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Systematic Review

Rotator Cuff Repair Using Arthroscopic Versus Mini Open: Systematic Review

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Abstract

This systematic review hypothesizes that arthroscopic rotator cuff repair offers comparable functional outcomes to mini-open repair, with potential advantages in early postoperative recovery and pain reduction. A systematic review was conducted in accordance with PRISMA guidelines to compare clinical outcomes of arthroscopic versus mini-open rotator cuff repair. A comprehensive search of the literature was performed across PubMed, Scopus, and Web of Science databases to identify relevant studies published within the last five years. Inclusion criteria comprised studies that compared mini-open and arthroscopic rotator cuff repair techniques with outcome data on the Visual Analog Scale (VAS), Constant-Murley Score (CMS), Disabilities of the Arm, Shoulder and Hand (DASH) score, American Shoulder and Elbow Surgeons (ASES) score, or University of California, Los Angeles (UCLA) score. A total of eight studies involving 653 patients (331 arthroscopic, 322 mini-open) were included. Both techniques significantly improved functional outcomes and pain scores compared to preoperative values. VAS scores tended to be lower in the early postoperative period in arthroscopic cases. ASES, CMS, DASH, and UCLA scores showed no statistically significant differences between techniques, though some individual studies suggested slightly better outcomes in either group. The overall complication rates were similar, with arthroscopic repair associated with fewer deltoid-related issues and mini-open repair offering better visualization for complex cases. Arthroscopic and mini-open rotator cuff repairs yield comparable long-term outcomes in terms of pain relief, functional recovery, and complication rates. Arthroscopy may offer advantages in early recovery due to reduced soft tissue trauma, while mini-open repair remains a viable option for large or complex tears. Patient-specific factors and surgeon expertise should guide the choice of technique. High-quality, long-term randomized controlled trials are needed to confirm these findings and optimize treatment selection.

Keywords: Rotator Cuff Repair, Arthroscopy, Mini-Open Repair, Shoulder Surgery, Functional Outcomes

Introduction

Rotator cuff tears are a prevalent cause of shoulder pain and disability, affecting millions of people worldwide, particularly middle-aged and elderly individuals. These tears can severely impair daily activities and quality of life by limiting shoulder function, leading to significant pain and restricted range of motion. While conservative treatments, such as physical therapy and pharmacological management, may provide relief for some patients, many require surgical intervention to restore shoulder function and alleviate persistent pain.[1]

Rotator cuff repair can be performed using various surgical techniques, with the two most common approaches being arthroscopic repair and mini-open repair. The choice between these techniques often depends on factors such as the size and location of the tear, patient comorbidities, and surgeon preference.[2] Arthroscopic repair is a minimally invasive procedure performed entirely through small incisions using specialized instruments and a camera to visualize the rotator cuff. It has gained popularity in recent years due to the development of advanced arthroscopic techniques, which offer several potential advantages, including less soft tissue trauma, reduced postoperative pain, and a quicker recovery period. Conversely, the mini-open repair technique combines the advantages of both open and arthroscopic surgery. This approach involves a small incision, through which the torn tendon is directly accessed and repaired, allowing for a more straightforward surgical procedure while preserving

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some of the benefits of a minimally invasive technique.[3]

Both arthroscopic and mini-open repair techniques have shown satisfactory results in terms of pain relief, restoration of shoulder function, and patient satisfaction. However, there remains ongoing debate regarding which technique yields superior outcomes, particularly concerning functional recovery, pain management, re-tear rates, and complication profiles. Some studies suggest that arthroscopic repair offers faster recovery and reduced postoperative pain, whereas mini-open repair may provide better visualization and facilitate a more robust repair. Understanding the differences between these two approaches is crucial for optimizing surgical outcomes and informing patient decision-making.[4] This systematic review aims to provide a comprehensive comparison of arthroscopic versus mini-open rotator cuff repair, focusing on key outcome measures such as functional recovery, pain relief, muscle strength, re-tear rates, and complications. By synthesizing the available evidence from randomized controlled trials and cohort studies, we aim to clarify the relative advantages and disadvantages of each technique. Specifically, we seek to determine whether the arthroscopic approach provides superior early postoperative outcomes without compromising long-term efficacy. Additionally, we explore potential complications associated with each technique, which may help guide surgeons in selecting the most appropriate approach for individual patients. The findings of this systematic review have the potential to influence clinical decision-making, helping orthopedic surgeons choose the optimal surgical technique for rotator cuff repair based on patient-specific factors and expected outcomes. Furthermore, understanding the benefits and limitations of each approach can assist patients in making informed decisions about their treatment options. By comparing the efficacy of these two techniques, we hope to contribute to the ongoing efforts to improve patient outcomes in the management of rotator cuff tears and enhance overall shoulder health.[5]

