institution, which may limit the generalizability of the results. The follow-up period of one year, although sufficient to assess functional recovery, does not provide information regarding long-term tendon integrity or the development of degenerative changes. Furthermore, postoperative tendon healing was not routinely evaluated using magnetic resonance imaging or ultrasonography. Future multicenter randomized controlled trials involving larger patient populations, longer follow-up, and imaging-based assessment of tendon healing are warranted to further clarify the comparative effectiveness of arthroscopic and mini-open repair.

Overall, the findings of the present study suggest that both arthroscopic and mini-open repair are reliable surgical options for treating rotator cuff tears. However, arthroscopic repair provides superior postoperative functional outcomes, greater recovery of shoulder motion, reduced pain, shorter hospitalization, and earlier return to daily activities while maintaining a low complication rate. These results support the increasing preference for arthroscopic repair in appropriately selected patients and experienced surgical settings.

CONCLUSION

Both arthroscopic and mini-open repair techniques were effective in improving pain, shoulder function, and range of motion in patients with rotator cuff tears over a one-year follow-up period. Significant postoperative improvements were observed in both groups with respect to functional outcome scores and clinical recovery. However, arthroscopic rotator cuff repair demonstrated superior functional outcomes, as evidenced by significantly higher Constant-Murley, ASES, and UCLA scores, lower postoperative pain scores, and better recovery of forward flexion, abduction, and external rotation compared with mini-open repair. Although arthroscopic repair required a longer operative time, it was associated with shorter hospital stay and earlier return to routine daily activities, reflecting the benefits of its minimally invasive approach. Furthermore, postoperative complication rates were low in both groups, with no statistically significant differences observed between the two surgical techniques.

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