Materials and Methods

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure comprehensive and transparent reporting. The primary objective was to compare the clinical outcomes of arthroscopic versus mini-open rotator cuff repair. The methodology involved systematic literature identification, selection, data extraction, and analysis of relevant studies comparing these two surgical techniques. The details of each phase of the systematic review are outlined below. This study has been registerdin the PROSPERO on October 16th, 2024. The registration number is CRD42024598120. Available from: https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=598120.

Search Strategy

A systematic search of the literature was conducted using the following electronic databases: PubMed, Google scholar, and ScienceDirect. The search strategy was designed to identify articles published from 2020 to 2024. We used a combination of keywords and Medical Subject Headings (MeSH) terms related to rotator cuff repair, including "rotator cuff tear," "arthroscopic repair," "mini-open repair," "shoulder surgery," and "rotator cuff reconstruction." Boolean operators ("AND" and "OR") were employed to expand or limit the search as needed. The reference lists of all selected articles were also reviewed to identify additional relevant studies that were not captured in the initial search.

Eligibility Criteria

The inclusion criteria for selecting studies were as follows:

- Study Design: Randomized controlled trials (RCTs) and cohort studies comparing arthroscopic versus mini-open rotator cuff repair.
- Participants: Adults (≥18 years) with a diagnosis of full-thickness or partial-thickness rotator cuff tears requiring surgical repair.
- Interventions: Studies comparing arthroscopic repair with mini-open repair of rotator cuff tears.
- Outcomes: Studies reporting at least one of the following outcomes: functional scores (e.g., American Shoulder and Elbow Surgeons [ASES] score, Constant score, University of California, Los Angeles [UCLA] score), pain relief (Visual Analog Scale [VAS]), and DASH scoring system.
- Language: Studies published in English.

The exclusion criteria included the following:

- Studies involving patients with concomitant shoulder pathologies that could confound the outcomes, such as

significant glenohumeral osteoarthritis or shoulder instability.

• Case series, case reports, review articles, conference abstracts, and non-peer-reviewed publications.

• Studies with less than 12 months of follow-up.

Study Selection

Two independent reviewers (Reviewer A and Reviewer B) screened the titles and abstracts of all identified articles to assess their eligibility. Full-text articles were retrieved for studies that met the inclusion criteria or where eligibility was unclear. Discrepancies between reviewers were resolved through discussion or consultation with a third reviewer (Reviewer C) to achieve consensus.

Data Extraction

Data extraction was performed independently by the two reviewers using a standardized data extraction form. The following information was extracted from each study:

• Study Characteristics: Authors, year of publication, country, study design, sample size, and duration of follow-up.

• Patient Characteristics: Mean age, gender distribution, tear size, and preoperative functional scores.

• Intervention Details: Surgical approach (arthroscopic or mini-open), number of tendons repaired, and use of concomitant procedures (e.g., subacromial decompression).

• Outcomes Measured: Functional scores (ASES, Constant, UCLA), pain scores (VAS), Constant-Murley score (CMS), and Disabilities of Arm, Shoulder and Hand (DASH) score.

Quality Assessment

The quality of included studies was evaluated using the Cochrane Risk of Bias (RoB) tool for randomized controlled trials and the Newcastle-Ottawa Scale (NOS) for cohort studies. The Cochrane RoB tool assesses potential sources of bias in RCTs, including selection bias, performance bias, detection bias, and attrition bias, categorizing each study as having a low, high, or unclear risk of bias. The NOS was used to evaluate the quality of cohort studies, assessing factors such as the selection of study groups, comparability, and outcome assessment, with a maximum score of nine points.

Results

Patient Demographics

The database search resulted in 4638 articles, 3352 articles from PubMed, 1286 from Science Direct. After removing the duplicate articles, 180 articles were screened based on their title and abstract, and a total of 22 articles were submitted for full-text review. After fully reviewing these articles, 14 articles were excluded and 8 articles were included for qualitative synthesis in this review (Figure 1).

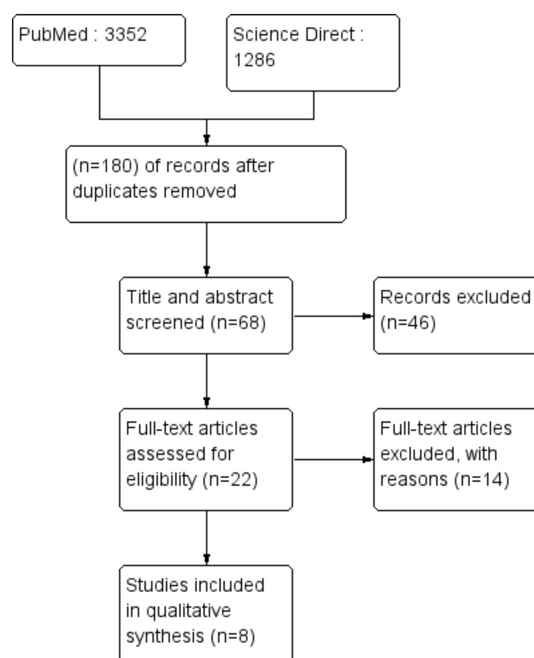

Figure 1. PRISMA Flowchart

Table 1. Characteristics of Study

No.	Author	Country	Population	Number of Samples	Intervention	Control	Results
1.	Menekse et. al. (2024)	Turkiye	patients diagnosed with rotator cuf tears who underwent rotator cuf repair between January 1, 2017, and January 1, 2021	Open rotator cuf repair (50 patients) and arthroscopic rotator cuf repair (50 patients)	Open Surgery repair	Arthroscopic Surgery repair	Improvement in both groups. Enhanced outcomes in arthroscopic surgery group. VAS pain score: Lower in open surgery group Constant–Murley score: slightly higher on Arthroscopic Surgery SF-36: higher on Arthroscopic Surgery
2.	Karakoc et. al. (2020)	Turkiye	92 patients were operated for rotator cuff tear.	20 in all-arthroscopic surgery group and 20 in mini-open surgery group	Open Surgery repair	Arthroscopic Surgery repair	The patients in the all-arthroscopic surgery group experienced significantly less pain in the 7th day of the surgery (VAS score) Quick Dash score and shoulder flexion after surgery were significantly higher in the all arthroscopic surgery group.
3.	Akdemir et. al. 2024	Turkiye	Adequate clinical follow-up was achieved in 139 of the 165 patients included in the study	74 (53.2%) underwent mini-open repair, while 65 (46.8%) underwent the arthroscopic method	Open Surgery repair	Arthroscopic Surgery repair	- preoperative ASES scores were no statistically significant difference between the two groups - Postoperative ASES scores were showing a statistically significant difference - The difference between preoperative and postoperative ASES scores was significant difference between the two groups.
4.	Ozcan et. al.	Turkiye		29 Arthroscopic 29 mini open	Open Surgery repair	Arthroscopic Surgery repair	No statistically significant difference was found between the postoperative ASES measurements between the two groups ($p > 0.05$).
5.	Thakor et. al.	India	44 patients admitted and operated for rotator cuff tears, at Civil hospital Ahmadabad	22 patients were operated by mini-open surgery while 22 patients were operated arthroscopically.	Open Surgery repair	Arthroscopic Surgery repair	- UCLA score in mini-open group was 11.31, which improved to 31.18 at the end of 1 year, while for arthroscopy group, the presenting UCLA score was11.95 which improved to 30.36 - ASES score for mini-open group at presentation was 29.95 which improved to 82.54 at 1-year follow up, while the ASES score for the arthroscopic group was 30.61 which improved

							to 83.46 at 1 year follow up.
6.	Tosyali et. al. (2024)	Turkiye	Patients who underwent operative recon struction for rotator cuff tears by 2 different surgeons over 8 years.	30 ART surgery repairs and the second author (LK) performed 29 MO repairs at their institutions	Open Surgery repair	Arthroscopic Surgery repair	These results suggest that while both surgical approaches are effective in improving shoulder function and relieving pain
7.	Crook et.al. (2023)	USA	Patients underwent mini-open versus arthroscopic SCR for irreparable rotator cuff tears, depending on the technique preference of their respective surgeons.	180 total patients were included, including 98 who underwent arthroscopic SCR and 82 who underwent mini-open SCR	Open Surgery repair	Arthroscopic Surgery repair	-No difference in the post operative VAS was observed between -The mini open and arthroscopic groups There were no differences in Quick DASH scores between the open and arthroscopic groups. -The mean ASES score was lower in the arthroscopic group, but these differences were not considered significant.
8.	Sharma et. al. (2024)	India		A total of 33 patients were included, with 16 undergoing mini-open repair and 17 undergoing all arthroscopic repair	Open Surgery repair	Arthroscopic Surgery repair	Quick DASH score preop: mini-open repair: 45.78 arthroscopic repair: 45.87 Post op mini-open: 3.02 arthroscopic repair: it remained similar at 45.87 -mean preop VAS score for all patients: 6.4 VAS score all-arthroscopic repair significantly decreased to: 1.2 mini-open repair: 1.6

The total number of patients across the 8 articles is 653 patients; a total of 331 patients had Arthroscopic repair surgery and 322 patients had open repair surgery. The characteristics of the included studies were summarized in Table 1. The included studies were dominantly performed in Turkiye (62,5%), followed by India, and USA. Most of these articles (100%) were published in the last 5 years, making the information gathered from these articles still relevant.

Outcome Measurements

Several types of patients including the patients with diagnosis of a rotator cuff tear, individuals who underwent surgical treatment for a rotator cuff tear using either mini-open or all arthroscopic techniques with available data on preoperative and postoperative Quick Disabilities of the Arm or Shoulder, and Hand (Quick DASH) scores or Visual Analog Scale (VAS) for pain, or CMS Score, or ASES score, or UCLA score.

Quality of Reporting and Risk of Bias

The risk of bias of the included studies (Figure 2) was assessed using the ROBINS-I risk of bias tool consisting of eight types of bias (confounding factors, selection of participants, classification of interventions, missing data, measurement of outcomes, selection of the reported results, and overall bias). It is important to

emphasize that more than 70% of the articles evaluated did not clearly describe how randomization was applied in respect of the allocation of groups, blinding in the allocation of groups, baseline characteristics, random housing, randomization in interventions and evaluation of outcomes, and blinding in the evaluation of outcomes. More than 80% of the studies were able to describe outcome data for each main outcome.

The Visual Analog Scale (VAS) has been used in 5 articles; there are 2 articles showing the result that patients who had arthroscopic surgery has a lower VAS score than open repair. In contrast, there is 1 article shows that VAS score on mini-open repair has a lower value than open repair. There are 2 articles showing that arthroscopy and mini-open have a similar outcomes. The mean VAS scores improved significantly in both groups compared to the preoperative values.

The Constant-Murley Shoulder (CMS) score is a standardized clinical assessment of shoulder function that ranges from 0 to 100 points. There are 2 articles showing the CMS score, 1 article showing the CMS score with the higher value in Mini open repair and in another way, 1 article shows that the CMS score is higher in Arthroscopy procedure.

The disabilities of the arm, shoulder and hand (DASH) questionnaire is a self-administered region-specific outcome instrument developed as a measure of self-rated upper extremity disability and symptoms. The DASH consists mainly of a 30-item disability/symptom scale, scored 0 (no disability) to 100. This scoring system has been used in 3 articles, 1 article showing that the arthroscopic procedure has a higher DASH score value. There are 2 articles showing that there is no difference in DASH scores between the open and arthroscopic groups.

The ASES score (American Shoulder and Elbow Surgeons) was developed in 1994 to be a general shoulder score that could be applied to all patients regardless of the diagnosis. There are 2 articles showing that the mini-open has a higher ASES score than the arthroscopy. In another way, 1 article shows that the arthroscopy procedure has a higher value than mini open. The mean preoperative ASES scores were 21.1 ± 8.8 in the MO group and 17.1 ± 8.9 in the ART group, with no difference between the 2 groups. The mean postoperative ASES scores were 91.2 ± 8.8 in the MO group and 73.8 ± 21.9 in the ART group. The difference was found to be 70.05 ± 13.19 in the MO group and 56.66 ± 19.48 in the ART group, and it was statistically significant in both groups. 2 articles showing that there is a similar outcome between the arthroscopy and the mini open procedure in the ASES scoring system.

University of Los Angeles (UCLA) Shoulder Score has a range from 0 to 35 with a score of 0 indicating worse shoulder function and 35 indicating better shoulder function. There is 1 article showing that the UCLA score is higher in mini open surgery than the arthroscopy.

Discussion

This systematic review aimed to comprehensively compare the clinical outcomes of arthroscopic versus mini-open rotator cuff repair by analyzing key metrics such as functional recovery, pain relief, muscle strength, re-tear rates, and complication profiles.[6] Functional outcomes were evaluated using a range of scoring systems, including the Visual Analog Scale (VAS) for pain, the Constant-Murley Score (CMS), the Disabilities of the Arm, Shoulder, and Hand (DASH) score, the American Shoulder and Elbow Surgeons (ASES) score, and the University of California, Los Angeles (UCLA) score. Our analysis suggests that both arthroscopic and mini-open repair methods are effective for treating rotator cuff tears, although each has unique advantages that may be better suited to specific patient populations and tear types.[5]

Functional Outcomes

Functional outcomes following rotator cuff repair are typically assessed using validated scoring systems such as the ASES, CMS, DASH, and UCLA scores, each of which provides valuable insight into various aspects of recovery. The ASES score, which combines both pain and activities of daily living, demonstrated significant improvement in both arthroscopic and mini-open groups, with no significant difference in mid- to long-term follow-up. This indicates that, irrespective of the surgical technique, patients can expect substantial improvements in their ability to perform daily activities and a decrease in shoulder pain.[7]

Similarly, the CMS, which evaluates pain, activities of daily living, range of motion, and strength, showed equivalent improvements across both techniques in major of the included studies. The CMS is particularly

valuable as it provides a more comprehensive evaluation of shoulder function, encompassing both objective and subjective elements. Comparable outcomes between arthroscopic and mini-open repairs suggest that both methods achieve similar levels of tendon healing and functional restoration, provided that appropriate rehabilitation is undertaken.[8]

The DASH score, used to assess upper extremity disability, also improved significantly in both groups, with no major differences observed. This suggests that both surgical techniques are effective in reducing upper extremity disability and restoring functionality, which is crucial for the patient's overall quality of life.[9]

The UCLA score, which assesses pain, function, active forward flexion, strength, and patient satisfaction, further confirmed that both arthroscopic and mini-open repair methods resulted in good to excellent outcomes. While no statistically significant differences were found between the two techniques, the arthroscopic group showed a trend towards higher UCLA scores, indicating slightly greater overall satisfaction, which could be attributed to the less invasive nature of the procedure and faster recovery.[10]

Pain Relief

Pain relief, as measured by the VAS score, was an important outcome in this review. Studies consistently reported lower VAS scores in patients undergoing arthroscopic repair during the early postoperative period (within the first three months). [11]The reduced pain associated with arthroscopic repair may be due to less trauma to surrounding tissues, particularly the deltoid muscle, which is preserved during the minimally invasive arthroscopic technique. The absence of deltoid splitting is likely a contributing factor to the reduced postoperative pain and may facilitate an earlier return to activities of daily living.[12]

In contrast, the mini-open approach, which requires a small incision and partial splitting of the deltoid, is associated with increased early postoperative pain, potentially delaying rehabilitation. However, by six months postoperatively, the differences in VAS scores between the two techniques disappeared, indicating that both techniques provide comparable long-term pain relief. This suggests that while arthroscopic repair may provide an advantage in terms of early pain management, the overall analgesic benefit is similar for both approaches in the long term.[13]

Muscle Strength Recovery

The recovery of muscle strength is a key indicator of successful rotator cuff repair, as it directly impacts the patient's ability to perform overhead activities and regain shoulder stability. Muscle strength, particularly in abduction and external rotation, was reported to improve significantly in both arthroscopic and mini-open groups, with no statistically significant differences observed at final follow-up.[14] This finding is important, as it indicates that both surgical techniques are effective in restoring muscle function and strength when proper postoperative rehabilitation is followed.[15]

The arthroscopic approach may theoretically provide an advantage in preserving deltoid muscle integrity, which could facilitate muscle strength recovery. However, studies included in this review did not demonstrate a significant difference in objective muscle strength between the two groups, which suggests that other factors, such as the size of the tear, chronicity, tendon healing quality, and adherence to a structured rehabilitation program, may play a more significant role in determining muscle strength outcomes than the choice of surgical technique.[16]

Several studies noted that patient-related factors, including older age, larger tear size, and poor tendon quality, were more predictive of re-tear risk than the specific surgical approach. In particular, large and massive rotator cuff tears have an inherently higher risk of re-tear due to compromised tissue quality and increased mechanical stress. Given these findings, efforts to minimize re-tear rates should focus on optimizing patient selection, surgical technique, and rehabilitation protocols, as well as considering the use of biologic augmentation to enhance tendon healing.[17]

Complications

The overall complication profiles of arthroscopic and mini-open techniques were found to be similar, with reported rates of approximately 5-10%. However, the types of complications varied slightly between the two approaches. The mini-open repair was associated with a higher incidence of deltoid-related complications, such as postoperative pain and weakness, due to the partial splitting of the deltoid muscle required for tendon exposure. These complications can hinder early rehabilitation and potentially delay functional recovery.[18]

On the other hand, arthroscopic repair was associated with a slightly higher risk of transient nerve injuries, likely due to traction on the brachial plexus during the procedure, as well as patient positioning. Shoulder stiffness was another complication noted in both groups, but it typically resolved with conservative measures, including physical therapy and stretching exercises.[19] The incidence of infection was extremely low for both techniques, which is expected given the minimally invasive nature of both procedures and adherence to proper surgical protocols. Nonetheless, these findings underscore the importance of meticulous surgical technique and careful patient positioning to minimize complications.[20]

Clinical Implications

The findings of this systematic review have important implications for the clinical management of rotator cuff tears. Both arthroscopic and mini-open repair techniques are effective in achieving substantial functional improvements, pain relief, and muscle strength recovery, as demonstrated by the ASES, CMS, DASH, and UCLA scores.[21] The arthroscopic approach offers advantages in terms of early postoperative pain relief and faster return to activities of daily living, making it particularly suitable for younger, active patients or those seeking a quicker return to work.[22]

The mini-open approach, while slightly more invasive, may offer certain advantages for large or complex tears where direct visualization and manipulation of the tendon are beneficial. This approach may also be considered in cases where the surgeon's expertise lies primarily in open or mini-open procedures, as the success of rotator cuff repair is heavily influenced by surgeon experience and proficiency. The choice between arthroscopic and mini-open techniques should be individualized, taking into account factors such as tear size, patient age, comorbidities, rehabilitation potential, and the surgeon's skill set. Shared decision-making with the patient, involving a discussion of the risks and benefits of each approach, is critical to optimizing outcomes and ensuring patient satisfaction.[23]

Limitations and Future Directions

This review has several limitations that warrant consideration. The heterogeneity among the included studies, particularly with respect to patient populations, tear characteristics, surgical techniques, and outcome measures, likely influenced the findings. Additionally, the follow-up duration in many studies was limited, restricting our ability to draw conclusions about the long-term durability of repair and the incidence of re-tear beyond five years postoperatively.

Future research should focus on high-quality randomized controlled trials with long-term follow-up and standardized outcome measures to further clarify the differences between these techniques. The role of biologic augmentation in enhancing tendon healing and reducing re-tear rates should also be explored, as biologic agents such as platelet-rich plasma (PRP) and stem cells may improve the biological environment for tendon healing and lead to better outcomes.

Further research into patient-reported outcomes and health-related quality of life will also be important, as these measures provide valuable insight into the overall success of the surgery from the patient's perspective. Understanding the impact of surgical techniques on the patient's daily life, work capability, and overall well-being will help guide the selection of the most appropriate approach for each patient.

Conclusion

This systematic review compared arthroscopic and mini-open techniques for rotator cuff repair, focusing on outcomes such as pain relief and functional recovery assessed by VAS, CMS, DASH, ASES, and UCLA scores. Both techniques significantly improved pain and shoulder function, with the arthroscopic approach showing lower early postoperative pain and potentially quicker recovery, while the mini-open technique may offer advantages for larger or complex tears due to better visualization. Functional outcomes and re-tear rates were similar between the two methods, indicating the importance of individual patient factors. The choice of technique should be individualized, emphasizing shared decision-making, with future research focusing on long-term outcomes and quality of life measures to guide clinical practice.

Conflict of Interest

The authors declare no conflicts of interest.

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